

A Handbook for



December 2013, Updated 2017

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Introduction

This Handbook contains specific, detailed information about each Action Item listed in the Single-Family/Townhome New Construction Checklist.

Handbook Organization

The Handbook is organized into 3 parts: *Introduction* (this section), *Action Items*, an information section containing narratives for each Action Item, and *Appendix*, containing tools that will help you with some of the Action Items.

Action Items describes environmentally friendly Action Items arranged in seven categories:

- Built Green Team
A few Action Items that will help you build the right team for your Built Green project.
- Site and Water
BUILT GREEN offers a variety of common-sense site protection, water protection, and development techniques you can use to earn points and be a “fish-friendly” builder.
- Energy Efficiency
This category promotes energy efficiency and improved comfort with Action Items intended to push your project beyond Energy Code minimums.
- Health and Indoor Air Quality
Action Items in this category include selected practices to improve indoor air quality and reduce health risks for occupants and installers.
- Materials Efficiency
Numerous options help you reduce job-site waste, saving both you and your customer money. In addition to using materials efficiently, this section offers recognition for using a variety of “green” building materials that are easier on the environment.
- Operation, Maintenance & Homeowner Education
The purpose of this section is to promote responsible homeowner operation and maintenance throughout the life of the home, by equipping your clients to continue the good work you have begun.
- Built Green Brand Promotion
Extra credit for innovation in marketing for Built Green brand.

Appendix provides charts and guidelines that will help you meet Action Items in the Energy Efficiency and Material Efficiency sections.

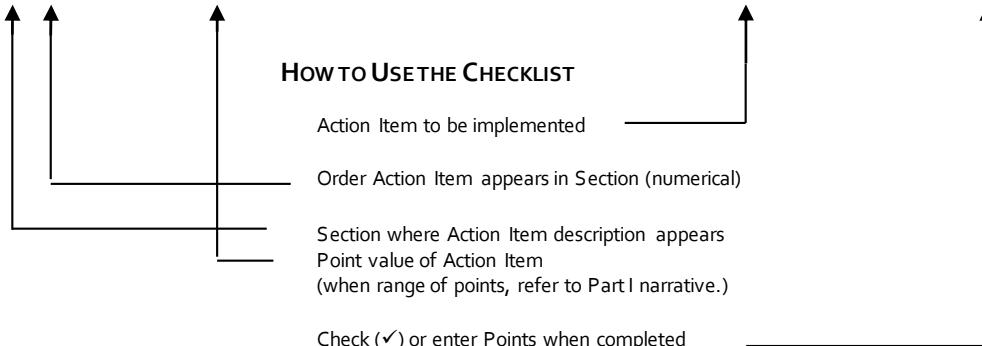
How to use the Handbook

For ease of use, the Single Family/Townhome New Construction Checklist coordinates directly with the Handbook Sections 1–7.

The checklists are “key-coded” to help you find information about each measure. The first number indicates what section to look in, and the following numbers indicate the order in which it appears. Here’s how it works, using an example Action Item from the Checklist:

In this example, the action “Use pervious materials for driveways, parking areas, walkways, and patios” is described in Section **Two** (Site and Water), Action Item **44**.

Number	Possible Points	CREDITS	Point Totals
2-44	2-6	Use pervious materials for driveways, parking areas, walkways, and patios	



PREREQUISITES

Meet selected star-level requirements

Category	Possible Points	Credit
<u>THREE-STAR REQUIREMENTS (100 points minimum)</u>		
	<i>required</i>	3rd party verification required (See reference)
	<i>required</i>	All star items
	<i>required</i>	Conform to the House Size Matrix (Table o-1)
	<i>required</i>	Meet all applicable codes and regulations
	<i>required</i>	Program Orientation (one time only)
Site & Water	<i>required</i>	Prohibit burying of construction waste
Site & Water	<i>required</i>	Stabilize all construction entrances with quarry spall or crushed rock
IAQ	<i>required</i>	Ensure proper drainage of crawl space
IAQ	<i>required</i>	All spot fans under 110 CFM are 1.5 sones or less
Materials	<i>required</i>	Post and implement a jobsite recycling plan
	<i>required</i>	Provide a building owners manual in accordance with credit 6-1
Energy	<i>required</i>	10% energy use improvement over Washington State Energy Code (2015)
	<i>required</i>	Achieve a minimum of 40 points in each of sections 2-5
	<i>required</i>	Achieve a minimum of 25 points in each of sections 2-5
<u>FOUR-STAR REQUIREMENTS (400 points minimum)</u>		
	<i>required</i>	Meet 3-Star requirements
	<i>required</i>	Achieve a minimum of 60 points in each of sections 2-5
Site & Water	<i>required</i>	No zinc galvanized ridge caps, copper flashing or copper wires for moss prevention
Site & Water	<i>required</i>	Landscape with plants appropriate for site topography and soil types, emphasizing use of plants with low watering requirements [drought tolerant]
Site & Water	<i>required</i>	Use the most efficient aerator available for kitchen faucets, lavatory faucets and showerheads
Energy	<i>required</i>	Achieve 20% improvement over Washington State Energy code (2015)
IAQ	<i>required</i>	Use low toxic/low VOC paint on all major surfaces
IAQ	<i>required</i>	Ventilate with box fans in windows blowing out during drywall sanding and new wet finish applications
IAQ	<i>required</i>	Use no products that contain added urea formaldehyde for any interior applications. (CARB II acceptable for meeting the requirement, though not for checklist points)
Materials	<i>required</i>	Practice waste prevention and recycling and buy recycled products (Section 5)
Materials	<i>required</i>	Achieve a minimum recycling rate of 50% of waste by weight

FIVE-STAR REQUIREMENTS (600 points minimum)

	<i>required</i>	Meet 4-Star requirements plus point minimum
	<i>required</i>	Achieve a minimum of 100 points in each of sections 2-5
Site & Water	<i>required</i>	Amend disturbed soil with compost to a depth of 10 to 12 inches to restore soil environmental functions (2-34)
Site & Water	<i>required</i>	Use previous materials for at least one-third of total area for driveways, walkways, and patios (See Action item 2-44)
Site & Water	<i>required</i>	Limit use of turf grass to 25% of landscaped area (2-61)
Site & Water	<i>required</i>	Avoid soil compaction by limiting heavy equipment use to building footprint and construction entrance (2-19)
Site & Water	<i>required</i>	Preserve existing native vegetation as landscaping (2-21)
Site & Water	<i>required</i>	Retain 30% of the trees located on site at the start of construction or, alternatively, achieve a Green Factor score of .6 or higher (2-23)
Energy	<i>required</i>	Pre-wire for future PV installation (3-93)
Energy	<i>required</i>	Achieve 30% improvement over Washington State Energy code (2015)
IAQ	<i>required</i>	Detached or no garage OR garage air sealed from house with automatic exhaust fan (4-27)
Materials	<i>required</i>	Achieve a minimum recycling rate of 70% of waste by weight
Materials	<i>required</i>	Use a minimum of 10 materials with recycled content

Conform to the House Size Matrix (Square Feet Limit Refers to Conditioned Space)

See the following tables to calculate your point totals. Program note: For multiple projects in the same community or plat, one checklist can be submitted *IF* the total point score on the BUILT GREEN checklist for each floor plan varies by less than 10%. THE House Size multiplier, however, must be calculated separately for each floor plan.

The most direct approach to resource efficiency is to build a smaller house. Although smaller houses generally cost less to build and operate, the national trend has been toward larger houses. In 1949, the average residence in the United States (not including the garage) was less than 900 square feet and housed 4.2 people. In 1991, the typical 2,000-square-foot residence housed only 2.6 people.

Larger homes tend to consume proportionally more materials because they include more features. Downsizing a conventionally framed house by 25% can save even more wood than substituting the most wood-efficient advanced framing (see Action item 3-23, *Use Advanced Wall Framing—24-in OC, w/Double Top Plate*). Smaller houses inherently reduce the embodied energy of a home (the total amount of energy used to extract, refine, produce, and distribute materials from their point of originto

installation and then ultimately to disposal). Small houses can be made space-efficient, functional, and livable through careful layout and design. Fortunately, there are a number of excellent resources available on compact house design.

Besides the size of a house, the shape of a house is one of the main factors in construction expenses. Complicated angles and shapes significantly increase the cost of the building. Also keep in mind it may cost less to build up than to build out, depending on local land and labor costs. Starting out with the most appropriate size and shape for your house reduces the costs of almost all aspects of construction, including waste disposal.

BUILT GREEN House Size Matrix

- Smaller houses use a multiplier for their overall points based on SF size.
- Larger houses are required to earn a minimum of points in the energy and materials section. (Points listed are for each section)
- Project size to include all conditioned space of house except for an Additional Dwelling Unit (ADU)

Table 0-1 House Size Matrix

Bedrooms							Multiplier	min. points req in energy section**	min. points req in materials section**			
1	2	3	4	5	6							
Smaller houses use a multiplier for their overall points based on SF size.												
Larger houses are required to earn a minimum of points in the energy and materials section. (Points listed are for each section)												
Project size to include all conditioned space of house except for an Additional Dwelling Unit (ADU)												
SF	<500	<700	<900	<1300	<1900	<2400	1.20	N/A	N/A			
	501- 800	701-1000	901-1200	1301-1750	1901-2350	2401-2700	1.15	N/A	N/A			
	801-1200	1001-1400	1201-1800	1751-2350	2351-2950	2701-3500	1.10	N/A	N/A			
	1201-1600	1401-1800	1801-2400	2351-3000	2951-3600	3501-4300	1.05	N/A	N/A			
	1600	1800	2400	3000	3600	4300	1.00	0	0			
	1601-1800	1801-2000	2401-2700	3001-3400	3601-4000	4301-4700	1.00	25*	25			
	1801-2000	2001-2200	2701-3000	3401-3800	4001-4400	4701-5100	1.00	35*+	35+			
	2001-2200	2201-2400	3001-3300	3801-4200	4401-4800	5101-5500	1.00	45*+	45+			
	>2200	>2400	>3300	>4200	>4800	>5500	1.00	55*+	55+			

= 2005 avg. Home size in WA State

* Energy Star Certification can be substituted for the required point minimum

Section 1 BUILT GREEN TEAM

- 1-1** Use Built Green member subcontractors, vendors, service providers, and real estate agents

1-10 POINTS

1 POINT PER MEMBER BUSINESS USED

Seek out Built Green members for all aspects of home design and construction. Built Green membership is open to licensed builders, developers, contractors, architects, and other building industry

professionals. Realtors and other stakeholders may join as Program Associates. Contact the MBA office for a list of members:

1-2

- A. Incorporate Built Green early in the design by conducting an eco-charrette with the homeowner & team to determine Built Green features to be included in the home.
- B. Identify team member roles and how they relate to various phases of green lot design, prep and development
- C. Create a mission statement that includes the projects goals and objectives

5 POINTS

Conduct an eco-charrette with the homeowner before the project has begun, using the Checklist to determine Built Green features to be included in the home. Goal setting and commitment to a green approach to the project can help ensure successful implementation of green strategies and actions. Review this checklist with all parties (e.g. owner, designer, engineer, general contractor, landscape professional) at an early stage in the design process. An integrated approach can help find innovative solutions, and ensure that team members are not working at cross purposes.

A knowledgeable team is established and team member roles are identified with respect to lot design, preparation, and development. A written mission statement that includes the project's goals and objectives is developed.

One of the earliest challenges for a builder in developing a green lot is assembling an effective team to help the builder implement best green practices throughout the process. Examples of possible team members include staff, site superintendents, utilities, excavators, landscape architects, wildlife biologists, ecologists, and arborists.

Those involved in the development phase must understand what the mission of the site is, what it means to be a green lot, and why green practices should be followed. Once the green intent of the builder is communicated to the lot development team, the builder should work with the team throughout the development process to identify and delegate responsibilities of team members, as well as facilitate coordination between the members to achieve best green practices.

Resources

- American Society of Consulting Arborists, <http://www.asca-consultants.org/why.html>
- American Society of Landscape Architects, <http://www.asla.org/members/pigroups.cfm>
- International Society of Arboriculture, <http://www.isa-arbor.com/home.asp>
- Society of American Foresters, <http://www.safnet.org/certifiedforester/>
- The Ecological Society of America, <http://www.esa.org/>

1-3

Provide all documentation/copies to third-party verifier electronically

1 POINT

Section 2 SITE & WATER

General Resources

- *Environmental Handbook for Washington Construction Contractors: Regulatory Guidance* (Publication #96-503), Solid Waste and Financial Assistance Program, Washington State Department of Ecology. 360-407-7472 or www.wa.gov/ecology/pubs.html.
- *Watershed Protection Tools*, Center for Watershed Protection, Ellicott City, MD. 410-461-8323 or www.cwp.org, multiple publications including *Site Planning for Urban Stream Protection*.

Product Information

GreenSpec – The Environmental Building News Product Directory and Guidelines Specifications, E Build, Inc., Brattleboro, VT, 1999. 802-257-7300 or www.buildinggreen.com. *GreenSpec* is organized in standard CSI divisions. Environmental Building News (EBN) also offers product reviews, information and lists some articles at the following web address: www.buildinggreen.com/products/productlist.html.

Surface Water Management

On-Site Residential Stormwater Management Alternatives. Washington State Department of Ecology, 1995. 360-407-7472 or www.wa.gov/ecology/pubs.html. Prepared by UW Department of Civil Engineering (Stephen Burges).

Stormwater and Urban Runoff Seminars—Guide for Builders and Developers, NAHB, Edited by Susan Asmus, Washington DC, 800-368-5242 x538 or www.nahb.com.

Stormwater Erosion and Sediment Control for Small Parcel Construction (WQ-R-93-012, Report #3 of 5). Washington State Department of Ecology, Water Quality Program. 360-407-7472 or <https://fortress.wa.gov/ecy/publications/publications/wqr93012.pdf>.

Keep it On Site! Residential Builder's Guide to Small Site Erosion Control and Stormwater Management, 1999. Prepared by O'Brien & Company for Kitsap County. Available at the BUILT GREEN Resource Library.

"*Stormwater Management: Environmentally Sound Approaches*," *Environmental Building News*, Sept/Oct 1994. 802-257-7300 or www.buildinggreen.com.

Stormwater Management For Construction Activities: Developing Pollution Prevention Plans And Best Management Practices: Summary Guidance. EPA#833-R-92-001, October 1992, EPA Office of Wastewater Management, 401 M St. SW, Mail Code EN-336, Washington DC, 20460. 800-245-6510, 202-260-7786 or <http://cfpub.epa.gov/npdes/stormwater/menufbmps/index.cfm>.

For more information about National Pollutant Discharge Elimination System (NPDES), see <http://cfpub.epa.gov/npdes/index.cfm>

Stormwater Management Manual for Western Washington, Volume V, Runoff Treatment BMP's Publication No. 05-10-33, Washington State Department of Ecology, 2012, Full document can be viewed and downloaded from <http://www.ecy.wa.gov/programs/wq/stormwater/manual.html> or call 360-407-6614.

Stormwater Management Manual for Western Washington, Volume II, Construction Stormwater Pollution Prevention. Washington State Department of Ecology, Water Division. 2012. Full document can be viewed and downloaded from <http://www.ecy.wa.gov/programs/wq/stormwater/manual.html> or call 360-407-6614.

International Erosion Control Association (IECA). 800-455-4322 or www.ieca.org. Provides technical assistance and an annual *Erosion Control Products and Services Directory*. IECA's Western Chapter addresses issues that are unique to the Western U.S.

SITE PROTECTION

Proximity

2-1 Locate site within one of the Urban Growth Area (UGA) designated areas

5 POINTS

Overall

2-2

Build on infill lot to take advantage of existing infrastructure, reduce development of virgin sites

5 POINTS

This credit is not applicable for homes in newly developed communities on greenfield sites.

Infill lots are developed areas with municipal water and sewer, electricity, and roads already available, *excluding* lots in designated critical areas or overly steep slopes.

In those cases where a building already exists on the lot, BUILT GREEN encourages using the existing structures if possible through renovation as the primary objective. However, if renovation is not possible, because the building is not structurally sound, then salvage and recycling demolition materials becomes the secondary goal. The measure is not intended to promote the razing of structurally sound structures to make way for larger buildings. Restoring homes on infills as opposed to razing an existing home, and building a new larger home can have dramatic benefits in reducing traffic and protecting habitat.

Resources

- "Designed to Fit," by Susan Jenkins, *Builder*, July 1998, pp. 136-148. Washington, DC, www.builderonline.com. (Four projects that demonstrate different forms of infill housing: attached, detached, high-density, and low-density).
- "Infill Housing That Fits," by Jamie Fisher, *Journal of Light Construction*, June 1998, p. 21. Williston, VT. 802-859-3669 or www.jlconline.org/bookstore.
- Policy Link, Equitable Development Toolkit, Infill Incentives, <http://www.policylink.org/EDTK/Infill/>
- Northeast-Midwest Institute and Congress for the New Urbanism, *Strategies for Successful Infill Development* (2001), <http://www.nemw.org/infillbook.htm>

2-3

Build on a greyfield lot

5 POINTS

Redevelopment of a Greyfield site can provide an efficient use of land and infrastructure. Greyfield redevelopment allows for the preservation of open space and wildlife habitat in the midst of growth.

Within these guidelines, a Greyfield site is defined as any site previously developed with at least 50% of the surface area covered with impervious material. The development of a Greyfield site can be daunting, but local or national incentives may exist to reward those builders who go through the process. Incentives may include the elimination of development related fees, contribution from the local government in the development of off-site improvements, and tax breaks. For more information, contact the Congress for the New Urbanism, Urban Land Institute, American Planning Association, or the International Council of Shopping Centers.

Resources

- Urban Land Institute, www.ulicenter.org
- American Planning Association, www.planning.org
- International Council of Shopping Centers, www.icsc.org
- Congress for the New Urbanism and PricewaterhouseCoopers, *Greyfields into Goldfields: From Falling Shopping Centers to Great Neighborhoods* (February 2001), http://www.cnu.org/cnu_reports/Executive_summary.pdf

- Congress for the New Urbanism and PricewaterhouseCoopers, *Greyfield Regional Mall Study* (January 2001), http://www.cnu.org/cnu_reports/Greyfield_Feb_01.pdf

2-4

Build on an EPA-recognized brownfield lot

5 POINTS

Remediation of a Brownfield lot results in the environmental restoration of a polluted site, a transformation that makes an abandoned site habitable. Like Greyfield and infill development, Brownfield development provides an efficient use of land and infrastructure while allowing for the preservation of open space and wildlife habitat.

The U.S. Environmental Protection Agency (EPA) characterizes Brownfields as—real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. The EPA estimates that there are 450,000 such sites around the country. Grants, loans, and training are available through the EPA's Brownfield Initiative to assist builders and developers in the remediation and development of Brownfield sites.

Resources

- U.S. Environmental Protection Agency, Brownfields Cleanup and Redevelopment: <http://www.epa.gov/Brownfields/index.html>
- U.S. Environmental Protection Agency has introduced two Web-based tools to give the public additional access to information about Brownfield properties and cleanup efforts. The tools allow residents to locate Brownfields in their area and provide access to information about cleanup grants. - www.epa.gov/Brownfields/bfwhere.htm

2-5

An adaptive reuse lot is selected

5 POINTS

Use a previously developed lot for a new purpose.

2-6

Build in a Built Green development

10 POINTS

Points cannot be combined Build in a Built Green or similarly certified development, such as LEED for Neighborhood Development (LEED ND), or LEED for communities. The Built Green Communities program and other similar programs promote voluntary land-use and community design guidelines which minimize environmental impact and promote the responsible community design to benefit all citizens. Objectives include preserving natural resources; balancing open space and density; reducing infrastructure costs through efficient design; reducing automobile usage, encouraging cost effective, innovative ideas and technologies; and creating diverse housing options. Refer to the Built Green Washington or USGBC website for a list of registered Built Green Communities and LEED ND projects, www.builtgreenwashington.org, www.usgbc.org.

2-7

Use an alternative foundation system that minimizes volume of foundation material and disturbance to soil and/or to water flow, for at least 50% of the foundation

5 POINTS

Low impact foundation systems or integrated pre-cast footings requires little to no excavation, and provide the following benefits

- Preserves site top soil

- Avoids expensive and time-consuming erosion prevention measures and drainage controls
- Maintains historic stormwater flows and natural topography on the site
- Affords an opportunity to help preserve salmon streams.

PIN Foundation Systems do not require traditional site excavation; instead Pin Foundation's FootPrint system involves pouring concrete into custom-designed forms that create a home's foundation, then driving 5-to-9-foot-long steel pins diagonally through both sides of the concrete to anchor it securely to the ground. The advantage of the foundation system is that the original soil is preserved without being disturbed.

PIN Foundations may cost up to 10% more than conventional foundations with excavation. If incorporated early in the planning stage, the reduction of site development costs coupled with an increase in environmental compliance that will result in a positive permitting process, and an opportunity to gain more Action items points – See Section Two *Protect Natural Processes on Site*.

Post and Pier foundations also offer the environmental benefit of minimizing excavation. Large beams run under the home's floor joists and are held up by posts. Each post rests on a separate concrete footing or pier. Be sure to consider seismic affects in design.

2-8

Build in a low-impact development

5 POINTS

Low Impact Development (LID) is a stormwater management strategy which uses various land planning and design practices and technologies to simultaneously conserve natural resource systems and reduce infrastructure costs. LID allows land to be developed, but in a cost-effective manner that helps mitigate potential environmental impacts. LID uses Best Management Practices (BMPs) that replicate pre-development hydrologic conditions. For additional information about LID, see The Low Impact Development Center, Inc. website, www.lowimpactdevelopment.org or U.S. EPA website, www.epa.gov/nps/lid.

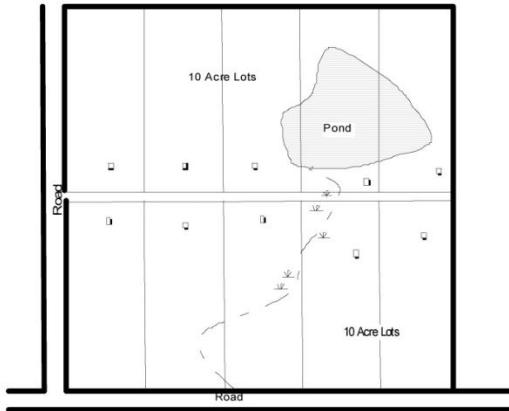
2-9

Build in a rural cluster development (RCD)

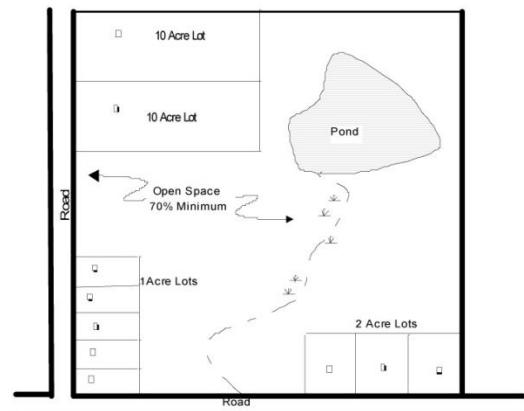
4 POINTS

Large-lot (10-acre) zoning has been the conventional way to minimize population density and retain rural character in Spokane County's rural areas. This method, while effective at controlling population density, has divided our rural lands with little sensitivity to the effects on rural resources and the natural environment. Large-lot zoning, combined with a lack of adequate road standards, has also created many miles of poorly maintained private roads, making fire and emergency access difficult.

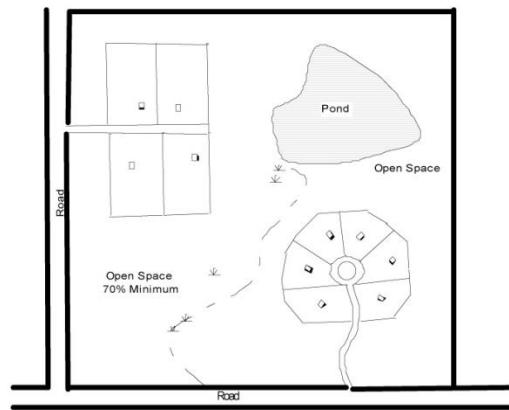
Rural residential clustering provisions provide an alternative to conventional large-lot zoning. Rural clustering encourages the grouping of home sites on areas of the site that are best suited for development, while retaining the remainder of the site for open space. Appropriately designed cluster developments can preserve active agricultural and forestry uses as well as protect sensitive environmental areas.



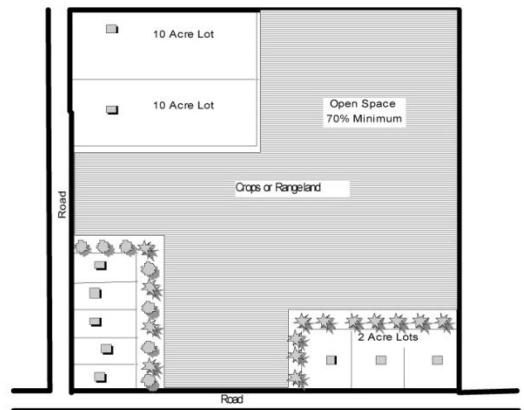
Example of a traditional rural subdivision



Example of rural cluster development



Example of a rural cluster development with residential clusters set back from the road



Example of rural cluster development used to conserve crop or rangeland

Figure 2-1 Examples of Rural Residential Development

Lot Design

2-10 Self-conduct a site inventory and assessment

3 POINTS

2-11 Complete a natural resources inventory under the direction of qualified professional

5 POINTS

The National Resources Inventory (NRI) is defined by the Natural Resources Conservation Services as "a statistically based sample of land use and natural resource conditions and trends on U.S. nonfederal lands."

The uses of the inventory are to:

- Determine the current or future, use, needs or protection of natural or man-made resources;
- Provide scientific basis for decision making about both regulatory and non-regulatory approaches;
- to preserve natural resources;
- To show the location and extent of existing resources, such as farmlands, surface and ground waters, and related features.

Resources

- Tree Care Industry Association, http://www.treecareindustry.org/public/gov_standards_a300.htm
- Natural Resources Conservation Service, <http://www.wa.nrcs.usda.gov/technical/NRI/index.html>
- Tree Protection during Construction, Owen E. Dell, landscape architect and contractor, P.O. Box 30433, Santa Barbara, CA 93130, 805-962-3253. Fact sheet with tips for making decisions about trees during site evaluation, design and construction.
- Pacific Northwest Chapter, International Society of Arboriculture, Silverton, OR. 503-874-8263, fax 503-874-1509, or e-mail info@pnwisa.org. Website, www.pnwisa.org/ provides lists of area certified arborists.
- Cooling Our Communities—A Guidebook on Tree Planting and Light-Colored Surfacing, Lawrence Berkeley Laboratory Report LBL-31587 (1992). To order, write to Superintendent of Documents (GPO Document #055-000-00371-8), PO Box 371954, Pittsburgh, PA 15220-7954. Attn: New Orders. Also available from Iris Communications, Eugene, OR, 800-346-0104 or www.oikos.com.

2-12

Conduct a third party review of the site development plan for critical areas and habitat protection (e.g. botanist, arborist, landscape architect)

5 POINTS

Resources

See Resources from Action item 2-11 above

2-13

Implement a plan to conserve the elements identified by the resource inventory as high priority resources. Create a protection and maintenance plan for priority natural resources/areas during construction

6 POINTS

A Plan is Implemented to Conserve the Elements Identified by the Resource Inventory as High Priority Resources. Create a Protection and Maintenance Plan for Priority Natural Resources / Areas During Construction.

Resources

See Resources from Action item 2-11 above

2-14

All tree pruning on site is conducted by or supervised by a Certified Arborist

2 POINTS

Resources

See Resources from Action item 2-11 above

2-15

Basic training in tree or other natural resource protection is provided for the on-site supervisor

3 POINTS

Resources

See Resources from Action item 2-11 above

Slope Disturbance

- 2-16 Long-term erosion effects are reduced through the design and implementation of terracing, retaining walls, landscaping, and restabilization techniques

6 POINTS

Defensible Space Precautions

- 2-17 Landscape fire buffer around house using native species that are fire resistant

1 POINT FOR PER METHOD

3 POINTS MAXIMUM

Homes built at the interface between wildlands and urban areas face the threat of wildfires. While wildfires are a natural part of Inland Northwest ecosystems, they can destroy life and property. There are many ways that home designers, builders, and owners can prevent homes from igniting. Actions taken to reduce ignition are directed to the area immediately surrounding a home; the home ignition zone. Defensible space zone: minimum 30-foot buffer, (up to 100-foot for steeper ground).

Buffer Plantings:

- Foundation plantings: low growing, free of dead material, well watered
- Use grey water or reclaimed water to keep landscaped areas well watered. (Check with local municipalities for water re-use regulations.)
- Maintain and water fire resistant plants and lawn. For plant material suggestions for the Inland West, see <HTTP://WWW.CNR.UIDAHO.EDU/EXTFOREST/FIREPROTECTBRO.PDF> (University of Idaho: Moscow Idaho)
- Use hardscape features for firebreaks around the home: driveways, gravel, concrete or paved walks and patios
- Raised beds made from non-flammable materials (rocks, brick)
- Use gravel instead of bark mulch against any structures and under decks
- Store firewood 30-100 feet away from any structure; keep vegetation away from pile
- Replace wooden patio furniture with ones made from nonflammable materials (metal and glass)
- Replace wood shake roofs with fire resistant materials

- 2-18 Reduce fire danger by removing underbrush and unhealthy vegetation on site (perform all measures listed in handbook)

3 POINTS

Reducing the amount of unhealthy vegetation around a home will reduce the heat source and in turn limit the possibility of ignition. Research shows that a high intensity wildfire burning 100-200 feet away will not ignite a home's wood walls. Consult with local fire district, DNR, Firewise, or other recognized fire authority for a recommended vegetation plan.

Create a fire resistant landscape for the entire property:

- Remove highly flammable brush, dead trees and shrubs from at least 100 feet around all structures

- Clean pine needles, leaves, and debris from roof, gutters, decks, and yards
- Compost or recycle yard debris instead of burning vegetation
- Prune all dead branches and limbs of trees 6-15 feet from ground. Leave at least 50% of the live branches on tree.
- Eliminate ladder fuels (vegetation structured like rungs of a ladder: leaves, grasses, small shrubs, large shrubs, and trees)

Protect Site's Natural Features

2-19 Avoid soil compaction by limiting heavy equipment use to building footprint and construction entrances

3 POINTS

Compacted soils are less able to absorb water, resist plant root penetration, and lack the porosity needed for adequate aeration. As a result, they tend to increase stormwater runoff, which disrupts the natural water cycle and stream dynamics.

Limit compaction of site soils by restricting and clearly marking heavy equipment use areas. On the jobsite, limit all vehicle traffic to designated areas, restrict parking vehicles on site, and arrange for particularly heavy vehicles (concrete trucks, cranes, etc.) to avoid the need for large turn-around areas. If porous pavement is planned for the driveway, that area should be left undisturbed during construction so that the subsoil is not compressed. An alternate access road should be used for construction vehicles. To protect exposed soils from excess traffic, locate equipment storage and job shack areas for easy access.

2-20 Trenching, significant changes in grade, and compaction of soil and critical root zones in "tree save" areas are avoided

4 POINTS

2-21 Preserve existing native vegetation as landscaping

3 POINTS

Native vegetation is adapted to the Northwest climate of rainy wet winters and dry summers. Retaining native vegetation in a landscape (rather than removing them and then replanting) also provides excellent erosion, sediment, dust, and pollution control. Finally, native plants are more resistant to naturally occurring disease, insects, and low levels of nutrients, thus reducing the need for fertilizer or pesticides.

During building layout, identify existing native plants, including trees and understory plants that you want to save. Precautions during site preparation include:

- Clear only actual areas needed to install driveways, parking areas, and building foundations.
- Clearly mark areas to be graded on plans and field stake or flag on site.
- Identify or flag non-clearing buffers, open spaces, and setbacks from streams, wetlands, and steep slopes as indicated on plat maps.
- Review site areas to be graded with excavation crew to ensure compliance with preservation plan.
- Fence critical areas, such as tree root zones, to prevent crushing or filling. See Action item 2-22 for more information on protecting trees.

- If trees only (not understory) are designated for protection, hand clearing of understory will help protect tree roots. Be careful, however, about exposing some trees by clearing around them—they may become hazards in strong winds or rain. Check with an arborist.
- Check grading operations frequently to prevent accidental damage to marked areas.
- Never park heavy equipment or store heavy materials under trees. See Action item 2-19, *Avoid Soil Compaction by Limiting Heavy Equipment Use to Building Footprint and Construction Entrances*.

Resources

Also see Resources for Action item 2-22. Resources on preservation include:

- *Building Greener Neighborhoods: Trees as Part of the Plan* (see Chapter 5: "The Construction Process"). Available from American Forests, Washington, DC, 202-955-4500 or www.amfor.org. Also available from NAHB. 800-223-2665 or www.builderbooks.com.
- "Preservation Specifications for New Construction Sites," specs for protecting on-site vegetation. Isabelle Greene & Associates, landscape architects, 2613 De la Vina St., Santa Barbara, CA 93105, 805-569-4045.
- Pacific Northwest Chapter, International Society of Arboriculture, Silverton, OR. 503-874-8263, fax 503-874-1509, or e-mail info@pnwisa.org. Website www.teleport.com/~pnwisa/. Provides a list of certified arborists in King and Snohomish Counties.

2-22

Take extra precautions to protect trees during construction

3 POINTS

If you are building in a development, work with your developer as soon as possible to arrange for tree retention.

Whenever possible, consult an arborist to select valuable individual trees for preservation. Keep all excavations, equipment and debris away from trees at a distance two times the size of the canopy from the tree trunk (drip line) when possible (this protects the root systems). If you must cut roots, cut as few as possible. Cut them cleanly. Once you remove the tree, get the rootball into a moistened burlap sack as soon as possible and re-bury the roots. (The roots begin to dry out almost immediately. Keeping the roots moist, preferably with the soil intact, helps minimize the impact of transplanting.) Preserve most of the important feeder roots. Whenever possible, protect entire stands of trees.

Post signs on trees to be saved, clearly indicating the tree's monetary value (cost of replacement). Charge subcontractor for tree damage based on these dollar values (optional).

Trees moderate surface temperatures, thereby reducing building heating and cooling requirements. Specifically, they can increase savings on energy bills by providing shade in summer and wind protection in winter. Trees also reduce stormwater runoff, reducing urban peak runoff, stabilizing soils, and preventing air pollution. All of which have great economic value to cities. Another benefit is that trees provide habitat for local wildlife. Studies show that a single mature tree can provide nearly \$300 annually in energy and resource value in terms of cooling, erosion and pollution control, and wildlife shelter. Trees may also protect some of your site's critical features like stream buffer zones.

In general, homes with mature trees sell for more money and at faster rates. According to 1,350 real estate agents surveyed by Bank America Mortgage, more than 50% believe trees have a positive impact on potential buyers' impressions of homes and neighborhoods. Additionally, 84% felt that a home with trees would be as much as 20% more salable. A NAHB survey reported that 43% of home buyers paid up to \$3,000 more, and 27% spent over \$5,000 extra for wooded lots. Studies in some regions of the country have found trees add as much as 30% to the selling price of lots.

Table 2-1 Potential Problems Associated with a Few Specific Trees

Tree Type	Potential Problems/Recommended Strategy
Dogwood Douglas Fir Maple Red Alder Western Hemlock Western Red Cedar	They may not adjust to environmental changes as easily as other species. Keep disturbance of these trees to a minimum.
Pacific Silver Fir	If very tall, they can tip over easily. Watch height.
Douglas Fir Western Hemlock	Thinning increases the possibility of tipping over. Keep stands of these trees dense.
Cottonwoods Maples Willows	Water-seeking roots—These trees thrive well in high moisture areas but keep away from sewer lines and filter fields.
Grand Fir Noble Fir Pacific Dogwood Pacific Silver Fir Red Alder Sitka Spruce Western Hemlock Western Red Cedar	Keep stands of these trees dense, whether one type or mixed varieties. These trees are very prone to disease caused by thinning or damage to any part of the trees.

Resources

Resources on preservation include:

- “Tree Protection during Construction,” Owen E. Dell, landscape architect and contractor, P.O. Box 30433, Santa Barbara, CA 93130, 805-962-3253. Fact sheet with tips for making decisions about trees during site evaluation, design and construction.
- Pacific Northwest Chapter, International Society of Arboriculture, Silverton, OR. 503-874-8263, fax 503-874-1509, or e-mail info@pnwisa.org. Website, www.teleport.com/~pnwisa/, provides lists of area certified arborists.
- *Cooling Our Communities—A Guidebook on Tree Planting and Light-Colored Surfacing*, Lawrence Berkeley Laboratory Report LBL-31587 (1992). To order, write to Superintendent of Documents (GPO Document #055-000-00371-8), PO Box 371954, Pittsburgh, PA 15220-7954. Attn: New Orders. Also available from Iris Communications, Eugene, OR, 800-346-0104 or shop.oikos.com/catalog.

2-23

Retain trees on site

1 POINT PER 20% PRESERVED
5 POINTS MAXIMUM

See Action item 2-22 above.

2-24

If building near wetlands, shorelines, bluffs, and other critical areas, preserve & protect beyond code or local requirements

3 POINTS

Numerous federal, state and local laws affect the use and protection of wetlands and other critical areas. Because of the considerable variation in local regulations, contact your local planning department to determine what actions constitute going beyond code.

Wetlands and riparian areas provide essential cover, feeding, nesting and breeding habitat for many species of fish and wildlife. They provide critical hydrological function by acting as a sponge, buffering the effects of storms on creeks. This buffering effect allows peak velocities to be reduced during storm events and provides base flows during dry times. Wetlands can also act as a natural recharge area for groundwater.

Protect wetlands and riparian areas from sediment using appropriate best management practices such as compost slope mulching and silt retention berms. Leave a vegetated buffer zone, a minimum of 100 feet wide on each side along streams or other water bodies unless approved plans indicate larger buffers are required. (Check with your local jurisdiction for buffer size requirements.)

Steep slopes are inherently unstable areas. Careful management of site drainage is probably the most cost-effective approach to minimizing bluff hazards. Even when circumstances dictate significant structural stabilization efforts, site drainage remains an essential component of proper management.

Throughout the construction process, maintain erosion control measures. See Action items 2-29. Numerous federal, state, and local laws affect the use and protection of wetlands and other critical areas. Because of the considerable variation in local regulations, contact your local planning department for requirements.

Resources

- *Protecting Natural Wetlands – A guide to Stormwater BMP's*, EPA, Office of Water (4502F) Washington, DC, EPA 843-13-96-001, October 1996. Call the Wetlands Hotline: 800-832-7828 or www.epa.gov/region04/water/wetlands/technical/bilio-online.htm.
- *Stabilization and Erosion Control Using Vegetation: A Manual of Practice for Coastal Property Owners*. Washington State Department of Ecology. 360-407-7472. Available on the "Surface Water and Groundwater on Coastal Bluffs" website: www.wa.gov/ecology/sea/pubs/95-107/using01.html. This site also contains information on drainage control, slope drainage, planning, case studies, links, and more.
- *Vegetation Management: A Guide for Puget Sound Bluff Property Owners*. Washington State Department of Ecology, 360-407-7472, www.ecy.wa.gov/biblio/9331.html.

2-25

Set aside percentage of buildable site to be left undisturbed

1-5 POINTS

POINT ALLOCATION	1 POINT	3 POINTS	5 POINTS
FOR LOTS < 0.25 ACRES	10%	15%	20%
FOR LOTS UP TO 1 ACRE	20%	30%	40%
FOR LOTS BETWEEN 1-5 ACRES	35%	50%	70%

This Action item requires that you set aside a percentage of the site that will not be cleared or graded. Include any critical areas in the set aside land area. The following points can be earned for setting aside undisturbed area:

Setting aside undisturbed areas helps preserve soil, water, and vegetation. Undisturbed areas stabilize soils and filter sediments from storm water runoff before they enter waterways. They also allow rainwater to stay on site and soak into the ground, recharging groundwater, instead of running off site. In addition, they provide a cost-effective head start on landscaping. Preserving natural features can add landscape beauty, enhance fish and wildlife habitat, and reduce noise. To ensure the benefit of this measure, set aside areas should be protected by covenant.

Coordinate with the grading designer and equipment operators to let them know about this goal and to help you come up with creative solutions. Review the set aside plans with subs, especially grading and excavation crews.

Resources

- *Building Greener Neighborhoods: Trees as Part of the Plan* (see Chapter 5: "The Construction Process"). Available from American Forests, Washington, DC, 202-955-4500 or www.amfor.org. Also available from NAHB: 800-223-2665 or www.builderbooks.com.
- The American Forests website, www.amfor.org, has information about CITYgreen, a GIS software that can model and map the cost savings from maintaining trees for a small site, such as a new subdivision. Select "Green Cities" option.

2-26

Measures are planned and implemented that will support wildlife habitat

4 POINTS

See Resources from Action item 2-11 above

2-27

Previously compromised environmentally sensitive areas are mitigated or restored

5 POINTS

Protect Natural Processes On-Site

2-28

Natural water and drainage features are preserved and used

6 POINTS

2-29

Install and maintain temporary erosion control devices that significantly reduces sediment discharge from the site beyond code requirements

2 POINTS

Erosion control best management practices (BMPs) are designed to minimize the loss of soil during construction. Often, as construction projects get underway, BMPs are installed, but not maintained on a regular basis. Check and maintain all BMP strategies regularly to avoid erosion. Better yet, provide back up to temporary control devices for additional protection.

In large development projects, specific measures for stormwater collection, storage, and treatment are required as part of the permitting process. The following are environmentally friendly approaches for any size development.

- Use compost barriers or berms, or silt control fencing at appropriate locations (choose filter fabric with proper porosity and ability to trap sediments for type of soil and its location). Recent studies by Washington State Department of Transportation and others have found properly constructed compost berms to be more effective and less costly than fabric fences for silt control.
- Install stabilized construction entrance (quarry spall or crushed rock). See Action item 2-19, *Avoid Soil Compaction by Limiting Heavy Equipment Use to Building Footprint and Construction Entrances*.
- Protect adjacent and downstream properties from adverse effects of increased runoff.
- Mulch exposed soils or use plastic sheeting. See Action item 2-48, *Preserve and cover topsoil on site for reuse*.

- Install temporary straw bale erosion and sedimentation control check dams in ditches during construction.
- Compost or hydroseed exposed areas as soon as possible.

Using compost for erosion control is a relatively new application (check with your local code enforcers and stormwater management officials first). Slightly coarse to coarse types of compost are well suited for holding surface soil in place even during heavy rainfall. See Action item 2-30, *Use Compost to Stabilize Disturbed Slopes*, for more information on using compost.

2-30

Use compost to stabilize disturbed slopes

1 POINT

This credit is only available on sites with defined slopes.

Soil left exposed on slopes will erode. Research has shown that compost can often outperform conventional slope stabilization methods.

Grade the slope to a ratio no steeper than 2 horizontal to 1 vertical (the maximum allowed by the UBC), or terrace steeper slopes with retaining walls. Apply compost to cover the entire exposed soil surface, extending approximately 3 feet over the top of the slope or meshing into existing vegetation. The compost application rate will vary depending upon degree of slope, soil type, and compost characteristics. As a rule of thumb, however, a 3 to 4-inch layer of compost will effectively control erosion on a slope of up to 45% for between one and three years.

Composts containing particles that range in size (½" or greater) will produce a more stable mat. Stable, relatively dry yard trimmings compost will also filter and bind pollutants from stormwater, reintroduce organic material, and enhance water retention/infiltration. Avoid very coarse composts if the slope is to be landscaped or seeded. In environmentally sensitive areas or where water quality is a concern, use only compost made from yard trimmings, uncontaminated wood by-product based materials, or well-stabilized biosolids.

Resources

- *Field Guide to Compost Use*, U.S. Composting Council, Alexandria, VA. 440-989-2748 or compostingcouncil.org. Limited supplies available: read-only version on website.
- *Summary of Projects Using Yard Debris Compost for Erosion Prevention and Control*, Portland Metro, Portland, OR. Available from Metro Regional Environmental Management, 600 NE Grand Ave., Portland, OR 97232-2736, Attn: Records. Send \$5.00 check for postage and handling.

Erosion control fabric:

There are a number of quality landscape fabrics available through local suppliers. When requesting a fabric, check to see if a recycled-content option has become available locally. Some environmentally friendly erosion control fabrics are:

- FibreNet, American Excelsior Co. 800-777-7645 (SOIL) or www.amerexcel.com. 100% biodegradable erosion control netting.
- North American Green erosion control blankets made of wheat straw and coconut fiber, available at ACF West, Portland, OR. 503-771-5115 or www.acfwest.com.
- BonTerra coconut or straw (or mixed) erosion control blankets, BonTerra America. 800-882-9489, e-mail: bonterra@moscow.com, or www.bonterraamerica.com. Available through Layfield Plastics. 800-796-6868 or www.geomembranes.com. Layfield carries other organic erosion control products for all applications.
- "Landlok," Synthetic Industries, Chattanooga, TN. 800-FIX-SOIL, 423-899-0444 or www.fixsoil.com. Erosion control mats with 15% recycled content. Available through Northwest Linings. 800-729-6954.
- Fabriscape, Inc., Chicago, IL. 800-992-0551 or www.fabriscape.com. Supplier for landscape fabrics for a variety of purposes, including slope containment. Check for environmentally friendly options.

2-31

Hydroseeding:

Specify hydro mulch with recycled cellulose:

- Fiber Mulch, Thermoguard. 800-541-0579 or 509-535-4500
- Nature's Own, Hamilton Mfg. Inc. 208-733-9689 or www.hmmfg.com.
- Agri Fiber Mulch, Greenstone/LP Corp. 916-387-9754 or www.greenstone.com.
- Conwed Hydro-Mulch, Pacific Products. 888-933-7770.

Stabilize disturbed areas within 14 days that are complete or will be left unworked for greater than 21 days using methods as recommended by the EPA or in the approved storm water pollution prevention plan (SWPPP), where required

3 POINTS

Bare soil will erode due to wind and water. Seed, replant, or cover exposed soils with compost, mulch, vegetation, and/or matting as soon as practical. Use wildflower seeds appropriate for this region for color and interest, such as along driveways. All disturbed areas should be treated in some way with landscaping, site features, or erosion control devices.

Grade the slope to a ratio no steeper than 2 horizontal to 1 vertical (the maximum allowed by the UBC), or terrace steeper slopes with retaining walls. Apply compost to cover the entire exposed soil surface, extending approximately 3 feet over the top of the slope or meshing into existing vegetation. The compost application rate will vary depending upon degree of slope, soil type, and compost characteristics. As a rule of thumb, however, a 3- to 4-inch layer of compost will effectively control erosion on a slope of up to 45% for between one and three years.

Composts containing particles that range in size (½ or greater) will produce a more stable mat. Stable, relatively dry yard trimmings compost will also filter and bind pollutants from stormwater, reintroduce organic material, and enhance water retention/infiltration. Avoid very coarse composts if the slope is to be landscaped or seeded. In environmentally sensitive areas or where water quality is a concern, use only compost made from yard trimmings, uncontaminated wood by-product based materials, or well-stabilized biosolids.

Resources

- *Field Guide to Compost Use*, U.S. Composting Council, Alexandria, VA. 440-989-2748 or compostingcouncil.org. Limited supplies available: read-only version on website.
- *Summary of Projects Using Yard Debris Compost for Erosion Prevention and Control*, Portland Metro, Portland, OR. Available from Metro Regional Environmental Management, 600 NE Grand Ave., Portland, OR 97232-2736, Attn: Records. Send \$5.00 check for postage and handling.

There are a number of quality landscape fabrics available through local suppliers. When requesting a fabric, check to see if a recycled-content option has become available locally. Some environmentally friendly erosion control fabrics are:

- FibreNet™, American Excelsior Co. 800-777-7645 (SOIL) or www.amerexcel.com. 100% biodegradable erosion control netting, also Recyclex® - permanent erosion control mat made from 100% recycled post-consumer "green soda bottles." www.curlex.com/pro_recyclex.php.
- North American Green erosion control blankets made of wheat straw and coconut fiber, available at ACF West, Portland, OR. 503-771-5115 or www.acfwest.com.
- BonTerra coconut or straw (or mixed) erosion control blankets, BonTerra America. 800-882-9489, e-mail: bonterra@moscow.com, or www.bonterraamerica.com. Available through Layfield Plastics. 800-796-6868 or www.geomembranes.com. Layfield carries other organic erosion control products for all applications.

- Fabriscape, Inc., Chicago, IL. 800-992-0551 or www.fabriscape.com. Supplier for landscape fabrics for a variety of purposes, including slope containment. Check for environmentally friendly options.
- Specify hydro mulch with recycled cellulose:
- Fiber Mulch, Thermoguard. 800-541-0579 or 509-535-4500 (warehouse in Tukwila).
 - Nature's Own, Hamilton Mfg. Inc. 208-733-9689 or www.hmi-mfg.com/ec__.php.
 - Conwed Hydro-Mulch, Pacific Products. 800-508-8681 or www.conwedfibers.com/mulches/hydromulch2000.html. Call 800-336-1180 for a local distributor.

2-32

Balance cut and fill, while maintaining original topography

3 POINTS

Minimizing or balancing cut and fill avoids expensive exporting or importing of topsoil. If you need to import fill to the site, use only approved materials for filling and grading. Avoid radically altering the basic topography to maintain existing site hydrology as much as possible.

This credit is not applicable for fully excavated sites.

2-33

Limit grading to 15 feet around structures, septic, ground-source heat pump fields, except for driveway access

4 POINTS

Soil that is compacted or contaminated by construction activity may become lifeless (see Action item 2-19, *Avoid Soil Compaction by Limiting Heavy Equipment Use to Building Footprint and Construction Entrances*). Designing for minimal grading helps retain healthy soil and natural water infiltration processes. Where grading is unavoidable, carefully remove and stockpile existing topsoil (see Action item 2-48, *Preserve and cover topsoil on site for reuse*), replacing it after rough grading.

This Action item is difficult to achieve on infill lots. In this case, apply 4" of compost to amend soils (see Action item 2-30, *Use Compost to Stabilize Disturbed Slopes*).

Avoid disrupting existing drainage patterns and minimize grade changes where possible. Grading for stormwater control should direct water to planted areas to minimize irrigation needs.

2-34

Amend disturbed soil with compost or suitable soil amendments to a minimum depth of 10" to restore soil environmental functions

4 POINTS

Test soil by a reputable soil lab to get data about the site soil's chemical and physical condition, as well as its biological health. These labs will provide specific recommendations for optimum soil amendment. Amendments may include sand or gravel for improved drainage, lime or other pH modifiers, or organic manure or compost to improve nutrient availability. Compost amendments reduce summer irrigation demand, reduce stormwater runoff and erosion, improve soil quality, and improve turf aesthetics.

Compost should be mature and stable. Ask your supplier for "Grade A" compost as defined by the Washington State Department of Ecology's Compost Guidelines. Mature composts settle less, provide stable nutrient sources, bind metals, and provide higher levels of beneficial organisms.

As a rule of thumb, a 2 to 1 ratio of existing soil to compost, by loose volume, will achieve the desired organics level of 8 to 13% by soil weight. The final depth of the amended soil will be between 10 to 12 inches, depending upon the equipment you use.

Resources

- Washington Organic Recycling Council, website provides information on soil health and function, includes resource list for compost specifications, erosion control, and case studies, <http://www.soilsforsalmon.org/>

2-35

Replant or donate removed vegetation for immediate reuse

2 POINTS

Plants and trees to be removed for construction can often be reused for landscaping on site. Replant as soon as possible and make sure you follow appropriate procedures so plants survive. If you can't replant immediately, protect the root ball while waiting to replant and water as needed. See Action item 2-21 *Preserve Existing Native Vegetation as Landscaping*.

Keep all excavations, equipment, and debris away from trees at a distance two times the size of the canopy from the tree trunk (drip line) when possible to protect root systems. If roots must be cut, cut as few as possible and cut cleanly. Immediately after removing the tree, transfer the root ball into a moistened burlap sack and re-bury the roots. This action keeps roots from drying out, minimizing the impact of transplanting. Preserve most of the important feeder roots. Whenever possible, protect entire stands of trees. For additional requirements, refer to municipal code and standards.

Some nurseries participate with local organizations involved in restoration projects to salvage native plants from development sites. See the Part II, *Section Two Resources* for this Action item for contact information.

2-36

Use plants donated from another site

2 POINTS

A developer can use plants/trees from other areas in the development or individual builders can work with local developers or other builders, to secure plant material being removed from sites. Or you can use plants from another of your projects.

2-37

Grind land clearing wood and stumps for reuse

3 POINTS

For builders working on multiple sites or large developments, grinding land cleared wood waste can be a cost-effective way to reduce jobsite waste and provide opportunities to reuse the material as mulch (on site or at other locations). Mulch can renew the soil by improving water and nutrient retention and can also be used to protect stockpiled topsoil. See Action item 2-48, *Preserve and cover topsoil on site for reuse*.

Always meet dust control requirements. Check with local jurisdiction for dust control requirements for construction projects.

Note: If grinder operates at a site for more than 30 days in a 12 month period, a permit may be required to operate. Check regulations in your area.

Resources

Grinders generally handle 6-inch maximum diameter materials. A 10 x 10 woodpile can be reduced to mulch and used to landscape the final project. Trees that are not ground can be cut for landscaping posts, fences, or firewood. For local mobile grinding services see:

- Check the phone book under "Land Clearing" for additional mobile grinder operators in your area.

2-38

Use a water management system that allows groundwater to recharge on site

5 POINTS FOR 50%

10 POINTS FOR 100%

Groundwater is a resource that may have only minimal direct impact on a particular site, but its purity is an important issue downslope where it seeps to the surface or is pumped out of the ground as potable water. Groundwater is "recharged" from surface waters infiltrating into natural recharge areas. It is important to understand the hydrology of your site so as not to interfere with these areas. See Resources Section for reference to Surface Water Design Manual.

In addition to preserving groundwater recharge zones, landform engineering can help reestablish proper water functions that may have been disrupted during site development. Landform engineering is the act of using the natural movement of water while manipulating and enhancing existing topographic conditions to improve a site's ability to catch, hold, and absorb water, mimicking natural drainage features. Water storage and nutrient collection processes contribute to forming a healthier ecological community within the landscape. This process allows water to infiltrate into the ground and enrich the life of the soil ecology. Examples of landform engineering that can contribute to a water management system include: mulching, contour trenches, swales and terraces, check dams, dry wells and sand traps, retention basins, and diversion ponds. Other alternative strategies include roof infiltration systems, level spreaders, and rainwater storage vaults or dispersion systems. These systems can be used alone or in combination to put runoff back in the ground through infiltration or dispersion through natural vegetation. Avoid directing runoff directly to a natural or constructed drainage system and keep runoff and sediment on site.

Resources

See Resources, *Surface Water Management*, for sources of information related to stormwater management and erosion control: particularly:

Landscape Plan

2-39

Species and locations for tree planting are identified that will provide summer shading of the dwelling and parking areas to moderate temperatures

5 POINTS

Properly placed trees within the landscape can be as effective as other home improvements in reducing heating and cooling costs. Good selection and placement of trees within the landscape can help cool your house in summer and allow the sun to warm the house in winter.

Effective tree placement will allow the winter sun to warm the roof and walls of your house. Placing deciduous trees that lose their canopy in the winter on the south side of the house allows solar access to these areas during winter, and shade during the summer.

Using landscaping to create microclimates that either encourage or prevent wind, light, or water to reach certain areas of the property can benefit on-site structures. Energy-conscious landscaping design can result in reduced operational costs for the homeowner, greater comfort, and less energy use. Deciduous trees placed south and west of the home can reduce heating and cooling loads by providing shading during hot summer days, and allowing winter sun to penetrate windows.-According to the U.S. Forest Service, trees properly placed around buildings (see Figure 2-2) can reduce air conditioning needs by 30 % and can save 20-50% in energy used for heating. Well-placed windbreaks of evergreens can reduce a building's heating bill by up to 20%. Examples of energy-saving design include:

- Maximum southern exposure with most windows facing south.
- Plantings on the east and northeast to filter the sun without blocking the light.
- Plantings on the south to create shade and channel breezes in summer without obstructing sun in winter.
- Mid-range colored materials for driveways, walkways, and parking spaces to reflect sun in summer and to absorb and re-radiate heat in winter.
- Paved areas located away from south windows and shaded with plantings.

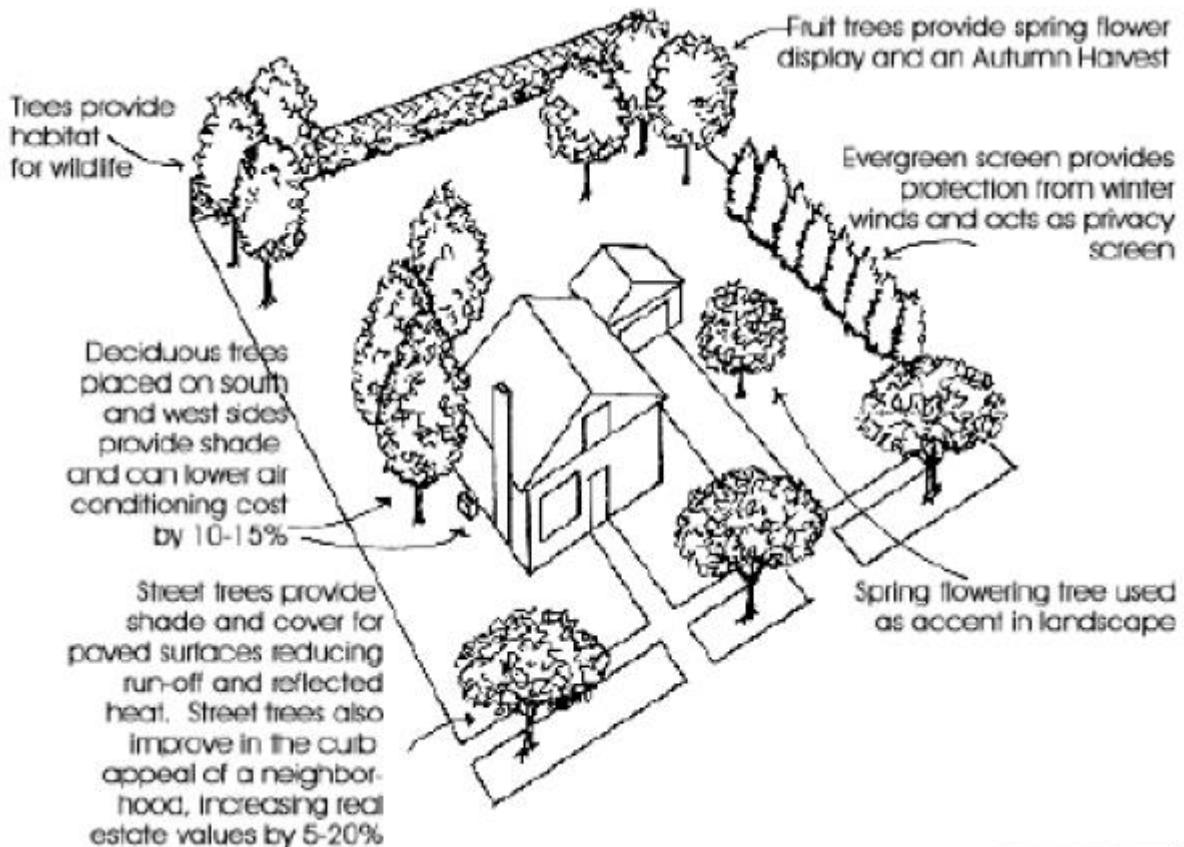


Figure 2-2 Tree Placement to Reduce Heating/Cooling Loads Naturally
(Source: Cool Communities, www.coolcommunities.org)

2-40

Vegetative wind breaks or channels are designed as appropriate to local conditions

4 POINTS

2-41

Achieve a Green Factor Score for urban or infill under 1 acre

1 POINT FOR A SCORE OF 0.3

2 POINTS FOR A SCORE OF 0.4

3 POINTS FOR A SCORE OF 0.5

4 POINTS FOR A SCORE OF 0.6

5 POINTS FOR A SCORE OF 0.7

The Seattle Green Factor is a program that requires new development in neighborhood business districts to meet a landscaping target using a menu of landscaping strategies that have been assigned variable points based on their efficacy. The Green Factor is designed to improve the amount and quality of urban landscapes, while allowing greater flexibility for developers and de-signers to meet open space requirements.

The Green Factor encourages layering of vegetation in areas visible to the public and in the public rights-of-way directly adjacent to new development. The program works using a simple spread -sheet that assigns variable points for different landscaping options. The values range from a factor of 0.2 to a factor of 0.7. Lower values correspond to lawn and groundcovers, small plants, while larger trees and shrubs, depending on their sizes are awarded higher corresponding point values. Bonuses are provided for rainwater harvesting and choosing plants with low water requirements. Use of larger trees, tree preservation, green roofs, and vegetated walls trigger more credits towards meeting a specific numerical target. A worksheet helps applicants calculate their project's score, allowing them to try different combinations of features to reach the requirement. The number of plants or the

square footage is multiplied by its point factor. Increasing plants or square footage will accomplish the aggregate 0.3 green factor.

In addition to being attractive, new green elements in the landscape will improve air quality and help reduce energy consumption, cooling the city in the summer and insulating it in the winter. They will also reduce stormwater runoff, decreasing water pollution and public infrastructure costs. For more information, see <HTTP://WWW.SEATTLE.GOV/DPD/CITYPLANNING/COMPLETEPROJECTSLIST/GREENFACTOR/>

2-42

Plant only trees that when full grown still allow for future solar install on south-side of property

3 POINTS

Impervious Surfaces

2-43

Install vegetated roof system (e.g. green roof) to reduce impervious surface

1 POINT PER 10% OF ROOF

10 POINTS MAXIMUM

Eco-roofs or green-roof systems are best suited for low-slope roofs. They are designed to protect the roof, permit the use of rooftop plantings, provide energy benefits, and provide initial water quality benefits. More commonly used in Europe, green-roofs can detain over 50% of rainwater from a typical storm. Stormwater detention reduces the often-high loads placed on sewer systems after a rainfall. Recent studies conducted in Germany show that green roofs can be effective in improving the quality of roof runoff.

Multi-layered green-roof systems are thicker than conventional roofs. Space must be allocated for the unusual insulation and roofing membranes. A green-roof includes a synthetic waterproof membrane, a drainage layer, a thin soil layer (2 to 4 inches), and a cover with specific plant species adapted to the extremes of a rooftop environment. A thick sod of native grasses interspersed with wildflowers can be a wonderful architectural element.

The green-roof can be very low maintenance, and is self-sustaining without need of irrigation, fertilizers, or pesticides. The first cost may be about 50% more than a good quality conventional roof, but they last about twice as long so they have a relatively low life cycle cost. They also help to reduce building heat gain and urban heat islands (temperature differences between developed and undeveloped areas that can affect the microclimate and human and wildlife habitat.). Additionally, the plantings absorb carbon dioxide. Consult an expert on installation and maintenance needs.

To receive credit must be at least 25% of all structures.

Table 2-2 Comparisons of Eco roofs and Conventional Roofs
 (Source: Tom Lipton, Spawning Great Ideas Proceedings)

Characteristic	Eco-roof	Conventional Roof
Stormwater Retention	15 to 35% in wet season, 65 to 100% in warm season	None
Peak flow mitigation	All storms	None
Temperature mitigation	All storms	None
Improves water quality	Yes, retains atmospheric deposition and retards roof material degradation	No
Air Quality	Filters air, prevents temperature increases, stores carbon	None
Energy Conservation	Approaches predevelopment air/surface energy relationship; insulates structures	None
Vegetation	Allows seasonal evapo-transpiration; provides photosynthesis, oxygen-carbon-water balance	None
Greenspace	Can replace 100% of greenspace lost to building footprint, although greenspace quality may be lost	None
Habitat	For some insects and birds	None
Livability	Buffers noise, eliminates glare, alternative aesthetic, offers passive recreation	None
Costs	About 30 to 60% more expensive for construction including retrofits	Highly variable from \$2 to \$10/ft ² for new construction and \$4 to \$5/ft ² for retrofits
Potential cost off-sets	Energy savings, higher rental values, sewer fee reductions, reduced need for insulation materials, reduced waste to landfills	None
Durability	Waterproof membrane protected from solar and temperature exposure, lasts more than 36 years, membrane protected from O&M staff damage	Little protection, exposure to elements, lasts less than 20 years
Maintenance	Once or twice a year to tend plants, once a year to assure drains are not clogged and check for damage from O&M	Once a year to assure drains are not clogged and check for damage from O&M

2-44

Use pervious materials for driveways, parking areas, walkways, and patios

2 POINTS PER 33% PERVERIOUS ACHIEVED

6 POINTS MAXIMUM

Pervious paving materials help to maintain water hydrology of the site. Pervious paving materials may initially cost more than conventional paving materials (such as asphalt), but pavement replacement is simplified, and expensive measures such as asphalt cutting for underground repairs are eliminated. Examples of permeable options include:

- Porous or "No Fines" concrete
- Uncompacted gravel (Note 1)

- Crushed stone (Note 1)
- Open or porous paving blocks
- A "Hollywood" driveway design (Note 2)

Notes:

1. Gravel or crushed stone is not considered pervious for *driveways* or *parking areas*. These materials will generally compact under vehicle traffic, unless it is reinforced with a cellular containment product. Use gravel and crushed stone for walkways and other light traffic areas.
2. A "Hollywood" driveway is made of 2 long strips of pavement for car support. The area between should be vegetated (preferably with a low-grow turf) or filled with gravel. Vegetated strips provide some infiltration of runoff, sediment filtering, and pollutant removal.

"Disconnecting" impervious surfaces on site is as important as the materials you select. Avoid situations in which one impervious surface drains onto another impervious surface, which magnifies stormwater runoff problems. A paved driveway, for example, should not drain onto a paved street. Try to separate impervious surfaces with areas of turf, other vegetation, or gravel. Curbs should be avoided, and the paved surfaces and vegetate filter strip. Filter strips should slope (no more than 5%) downhill away from the paved surfaces. Grass in these strips are to be used as part of the stormwater conveyance system, or any ground cover (groundcover should be dense enough to discourage channelizing and erosion).

Eliminate Water Pollutants during Construction

The Washington State Department of Ecology offers a variety of publications as part of their Hazardous Waste and Toxics Reduction Program. To order, by telephone call 360-407-7472. Or see www.wa.gov/ecology/pubs.html or e-mail ecypub@ecy.wa.gov. Recommended publications include (URL given where the publication is available online):

- *Free Help for Businesses* (Publication #96-407). This fact sheet summarizes free technical assistance offered by the DOE's Hazardous Waste and Toxics Reduction Program. Available online at www.wa.gov/ecology/pubs/96407.pdf.
- *Hazardous Waste Generator Checklist* (Publication #91-012b). This checklist will help you determine if your business produces hazardous wastes and summarizes your responsibilities if you do.
- *Hazardous Waste: More Common Than You Think* (Publication #91-012a.) This report identifies businesses, which generate hazardous waste, and gives examples of the different categories of hazardous waste. It also offers suggestions about reducing and recycling hazardous waste.
- *Hazardous Waste Service Providers Directory* (Publication #98-412). This directory is intended to assist hazardous waste generators to identify and contact businesses that will help manage hazardous wastes. It also contains names and addresses for Moderate Risk Waste Coordinators listed by County and Native American Tribal Contacts. Available online at www.wa.gov/ecology/pubs/98412.pdf.
- *Pollution Prevention Planning Guidance Manual* (Publication #91-2). Available online at www.wa.gov/ecology/pubs/q1002.pdf.
- *Sara Title III, Emergency Planning and Community Right-to-Know, A Guide for Business* (Publication #93-BR-01). Available online at www.wa.gov/ecology/pubs/q3bro01.pdf.
- *Site Hazard Assessment Guide* (Publication #F-TC-91-111). This Washington State Department of Ecology Focus Sheet relates to site hazard assessments, which is the first step in the process for cleaning up a hazardous waste site.
- *Step by Step: Fact Sheets for Hazardous Waste Generators* (Publication #91-012). This packet of information contains guidance for generators of hazardous waste. It includes the following information sheets: how to identify hazardous waste; obtaining a RCRA identification number; filling out annual reports; performing preventive maintenance; how to properly accumulate hazardous waste; planning for emergencies; using and managing containers; arranging for proper transportation and disposal; manifesting shipments of hazardous waste; and keeping records of hazardous waste activities.

- *What is a Small Quantity Generator? Your Regulatory Status Under the Dangerous Waste Regulation* (Publication #96-404). This brochure offers an overview of the standards that apply to small quantity generators. It also lists resources that can offer help. Available online at www.wa.gov/ecology/pubs/g6404.pdf.

Also see:

- *The Regulation of Solid and Hazardous Wastes: A Builder's Guide*, NAHB Research Center, Upper Marlboro, MD, 800-638-8556 or www.nahbrc.org.
- Local hazardous waste resources include:
- The Washington State Department of Ecology, Northwest Regional Office, Hazardous Waste Specialists, 425-649-7040.

Also see the General Resources at the beginning of this Section for information on erosion control.

2-45

When construction is complete, leave no disturbed areas uncovered or unstabilized

2 POINTS

All disturbed areas should be treated in some way with landscaping, site features, or erosion control devices.

Bare soil will erode due to wind and water. Seed, replant, or cover exposed soils with compost, mulch, vegetation, and/or matting as soon as practical. Use wildflower seeds appropriate for this region for color and interest, such as along driveways..

2-46

Do not bury construction waste

1 POINT

Pursuant to state regulations, all solid waste, including construction waste generated by contractors, must be disposed of at a proper disposal site permitted by the jurisdictional health department. Demolition waste can be disposed of at a permitted inert/demolition landfill or other landfill that accepts this material. Call the Department of Ecology's regional offices for information on permitted landfills in your area. The Built Green Program promotes waste reduction and recycling. (*Section Five: Materials Efficiency*, includes more information on ways to reduce your waste and disposal costs.)

- Information on fire protection

Gifts could include:

- Non- or low-toxic cleaning supplies, such as environmentally friendly laundry or dish detergent, or paper products with recycled-content
- Environmentally friendly furnace filter(s)
- Native species flower seeds
- Environmentally friendly gardening supplies

2-47

Establish and maintain a single stabilized construction entrance (quarry spall, crushed rock or concrete)

1 POINT

Since construction traffic can help contaminate storm and surface water, establish a single stabilized entrance to minimize potential impact. Properly constructed, a single entrance can reduce compaction on site (see Action

item 2-19, Avoid Soil Compaction by Limiting Heavy Equipment Use to Building Footprint and Construction Entrances).

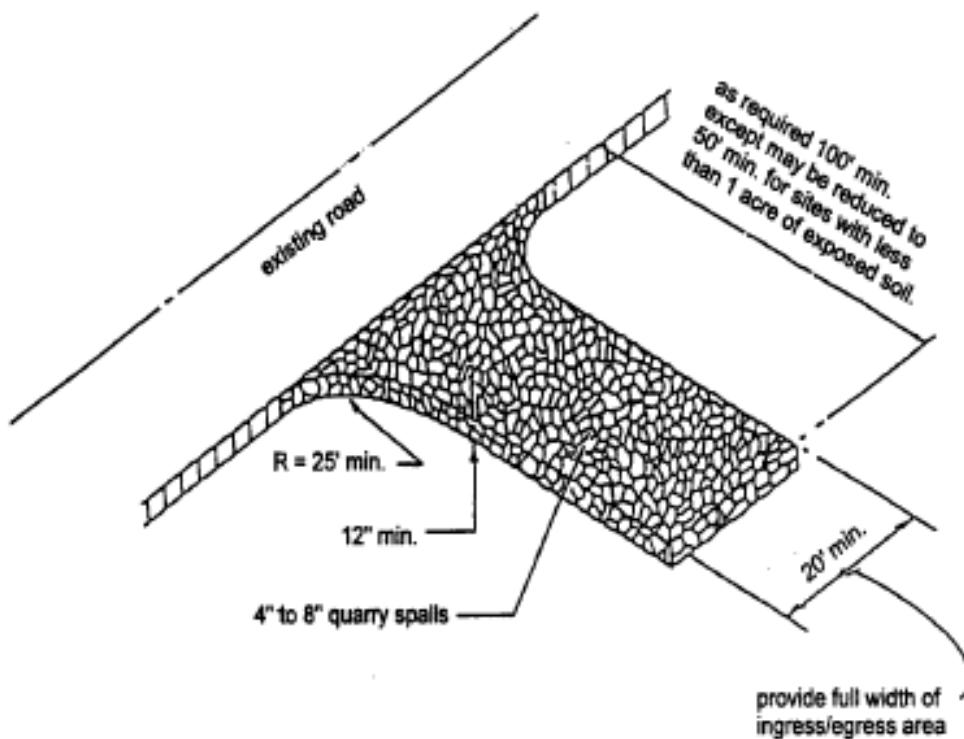


Figure 2-3 Stabilized Construction Entrance

Figure 2-3 Stabilized Construction Entrance illustrates examples of a stabilized construction entrance. Use crushed rock, asphalt, or cement. Pave driveways to the intersecting road edge before installing construction entrance (prevents damage to roadway). Install a driveway culvert if a roadside ditch is present. Construct entrance on a firm, compacted subgrade (reduces maintenance). Place geotextile or groundwood chips under gravel to prevent sediment from pumping up into the rock pad. Grade the entrance so that runoff drains back onto construction site. Direct water draining from tire wash or any other related runoff to sediment trap or pond.

Carry out periodic inspections and maintenance including washing, top-dressing with additional stone, reworking, and compaction. Plan for periodic street cleaning to remove any sediment that may have been tracked out. Sediment should be removed by shoveling or sweeping and transported to a suitable disposal area where it will not be re-eroded. Consider installing fencing as necessary to restrict construction traffic to stabilized entrance.

2-48

Preserve and cover topsoil on site for reuse

3 POINTS

Stockpile topsoil removed during grading for use during final landscaping. The top layer of soil is the most valuable, and should be separated and used again on site as a top layer in grading planting areas. However, bare soil will erode due to wind and water. Protect stockpiled topsoil from erosion by covering with mulch (preferred) or plastic (less preferred because it can cause rapid runoff) until ready for reuse. Surround all stockpiles with a silt fence or compost berm and inspect regularly for proper coverage or sign of erosion, especially after a large storm. Screen soil to remove debris before redistributing for final grading and landscaping.

Native topsoil is best adapted to the site. Limit importing topsoil as much as possible. "New" topsoil is not adapted to your site and thus cannot offer the same nutrient structure, disease resistance, or hydrologic capabilities.

If you do have extra topsoil remaining after final grading and landscaping, consider mixing it with non-organic and inert material to be used as fill (make sure fill materials are clean). Also you can use it in the construction of slopes, or sell it to homeowners, landscapers, or other businesses for reuse.

Absolutely no topsoil should be disposed of in low areas or wetlands. Disposing of topsoil in lowlands or wetlands threatens water quality and quantity and endangers wildlife habitat.

2-49

Wash out concrete trucks into storage containers, slab, or subbase areas.

1 POINT

Over the life of a project one to three yards of concrete slurry and lime can be generated from washing out concrete trucks. Cementitious runoff can contaminate the site, harm local waterways, aquatic habitat and fish species, reduce conveyance capacity of surrounding stormwater systems, plug infiltration facilities, and contaminate treatment facilities.

The Stormwater Management Manual requires that Best Management Practices shall be used to prevent or treat contamination of stormwater runoff by pH modifying sources. BMPs include allowing concrete truck chutes, pumps, and internals, along with hand tools, to be washed out only into formed area awaiting install of concrete or asphalt. For equipment that cannot be easily moved or driveway wash-down, the wash water cannot directly drain to natural or constructed stormwater conveyances. Wash water and leftover product can also be contained in a lined container and removed off site for proper disposal such that it does not violate groundwater or surface water quality standards.

Code allows for self-installed concrete washouts on the site. However, these self-installed structures are much less reliable and are prone to leaks. Prefabricated washout containers that are delivered to the site resist damage and protect against spills and leaks.

Resources

For general information about washing out work vehicles see:

- "Vehicle and Equipment Washwater Discharges" (excerpted from *Best Management Practices Manual*) (Publication No. WQ-R-95-56). Washington State Department of Ecology. 360-407-7472 or www.wa.gov/ecology/pubs.html.
- "Concrete Washout" by National Pollutant Discharge Elimination System (NPDES). Available online at <http://cfpub.epa.gov/npdes/stormwater/menufbmps/index.cfm?action=browse&Rbutton=detail&bmp=17>.

2-50

Establish and post clean up procedures for spills to prevent illegal discharges

1 POINT

Requirements for cleaning spills or releases vary with the material. You should become familiar with cleanup procedures for the materials you use regularly. Included in your Clean-up Procedures should be components of a safety program, which considers the range of potential spills and establishes appropriate emergency actions. See the Resources Section for references designed to help you establish clean-up procedures and for contact information for large spills.

Make sure everyone, especially subcontractors, is aware of your procedures by posting them prominently in a central location and referring to them regularly during safety meetings.

Resources

See *Resources, Hazardous Waste*, above. Especially, see:

- Pollution Prevention Users Guide: For use with Pollution Prevention Plan
<https://fortress.wa.gov/ecy/publications/publications/0204023.pdf>, order by telephone 360-407-7472, online at <https://fortress.wa.gov/ecy/publications/UIPages/Home.aspx> or e-mail ecypub@ecy.wa.gov.
- Step by Step: Fact Sheets for Hazardous Waste Generators (Publication #91-012). See Resources, Hazardous Waste, above.

Also, ask for:

- *Reporting Releases of Hazardous Substances* (Publication Number R-TC-94-133). Washington State Department of Ecology. 360-407-7472 or www.wa.gov/ecology/pubs.html.

2-51

Reduce hazardous waste through good jobsite housekeeping

1 POINT

Eliminating sources of hazardous waste by using good housekeeping and non-hazardous alternatives is the best way to curb your hazardous waste generation, reduce costs associated with disposal, improves air quality, and avoid potential liability. If you are not able to substitute less or non-toxic alternatives and still need to purchase a hazardous product, use care in purchasing and managing the product. Here are some ideas:

- Avoid overstocking hazardous materials. Dated materials become hazardous waste.
- Adopt a "first-in, first-out" policy to prevent raw materials from becoming obsolete.
- Label hazardous waste containers properly to avoid mixing incompatible wastes or contaminating clean materials.
- Keep excess material in original containers.
- Keep containers closed to prevent evaporation into the air.
- Control access to storage areas and routinely inspect containers.
- Inspect containers upon receiving. Reject leaking or damaged containers. These can lead to a hazardous materials spill.
- Promptly clean up spills and know response procedures ahead of time.
- Maintain vehicles and equipment at a central location, preferably in a garage or maintenance facility. Keep vehicles tuned and leak-free. Fluids removed from vehicles should be recycled or disposed of at an approved facility.

Resources

See Resources, Hazardous Waste and Action item 2-50, Establish and Post Cleanup Procedures for Spills to Prevent Illegal Discharges.

Software estimating/take off systems are available to help accurately estimate the quantity of materials you will need for a specific job. Trade magazines often review these programs and provide cost and contact information.

2-52

Produce no hazardous waste

3 POINTS

2-53

Construct tire wash, establish and post clean up protocol for tire wash

3 POINTS

For on-site tire wash, make sure the area is:

- Well marked as a wash area.
- No larger than the largest vehicle.
- Posted with a sign that forbids washing with solvents or changing oil and indicates nearest oil recycling area.

In addition, pave and drain the area to an oil-water separator if it is connected to the sanitary sewer, or direct tire wash water to other sediment trap or pond. Provide temporary gravel base on site to keep vehicles clean.

Post tire wash protocol for all trades or field labor using vehicles on site. Procedures may include:

- Washing vehicles off-site. Take them to an appropriate location (in other words, a car wash or back to your central site).
- If taking the vehicle off-site is impractical or counterproductive, perform all washing in a designated area.
- Require biodegradable detergents. Detergents or cleaners containing phosphate are prohibited. Minimize quantity of soap, detergents, or other chemicals used.

Resources

For information about washing out work vehicles in general see:

- "Vehicle and Equipment Washwater Discharges" (excerpted from *Best Management Practices Manual*) (Publication No. WQ-R-95-56). Washington State Department of Ecology. 360-407-7472 or www.wa.gov/ecology/pubs.html.

For information about washing out work vehicles in general see:

- "Vehicle and Equipment Washwater Discharges" (excerpted from *Best Management Practices Manual*) (Publication No. WQ-R-95-56). Washington State Department of Ecology. 360-407-7472 or www.wa.gov/ecology/pubs.html.

2-54

Use slow-release organic fertilizers to establish vegetation

2 POINTS

Studies have shown that 62% of the phosphorus entering Lake Sammamish is coming from single-home residential areas. The primary source for this contaminant is fertilizers and soil wash-off. Excess nutrients promote algae blooms, which in turn threatens fish and aquatic life. Moderate fertilization with natural or natural/synthetic slow-release combination fertilizers will help build soil nutrient reserves and biodiversity without contaminating waterways.

2-55

Use less-toxic form releasers

2 POINTS

Forms are commonly coated with fuel oil to prevent the concrete from sticking to the form. Runoff, incidental drips, and spills contaminate soils and may enter storm drains thereby contaminating surface water. Use less toxic form releasers or strategies, such as "kick-hard," vegetable oil spray, or waxing or painting the forms prior to use.

Resources

- "Kick hard." Don't use form oil at all and clean forms promptly after use. This works on smaller pours.
- Use vegetable oil sprays (mix vegetable oil with water and apply using pump can).
- Wax or paint the forms.

- Cast Off-W, ChemRex, Inc. (makers of Sonneborn Building Products), Shakopee, MN. 800-433-9517. Contains a significantly lower level of petroleum distillate than traditional products.
- BioForm, Leahy-Wolf Co. 847-455-5710. Product is non-toxic, biodegradable, and non-staining.

New products that eliminate the need for wood forms include:

- Steel forms.
- Formadrain, CertainTeed Corporation, Pipe and Plastics Group, Valley Forge, PA. 610-341-6950 or www.certainteed.com. Manufactured out of PVC, it serves as the form, but stays in place. The product is perforated and is designed to drain the foundation or vent radon as well.
- Soy Form Away, SoySolv Industrial Solvents and Cleaners, Tiffin, OH. 800-231-4274, 419-992-4595, or www.sloysolv.com. Water-based, non-toxic, soap and water cleanup and made from a renewable resource. Available through D.J. Stevens Distributing, San Diego, CA. 614-424-3220.

2-56

Use non-toxic outdoor materials for landscaping (plastic, non-treated wood)

1 POINT

Using non-- or low-toxic materials in the landscape helps preserve soil and water quality. Examples include low-toxic wood preservatives, naturally rot-resistant woods, and plastic lumber (preferably with recycled content). See *Section Five: Materials Efficiency Action items 5-117, Use Reclaimed or Salvaged Material for Landscaping Walls* and *5-119, Use 100% recycled-content plastic or wood polymer lumber for decks and porches, or third party certified wood products* .

Resources

For general and product information for low toxic landscape materials and methods, consult:

- *Resource Guide to Sustainable Landscapes and Gardens*, Wesley Groesbeck and Jan Striefel, 1995. Environmental Resources Inc., Salt Lake City, UT.

Unlike wood, recycled-content plastic lumber and landscape edging does not need to be treated with toxic finishes for outdoor use. It also has the benefit of being resource efficient. Your local supplier may carry a brand of recycled-content plastic lumber, but if not, some locally distributed products include:

- ChoiceDek, manufactured by A.E.R.T. (Advanced Environmental Recycling Technologies), Akron, OH. 800-951-5117 or www.choicedek.com.
- SmartDeck, Eaglebrook plastic lumber, Chicago, IL. 312-491-2500 or www.eaglebrook.com. Distributed by Northwest Recreation, Tualatin, OR. 800-448-4858.
- Enviroedge landscape edging (plastic bender board and stakes), Enviroedge Products Co., Huntington Beach, CA. 800-549-3343. Available at Home Depot stores.
- Rebound, Recycled Plastics Marketing (RPM), Redmond, WA. 800-867-3201 or 425-867-3200.
- RESCO plastic lumber, by RESCO Plastics, Coos Bay, OR. 541-269-5485 or www.rescoplastics.com. Available from T. R. Strong Building Systems in Olympia. 360-705-2868 or www.baubuilder.com.
- TREX Easy Care Decking, Winchester, VA. 800-BUY-TREX or www.trex.com. Many local suppliers.
- Vanco Associates, Edmonds, WA. 253-826-9659. Distributes recycled-content plastic landscaping timbers.

See also Section Five Resources: Materials Efficiency for sustainable lumber Action items.

2-57

Do not clear or grade during wet weather periods

5 POINTS

Phase construction and plan ahead to avoid clearing and grading wet weather periods, primarily November through March. This is particularly important for soils that are easily eroded. To find out if the soils at your site qualify as "easily eroded," go to the Soil Conservation Surveys (SCS) at your local library. Each County has these surveys that classify soil types throughout the County. Locate your site on the surveys to determine your site's soil type. The surveys include a discussion of the engineering properties including erosion potential, classified as "light to moderate" or "severe."

Consult your code official for more information. Also consult your local municipality to determine the specific regulations for wet weather clearing and grading that apply for your site.

2-58

Do not use zinc galvanized ridge caps, copper flashing, or copper wires for moss prevention

2 POINTS

Zinc galvanized ridge caps, copper flashing, copper wires, and shingles impregnated with copper or zinc granules are sometimes installed on roofs to discourage moss and other growth. However, they are of environmental concern because the zinc and copper will leach from these products into stormwater. Once a part of the water cycle, they can accumulate to toxic levels in the food chain. See Action item 2-73, *Educate Homeowners about Fish-Friendly Algae/Moss Control*.

Moss and Algae can most effectively be removed using a stiff corn broom on a hot summer day. Avoid the use of pressure washers to remove moss and algae, since these can damage shakes and shingles, reducing their effectiveness and service life.

Resources

See Action item 6-12, Educate Owner/Tenant about Fish-Friendly Moss Control.

Heat Island Mitigation

2-59

Use light-colored hardscaping: Horizontal hardscaping materials are installed with a Solar Reflectance Index of 29 or greater for minimum 50% surface area

2 POINTS

Heat islands are created when urban surfaces, such as hardscapes, absorb solar radiation. Shading the pavement cools the air surrounding it before that air reaches a building's walls and windows. Landscape features such as mature trees or hedge rows, exterior elements such as overhangs or vertical fins, and horizontal reflecting surfaces called light shelves are all strategies that can help reflect solar radiation.

Planting trees and vegetation is a simple and effective way to reduce heat islands. Shade trees and other foliage can lower air temperature by up to 9 degrees. Widespread planting in a city can decrease local surface and air temperatures. Strategic planting around buildings directly cools the interior of buildings and buildings, decreasing air conditioning costs and peak energy demand.

Trees and vegetation cool the air by providing shade and through evapotranspiration (the evaporation of water from leaves). The U.S. Department of Agriculture Forest Service estimates that every 1% increase in canopy cover results in maximum mid-day air temperature reductions of 0.07° to 0.36° F (0.04° to 0.2°C).

Since the goal is to provide shading for hardscapes, building features, such as overhangs and light shelves also help to reflect solar radiation and can be incorporated into the overall design to serve many beneficial functions for the building and the surrounding site.

For information on overhangs, see Action items 4-48 and 4-49.

High Albedo, light-colored, and cool roofs are all terms used to describe an alternative roofing strategy that lowers the absorption of solar energy, reduces surface temperatures, and decreases the heat transfer into a building. Typically, they are white and are made of either metal, single ply membrane, or elastomeric coating over a conventional roof.

Dark materials absorb more heat from the sun. Roads and parking lots paved with black asphalt concrete and other dark materials can become up to 70°F hotter than the most reflective white surfaces. The energy of the sunlight is converted into thermal energy and pavements get hot, heating the air around them and contributing to the heat island effect. Dark colored roofs also heat the air around the building, contributing to the heat island effect. The efficacy of high albedo roofs is dependent on climate situations. In our region, unless the building is planning an air conditioning system, it may not be advantageous to utilize this strategy. This is due to the extra cost of the roofing materials, the potential for degradation of high albedo coatings, and the potential to increase costs for heating. However, if the building intends to supply air conditioning, this strategy can be effective since these roofs minimize the absorption of summer heat, thereby reducing air conditioning costs. These roofs reduce air conditioning cost in two ways; first, by reflecting solar gain, then by providing cooler roof intake air.

Cool paving materials minimize the absorption of solar heat and the subsequent transfer of this heat to the surroundings. There are two types of cool paving materials: lighter-colored materials and porous materials.

- **Lighter-colored materials** have higher solar reflectance, so they absorb less of the sun's energy and stay cooler. Permeable, or porous, pavements allow water to filter into the ground, keeping the pavement cool when moist (this pavement alternative also serves as a stormwater management technique). Permeable pavements can be constructed from a number of materials including concrete, asphalt, and plastic lattice structures filled with soil, gravel, and grass, see Action item 2-44, *Use pervious materials for driveways, parking areas, walkways, and patios*.
- **Pervious pavements** are less able to absorb and store heat than conventional pavements. The lower density of the material (15 - 25% void spaces) reduces heat storage capacity. The open void structure in the pervious pavement allows cooler earth temperatures from below to cool the pavement. These factors allow pervious pavement systems to approach natural ground cover in heat absorbing and storage capacity. In addition, the lighter colors of some pervious pavement systems further reduce the heat absorbing capacity of the pavement.

WATER PROTECTION Outdoor Conservation

Although outdoor water use varies widely from site to site, on average it accounts for about 50% of residential water use. However, proper selection of plants and turf, landscape arrangement, irrigation equipment, use of soil amendments, and irrigation scheduling can dramatically reduce outdoor water use. Along with indoor conservation measures, outdoor water conserving features can help reduce daily water use from an average of 80 gallons per day (gpd) to 50 gpd.

2-60

Mulch landscape beds with 2 inches of organic mulch

1 POINT

If the new landscape isn't already densely planted, mulching is the next best solution to reduce the number of weeds and makes weed removal easier (which in turn, helps minimize herbicide use). Mulching provides soil nutrients, increases the capacity of the soil to retain moisture, moderates soil temperature, and limits soil erosion.

Non-woody mulches, compost, cut grass clippings, or leaves are best for annuals. Woody mulches, wood chips or bark, work best with perennial shrubs and trees. However, limit the use of bark mulch as much as possible, and never use in areas that drain directly into storm sewers or open water. Bark produces a toxic leachate that can end up in water supplies.

2-61

Limit use of turf grass, or use no turf grass

3-12 POINTS

3 POINTS FOR EVERY 25% OF LANDSCAPED AREA THAT DOES NOT INCLUDE TURF GRASS.

12 POINTS FOR NO TURF GRASS

Design turf areas where they will be functional and well adapted to the site. Specifically, place turf in areas expected to be used for walking or playing. Lawns work well in sun to light shade, with well-drained soils and on level to slightly sloped areas. Don't plant lawns in heavy shade or in areas with saturated soils or heavy slopes. Always keep turf away from the water's edge because of the increased likelihood of chemical contamination, because it reduces habitat and shading for wildlife, and because of the possible increase in erosion potential. Finally, design the lawn in a shape that can be efficiently watered, in other words, it matches the irrigation system design. For instance, use an oval shape to accommodate sprinkler sprays or pop-up irrigation sprays.

Although turf grass is a traditional component of residential landscaping, it is not necessary for a beautiful and luxurious landscape. In fact, a landscape, which uses existing vegetation along with well-constructed new plantings, can offer a beautiful, low-maintenance alternative to the "traditional" fare.

Constructed landscapes that mimic ecological habitat models can decrease life cycle maintenance costs, enhance wildlife survival, and blend edges of adjoining existing vegetation. To mimic ecological habitat models, emulate natural succession by planting larger deciduous trees with smaller conifers to gradually develop canopy. Deciduous trees generally perform better in south-facing areas, while conifers are better suited near streams or on the north side of the plot.

Use native plants in the constructed landscape. They:

- Are diverse in color, form, and texture offering a wide variety to fit any design.
- Are adapted to our climate – rainy wet winters and dry summers. After initial one to two seasons of irrigation, many native plant species become established and require little to no irrigation.
- Are adapted to our naturally occurring low levels of nutrients.
- Are resistant to local insects and diseases, which allow for minimizing fertilizer and pesticide use.
- Provide habitat for local wildlife.

2-62

Use drought-tolerant grass type

2 POINTS

When planting a new lawn, select a grass mix that is suitable for the sun conditions and the lawn's intended use, and grows slowly, requiring less frequent mowing. Use locally adapted rye-fescue seed blends. Be aware that tall and other fescue grasses can be drought-tolerant if given a deep soil culture for their long roots – they need more water if planted in shallow soil. Mixes containing clover, bentgrass, yarrow, chamomile, and English daisies are another option where an informal-looking lawn fits the landscape. These mixes are extremely drought-tolerant and offer a variety from traditional lawns.

Regardless of the type of grass you choose, always plant densely. Thick, dense, and thatchy well-established lawns absorb and infiltrate rainwater better than thinly planted plots. (Soil conditions can significantly affect lawn establishment. See also Action item 2-34, *Amend disturbed soil with compost or suitable soil amendments to a minimum depth of 10" to restore soil environmental functions.*)

2-63

Landscape with plants appropriate for site topography and soil types, emphasizing use of native plants with low watering requirements (drought-tolerant)

2 POINTS

In the summer, up to 50% of the water used by municipal systems is for outdoor irrigation. The increased demand in summer coincides with a drop in reservoir and stream levels when precipitation dramatically decreases, putting tremendous pressure on local water supplies.

Examples of water saving landscaping techniques you can include:

- Use established vegetation (see Action item 2-21, *Preserve Existing Native Vegetation as Landscaping*, for more information)
- Limit turf areas, choose appropriate turf types and plant in suitable areas (see Action item 2-61, *Limit use of turfgrass, or use no turf grass*)
- Cluster plants with similar water requirements ("water-use" zones)
- Plant native species that will adapt well to the site
- Plant species from other geographic areas with similar climates
- Plant certain species from Mediterranean climates (check with your local nursery for ideas).

The Pacific Northwest has hundreds of attractive plants that require very little water once they are established. Ask your local nursery or landscaping contractor for information about the water efficient trees, shrubs, perennials, and ground covers they supply. Keep in mind that some low water use plants may have certain needs, such as shade, which when not met can lead to increased water use.

Constructed landscapes that mimic ecological habitat models can decrease life cycle maintenance costs, enhance wildlife survival, and blend edges of adjoining existing vegetation. To mimic ecological habitat models, emulate natural succession by planting larger deciduous trees with smaller conifers to gradually develop canopy. Deciduous trees generally perform better in south-facing areas, while conifers are better suited near streams or on the north side of the plot.

Use native plants in the constructed landscape that are:

- Diverse in color, form, and texture offering a wide variety to fit any design
- Adapted to our climate – cold, snowy winters and hot, dry summers. After initial one to two seasons of irrigation, many native plant species become established and require little to no irrigation
- Adapted to naturally occurring low levels of nutrients
- Resistant to local insects and diseases, which allow for minimizing fertilizer and pesticide use
- Native to provide habitat for local wildlife.

Landscapes can also be Xeriscaped, which means that once established, the landscape will survive without any watering needs. Xeriscaping has become popular in dry areas over recent years and increasingly more resources are available on it. See Part II, Resources for more info on Xeriscape options in our area.

2-64

Plants with similar watering needs are grouped (hydrozoning)

5 POINTS

Although turf grass is a traditional component of residential landscaping, it is not necessary for a beautiful and luxurious landscape. In fact, a landscape, which uses existing vegetation along with well-constructed new plantings, can offer a beautiful, low-maintenance alternative to the "traditional" fare.

Constructed landscapes that mimic ecological habitat models can decrease life cycle maintenance costs, enhance wildlife survival, and blend edges of adjoining existing vegetation. To mimic ecological habitat models, emulate natural succession by planting larger deciduous trees with smaller conifers to gradually develop canopy.

Deciduous trees generally perform better in south-facing areas, while conifers are better suited near streams or on the north side of the plot.

Use native plants in the constructed landscape. They:

- Are diverse in color, form, and texture offering a wide variety to fit any design
- Are adapted to our climate – rainy wet winters and dry summers. After initial one to two seasons of irrigation, many native plant species become established and require little to no irrigation.
- Are adapted to our naturally occurring low levels of nutrients
- Are resistant to local insects and diseases, which allow for minimizing fertilizer and pesticide use.
- Provide habitat for local wildlife

In the summer, up to 50% of the water used by municipal systems is for outdoor irrigation. The increased demand in summer comes at the same time reservoir and stream levels drop and precipitation dramatically decreases, putting tremendous pressure on local water supplies.

Examples of landscaping techniques you can use that will result in low water use include:

- Use established vegetation
- Limit turf areas, choose appropriate turf types and plant in suitable areas
- Cluster plants with similar water needs (—water-use zones)
- Plant native species that will adapt well to the site
- Plant species from other geographic areas with similar climates
- Plant certain species from Mediterranean climates (check with your local nursery for ideas)

The Northwest has hundreds of beautiful plants that require very little water once they are established. Ask your local nursery or landscaping contractor for information about the water efficient trees, shrubs, perennials, and ground covers they supply. Keep in mind that some low water use plants may have certain needs, such as shade, which when not met can lead to increased water use.

Resources

- Washington Native Plant Society, <http://www.wnps.org/landscaping/eastshrubs.html>

2-65

Pre-plumb for greywater reuse for irrigation

4 POINTS

Greywater is all wastewater generated in the house except from toilet flushing. Sometimes referred to as “reclaimed” or “recycled” water, this includes wastewater from laundries, showers, and sinks. Greywater can be collected and stored for reuse as a nutrient-rich irrigation source, which conserves water. To use greywater, a dual plumbing system must be installed to separate it from blackwater, which is wastewater generated from toilet flushing.

Greywater systems are currently treated as an “exception” to the code. Systems are approved, on a case-by-case basis as “experimental” systems, requiring compliance with stringent local and state regulations. If approved, greywater irrigation systems are generally required to be subsurface, although some local jurisdictions permit aboveground irrigation. Factors affecting the approval and use of greywater irrigation systems include soil depth and characteristics as well as drainage and flooding patterns. Other guidelines include setbacks for greywater irrigation lines from property or potable water line.

Note: If you choose to plumb for greywater irrigation, you should also consider providing plumbing to use greywater for toilet flushing (see Action item 2-82, *Bonus Points: Stub-in plumbing to use greywater or rainwater for indoor reuse.*)

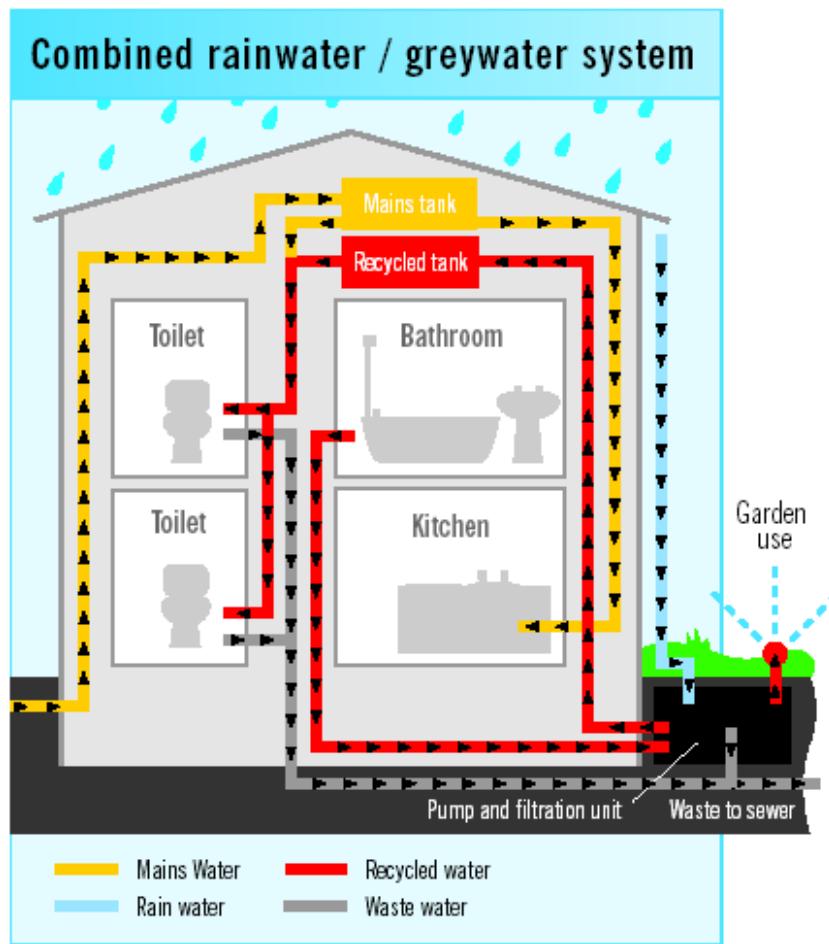


Figure 2-4 Rainwater/Greywater System

Resources

- “Some chemicals in greywater can be harmful to plants (For information about suitable plants for greywater, please see Greywater Plant Choices at: <http://www.doh.wa.gov/ehp/ts/ww/greywater/greywater-5.htm#plantchoices>.” (excerpted from Water Conservation, Using Greywater Fact Sheet, Washington State Department of Health, <http://www.doh.wa.gov/ehp/ts/WW/GreywaterFact.PDF>.)

Note: If you choose to plumb for greywater irrigation, you should also consider providing plumbing to use greywater for toilet flushing (see Action item 2-82, Bonus Points: Stub-in plumbing to use greywater or rainwater for indoor reuse.)

- Recommended Standards and Guidance For Water Conserving On-site Wastewater Treatment Systems, Appendix D, Greywater Reuse, http://www.ecy.wa.gov/programs/wq/trmdl/spokaneriver/dissolved_oxygen/docs/WaterConservSystems-2000.pdf

2-66

Install greywater system for irrigation

5 POINTS

Recycled water includes both rainwater and greywater.

See Action item 2-65, *Pre-plumb for greywater reuse for irrigation* for discussion of greywater and related requirements. In cases where greywater for irrigation is acceptable, plumbing for greywater would be hooked up to the irrigation system. The irrigation system can be supplied using the tank(s) and a small-scale pressurized pump system.

In cases where you would be using collected rainwater (on a per site basis, a more cost-effective approach), hook up the irrigation system to the rooftop cistern (see Action item 2-68, *Install Rainwater Collection System (Cistern) for Reuse*). These systems can provide significant quantities of irrigation water. Whether a rooftop cistern will be sufficient to meet all of the irrigation demands during the dry season will be dependent upon the irrigation requirements of the landscape and the system's storage capacity.

2-67

Install landscaping that requires no potable water for irrigation whatsoever after initial establishment period (approx. 1 yr), excluding food production

10 POINTS

The goal of this credit is to select a landscape plan that includes drought-tolerant plantings, smart plant placement, and that no potable water will be used for irrigation after the initial establishment period of about one year.

Select plants that are native to the area or suitable for our climate and rainfall characteristics. You should amend soil with compost to help establish good soil conditions to establish new plants; proper placement of individual plants in the landscape can reduce supplemental watering needs. Add hardscape and mulch or bark areas as landscape features that do not require watering.

For initial establishment irrigation consider using greywater – non-potable wastewater from the house from bathtubs, showers, bathroom sinks, washing machines, dishwashers and kitchen sinks, any water source in the home except for toilets. This wastewater is collected and filtered of household contaminants such as bacteria, bleach, high pH wastewater, nitrates, oil and grease, food and hair, etc. Check with the county health agency for a wastewater treatment permit and to confirm local code requirements, and system design suggestions. Consider the source and characteristics of the greywater, the physical characteristics of the site, and how the greywater will be used on site for irrigation. All greywater systems must be below or sub-surface, no sprinkler systems area allowed.

Be prepared, or prepare the homeowner to remove the temporary system after the initial plant establishment period. A carefully selected and planted landscape designed for specific site characteristics should be established and no longer requires supplemental watering after about one year.

Resources

See General Resources

- Saving Water Partnership, Smart Watering, part of the Natural Lawn & Garden series, 2004, available at http://www.savingwater.org/outside_watering.htm or 206-633-0224.

2-68

Install rainwater collection system (cistern) for reuse

1 POINT PER 100 GALLONS OF STORAGE CAPACITY

EXAMPLE: 500 GALLONS = 5 POINTS

10 POINTS MAXIMUM

Rainwater collected from the roof is a free source of landscape irrigation water. Rainwater can also be harvested from soil surfaces and outdoor paved surfaces. Let the homeowner know that rainwater supply is *not* intended for potable use (in other words, is *not* for drinking). Rainwater collection for *potable* water use can be done, but

requires case-by-case approval and compliance with stringent local and state health regulations. Check with your local municipality for rainwater collection regulations.

A rooftop rainwater collection system consists of a suitable roof and gutter system, a storage tank(s), and a simple filtration system. The irrigation system can be supplied using the tank(s) and a small-scale pressurized pump system. These systems can provide significant quantities of irrigation water. Whether a rooftop cistern will be sufficient to meet all of the irrigation demands during the dry season will depend on landscape irrigation requirements and the system's storage capacity.

Individual cisterns can be located beneath each downspout, or the desired storage volume can be provided in one large, common cistern that collects rainwater from several sources. Pre-manufactured residential-use cisterns come in sizes ranging from 100 to 1,400 gallons. Cisterns should be located for easy maintenance or replacement.

For collecting rainwater from roof areas:

- Use appropriate roofing materials such as metal, tile, or fiber cement. Lead-containing materials, such as flashing, should not be used in catchment roofs. Likewise, ensure that no zinc, moss prevention measure such as galvanized ridge caps, copper flashing, or copper wires are used. Asphalt composition roofs should not be used for collecting water for watering any food producing plants.
- Construct cistern or tank storage sized for the rainfall amount and roof size, with appropriate overflow devices. Cisterns can be made of concrete, ferro-cement, stone, or prefabricated metal, plastic, or fiberglass. Use only watertight, opaque materials and provide a cover.
- Provide an overflow route to direct excess flows away from building and in such a manner as to avoid impact to downstream properties.
- Install gutters and downspouts sized for the roof and rainfall intensity.
- Install screening devices or roof washers to filter out leaves, debris, and sediment that can clog the system.

For collecting and harvesting water from the soil surface and outdoor paved surfaces:

- Use open conveyances such as grass or gravel swales to direct and deliver harvested water to storage areas, such as small ponds, for reuse as irrigation water.
- Provide a pressurization system to deliver irrigation water.
- Incorporate aquatic plants to maintain storage pond's ecological balance.

See Action item 2-65, *Pre-plumb for greywater reuse for irrigation* for discussion of greywater and related requirements. In cases where greywater for irrigation is acceptable, plumbing for greywater would be hooked up to the irrigation system. The irrigation system can be supplied using the tank(s) and a small-scale pressurized pump system.

In cases where you would be using collected rainwater (on a per site basis, a more cost-effective approach), hook up the irrigation system to the rooftop cistern. These systems can provide significant quantities of irrigation water. Whether a rooftop cistern will be sufficient to meet all of the irrigation demands during the dry season will be dependent upon the irrigation requirements of the landscape and the system's storage capacity.

2-69

Irrigation system is designed by a professional in accordance with EPA WaterSense requirements (or equivalent) and installed in accordance with EPA WaterSense Program or equivalent

3 POINTS

Designed by a professional in accordance with EPA WaterSense requirements, or equivalent

Installed in accordance with EPA WaterSense program, or equivalent

2-70

Evapotranspiration- (ET-) based irrigation controller with a rain sensor

4 POINTS

2-71

Soil moisture sensor based irrigation controller

4 POINTS

Each irrigation zone has a solenoid valve on it that is controlled via wire by an irrigation controller. The irrigation controller is either a mechanical or electrical device that signals a zone to turn on at a specific time and keeps it on for a specified amount of time. "Smart Controller" is a recent term used to describe a controller that is capable of adjusting the watering time by itself in response to current environmental conditions. The smart controller determines current conditions by means of historic weather data for the local area, a soil moisture sensor (water potential or water content), weather station, or a combination of these.

2-72

Install a leak detection system with excess water flow shutoff

2 POINTS

2-73

An integrated pest management plan to minimize chemical use of pesticides and fertilizers is established

4 POINTS

The National Information System of the Regional Integrated Pest Management Centers describes the pest management plan as "a pest-by-pest" approach to identifying the current management practices (chemical and non-chemical) and those under development. Plans also state priorities for research, regulatory activity, and education/training programs needed for transition to alternative pest management practices.

Indoor Conservation

2-74

Plumbing system with all plumbing fixture fittings (faucets & showerheads) located such that the volume of the water contained in each pipe run between the water heater and fixture fitting is a maximum of 6 cups (1.42 liters) (86.63 cubic inches) (0.38 gallons)

8 POINTS

Small diameter flexible pipes are run from a manifold with branched outlets located near the water heater directly to the fixtures, thereby reducing the volume of water in the individual pipe. Use 3/8 piping for sinks and 1/2 piping for other fixtures.

Use central core plumbing which means locating the water heater to within 15 feet of all hot water fixtures, including bathrooms, kitchen and laundry.

2-75

For bathroom faucets, select fixtures with less than 1.5 GPM

2 POINTS

EPA Act 92 limits the flow rate of residential kitchen and lavatory (bathroom) faucets to 2.5 gpm (9.5 lpm) at 80 psi, or 2.2 gpm (8.3 lpm) at 60 psi—although some faucets today achieve the federally mandated flow with either aerators or flow restrictors that can be removed, allowing the flow to be significantly increased. EPA's WaterSense has adopted a more aggressive maximum flow rate of 1.5 gpm (5.7 lpm) at 60 psi for residential lavatory faucets;

because of the need to fill kitchen pots with water, however, a WaterSense standard for kitchen faucets has not been adopted. In kitchens, flow controllability tends to be a more significant water-saving feature. While sensors that turn on the flow when a user's hands are properly positioned—most common in commercial buildings but making their way into homes—might seem like a water-saving feature, studies have shown that they often increase water use because they turn on unnecessarily or stay on longer than needed.

Simple, inexpensive aerators can adapt any modern kitchen or lavatory faucet into a water-efficient unit—with flow rates as low as 0.5 gpm (2 lpm). The lower the flow rate, however, the longer it takes hot water to reach the user). A perception of greater flow can be achieved by aerating the water stream or by creating a laminar flow (essentially a hollow cylinder of water that appears to be solid). Significant savings can be achieved with faucets—and especially kitchen faucets—by installing a foot- or knee-operated control so that users can turn the water on and off without using their hands (and while retaining the desired temperature mix). A less expensive option is a simple lever control on the faucet itself that allows the user to temporarily reduce the flow (though usually not turn it all the way off) with a simple flick of the finger.

(Source: February 1, 2008 Feature "Water: Doing More with Less" from Environmental Building News)

Consumer performance complaints with reduced flow rates are most often associated with the "feel" of the water coming from the faucet and clogging associated with equipment that reduces flow rate with small hole screening. Faucets with flow rates less than 2.5 gpm that have the "feel" of higher flow and that are guaranteed against clogging are now available. Remember that not all brands are created equal, so talk to your supplier. The added cost of higher-performance, low-flow heads is minimal, generally less than \$25 per head.

2-76

Self-closing valve, motion sensor, metering, or pedal-activated faucet is installed to enable intermittent on/off operation

1-3 POINTS

1 POINT PER FAUCET, 3 POINTS MAXIMUM

Once more people experience the convenience and water savings of foot- and knee-operated controls for faucets, these devices are likely to become more common—especially if less expensive models enter the market. We may also see sensor-activated controls that actually save water. Finally, we may see regulations for faucets that prevent them from being modified to increase the flow above the legal limit.

(Source: February 1, 2008 Feature "Water: Doing More with Less" from Environmental Building News)

2-77

For showers, install showerheads with less than 2.0 GPM

1 POINT

Showerheads, like toilets, are regulated by EPAct92, which established a limit of 2.5 gallons per minute (gpm; 9.5 liters per minute, or lpm) at 80 psi of water pressure. Because showers use hot water, reducing water use also saves energy. Replacing an older showerhead, which may flow at 5 gpm (20 lpm) or more, with a unit that uses 2.0 gpm (8 lpm) or less can pay for itself through reduced water and energy use in just a few months. Some early low-flow showerheads atomized the water into tiny, high-pressure droplets that did not wet the body effectively and quickly cooled off through evaporation. Some showerheads today achieve the federally mandated flow with restrictors that can be easily removed by a plumber or user, allowing the flow to be significantly increased—thus circumventing the regulations. Another way people have circumvented requirements is by installing multiple showerheads and body-wash nozzles in one shower system or by creating rain-like water sculptures that manufacturers claim are not showers at all.

The best showerheads today have been designed for water efficiency from the ground up. Some models rely on the Venturi effect to aerate droplets and create the feel of a forceful shower while using relatively little water—as little as 1.5 gpm (5.7 lpm); a challenge here is to keep the aeration from making the droplets too small. Other manufacturers have gone even further in showerhead redesign, creating a pulsed shower with large droplets.

EPA's WaterSense is working on a standard for showerheads that will likely bring us WaterSense-labeled products by the end of 2009 with a maximum flow of 2.0 gpm (8 lpm), or possibly lower. (The *GreenSpec* standard for showerheads is 1.75 gpm [6.6 lpm].) Plumbing manufacturers are developing methods of measuring the wetting performance and heat retention of showerheads, according to Koeller, and EPA could eventually incorporate such performance attributes into WaterSense standards. Look for the multiple-showerhead loophole to be addressed in some way in the next several years. Also, regulations may prevent showerheads from being modified to increase flow above the legal limit.

(Source: February 1, 2008 Feature "Water: Doing More with Less" from Environmental Building News)

2-78

Install at least 1 kitchen faucet with less than 2.0 GPM

1 POINT

See Action item 2-75 above.

2-79

Select high-performance low-flush or dual-flush toilets (1.28 gpm)

1 POINT PER TOILET

4 POINTS MAXIMUM

Federal law mandates all new toilets use no more than 1.6 gallons per flush (gpf). Toilet flushing is the largest single use of water (up to 40% of residential water use), and water savings from the new standard is significant compared to the older models that used 3 to 5 gpf.

High-efficiency toilets today are available with gravity-flush, pressure-assist, and flushometer-valve mechanisms. Pressure-assist toilets, which compress air at the top of the refill tank to increase the flush velocity, use as little as 0.8 gpf (3 lpf) and typically achieve excellent performance. Flushometer-valve toilets, which use direct water pressure without a tank, are common in commercial buildings. Dual-flush toilets, pioneered by Caroma in Australia, now dominate Australia and much of Europe. Introduced into North America by Caroma in 1999, most dual-flush toilets use 1.6 gpf for solids and 0.8 to 1.1 gpf (3–4 lpf) for liquids and paper. Caroma recently introduced a model with a full flush of 1.28 gpf (4.8 lpf) and a reduced flush of 0.8 gpf.

HETs may become standard nationwide. California has passed legislation that will mandate that all new toilets sold or installed in the state after 2014 be HETs. According to Barbara Higgins, executive director of the Plumbing Manufacturers Institute, the plumbing industry is lobbying to make this requirement the new federal standard—with a clearly defined schedule that gives manufacturers time to modify their products.

(Source: February 1, 2008 Feature "Water: Doing More with Less" from Environmental Building News)

Resources

- *How to Buy a Water-Saving Replacement Toilet*, US Department of Energy, FEMP Available online at www.eren.doe.gov/femp/procurement/pdfs/toilet.pdf. A publication of the Federal Emergency Management Program, this two-page fact sheet is primarily for federal agencies, but provides good general information for residential builders as well.
- For a recent report / survey on low flow toilets performance and cost comparison, see terrylove.com/crtoilet.htm.
- Top performers in consumer and plumber surveys include models manufactured by Toto (Drake and Ultramax series), Gerber, and Western, which can be purchased from plumbing contractors. Brands like American Standard, Briggs, Crane, Eljer, Kohler, Mansfield, and Universal Rundle can be purchased from both plumbing contractors and in many hardware stores.

One highly rated low flow toilet is:

- Gerber Ultra Flush toilet with the Sloan FLUSHMATE Flushometer Tank System, available from Love Plumbing and Remodel, 18628 NE 25th St, Redmond, WA 98052, terrylove.com/toilet1.htm.

2-80

Install composting toilets

10 POINTS

Composting toilets convert human waste into nutrient-rich fertilizer for non-food plants rather than mixing the waste with potable water and flushing it down the drain. The advantages of these toilets include dramatic reductions in water use, reduced groundwater pollution or sewage treatment impacts, and a recycling of nutrients. One toilet can accommodate up to five persons. The payback period is about 10 years.

Some composting chambers can be used with microflush toilets; however, most are non-flush units. If composting toilets are used, greywater treatment and disposal must be addressed. Systems must meet local health department regulations for alternative on-site sewage systems.

Resources

- Composting Toilet World, for general and product information, <http://www.compostingtoilet.org/>.
- Envirolet Composting Toilets by Sancor, available on-line at <http://www.envirolet.com/>
- Composting Toilets by Sunmar, www.sun-mar.com,

2-81

Install system to refill toilet with hand-wash water

1 POINT PER TOILET

2 POINTS MAXIMUM

2-82

Stub-in plumbing to use greywater or rainwater for indoor reuse

4 POINTS

The use of potable (drinking) water to flush toilets is not the best use of this limited resource. Although the use of greywater for toilet flushing is not currently allowed by code, this is expected to change in the near future as potable water resources in our region become more even more limited. Additionally, these systems are now permitted with a variance on a case-by-case basis.

Greywater collection requires dual plumbing distribution lines and a storage tank. This Bonus Action item provides the additional plumbing required to allow for future connection to greywater for toilet flushing.

Note: If you choose this Action item, you should also consider providing for the use of greywater for irrigation (see Action item 2-65, *Pre-plumb for greywater reuse for irrigation*).

2-83

Install greywater or rainwater system for indoor reuse

8 POINTS

Using recycled water (normally greywater) for toilet flushing and laundry conserves our valuable potable water resources. Currently considered an "exception" allowed by code, the use of greywater for toilet flushing and laundry may be approved on a case-by-case basis. This "experimental" system will require compliance with stringent local and state regulations.

New systems can qualify builders for up to 25 points for each project in the checklist, see Action items, 2-65, *Pre-plumb for greywater reuse for irrigation*, 2-41, *Sub-Surface or Drip System Used for Irrigation*, 2-67, *Install landscaping that requires no potable water for irrigation whatsoever after initial establishment period (approx. 1 yr), excluding food production*, see Resources for more information.

Resources

"Some chemicals in greywater can be harmful to plants" For more information, see 2-65, *Pre-plumb for greywater reuse for irrigation*, above.

- Recommended Standards and Guidance For Water Conserving On-site Wastewater Treatment Systems, Appendix D, Greywater Reuse, www.doh.wa.gov/ehp/ts/WW/GreywaterFact.PDF

2-84

Install a recirculating pump for domestic hot water w/timer or motion sensor

2 POINTS

Recirculating pumps can be used with standard plumbing. The pump rapidly moves water from the water heater to the fixtures, saving the water that is conventionally wasted while occupants wait for the water to heat up. In addition to the convenience of on-demand hot water, this system can also save energy. The amount of energy and water savings varies on the system use, controls, and the plumbing design. Select systems with manual controls to avoid have the system operate continuously, which can waste hot water energy.

Resources

- Hot Water Recirculation Systems, www.toolbase.org/Technology-Inventory/Plumbing/hot-water-recirculation.

2-85

Urinal is installed with a flush volume of 0.5 gallons or less

2 POINTS

The maximum flush volume for urinals in the U.S. is one gallon, and most urinals today use the full gallon. This profligate waste led to the introduction of waterless urinals in the 1990s. In a sizeable office or institutional building, a waterless urinal can save as much as 40,000 gallons (150,000 l) per year. However, most waterless urinals rely on regular replacement of a vegetable-oil-based fluid and a disposable cartridge to maintain performance of the sanitary trap. Keeping waterless urinals clean and preventing the deposition of uric salts in the drain line has proven to be problematic.

Waterless urinals are gaining acceptance in many parts of the country and, if properly installed and maintained, should prove satisfactory. Two companies, Caroma in Australia and Ecotech Water in the U.S., have introduced waterless urinals that rely on a rubberized membrane that lets liquid through and then curls up to provide a mechanical seal between uses. That seal allows rinse-water to be poured through the urinal periodically for cleaning without washing away expensive sealant fluid.

As the market gains experience with waterless urinals, we can expect to see installation and operation guidelines that improve performance and user satisfaction. Meanwhile, ultra-low-flush urinals will likely capture some of the waterless urinal market share. EPA plans to offer a WaterSense label for high-efficiency urinals (HEUs), which are likely to be defined as using 0.5 gpf (2 lpf) or less. (BuildingGreen's *GreenSpec Directory* standard for urinals is currently 0.25 gpf (0.95 lpf).

The Ecoblue Cube takes a very different approach to reducing water use in urinals, with a small cube-shaped urinal cake that releases beneficial bacteria. These bacteria line the bowl, trap, and pipes, preventing odors and uric acid deposition. If this product works, it could significantly reduce water use in urinals of all types by allowing them to be flushed only periodically.

(Source: February 1, 2008 Feature "Water: Doing More with Less" from Environmental Building News)

Indoor Water Quality

2-86

Provide compost or worm bins instead of a food garbage disposal

3 POINTS

There are both environmental costs and benefits when using a garbage disposal.

Environmental costs:

- *Waste from garbage disposers can overburden old municipal sewage systems.* Americans throw away more than 25 percent of the food we prepare, according to the Environmental Protection Agency. Garbage disposers can double the volume of non-liquid material that goes down the drain, displacing food waste from land to water. Many sewer systems around the country are more than 100 years old and operating beyond their design capacity--resulting in more than 40,000 overflows of sewage treatment systems each year. When these old systems fail, they can release raw sewage containing high levels of nitrogen, chemical contaminants, and microbial pathogens into local waterways--causing harm to ecosystems, animals and humans.
- *Food waste also increases septic tank maintenance.* If you have a septic system, using a garbage disposer can mean emptying it twice as often. According to the Environmental Protection Agency, half of all septic systems are at least 30 years old. As many as 20 percent or more are malfunctioning in some way, and 10 percent or more back up onto the ground surface or into homes each year. Failing septic systems are the third most common cause of ground water contamination.
- *Waste from garbage disposers can clog your drain or worse.* Old plumbing systems can easily be overburdened. You'll want to check on the condition and capacity of your pipes before deciding to use a disposer.
- *A disposer uses more water.* While garbage disposers are not going to have a large impact on your household's electricity use, they do require running water to move the waste down the drain—about 700 gallons per year.

Environmental benefit:

- *Disposers can reduce the amount of solid waste that ends up in landfills and incinerators.* A few municipalities have actually encouraged consumers to install garbage disposers, especially in places where water is plentiful, the sewage treatment infrastructure has been expanded and modernized, and landfill space is scarce.

(Source: *Garbage disposers: Green buying guide 7/09*,
<http://www.greenerchoices.org/printProduct.cfm?product=garbagedisposer>)

Composting is an old technique that has made a comeback in recent years. The process turns organic wastes (such as grass clippings and food waste) into humus, which is vital to soil fertility. About thirty percent of household waste is compostable.

Worm bins are one technique that is growing in popularity. They are appropriate for treating primarily vegetative food waste and small amounts of grass clipping. By providing homeowners with a compost or worm bin, you promote this form of waste reduction. In addition, you provide the homeowner with an organic alternative to chemical fertilizers typically used to boost soil fertility. Finally, this organic stream is not added to the sewer system, by avoiding the need for sink disposal units.

You may want to build in a convenient method of collecting food waste in the kitchen. A covered "waste box" can be installed next to the sink. Food waste can then be dropped through a chute into the bin underneath. Additionally, new ready-made food chutes are now available that can be inserted into the kitchen cabinetry.

2-87

Install a whole house water filter system

2 POINTS

Generally, no one single whole house water filter can filter chemicals, microorganisms, and sediments. Find a dual purpose "effective" product or design a multi-filter system to capture all contaminants. Whole house systems are inline systems at the point of entry.

Whole house systems remove chlorine and other chemicals as they enter a home's plumbing system. Like other fixture-fixed water filters, these systems provide a higher quality drinking water, but they also alleviate the effects of asthma and allergies by reducing chlorine in indoor air.

Resources

Ask your supplier.

2-88

Install water filtration system for consumptive use

2 POINTS

2-89

Install a chemical and salt free water softener system

2 POINTS

Hard water can cause residue build-up on fixtures and faucets. Calcium and magnesium chemicals in hard water prevent soaps and detergents from lathering, which lead to build-up. Overtime, scale can build up in plumbing and appliances, which decrease their longevity. Chemicals released from conventional water supply can lead to long term health effects. A water softener system can reduce these problems as well as save money long-term.

Conventional water softener systems consist of chemical or salt treatments. Research shows that these chemicals and salt show up in local water bodies, affecting water quality. Alternative systems or "no waste" systems generally work on the principal that rather than trying to remove calcium and magnesium from water, they simply realign molecules into larger crystals, so that they don't fall out of solution and cause pipe build-up. They do this by forcing water to pass through a tube with a rough alloy surface inside of it—the roughness of the surface (and the material it is made out of) encourages molecules to form into crystals. The larger crystals don't gunk up pipes, drains, toilets, etc, the water retains its healthful drinking qualities, and the water also doesn't interfere with soap lathering the way hard water does.

2-90

Separate outdoor water supply prior to filtration

1 POINT

By excluding water for exterior use from the filtration system, you will significantly reduce wear and tear, and the rate of cleaning and replacement of filtration media. This will reduce cost and maintenance time for the homeowner, and improve resource efficiency.

2-91

Provide spot water filtration using reverse osmosis or biodegradable carbon filter in kitchen and bathrooms

1 POINT PER FIXTURE
3 POINTS MAXIMUM

Providing high-performance filtration, using reverse osmosis or comparable media filtration at the point of use provides the best overall approach to water quality, since you filter only the water that is used for human consumption and/or human hygiene.

ENVIRONMENTAL DESIGN CONCEPTS

Resources

- *Cost Effective Home Building, A Design and Construction Handbook*, NAHB Research Center, Upper Marlboro, MD, 800-638-8556 or www.nahrc.org.

- *Green Development: Integrating Ecology and Real Estate*, and *Green Developments CD-ROM, Version 1.0*, Rocky Mountain Institute, Snowmass, CO. 970-927-3851 or www.rmi.org. Information on over 100 "green" developments.
- NAHB Research Center's "ToolBase Hotline" is available to answer builder questions, 800-898-2842, www.nahbcrc.org/ToolBase.

2-92

Provide accessory dwelling unit or accessory living quarters

10 POINTS

An accessory dwelling unit (ADU), also known as a "mother-in-law" apartment or "granny flat," is a small, secondary unit on a single-family lot. ADUs are detached or separate from the living quarters (such as converted garages). Accessory living quarters, on the other hand, are built *into* existing living quarters.

ADUs and accessory living quarters contribute to the versatility of the home-site and diversity of the neighborhood. For example, they can be used to better adapt to changing family arrangements such as older parents moving in with their children or grown children moving back into the house after college or life-style change. They can also be rented to students or those with lower incomes; and for homeowners on a fixed income, the rental income can help with a mortgage. Mixing this type of less expensive housing into established neighborhoods reduces the demand for large apartment projects while also providing greater variety among housing choices. They also promote density in urban areas.

Check with the local jurisdiction for requirements including minimum or maximum size or setbacks. Be sure to include ADUs in your permit process.

Resources

- *Green Development*, p. 227 (listed above).

2-93

Maintain clear area to south of house for passive and active solar access

2 POINTS

2-94

Provide a covered front porch

3 POINTS

Front porches are elements of traditional neighborhoods that help extend living space outdoors, connecting private and public spaces. Among other functional uses, such as providing summer shade, porches enhance neighborhood safety by providing "eyes on the street." Allowing the porch to encroach slightly into the front setback makes the area more visually interesting for pedestrians without reducing the size of the backyard.

Resources

See resources listed under *Design Alternatives* above.

2-95

Position garage so it is not in front of house, while minimizing impervious driveway area

3 POINTS

To receive points for this credit, you cannot locate the garage in the front, or in any way facing the street.

The best place to put the garage is behind the house (where it began as a carriage house). Alley access, if that's part of a new development or an element of the infill lot you selected, reduces the dominance of cars and driveways in the front of the house, providing more visually interesting and safer sidewalks.

However, if alley access is not part of your development, you may wish to place the garage door openings to the side of the house to present a consistent look for the front of the house. The driveway can easily lead to the side entrance.

Resources

See Design Resources above.

- For information on varied garage placement and orientation, see http://www.ci.salinas.ca.us/Admin/MuniCodes/CodeFiles/_DATA/CHAP37/Article_II__Base_District_Regulation/Sec_37_34_Low_density_reside.html.

2-96

Minimize garage size

2 POINTS FOR 2-CAR GARAGE

5 POINTS FOR 1-CAR GARAGE

Minimizing garage size may help to encourage people to consider alternate transportation methods like mass transit, biking, or walking. It also helps to reduce the focus on having multiple cars.

Resources

See Design Resources above.

2-97

Build within $\frac{1}{4}$ mile of a transit stop

3 POINTS

When selecting sites for development, consider access to public transportation. Selecting sites that are within $\frac{1}{4}$ mile of a transit stop promotes the use of public transportation, which in turn provides environmental and community benefits.

2-98

Design to promote and encourage pedestrian-friendly and safe neighborhoods

1 POINT PER MEASURE

5 POINTS MAXIMUM

There are many ways to create more pedestrian friendly and safe neighborhoods. The following are example of design innovation and points awarded which will address this credit:

- Good visibility in front yard (no fences 5' or higher) and front door visibility from street
- Accessibility for bikes (at least 1 access with no steps or curbs)
- Special bike storage designed into garage OR separate storage outside
- Edible landscaping in front yard/in planting strip/or install vegetable garden planter boxes
- Plant street trees in courtesy strip
- Build North Area of the Lot First, Retaining South Area for Outdoor Activities

2-99

Bury utility lines in common trenches

2 POINTS

2-100 Utilities are installed using one or more alternative means such as tunneling instead of trenching, use of smaller (low ground pressure) equipment, or geomats to spread the weight of construction equipment, shared utility trenches or easements, and placement of utilities under streets instead of yards.

5 POINTS

2-101 Use dark sky compliant fixtures to minimize night glare

1 POINT

CREDIT NOT AVAILABLE WHERE REQUIRED BY LOCAL CODE

2-102 Build on a lot that is within ½ mile of at least six essential services

3 POINTS

Examples

- Grocery store,
- post office,
- place of worship,
- community center,
- daycare center,
- bank, school,
- restaurant,
- medical/dental office,
- laundromat/dry cleaner, etc

2-103 Driveways or parking are shared between multiple units

4 POINTS

2-104 Proximity to bike amenities within 1 mile

3 POINTS

Extra Credit for Site and Water

2-105 Extra credit for innovation in Site and Water

1-10 POINTS

You may submit a site or water saving strategy or system, not specifically called out in this Section, for consideration for an Extra Credit for Innovation. All extra credits will be approved by the Program Director. If approved, add up to 10 points to your Section total

Section 3 ENERGY EFFICIENCY

General Resources

- For Washington State Energy Code and Ventilation and Indoor Air Quality Code resources, see *Section One Resources: Build to "Green" Codes and Regulations* in Part II of this Handbook.
- *Washington State Energy Code Builder's Field Guide*, 6th edition 2004. Available through WSU Cooperative Extension, Educational Materials. To order, call 360-956-2000. This guide is available in PDF for free on the Internet http://www.energy.wsu.edu/documents/code/bfg/2004/BFG_Full_2004.pdf.
- "Energy Ideas Clearinghouse." The EIC is your library for information on energy efficient construction. EIC will provide customized responses to specific questions about energy efficiency, moisture control, ventilation, and green building. 800-872-3568 or e-mail EnergyLine@energy.wsu.edu. Or you can browse for resources yourself online at www.energyideas.org. The EIC is funded by the Northwest Energy Alliance, Olympia, WA, www.nwalliance.org.
- Formerly known as the Energy Efficiency and Renewable Energy Network (EREN), the site is now US DOE Energy Efficiency and Renewable Energy (EERE), a source of free information from the Department of Energy, www.eere.energy.gov
- NAHB Research Center's "ToolBase Hotline" is available to answer builder questions, 800-898-2842, www.nahbcrc.org/ToolBase.
- The Florida Solar Energy Center has done extensive research and testing on a range of issues related to energy efficiency in buildings, including comparisons of different building systems, 407-638-1000 or their website at www.fsec.ucf.edu.

Product Information

- *GreenSpec—The Environmental Building News Product Directory and Guideline Specifications*, E Build, Inc., Brattleboro, VT, 802-257-7300 or www.buildinggreen.com. GreenSpec is organized in standard CSI Divisions. *Environmental Building News* also offers product reviews, information, and also posts some journal articles at www.buildinggreen.com/products/productslist.html.
- *REDI Guide (Resources for Environmental Design Index)*, web database, diskette, or printed handbook; a good resource for energy-efficient products. Available from Iris Communications, Eugene, OR, 800-346-0104, or online at data.oikos.com/products.

Software

- Building Energy Software Tools Directory is available from EERE at http://www.eere.energy.gov/buildings/tools_directory/countries_sub.cfm.
- Energy Gauge, <http://energygauge.com/>, 1679 Clearlake Road, Cocoa, FL, 321-638-1492. Approved for 2007 edition.
- RemRate, available from Architectural Energy Corporation, <http://www.archenergy.com/products/remrate>, 2540 Frontier Avenue, Suite 201, Boulder, Colorado 80301, 303-444-4149. Approved for 2007 edition.

Technical Books and Guides

- *Builder's Guide*, by Joe Lstiburek. Published for four climate versions (For Pacific Northwest, appropriate climate type is "Mixed-Humid.") The guide includes illustrations and resources for such subjects as house layout and design, foundations, framing, HVAC, insulation, drywall, plumbing, electrical systems, painting, sheathing and windows all with respect to moisture control, energy efficiency and proper ventilation. Published by and available from Building Science Corporation, Westford, MA, 978-589-5100, or <http://www.buildingsciencepress.com>. Cost is \$40.00 plus S&H. Also available from the *Journal of Light Construction* Bookstore, 800-859-3669, or online at <http://jlc.buysub.com/>.
- *Iris Catalog*, publications, videos and software for the building industry, from Iris Communications, Eugene, OR, 800-346-0104 for a free printed catalog or browse the online at shop.oikos.com/catalog.

- *No-Regrets Remodeling: Creating a Comfortable Healthy Home That Saves Energy* (1997), published by *Home Energy Magazine* (See www.homeenergy.org/booksnguides) Cost is \$19.95 U.S. (plus \$3.50 S&H). To order, call 510-524-5405.
- *Twenty-First Century Townhouses: An Illustrated Guide*, NAHB Research Center, Upper Marlboro, MD. Cost is \$10.00 for the book and \$25.00 for the video. To order, call 800-638-8556 or order online at eshop.nahbrc.org/cgi-bin/nahbrc.storefront.

Solar

- *Passive Solar Buildings*, ed. by J. Douglas Balcomb, MIT Press, 1992. (\$70.00 at amazon.com).
- *Passive Solar Design and Construction Handbook*, by Steven Winter Associates. Published by John Wiley & Sons, 1997, ISBN: 0-471-18308-3. To order from John Wiley & Sons, call 800-225-5945 or e-mail catalog@wiley.com or order online at catalog.wiley.com. Cost is \$90.00 plus S&H. Also available from Iris Communications, 800-346-0104 or online at shop.oikos.com/catalog.
- *The Passive Solar House*. Ten “solar principles” highlight key concepts. Includes a series of worksheets and extensive tables. Available from Iris Communications, 800-346-0104, or www.oikos.com. (\$25.00)
- *The Residential Building Design and Construction Workbook*, available from Cutter Information Corp. in Arlington, MA. 800-964-5118 or www.cutter.com.

OVERALL

3-1 Document a reduction in overall home energy use using approved energy modeling software

1-50 POINTS

1 POINT PER 1% IMPROVEMENT OVER CODE

Approved Modeling Software:

- WSU UA Alternative Worksheet
- REM Rate
- Energy Gauge
- TREAT
- ResCheck
- *Other software may be allowed upon prior approval*

3-2 Build a zero net energy home that draws zero outside power or fuel on a net annual basis (based on modeling)

50 POINTS

A Zero Net Energy Home combines state-of-the-art, energy-efficient construction and appliances with renewable energy systems such as solar water heating and electricity resulting in a house that produces as much or more power than it consumes. Generally, Zero Net Energy Homes are connected to the utility grid, with energy consumption measured on an annual basis, allowing for excess energy produced to be sold back to the utility.

Zero Net Energy Homes optimize climate-specific design, passive solar heating and cooling, solar thermal and solar electric systems (active solar), and energy efficient construction, appliances, and lighting. The goal of this strategy is performance-based, so you must use other Action items in this section, as well as other sections from the checklist, as part of your plan to achieve a net zero energy consumption rate for the home. For instance, geothermal heating might help the house achieve net zero along with photovoltaic power generation, an advanced shell design, a super high efficiency distribution system, and exceptional ventilation to reduce cooling loads.

- Building a net-zero home is possible with the Inland Northwest climate conditions, but requires much up-front planning to ensure ultimate performance of the home. Coordination with the local utility is also required regarding the potential for feeding and selling excess energy into the grid. To guarantee that the home achieves net-zero performance, consult with a third party verifier and submit the verification results to the HBA along with the completed Built Green Checklist for the home. Refer to the resources section in Part II for a list of HBA approved Third Party Verifiers.

Program note: wood burning heating options do qualify for zero-net energy IF it comes from pellet stoves or EPA certified stoves. Absolutely no Russian or Rumsford stoves allowed. "Creative" fireplaces use electric power and can be used in place of traditional fireplaces.

Resources

- DOE Building Technologies Program, <http://www.eere.energy.gov/buildings/>.
- "Moving Toward Zero Energy Homes" by U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. Available online at www.eere.energy.gov/buildings/info/documents/pdfs/35317.pdf.
- "On the Path to Zero Energy Homes" by U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. Available online at www.eere.energy.gov/buildings/building_america/pdfs/29915_zeb_path.pdf.
- National Renewable Energy Laboratory's (NREL) Photovoltaic (PV) research (<http://www.nrel.gov/pv/>) provides "A Consumer's Guide to Buying a Solar Electric System," <http://www.nrel.gov/docs/fy99osti/26591.pdf>.
- The Net-Zero Energy Home (NZEH) Coalition, www.netzeroenergyhome.ca/
- "The Near-Zero-Energy House" by Solar Today, May/June 2005. Available online at www.solartoday.org/2005/may_june05/ZEH.htm.

ENVELOPE

Thermal Performance

3-3

Document envelope improvements beyond code (UA Alternative approach)

1 POINT PER 1% IMPROVEMENT OVER CODE
40 POINTS MAXIMUM

The current Washington State Energy Code allows three possible approaches to demonstrate compliance. Check with Washington State Energy Office for the most recent updates in the Energy Code.

The UA Alternative Approach allows you to trade off the thermal efficiency of one component for another. It compares building envelope heat loss rates of the proposed house design to a Code-defined reference house.

The Washington State Energy Program (WSU) and your local building department have developed spreadsheets to calculate performance using this approach.

Use a spreadsheet, or code forms to document improved performance (Total UA {area x U-Factor} of the proposed building / UA of the WSEC code reference building). Score one point for each percent of energy saved, calculated as follows:

Divide your proposed total UA by the Target UA Total. Subtract that number from 1, and multiply the result by 100, rounding to the nearest number. That is the number of points you will take.

Example: If your Proposed UA Total is 205, and the Target UA Total is 235, divide 205/235, the result will be .8723. Subtract this from 1, and you get .1277. Multiply by 100, and you get 12.77. Round to 13, and score 13 points.

Resources

Document results using Chart 3-A, "BUILT GREEN Component Performance Method" in the Appendix. Provide a completed copy of Chart 3-A to the homeowner as part of their Operations & Maintenance Kit.

- http://www.energy.wsu.edu/documents/code/CPWorksheets/CPWorksheet_instruct.pdf

3-4

Document envelope improvements beyond code (prescriptive approach)

1-40 POINTS

Use the prescriptive approach and Chart 3-B, provided in Appendix, to note the actions you will take to improve efficiencies above and beyond that prescribed by the energy code for building components. Note the efficiencies you expect to achieve.

See Chart 3-B for point assignments, which are based on measures taken (range is 1 to 55 points).

The prescriptive approach is the simplest method of code compliance. There are two different forms for documenting prescriptive code compliance.

The original chart was produced using a base model home and the component trade off method. Each measure is input individually, and the upgrade is assessed in the same manner at Chart 3-A, see above.

See Appendix Section for weblinks that can help you with the new code changes.

Resources

See Chart 3-B, "BUILT GREEN Prescriptive Scoring Method Upgrades for 'Other Fuels'" in the Appendix.

- Washington State University Cooperative Extension Builder's Field Guide, 6th Edition contains "Prescriptive Approach – Simple Form for the Washington State Energy Code (2004 Second Edition), Climate Zone 1, by Washington State University Cooperative Extension Energy Program. Available online at www.energy.wsu.edu/documents/code/wsec2004/Simple1.pdf.

3-5

Home is ENERGY STAR Homes Northwest certified

10 POINTS

ENERGY STAR Northwest Homes is a joint program of the Environmental Protection Agency (EPA), the Department of Energy (DOE), and the NW Energy Efficiency Alliance to promote smart consumer choices for products, building upgrades, and homes that go beyond our already stringent local codes to save money while preventing pollution.

As Built Green members, builders agree to construct new homes that offer a 15% improvement in energy consumption over WEC compliance. Once a home's performance is verified by an *independent, third-party expert*, the home can bear the ENERGY STAR label.

Contact Dave Hetherington, Sr. Program Manager for Northwest ENERGY STAR, for current information; By phone at (503) 808-9003 ext 103 or via email at DHetherington@fluidms.com.

For details of the specification of this program, please see **Error! Reference source not found..**

Table 3-1 Pacific NW ENERGY STAR New Construction Specification for Site-built, Single Family Dwellings

COMPONENT	WA NW REQUIREMENTS		
	Envelope Path	Ducts Inside Path	Equipment Path
Ceiling	R-49 (R-29 at the Edge)	R-49 (R-29 at the Edge)	R-49 (R-29 at the Edge)
Above Grade Wall	R-21 + R-5 Exterior Foam	R-21	R-21
Below Grade Wall	R-21 (interior) or R - 10 (exterior)	R-21 (interior) or R - 12 (exterior)	R-21 (interior) or R - 12 (exterior)
Slab	R-15 (2ft. perimeter)	R-15 (2ft. perimeter)	R-15 (2ft. perimeter)
Window	U-.25	U-.30	U-.30
Glazing Area	21%	21%	21%
Heating System	9.0 HSPF 92 AFUE	9.0 HSPF 92 AFUE	9.0 HSPF 94 AFUE
Water heating system	Gas 0.61 EF/ Elec 0.93 EF	Gas 0.61 EF/ Elec 0.93 EF	Gas 0.82 EF/ Elec 2.0 EF
Framing Type	Int. Framing, 6 sided V-Walls	Adv. Framing or R-5 Exterior Foam, 6 sided V-Walls	Adv. Framing or R-5 Exterior Foam, 6 sided V-Walls
Envelope Tightness	4.0 ACH @50 Pa		
Ventilation	Central Exhaust or HRV		
Duct Tightness	3.75% @25Pa, 6% @ 50 Pa, or 75cfm	Not Required	3.75% @25Pa, 6% @ 50 Pa, or 75cfm
Lighting	80% CFL or Pin-based		
Appliances	All built-ins are ENERGY STAR		
Plumbing	1.75 gal/min (shower head), 1.0 gal/min (faucet)		

See Section Three Resources in Part II for the website providing more information about this program and how to join.

by the HBA, refer to the Section Three Resources in Part II of this handbook.

3-6 Install no more than 1% of conditioned floor space of skylights, or NO skylights

1 POINT IF SKYLIGHTS ARE LESS THAN 1% OF CONDITIONED FLOOR SPACE

2 POINTS IF NO SKYLIGHTS

Because skylights use sunlight in addition to daylight, they can be three to ten times smaller than a window while collecting the same amount of light. Beyond a certain skylight to floor ratio, increases in heating and cooling loads can outweigh lighting energy savings, thus increasing the overall energy use of the home. Installing no more than 1% of the floor space with skylights provides optimum daylighting while maintaining the overall energy efficiency of the envelope.

See the Resources Section in Part II for references to Skylighting Guidelines and an excel program, called SkyCalc that can be used to determine the most effective skylight design for your project.

Resources

- "Modular Skylight Guidelines and Report" by The Heschong Mahone Group, Inc. is available at <http://www.h-m-g.com/downloads/>.
- "Design Guidelines: Skylighting Guidelines" by Energy Design Resources, <http://www.energydesignresources.com/resource/140/>.
- SkyCalc software by Energy Design Resources, available online at www.energydesignresources.com/resource/129/.

3-7 Skylights maximum of U-0.2

5 POINTS

3-8 All windows w/ maximum of U-0.20

10 POINTS

3-9 Design with low window to floor ratio (<12%)

3 POINTS

3-10 Install full continuous rigid insulation beyond code beneath any slabs on grade

5 POINTS

3-11 Install dense-packed cellulose (over 2.5 lbs/inch), wet-blown cellulose, blown-in foam, fiberglass BIBS, or blown-in fiberglass as insulation

5 POINTS

To receive credit for this Action item, insulation can be cellulose, wet-blown cellulose, blown-in foam, fiberglass bibs, or fiberglass. This installation provides the ideal thermal stop and reduces air leakage.

Blown-in insulation products, including cellulose or Icynene, have an advantage over fiberglass in that they provide better penetration and filling of cavities and are made from non-toxic materials. The insulation can be dry-blown or poured loose-fill into enclosed cavities, but is most commonly wet-sprayed. When sprayed, the product leaves few voids, reducing problems with air infiltration. Blown insulation must be carefully installed to prevent "overblowing," which reduces the R-value for a given, installed thickness. Careful installation of blown insulation in attics assures even coverage, avoiding high and low areas with varying R-values, and avoids blocking ventilation paths. Ask how the insulation contractor controls for the proper amount of insulation material and depth.

Fiberglass Blown-In-Blanket (BIB) is similar to "wet-spray" cellulose in that the material is mixed with latex adhesive, misted with water to activate the glue, and blown into wall stud cavities. Over time, cellulose in attic installations may settle and lose its R-value, to compensate for this, it is recommended to install 20% more in this area. Check the manufacturer's claims regarding "settled thickness" recommendations. For wall cavity applications, research indicated that it is possible to install without settling, so long as initial installation was done to proper density.

Cellulose can also be dry-packed into wall cavities. Cellulose insulation is made from 100% post-consumer recycled newspapers or telephone books and is usually combined with boric acid or sodium borate as a fire retardant. An additional benefit of boric acid is that it kills carpenter ants and termites. See also Action items 5-

115, All insulation to have a minimum of 40% recycled-content, and 5-116, Use Environmentally Preferred (EPP) Insulation Products (Formaldehyde-Free, CFC-Free, HCFC-Free).

Soy Based Foam insulation expands to 100 times its volume to fill every space and void and create a barrier and thermal seal. It is not affected by moisture, mold, insects or rodents, and is produced from plant-based and recycled renewable resources that reduces demand and dependence on non-renewable petroleum reserves. It is usually water blown, has no VOC's nor does it contain urea or ozone depleting CFS's or HCFC's, doesn't settle, and provides an R-Value of 3.6 per inch or greater. It also has a high fire class rating, at Class 1.

Installation usually involves using special equipment that blows the insulation through and into the cavities or attic space. Generally professional installers ensure proper density and complete coverage. See the Resources Section for references to help determine proper density. If you contract with a professional insulation installer, have them include air-sealing in the estimate. See Action item 3-15, *Use Airtight Drywall Approach to Framed Structures*.

Other considerations to think about are selecting the appropriate material for areas around pipes, remembering not to cover eave vents in attic installations, and wearing protective clothing and respirators based on the material you choose.

Resources

- "Loose-Fill Insulation" by U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy. Available online at www.eere.energy.gov/consumer/your_home/insulation_airsealing/index.cfm/mytopic=11650.

3-12

Install frost-protected shallow foundation, minimum R-10 insulation

5 POINTS

Frost-protected shallow foundations (FPSF) have been used in some of the coldest climates in the world to improve energy efficiency through moderating the temperature of the foundation. FPSF also reduce construction costs while achieving the same impact as sinking foundations below the frost line. Implementing a frost-protected shallow foundation still affords protection to the foundation from frost heaves, while reducing the amount of excavation and construction material needed to extend foundations below the frost line. In heated buildings the insulated foundation uses the radiated heat from the building and the underlying earth to reduce the impact of frost. For unheated buildings, such as garages latent heat from the ground is enough to reduce the chance of possible frost heaves. When implementing FPSF follow IRC design guidelines and specifications.

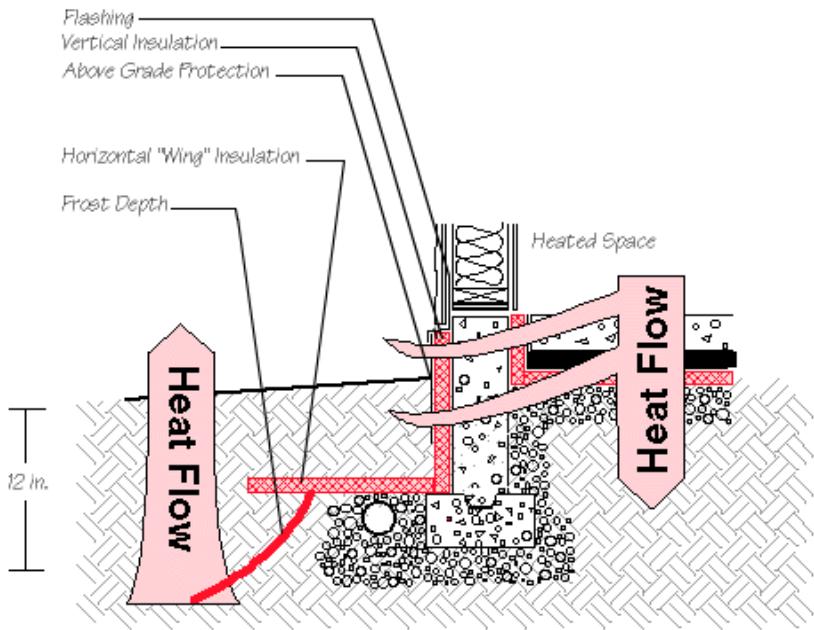


Figure 3-1 Heat Exchange Occurring at an insulated building foundation

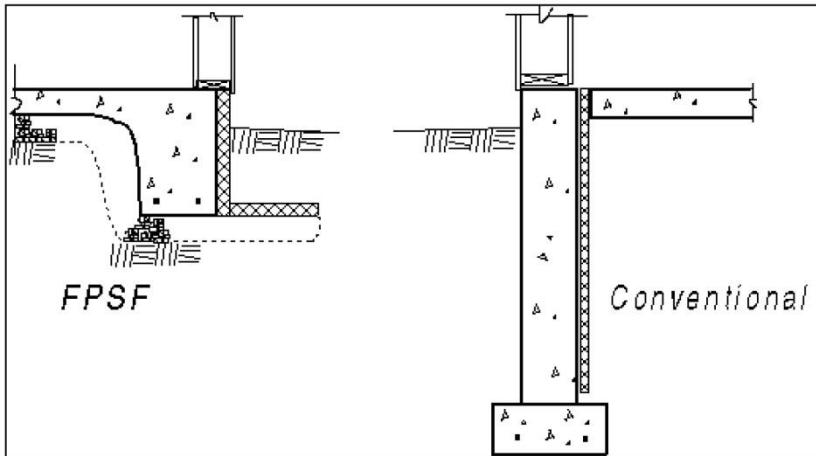


Figure 3-2 A frost protected shallow foundation in comparison to a conventional house foundation.

<http://oikos.com/esb/43/foundations.html>

3-13

Skylight shafts insulated to R-38, covered with GWB, OSB or other rigid sheathing to prevent air movement through the insulation from degrading the insulation value

2 POINTS

3-14

Specify and use raised-heel trusses ($\geq 8\text{in.}$) or SIPs roof, to allow full insulation over conditioned space

2 POINTS

Use full-depth insulation to the outer edge of conditioned space, using a raised-heel truss or extended truss work at least 6" over exterior wall/top plate. The specification of energy heels in the original truss order should not add costs. Figure 3-3 provides options to maintain full heel insulation (advanced frame ceiling).

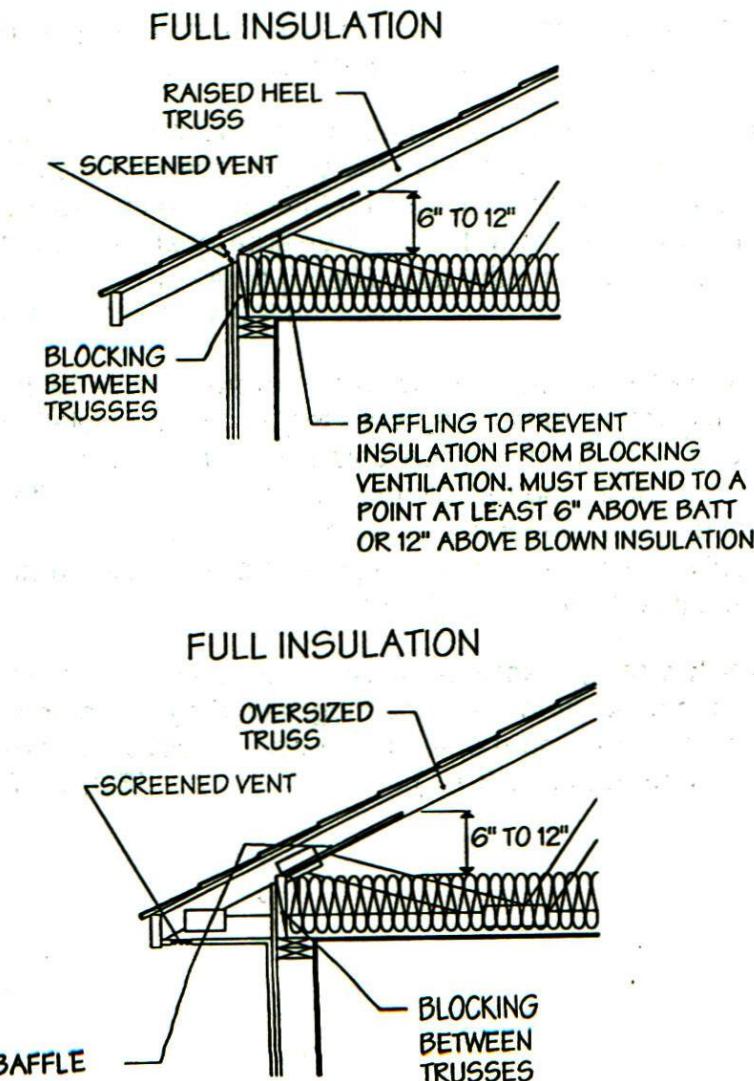


Figure 3-3 Construction Details, Full Heel Insulation
(Source: Washington State Energy Code Builder's Field Guide)

Resources

The figure provides options to maintain full heel insulation (advanced frame ceiling).

- *Washington State Energy Code Builder's Field Guide*. See Chapter 3,—Framing, II (listed in General Resources above).

Air Sealing

Proper air sealing can have a major impact on energy savings. Department of Energy estimates that up to 30% of a home's energy can be lost through air leaks. Typical areas for sealing include under sill plates, around windows, doors, framing members, and electric, plumbing and mechanical penetrations. Sealing materials, which include caulk, sealant, foam, and tape, are easy to find and inexpensive.

Please note that “tightening” the home to save energy requires careful attention to indoor air quality.
Providing an adequate, controlled supply of fresh air to the home is addressed in **Section Four: Health and Indoor Air Quality**.

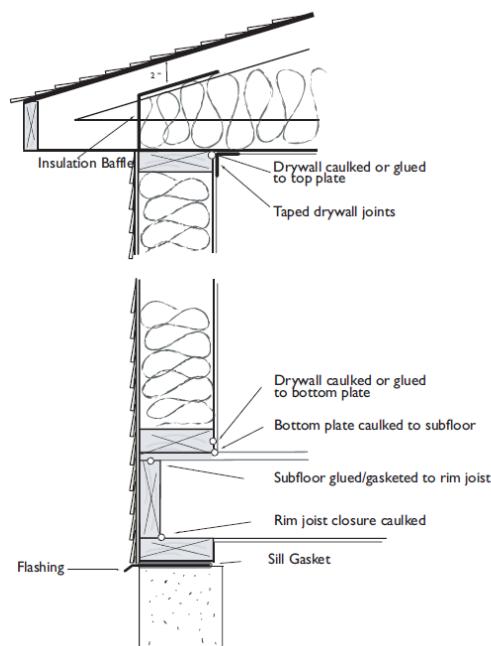
3-15

Airtight drywall approach for framed structures using thermal enclosure checklist

3 POINTS

The airtight drywall approach (ADA) for framed structures is an advanced sealing package that goes beyond basic practice. Specifically, it includes caulk or gasket drywall installed on exterior walls at the top and bottom plates, windows and doorframes; caulk or gasket drywall installed on interior walls at intersections with exterior ceilings; and caulk or gasket electrical, plumbing or mechanical penetrations in the drywall.

Proper attention should be given to the quality and durability of the sealing materials as well as the type of sealant for the size of the gap. Install quality, self-closing dampers on vents to prevent backdrafts on windy days.



Resources

- Advanced Framing, Techniques, Troubleshooting, and Structural Design. 46 Selections from the Journal of Light Construction, pp 274-276. Order at 800-859-3669 or www.jlconline.com/bookstore.
- Builder's Guide, by Joe Lstiburek (See Resources, Technical Books and Guides, above).

3-16

Blower door test results better than 3.5 ACH₅₀ (5 points), or 2.5 ACH₅₀ (10 points)

NOT APPLICABLE IF CLAIMING UNDER WSEC TABLE 406.2

THIS CREDIT IS ONLY AVAILABLE IN CONJUNCTION WITH ACTION ITEM 4-64, AND THE INSTALLATION OF A WHOLE HOUSE FAN BEYOND CODE REQUIREMENTS.

5 POINTS IF BLOWER DOOR TEST RESULTS IN BETTER THAN 3.5 ACH₅₀
10 POINTS IF BLOWER DOOR TEST RESULTS IN BETTER THAN 2.5 ACH₅₀

Blower door tests are used to both identify air leakage paths in a home and to quantify air leakage ranges. Blower doors are also used to locate duct leaks.

A blower door consists of a variable speed fan sealed into an exterior doorway and used to blow air into or out of a house. When air is blown out of the house, the house develops a slight negative pressure (or vacuum) relative to outside. The pressure differential drives outside air into the house (infiltration) through any available openings in the exterior shell. These leaks can be located by touch or with smoke, then sealed.

In addition, the pressure induced by the blower door can be used to yield a quantitative estimate of the "leakiness" of the home (in square inches). Additional calculations yield the approximate natural air change rate (ACH).

Blower door tests of homes built to code average 0.34 ACH. Reducing to 0.30 ACH through improved air sealing will reduce annual energy use by about 8% and is very achievable. (Homes with forced air systems will have a slightly higher ACH.)

It's best to do a blower door test once just before sheet rock and once after sheet rock, but before attic insulation is blown in.

Resources

Blower Door Testing, a seven-minute video, demonstrates generic blower door set-up procedures and shows how to conduct air leak diagnostics using smoke sticks; also includes examples of many air leakage sites. Available from Iris Communications, Eugene, OR, 800-346-0104 or www.shop.oikos.com/catalog, \$15. Many full-service heating contractors will perform blower door tests.

Blower door manufacturers include:

- The Energy Conservatory, Minneapolis, MN, 612-827-1117. See <http://www.energyconservatory.com/articles> for links to articles in *Home Energy Magazine* about blower doors and testing.
- Infiltec, Falls Church, VA, 703-820-7696 or 540-943-2776, or www.infiltec.com.
- Retrotec, Bellingham, WA, 360-738-9835 or www.retrotec.com.

3-17

Use an air barrier on the exterior wall assembly installed per manufacturers guidelines

3 POINTS

Exterior Air Barrier—An air barrier material is any House Wrap, sprayed applied fluid or other building material with air permeance less than or equal to 0.02 L/(s·m²) @ 75Pa (0.004 cfm/ft² @ 1.57 psf) as measured in accordance to ASTM E2178 Standard Test Method for Air Permeance of Building Materials. Material should be installed continuously on building walls according to manufacturer's guidelines regarding detailing, taping of seams and fastening method.

Adding an External Air Barrier has many long term performance characteristics to a building envelope.

Improved Comfort: A tighter building envelope reduces the drafts and can maintain a more consistent level of comfort throughout the house.

Improved Indoor Air Quality: A tighter building envelope reduces the infiltration of moisture and outdoor air pollutants.

Lower Energy Bills: Air leakage accounts for 25% to 40% of the energy used for heating and cooling. Installing the air barrier on the exterior of a wall surface also reduces the "wind washing" effect which helps to protect the designed R-Values of the insulation products used in the wall system.

Reduced Condensation Issues: A tighter building envelope can reduce the amount of air transported moisture which can condense on cold surfaces within the envelope.

Reduced Obsolescence: Tighter building envelopes are expected to become standard practice for the building industry

Reduce Thermal Bridging

Where framing members make full connection between the interior drywall and exterior sheathing, a cold spot forms. These areas increase heat loss, reduce comfort, and increase condensation on interior surfaces. In addition, cold spots attract dirt and will soil faster.

Limit the number of framing members that fully bridge the interior and exterior surfaces to save energy and produce a more comfortable home. The thermal bridges that allow heat to escape include solid headers over doors and windows and other paths for conductive heat loss.

3-18

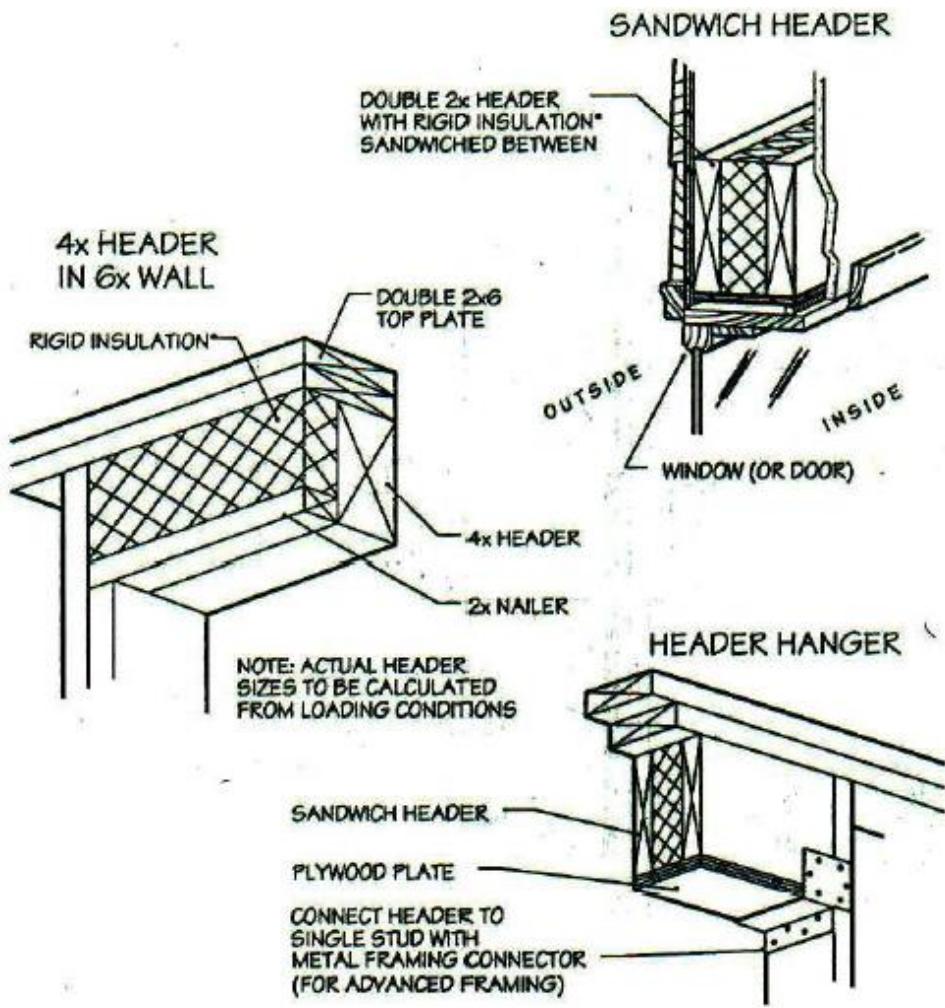
Use insulated headers

1 POINT

As much as 4% of the area of the typical building envelope consists of window and door headers. Insulated headers reduce thermal transfer (bridging) found in standard construction using solid wood headers for exterior window and door openings (see Figure 3-4). Although they can be purchased pre-assembled, they are often built on-site by sandwiching rigid insulation between the lumber. Using insulated headers achieve higher R-values without sacrificing structural integrity.

Typically, 4x and 6x have been used for header stock, but they should only be used when structurally necessary. Doors in non-load bearing walls do not require structural headers. Building codes allow these practices and recognize this proven performance.

If you use a King Stud and insulated header or a let-in header with framing clips instead of cripple studs, you save lumber and there will be more room in your walls for insulation.



* RIGID INSULATED HEADERS REQUIRED ONLY FOR ADVANCED FRAMING. OTHERWISE FILL CAVITIES WITH REGULAR WALL INSULATION.

Figure 3-4 Insulated Headers
(Source: Washington State Energy Code Builder's Field Guide)

Note: Points are awarded *only* for improvements that are above and beyond Washington State Energy Code requirements.

Resources:

- *Washington State Energy Code Builder's Field Guide*, See Chapter 3, "Framing," (listed in General Resources above) as well as references listed in the *Field Guide*.
- Ask your local building supply house for "The Nailer," a recycled-content plastic drywall clip that is wider and easier to use than many other clips. It can be installed with a stapler using 1/2-staples.

3-19

Where applicable, use 2-stud instead of 3-stud corners, and fully insulate corners

1 POINT

Of the 3 studs usually placed in corners, only one is required for the structural load. The others are used for drywall backing for the interior and exterior sheathing. Constructing 2-stud corners reduces material use and leaves additional space for insulation. (see Figure 3-5). Drywall clips spaced two feet apart can provide back-up for interior finish materials. Place the clips where one wall abuts another, or where two walls intersect at corners.

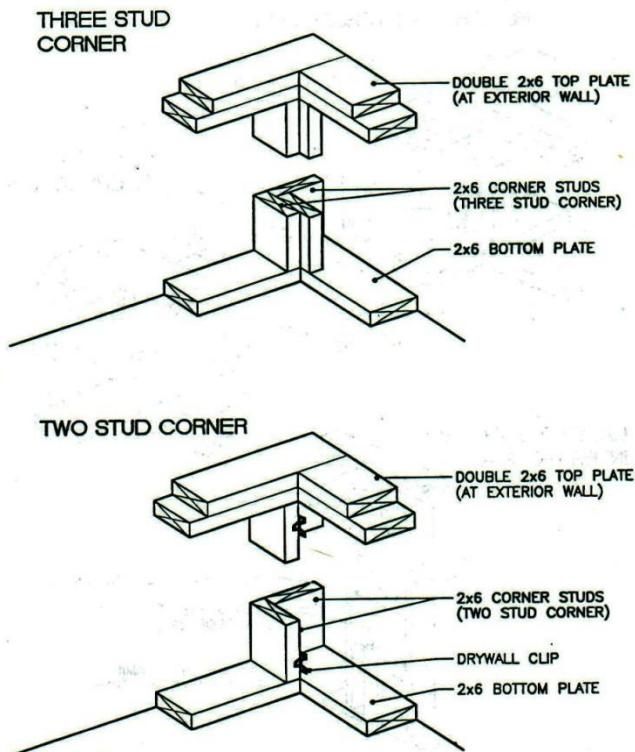


Figure 3-5 Corner Construction
(Source: Washington State Energy Code Builder's Field Guide)

Resources

- *Washington State Energy Code Builder's Field Guide*, See Chapter 3, "Framing," (listed in General Resources above).
- Ask your local building supply house for "The Nailer," a recycled-content plastic drywall clip that is wider and easier to use than many other clips. It can be installed with a stapler using 1/2" staples.

3-20

Fully insulate at interior/exterior wall intersection by open cavity framing

1 POINT

Optional framing details provide for easy placement of insulation. Ladder Blocking can also be used to create room for insulation. Refer to the Washington State Energy Code Builder's Field Guide.

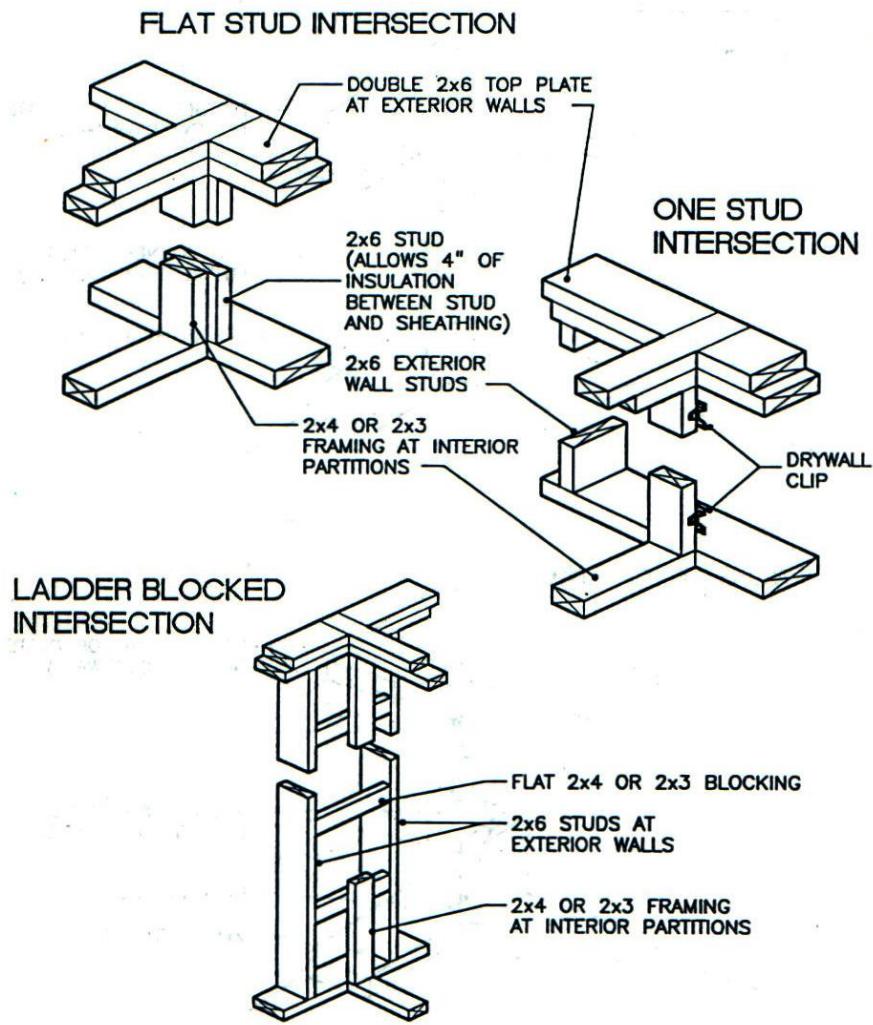


Figure 3-6 Construction Details for Easy of Insulation
(Source: Washington State Energy Code Builder's Field Guide)

Resources

See Chapter 3, "Framing," in *Washington State Energy Code Builder's Field Guide* (listed in General Resources above).

3-21

Use structural insulated panels (SIPs), insulated concrete forms (ICFs) or straw bale for exterior walls around conditioned space

10 POINTS

Because SIPS contain few framing members, they have fewer thermal bridges than conventional wood frame construction. Do not select SIPs made with CFCs. See Action item 3-15, *Use Airtight Drywall Approach for Framed Structures* for more information.

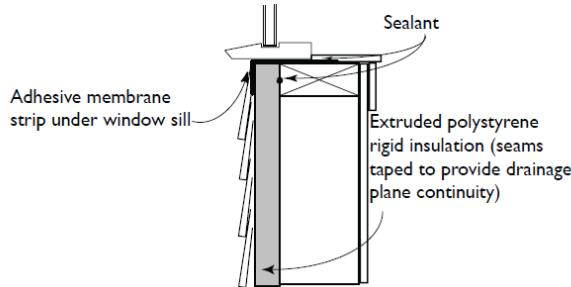
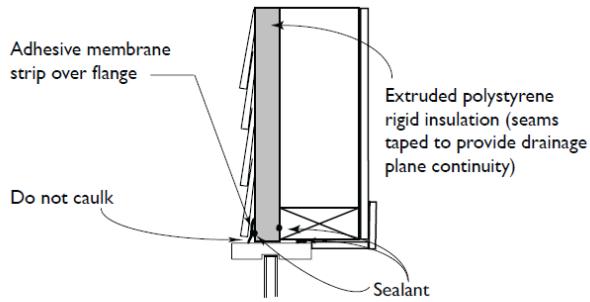
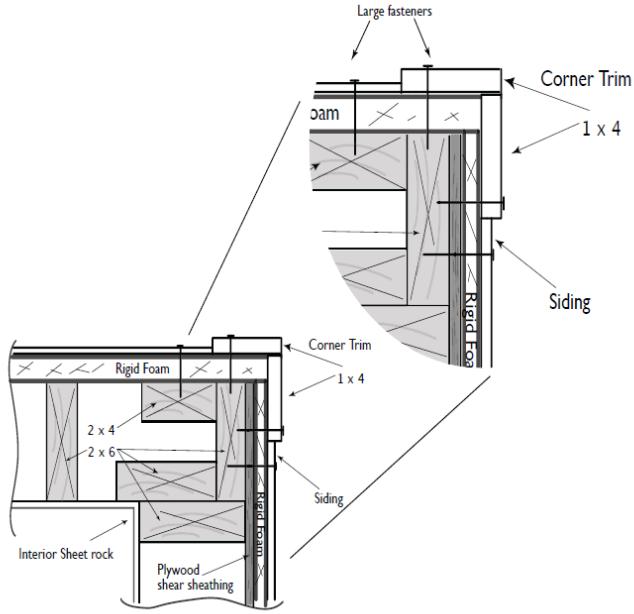
ICFs are rigid plastic forms which hold concrete in place afterward to function as thermal insulation in concrete walls. Typical insulation values range from R-17 to R-26 compared to R-13 to R-19 for most wood-framed walls.

Straw bale insulation provides an excellent, non-toxic insulation. It is predicted that a straw bale home can save as much as 75% of energy costs resulting in savings to homeowners and reduction of fossil fuels and CO₂ emissions.

2 POINTS

Rigid foam insulation has the highest R-value per inch of any common type of insulation. Applying the foam to cover all of the wood framing reduces thermal bridging associated with batt or blown-in insulation. Another approach that essentially eliminates the thermal bridges of framing lumber is to use continuous rigid foam insulation as an exterior sheathing material. This approach is particularly useful where local code requirements require the use of additional framing materials for severe seismic and wind load requirements. It can be used to meet energy code requirements for wall R-values using a 2x4 wall with 2" of extruded polystyrene (XPS), or to raise both the nominal R-value and the whole-wall R-value of a 2x6 wall with rigid foam generally between 1/2" and 2".

- Use rigid foam that is vapor retardant (e.g. XPS), not a vapor barrier (e.g polyisocyanurate or foam backed product) to allow walls to dry to the outside in winter;
- Rigid foam can provide an effective drainage plane and must be flashed, and sealed and taped at seams. Alternately, an externally applied house wrap or builder paper may be used for the drainage plane;
- Foam may replace wood sheathing, reducing material costs;
- Use let-in wood or steel bracing for stability and to meet required sheer performance;
- Plywood may be required in some locations to meet sheer requirements. Use thinner sheets of foam to shim over these panels;
- Fasteners for siding and trim must be long enough to penetrate foam and required depth of wood;
- Use siding that only requires fastening at required stud spacing (16" or 24") if using only foam for sheathing;
- At rough openings, flashing details and window/door placement should be moved outward to align with the drainage plane;
- Cantilever gable truss to line up with face of foam sheathing by sistering a bearing block to the bottom chord, bearing on the framing top plate;
- Adequately protect foam from pest infestation at bottom of wall.



3-23

Use advanced wall framing, 24-inch on-center, w/ double top plate

3 POINTS

Advanced Wall Framing is a code recognized process that incorporates 24-inch on-center framing with increased insulation. Other features include two-stud corners and intersections or other means of fully insulating corners and one stud is used to support each header (see Action item 3-19, *Where Applicable, Use 2-Stud Instead of 3-Stud Corners, and Fully Insulate Corners*), insulated headers consist of double 2x material with R-10 insulation between the header and exterior sheathing. Sandwich headers are common using advanced framing techniques, and full insulation where interior partition walls meet exterior walls (see Action item 3-20, *Fully Insulate at Interior/Exterior Wall Intersection*).

To help increase the efficiency of exterior walls, use ladder partitions. The usual practice of adding extra studs in the exterior wall to provide nailing for drywall creates an inaccessible pocket that can't be insulated after exterior

sheathing is installed. In ladder partition, the horizontal blocking across the front of the wall cavity allows for plenty of insulation behind. This alternative saves lumber and improves R-value.

On average, advanced framing uses 30% less lumber, takes less time to construct and costs less to build because the reduced use of lumber more than offsets the additional cost of header insulation. Construction cost savings is estimated at \$0.29 per square foot of wall area. Total savings for this measure alone are 2 to 4% of total energy use.

You'll need to use sheathing, siding and drywall rated for 24-inch stud spacing. Fewer studs mean fewer plumbing and electrical penetrations and fewer nail or screw holes to seal and sand. Although more insulation is required, wider stud spacing results in fewer pieces of insulation and therefore faster installation.

Tip: To eliminate concerns about "wavy walls," install exterior sheathing horizontally rather than vertically.

To receive credit must be at least 85% of Building Envelope

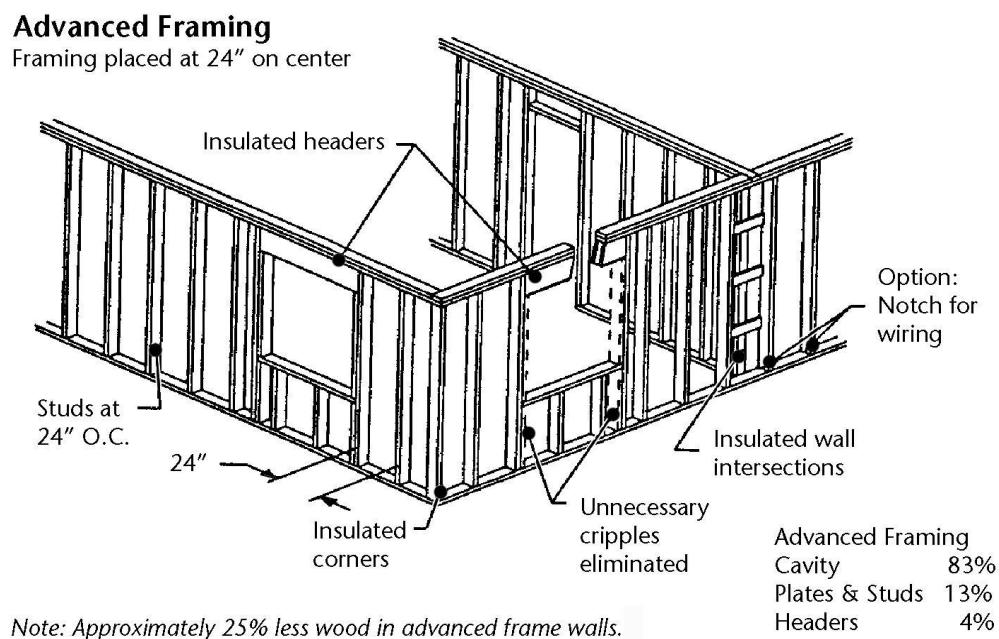


Figure 3-7 Advanced Framing

Resources

- *Washington State Energy Code Builder's Field Guide.* (See General Resources, above.) See Framing Chapter.
- *Builder's Guide*, by Joe Lstiburek. (See Resources, Technical Books and Guides, above.)
- *Advanced Framing, Techniques, Troubleshooting, and Structural Design.* Published by the *Journal of Light Construction*. A good general reference for advanced framing. Covers a broad range of topics on tools, building layout, floor, wall, and roof framing, engineered lumber, energy details and more. Available from the *Journal of Light Construction* Bookstore, 800-859-3669, fax 802-434-4467 or online at www.jlconline.com/bookstore.
- See *Super Good Cents Builder's Guide to Energy-Efficient Construction* for information on advanced air sealing techniques. Available from Bonneville Power Administration, 800-622-4520 (\$10).
- For information about efficient (or "Advanced") framing, contact the Energy Ideas Clearinghouse (See General Resources, above.)

4 POINTS

As an alternative to 3-23, using Advanced Framing with a single top plate, further reducing thermal bridging and materials usage.

This approach requires stacked framing so that rafters, trusses, joists and studs are vertically aligned to properly transfer loads through the frame to the foundation.

3-25

Use drywall stops or clips for backing

1 POINT

3-26

Innovative stick framing to reduce thermal bridging, by methods such as double wall framing and horizontal wall furring

3 POINTS

TO RECEIVE CREDIT MUST BE AT LEAST 85% OF BUILDING ENVELOPE

There are other innovative stick framing alternatives that reduce thermal bridging. Double Wall Framing provides for load bearing interior wall and a lighter framed exterior wall that supports the exterior finishes. This technique allows for a wide range of higher insulation values. The primary benefit of this technique is that it thoroughly reduces thermal bridging.

Rigid foam insulation has the highest R-value per inch of any common type of insulation. Applying the foam to cover all of the wood framing reduces thermal bridging associated with batt or blown-in insulation. In addition, foil-faced sheathing and extruded polystyrene sheathing retard movement of water vapor. First, vertical studs carry the load. Then the horizontal framing goes over the vertical studs to make the wall thicker and where additional insulation is installed. Because the two framing layers only touch at intersection, there is an increase in efficiency. Installing horizontal wall furring strips accelerates drying of rain-wetted siding to minimize moisture-associated problems in the envelope.

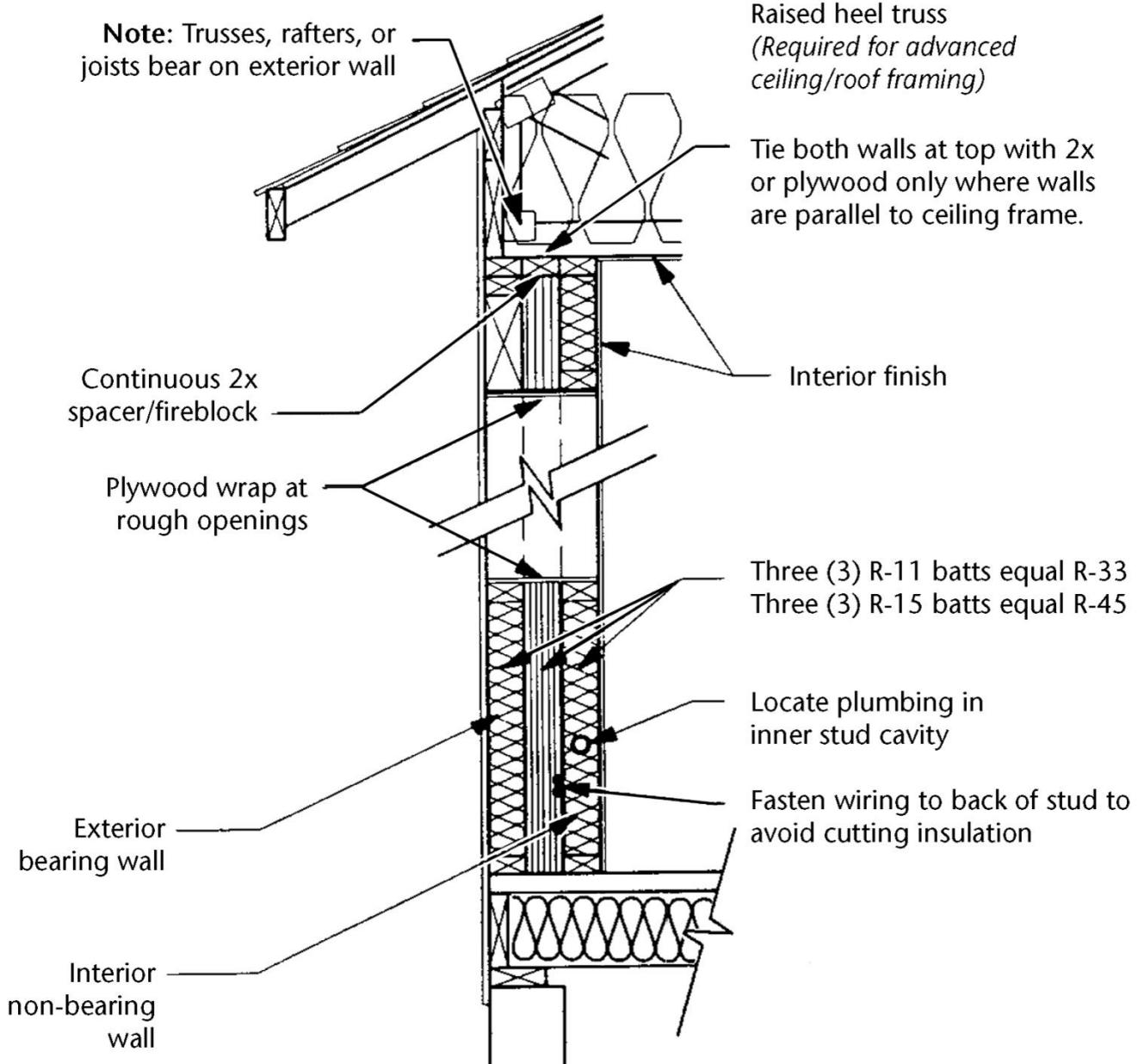


Figure 3-8 Double Wall
(Source: Washington State Energy Code Builder's Field Guide)

Resources

See General Resources above, particularly the field guides.

3-27

Free air movement in attic or on site framed roof systems exceeding code by 15%

10 POINTS

3-28

Install storm door system with magnetic seal

3 POINTS

Solar Design Features

Good solar design can reduce heating bills and eliminate the need for mechanical cooling. Solar features also provide consumers with attractive natural lighting and reduce interior temperature swings. However, solar design is a comprehensive practice. If you approach it piecemeal, you may end up overheating the home, causing discomfort and increasing the demand for cooling.

To be effective, solar strategies must be considered during the design phase of a project. By placing approximately 50% of the glazing on the south side of the structure and including thermal mass features in the living space of the home, you can achieve 20% savings in energy. (There may be additional cost in construction for these features.) Simple, easy-to-use software is available to help the designer optimize the solar design.

3-29

Orient home on site to optimize passive solar strategies

5 POINTS

The best use of solar energy on site involves many aspects, such as building orientation, building design, and landscape placement. The long walls of a home (and windows in those walls) absorb the most heat from solar radiation. Orient buildings so that longer walls face north and south, so that they can be protected from the high angle sun using roof overhangs. The east and west walls are exposed to lower angle sun, which can be blocked with vertical shading, fences and deciduous plantings that will shade in summer, but let sun through in winter.

Homes are generally located on a site to maximize views and access roads. When planning for solar orientation, there may be trade-offs to address these and other considerations.

3-30

Passive solar design, basic features installed

5 POINTS

Basic features include east/west orientation, optimal glazing, and properly sized overhangs. These strategies will prevent excessive solar gains in the summer while allowing the sun to enter the home during the heating season.

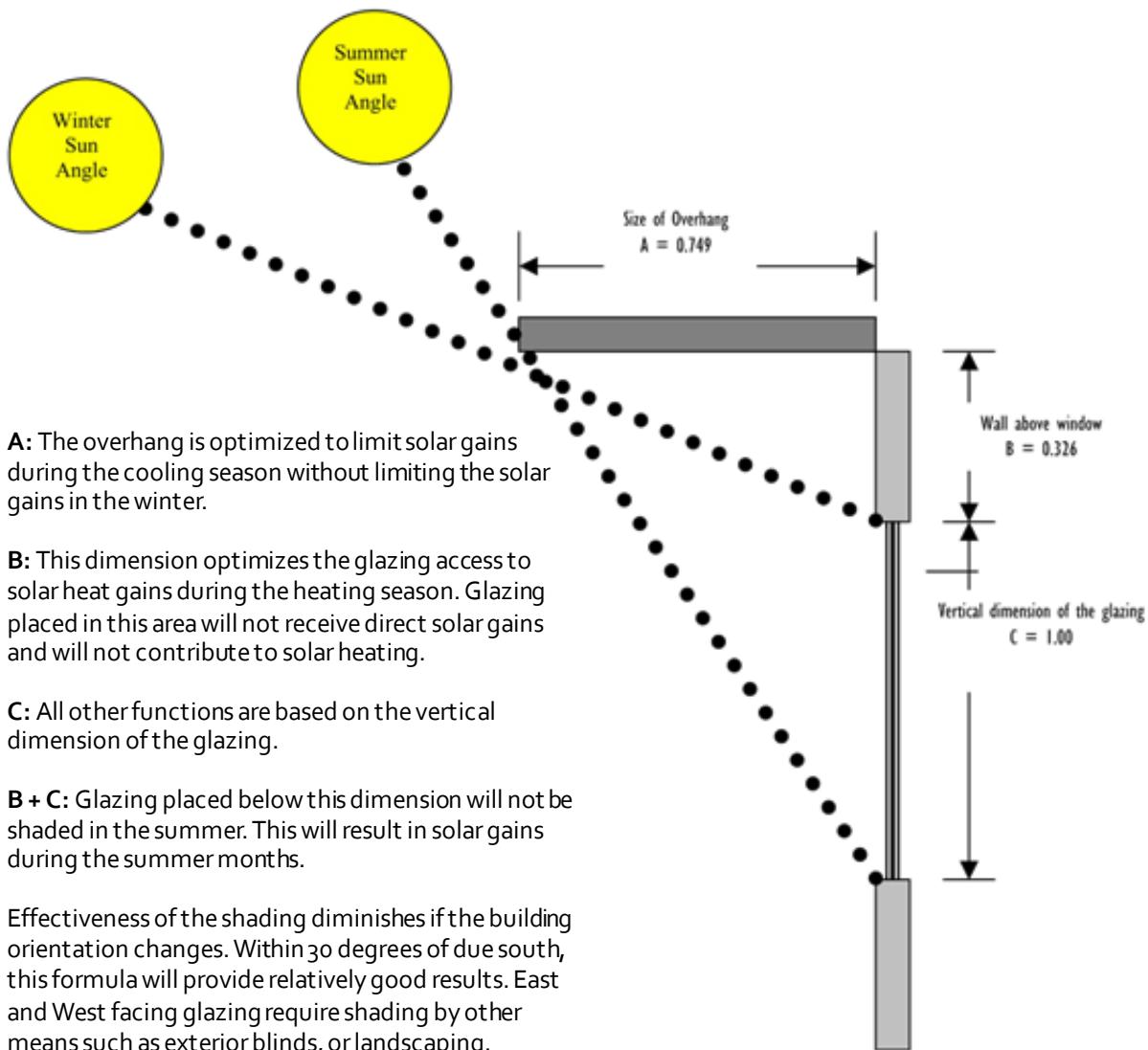


Figure 3-9 Overhangs
(Source: Washington State University Cooperative Extension Energy Program)

Resources

See diagram in Part I for this Action item.

- *Turn to Solar for Lower Heating Costs*, Energy Source Builder #42, December 1995, IRIS Communications, Eugene, OR, www.oikos.com/esb/42/solar.html. Provides good general background information.
- Sun Angle shareware program, susdesign.com/sunangle. Allows you to find solar angles at any time of day; a useful tool for locating and sizing overhangs.

See Resources, Solar, above.

3-31

Passive solar design, advanced features installed

1-12 POINTS

Advanced passive solar is performance based. It is best to document a reduction in total space conditioning for heating and cooling. Then, demonstrate how the home will stay within reasonable temperature range.

If you choose not to demonstrate the total reduction in space conditioning energy, consider that passive solar designs from the 1970's do not work with contemporary glazing products. Also, combining passive solar design with advanced framing, see Action item 3-23, *Use Advanced Wall Framing*, is a good idea, but may require adjusting solar techniques to work with the tightness of this framing system.

Advanced passive solar design features may include orienting windows to maximize passive solar, designing thermal mass correctly to correlate with window design, and providing East and West Shading.

To make the best use of passive solar, orient the majority of the building's glazing within 22 degrees of due South. Due South can be located with a simple compass. Remember to make the correction for magnetic North, which is 21 to 22 degrees East in the Puget Sound area. Obviously, this assumes there will be windows on the south side; for solar heating benefit, these should not be obstructed in winter. To prevent overheating, window glass on the south side of the building should not exceed 8% of the floor area. However, window area can be increased significantly (and solar performance enhanced) if there is accessible thermal mass in the space to absorb excess heat. Building components that can add mass to the home include concrete floors, tile, extra drywall, and to some extent, wood flooring. Consider the installation of skylights in a south-facing roof. Install with blinds to control the heat.

Use glazing with Solar Heat Gain Coefficient less than 0.40 or provide natural shading with landscaping. East and west shading strategies help protect against overheating the home. The most shading is provided by means of exterior shading devices, especially trees and other natural landscaping. They block the heat before it gets to the window. In addition, windows made using specially coated or tinted glazing reduce the window's solar heat gain coefficient (SHGC). They block the heat gain without rejecting too much visible light. For comparison, standard clear glass has a SHGC of 0.85. Special coatings/tinting can produce windows with SHGC down to 0.38, depending upon the treatment. These can be especially useful if the home has an attractive view to the West.

Resources

See Solar listing in General Resources above.

Efficient Windows Collaborative, www.efficientwindows.org, provides general but useful information for selecting windows for different types of climates and orientations. Also see resources for Action item 2-39 Species and locations for tree planting are identified that will provide summer shading of the dwelling and parking areas to moderate temperatures.

3-32

Model solar design features using approved modeling software

3 POINTS

Gaining experience by using approved modeling software allows you to determine the effectiveness of incorporating these strategies into your project. See the Resources Section for a list of approved modeling software or consult the Program Director.

Resources

See Software above under General Resources, for approved modeling software for Washington State code.

3-33

Design and implement passive cooling system (no A/C; radiant cooling or passive cooling system)

5 POINTS

The best option is to initially design the home to make the best use of natural ventilation and passive cooling techniques. See Action items 3-31 and 3-31, on *Passive Solar Design*, and 3-35, *Two Properly Supported Ceiling Fan Pre-Wires*.

An operable skylight can be used to create controlled natural ventilation, allowing warm air that has risen to the top of the house to escape, and drawing up cool air from below. However, skylights can be a source of unwanted solar heat gain and/or thermal loss, so location should be carefully selected, and the benefits weighed against the disadvantages.

By employing passive cooling techniques into modern buildings, you can eliminate mechanical cooling or at least reduce the size and cost of the equipment. Passive cooling, which is based on the interaction of the building and its surroundings, can eliminate or at least partially offset the need for mechanical cooling in the project. The four major passive cooling strategies include:

Natural ventilation depends solely on air movement to cool occupants. Window openings on opposite sides of the building enhance cross ventilation driven by breezes, as do openings in tall spaces (stacks) in building ceilings. With openings near the top of the stack, warm air can escape, while cooler air enters the building from openings near the ground. Ventilation requires the building to be open during the day to allow air flow. While operable skylights can be used to control natural ventilation, they can also be a source of unwanted solar heat gain and thermal loss. If skylights are used, locations must be considered carefully.

High thermal mass depends on the ability of materials in the building to absorb heat during the day. Each night the mass releases heat, making it ready to absorb heat again the next day.

High thermal mass with night ventilation relies on the daily heat storage of thermal mass combined with night ventilation that cools the mass. The building must be closed during the day and opened at night to flush the heat away.

Evaporative cooling lowers the indoor air temperature by evaporating water. In dry climates, this is commonly done directly in the space. But indirect methods, such as roof ponds, allow evaporative cooling to be used in more temperate climates too.

Any skylight or clerestories used for this Action item must be operable, and have a U-factor smaller or equal to .45 & Solar Heat Gain Coefficient smaller or equal to .35.

Before adopting a passive cooling strategy, you must be sure that it matches & responds to specific site climate conditions.

Resources

- U.S. Department of Energy, Energy Efficiency and Renewable Energy, website offers links to many documents on energy efficiency, including information on skylights, www.eere.energy.gov.
- Build It Solar offers numerous solar techniques, including passive cooling techniques.
http://www.builditsolar.com/Projects/Cooling/passive_cooling.htm

HEATING/COOLING SYSTEM

Equipment & Distribution

Heat loss from the average ducted air distribution system can reduce the overall system efficiency by 30%. Reducing duct air leakage and improving duct insulation has potential to significantly reduce utility bills and prevent or eliminate associated comfort and health problems. Specifically:

- Heating and cooling costs can be reduced by as much as 20-30%.
- Comfort can be improved by ensuring adequate delivery and return of conditioned air.
- Downsizing of heating and cooling equipment is possible.
- Entry of mold, radon, dust, and moisture into the house can be reduced.

At the beginning of a project, give consideration to:

- Location of the duct work.

- Duct type and size.
- Sealing method.
- Insulation method, R-value.
- Providing equal cross-sectional area for supply and return duct openings, and eliminating non-communicating ducts. (Each supply duct needs to “see” a return duct, and visa-versa. If there is a door between them, a transfer duct is required.)

As discussed below, it is preferable to locate ducts within the building envelope. However, this option is not always possible, even with new construction. In this case, ducts should be sealed with mastic and better perhaps insulated (See Action item 3-38, *Use Advanced Sealing of All Ducts Using Low Toxic Mastic*).

3-34

Centrally locate heating/cooling system to reduce the size of the distribution system

1 POINT

Locating the furnace in a central, well-insulated mechanical closet can save energy by reducing delivery distance and heat loss. (It can also conserve material use by requiring less ducting.) Make sure you provide sufficient make-up air.

3-35

Provide two properly supported ceiling fan pre-wires

1 POINT

Provide wiring and switching needed for a ceiling fan in the original electrical plan. If installed, a ceiling fan can be used as a low-energy option to provide cooling on hot summer days.

3-36

Install properly supported ENERGY STAR ceiling fans

1 POINT PER FAN
2 POINTS MAXIMUM

A ceiling fan can be used as a low-energy option to provide cooling on hot summer days. Must install an ENERGY STAR Fan and accessible switching.

3-37

Use foil-covered external insulation on metal ducting

1 POINT

3-38

Use advanced sealing of all duct joints using low-toxic mastic

1 POINT

Efficiency of the heating distribution system can be improved by 15% if the ducts located in the crawlspace or attic are sealed better than standard practice. Using mastic to seal commonly used fittings or using improved duct fittings with gaskets reduce the air leakage rate of the heating system and the structure as a whole. Additional benefits may include improved comfort by reducing drafts, improved occupant control of the distribution of heat to individual rooms, and a reduction of dirt introduced into the home.

The cost for this measure will vary depending upon the HVAC contractor and the system. Be sure to obtain individual system bids from the HVAC contractor you will use.

Note: The home needs to be pressure balanced with the goal of reducing backdrafts. If the furnace return is adjacent to a combustion appliance it will backdraft even with a perfectly airtight duct system.

Use this sealing technique for Heating Recovery Ventilation Systems; see Action item 3-50, *Install Heat Recovery Ventilator*.

Resources

Local sources for low toxic duct mastics include:

- Hardcast Versa Grip Mastic, Gensco, Tacoma, WA, 253-620-8203, www.gensco.com. Many northwest distributors.
- Hardcast Versa Grip Mastic for RCD Mastic, Albina Wholesale, 888-639-3330, www.albina.com/whsl/

3-39

Third-party duct test results less than 4% loss of conditioned floor area (50 pascals)

2 POINTS

To qualify for this credit, the results of the duct test performed by a third-party must be less than 4% loss of floor area to outside/total flow, e.g., a 1,000 square foot house should have less than 40 cfm of leakage in the ductwork. If the ductwork is sealed tightly with mastic and other moderate sealing efforts are employed it should at least pass at level of duct tightness of 4-5% of the floor area. See Air Sealing sub-section above for ideas on how to maximize air sealing to achieve this credit. Additionally, consider that achieving this result could be difficult in a large structure, see prerequisites, Conform to House Size Matrix.

Resources

- To locate ENERGY STAR Builder Option Package Verifiers, go to <http://www.energystar.gov/>. Verifiers are listed as Home Energy Raters on the New Home Partner Locator Search Page (http://www.energystar.gov/index.cfm?fuseaction=new_homes_partners.showHomesSearch).

For general information, see the article, "Pipe Dreams," in *Northwest Energy Efficiency Alliance Newsletter*, Volume 3, Issue 1 (Winter 1999), Northwest Energy Efficiency Alliance, 800-411-0834, www.nwalliance.org/news/newsletters/neeaWinter99.pdf.

For information about Performance Tested Comfort Systems air leakage testing/criteria, contact a certified contractor or call the WSU Cooperative Extension Energy Program, 360-956-2000, www.energy.wsu.edu/buildings.

3-40

Place all ducts in conditioned space

3 POINTS

A heating system's efficiency can be improved by 30% or better if the entire heating system is located within the conditioned space. Points are awarded for this Action item, ONLY if ALL ducts are in the conditioned space – see the next Action item to get points for partial inclusion.

Besides adding energy efficiency, this practice also reduces moisture problems and can also reduce dust and other indoor air quality problems.

Strategies to consider include: constructing bulkheads, dropped soffits, tray ceilings, running ducts through open-web floor joists, and placing ducts in closets, conditioned crawlspaces, and attics.

Incorporating all ducts in the conditioned space may cost slightly more than conventional methods, however, costs can potentially be offset by reducing the size of the equipment, eliminating duct insulation, minimizing duct length, and reducing overall material costs.

Resources

- "Ducts in Conditioned Space" from the ToolBase TechSpecs of The Partnership for Advancing Technology in Housing (PATH), available online at www.toolbase.org/pdf/techinv/ductsinconditionedspace_techspec.pdf/.

3-41 Insulate any ducts located in unconditioned space to at least R-11

1 POINT

Un-insulated ducts in the crawl space can actually *increase energy* use in the home, lead to increases in crawl space moisture, and cause frozen water pipes. To avoid these problems insulate all ducts to at least R-11. See Action item 3-42, *Locate Heating/Cooling Equipment Inside the Heated Space* and Action item 3-40, *Locate All Ducts Inside the Conditioned Space*).

3-42 Locate heating/cooling equipment inside the conditioned space

5 POINTS

As noted above, a heating system's efficiency can be improved by 30% or better if the entire heating system is located within the heated space. In many cases this will be a no-cost measure. For forced air heating systems, moving the ducts inside usually increases the cost of framing and drywall. But the HVAC bid will be lower, off-setting these costs. Even if the total cost increases some, the energy savings will more than pay for the change in construction details. Carefully planned hydronic systems or in-space heating systems will also provide these benefits.

- Forced Air Systems: Locate most ducts inside heated space; ducts outside heated space to be insulated to R-11
- Hydronic Systems: Locate most components inside the heated space.

Resources

- "Ducts in Conditioned Space" from the ToolBase TechSpecs of The Partnership for Advancing Technology in Housing (PATH), available online at www.toolbase.org/pdf/techinv/ductsinconditionedspace_techspec.pdf/.

3-43 Air handling equipment or return ducts are not located in the garage, unless placed in isolated/air sealed mechanical rooms with an outside air source

3 POINTS

3-44 Design the distribution system using ACCA Manual D

2 POINTS

3-45 Use ductless distribution system (e.g. hydronic, radiant, ductless minisplits)

10 POINTS

A ductless distribution system is generally more efficient than a system that utilizes ducts. Ductless systems also have the added benefit of better indoor air quality. Ductless systems allow for easy installation, less maintenance, quiet operation, more efficiency, and zone control. Air leakage in forced air heating systems frequently impact indoor air quality. Duct leaks bring air into the building from undesirable locations, such as attics, crawl spaces, and the garage. Duct leaks can also induce combustion equipment backdrafting. These problems will not exist at all if a ductless heating system is used, such as a ductless electric heat pump or radiant floor system.

To receive credit equipment must meet the following guidelines:

- Hydronic Systems 85% Efficiency or better
- Ductless Split Heat Pump 10.0 HSPF Minimum (Single indoor fan coil)
- Ductless Split Heat Pump 8.5 HSPF Minimum (2 or more indoor fan coils)

Note: Standalone zonal electric baseboards do not count for this credit. In addition, please note currently Washington state regulations prohibit the install of an outdoor wood fired boiler.

3-46

Where appropriate, install furnace fan or pumps with an electrically commutated motor (ECM)

3 POINTS

An ECM motor will reduce motor energy use by about 331 kWh per year. However, because the motor gives off waste energy as heat to the home, the energy it is not truly lost during the heating season, and financial savings are about half what might otherwise be expected. If used with an air conditioner, however, the electrical energy savings could double. For these reasons, consider an ECM motor when installing heating or cooling equipment.

Note: The most appropriate use of an ECM is on equipment specifically designed to take advantage of the motor's part load capability. This is most commonly found on high quality heat pump systems with variable speed fan controls and some variable speed gas furnaces.

3-47

Locate registers towards center of home rather than at outside walls minimizing ducting and loads on unit

1 POINT

Controls

3-48

Select high-efficiency heat pumps instead of electric heat (add, or heat pump with efficiency that exceeds code requirements)

3 POINTS

NOT APPLICABLE IF CLAIMING UNDER WSECTABLE 406.2

Most heat pumps act by transferring heat from an environmental source, air, water or ground, into the dwelling. A new type of heat pump is the absorption heat pump that uses heat as the energy source. These systems offer an energy-efficient alternative to furnaces and air conditioners. In fact, high-efficiency heat pumps also dehumidify better than standard central air conditioners, resulting in less energy usage and more cooling comfort in summer months, according to the Department of Energy. All of these varieties are suitable to our climate.

Air-source heat pumps are the most common and are available in a ductless version, called a mini-split system. Geothermal (ground-source or water-source) systems provide higher efficiencies, however, they cost more to install and has some site-specific limitations. See Action item, 3-55, *Install Geothermal Heat Pumps*.

To select the highest efficiency heat pump, look for the Energy Guide label. Heating efficiencies are rated according the heating season performance factor (HSPF) and the cooling efficiency is determined by the seasonal energy efficiency ration (SEER). High efficiency pumps will have a HSPF between 8 and 10, and a SEER between 14 and 18. In our climate focus should be on getting the highest HSPF possible.

Finally, as with any system, performance is affected by leaky ducts. Be sure to maintain 400-500 cfm airflow for each tone of the heat pump's air-conditioning capacity. Efficiency and performance deteriorate if airflow is less than 350 cfm per ton. To ensure optimum functioning, be sure to include appropriate servicing information in the *Operations & Maintenance Kit* that is part of Section 1.

Resources

Heat Pump Systems, by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy provides more information on these specific types of heat pumps (www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12610):

- Air-Source Heat Pumps
- Ductless Mini-Split Heat Pumps
- Geothermal Heat Pumps
- Absorption Heat Pumps.

American Council for an Energy-Efficient Economy, Consumer Guide, *The Most Energy-Efficient Conventional (Air-Source) Heat Pumps*, good general information <http://www.aceee.org/consumerguide/topfurn.htm>. Plus link to *The Most Efficient Conventional (Air-Source) Heat Pumps*, <http://www.aceee.org/consumerguide/hp.pdf>, revised 2005.

3-49

Install a heating system with zonal controls

5 POINTS

This credit is awarded for installing a zoned heating system, not for programmable thermostats.

Use any heating system that allows for separate zones, see Action items 3-45, *Use Ductless Distribution System (e.g. Hydronic, Radiant, Ductless Minisplits)*.

Heat Recovery

3-50

Install a heat recovery ventilator (HRV) or energy recovery ventilator (ERV)

5 POINTS

NOT APPLICABLE IF CLAIMING UNDER WSECTABLE 406.2

A heat recovery ventilator (HRV), also known as an air-to-air heat exchanger (AAHX), provides an energy efficient and effective ventilation system that cannot be matched by exhaust-only ventilation systems commonly used in houses. With these units, waste sensible heat (the energy responsible for raising or lowering temperature) in the exhaust airstream is transferred by a heat exchanger into the incoming air stream, significantly reducing the energy required to heat cold outdoor air to interior comfort levels. These units are able to recover 50% to 80% of the heat energy that would otherwise be lost through ventilation. Even in Western Washington's mild climate, these energy savings pay for the HRV long before the equipment reaches its rated service life.

An energy recovery ventilator (ERV) has the same basic function as an HRV, except that in addition to transferring sensible heat, it also transfers latent heat (the energy responsible for changing the moisture level). This makes an ERV a good option in warm and humid climates. Learn more about which system will work for your project, [HTTP://ENERGY.GOV/ENERGYSAYER/ARTICLES/WHOLE-HOUSE-VENTILATION](http://ENERGY.GOV/ENERGYSAYER/ARTICLES/WHOLE-HOUSE-VENTILATION)

Another advantage of an HRV or ERV system is that it provides high quality ventilation to the house for maintaining indoor air quality (see Action item 4-8o, *Bonus Points: Provide Balanced or Slightly Positive Indoor Pressure Using Controlled Ventilation*).

Resources

For information about air exchangers or other ventilation systems, contact your mechanical subcontractor or:

- "Energy Ideas Clearinghouse." EIC will provide customized responses to specific questions about ventilation, 800-872-3568 or e-mail EnergyLine@energy.wsu.edu. Or you can browse for resources yourself online at www.energyideas.org (listed under General Resources, above).
- *Healthy House Building: A Design and Construction Guide*, by John Bower, The Healthy House Institute, Unionville, IN. (Good information on optimizing air distribution and ventilation.) Available from Iris Communications, 800-346-0104 or www.oikos.com (Item # 7503, \$22).
- *Understanding Ventilation: How to Design, Select, and Install Residential Ventilation Systems*, by John Bower. Available from the *Journal of Light Construction* Bookstore: 800-859-3669 or www.jlconline.com/bookstore.
- "Energy and Heat Recovery Ventilators (ERV/HRV)" from the ToolBase TechSpecs by The Partnership for Advancing Technology in Housing (PATH), www.toolbase.org/Technology-Inventory/HVAC/energy-recovery-ventilators.

HRV and ERV manufacturers include:

- *Aldes* compact heat recovery ventilators, from American Aldes Ventilation Corporation, Sarasota, FL, 941-351-3441, www.americanaldes.com.
- *Guardian*, by Broan Mfg. Company, Hartford, WI, 800-368-8663, www.broan.com.
- *PerfectAire*, by Research Products Corp., Madison, WI, 800-334-6011, www.resprod.com.
- *Perfect Window* fresh air ventilation system, by Honeywell Corporation, Minneapolis, MN, 800-345-6770 or www.honeywell.com.
- *VanEE*, by Conservation Energy Systems, Saskatoon, Saskatchewan, Canada, 800-667-3717.

Heating / Cooling

3-51

Select ENERGY STAR heating/cooling equipment

5 POINTS

NOT APPLICABLE IF CLAIMING UNDER WSECTABLE 406.2

By selecting ENERGY STAR rated heating and cooling equipment you are assured of significant energy savings. The upgrade encompasses many different types of equipment, including 90% AFUE furnaces, 7.4 HSPF heat pumps, and ground source heat pumps.

The Energy Policy Act of 2005 provides a federal income tax credit to consumers who purchase Energy Star qualifying products; you can use these as guidelines:

- Furnaces: 95% AFUE or greater
- Boilers: 95% AFUE or greater
- Electrically Efficient Gas- and Oil-Fired Furnaces
- Gas and Oil-Fired Water Heaters: 80 EF or greater
- Electric Heat Pump Water Heaters: 2.0 EF or greater

Resources

- The EPA lists online products that currently qualify for the ENERGY STAR label and a store locator, see <http://www.energystar.gov>. Or e-mail labeling@energystar.gov or call the ENERGY STAR hotline at 1-888-STAR-YES.

3-52

Install high-efficiency auxiliary heating units, e.g. EPA-approved pellet stove, russian fireplace, masonry radiant heater

2 POINTS

Wood or coal-burning stoves and fireplaces can be troublesome if not completely sealed. Even if a fuel-burning device is connected to a chimney, pollutants can enter the home through spillage, backdrafting (whenever there is even a slightly negative air pressure in the house), or due to lack of maintenance or damage to the chimney.

3-53

Properly size HVAC system using ACCA Manual J (do not oversize)

2 POINTS

TO RECEIVE POINTS FOR THIS CREDIT, CONTRACTORS SHOULD SUBMIT LOAD CALCULATIONS AND SHOW INVOICES FOR EQUIPMENT OF PROPER SIZE.

The benefits of properly sizing HVAC systems include satisfied and comfortable customers, lower initial and operating costs, reduced callbacks, longer equipment run times and less cycling, and proper dehumidification during the cooling season. Yet, many contractors regularly oversize air conditioning units. All HVAC equipment must be sized per manual J, ARI standards and guidelines. This equipment must be installed with matching Thermal Expansion Valve or (TXV). Manual J, which provides guidelines for estimating and calculating HVAC loads, has a substantial over sizing margin which can encourage significant over sizing of units.

To properly size HVAC systems, air infiltration measurements must be estimated unless a blower door test is performed (see Action item 3-16). The calculation outlined in Manual J (which is published by the Air Conditioning Contractors of America (ACCA), estimates heat loss from the building through walls and ceilings, leaky ductwork, and infiltration through windows, doors, and other penetrations as well as heat gain into the building from sunlight, people, lights and appliances, doors, walls, and windows, and infiltration through wall penetrations. To account for Manual J's large over sizing margin, this credit requires a maximum over sizing of less than 15% of that margin.

The efficiency of central air conditioning units is governed by U.S. law and regulated by the U.S. Department of Energy (DOE). Every air conditioning unit is assigned an efficiency rating known as its "seasonal energy efficiency ratio" (SEER), which is determined by its total cooling output divided by its total energy consumption. The more efficient the air conditioning equipment, the higher the SEER rating, and the less expensive it is to operate. All central air conditioners manufactured in the United States after January 23, 2006 must meet the new federal minimum 13 SEER/EER rating, a 30 percent increase from the current minimum standard.

All air conditioners include an indoor (coil) unit and an outdoor (condensing) unit, which work together to maximize efficiency and comfort. Proper matching of the coil and condenser will result in higher efficiency.

The standard thermal expansion valve (TXV) is a dynamic valve that has three main functions: to provide a constant amount of evaporator superheat, to keep the entire evaporator full of liquid/vapor, and to prevent liquid refrigerant from going back into the compressor. It also helps the air conditioner operate at maximum efficiency.

3-54

Use direct vent gas or propane hearth products (AFUE rating)

2 POINTS

Combustion appliances in general can be troublesome if not completely sealed. They can inadvertently admit noxious gases such as carbon monoxide into the air. Even if a fuel-burning device is connected to a chimney, pollutants can enter the house through spillage, backdrafting (whenever there is even a slightly negative air pressure in the house), or due to lack of maintenance or damage to the chimney.

3-55

Install geothermal heat pumps

10 POINTS

NOT APPLICABLE IF CLAIMING UNDER WSECTABLE 406.2

As mentioned above in Action item, 3-48, *Select High Efficiency Heat Pumps Instead of Electric Heat* geothermal (ground-source or water-source) systems provide higher efficiencies, however, they cost more to install and has some site-specific limitations.

Geothermal systems use the ground instead of outside air to provide heating, cooling, and in most cases, hot water. Using the ground's relatively constant temperature as the exchange medium for these systems, results in the most efficient system that is best at producing comfortable heating and cooling.

Conventional ductwork is generally used with these systems. Many systems are being equipped with a separate heat exchanger to meet of the a household's hot water needs, particularly when the system is not operating, typically in the spring and fall.

As to site-specific limitations, installation can be impacted by lot size, the condition of the subsoil, and the landscape, which in turn can affect the applicability of this system to a particular site.

Resources

The Geothermal Technologies Program, www1.eere.energy.gov/geothermal, by the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, provides more information, including

- "Geothermal Heat Pumps" by U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, www1.eere.energy.gov/geothermal/heatpumps.html.

Other information available:

- "Geothermal Heat Pumps" from A Consumer's Guide to Energy Efficiency and Renewable Energy by DOE's EERE, www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12640
- "Geothermal Heat Pumps" by ENERGY STAR, www.energystar.gov/index.cfm?c=geo_heat.pr_geo_heat_pumps.

WATER HEATING

Resources

- *Consumer Guide to Home Energy Savings*, by Alex Wilson and John Morrill, is updated annually (See General Resources above). For the water heaters that the 7th Edition lists as "Top-Rated Energy-Efficient," see www.aceee.org/consumerguide/topwater.htm.

Distribution

3-56

Locate water heater within 20 pipe feet of highest use

1 POINT

Locating the hot water heater near the point of highest use will minimize pipeline energy loss. Typically, the point of highest demand is the shower.

3-57

Insulate all hot water pipes

1 POINT

This measure reduces standby heat loss from the water tank. The tank continuously heats the piping and the water in it even when no water is being used. They act as "cooling rods." Insulating them reduces the rate of heat loss.

3-58

Design home with single plumbing wall

3 POINTS

3-59

Use 3/8" pipe (PEX) tubing

2 POINTS

3-60

Install an on demand hot water recirculation system

1 POINT

Drainwater Heat Recovery

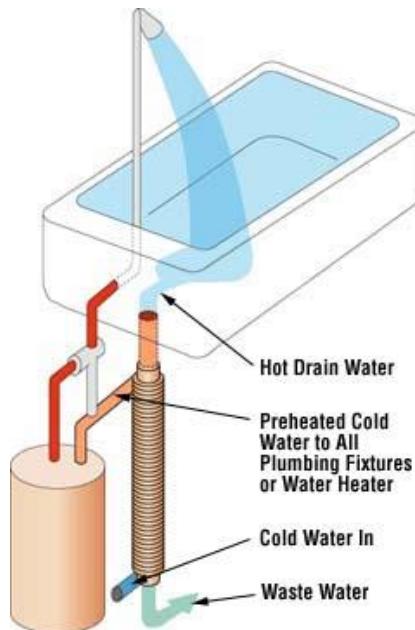
3-61

Install drainwater heat recovery system (DHR)

3 POINTS

A significant amount of energy is lost when draining warm wastewater. Drainwater heat recovery (DHR) devices fit into existing drain lines to capture some of that exiting energy. DHR systems use drainwater to preheat cold water going to a shower or to a water heater. DHR systems reduce the energy needed to heat water and can increase the capacity of water heaters.

DHR systems cost between \$300 and \$500, plus installation.



From EERE, from Toolbase Services

For these to work, the drain and water heater needs to be under the primary shower. The water demand and drain use need to occur simultaneously.

Resources

Drainwater heat recovery systems are available from:

- Doucette Industries, Inc., York, PA, 800-445-7511, www.doucetteindustries.com.
- Earthstar Energy Systems, Waldoboro, ME, 207-832-6861.
- TR Strong Building Systems, Olympia, WA, 360-705-2868, www.baubuilder.com.
- Vaughn Manufacturing Corporation, Salisbury, MA, 800-282-8446 or www.vaughncorp.com/.
- "GFX Wastewater Heat Reclaimer in Contention," *Environmental Building News* Volume 8, No. 9, September 1999, and "Recovering Heat from Wastewater," *Environmental Building News* Volume 6, No. 8, September 1997. Available online at www.buildinggreen.com/products/gfx.html.

See also the NAHB Research Center's ToolBase TechSpecs on Drainwater Heat Recovery, available online at: www.toolbase.org/Technology-Inventory/Plumbing/drainwater-heat-recovery.

"Drain-Water Heat Recovery" from A Consumer's Guide to Energy Efficiency and Renewable Energy by DOE's EERE, www.eere.energy.gov/consumer/your_home/water_heating/index.cfm/mytopic=13040.

Water Heating

Water heating typically accounts for 15 to 25% of the energy used in a home. Consequently, improvements in water heating efficiency offer good opportunities to save resources *and* money. Fuels with greater heating value include natural gas, propane, and fuel oil.

The water heating improvements listed below are based on the water heater being located inside the conditioned space of the home. Water heaters located in the garage or other interior spaces are likely to save more. These upgrades are commonly available in 40-gallon and 50-gallon units.

2 POINTS

NOT APPLICABLE IF CLAIMING UNDER WSECTABLE 406.2

See Action item 3-6o, *Install an on demand hot water recirculation system*, for additional information.

With instant or demand or “tankless” water heaters, you only heat the water you use. Instead of storing hot water in an insulated tank, the water is heated, on demand, at the point of use. These systems can save as much as 3 to 4 gallons per use, considering that this is the amount of cooled water that must be drained before hot water arrives at the faucet in traditional systems. In addition, standby energy losses represent 10% to 20% of a household’s annual water heating costs.

In the past, instant hot water systems were either electric (converting only a third of the primary energy into usable thermal energy), or if they were gas fired, they were equipped with continuously burning pilot lights that wasted energy. Newer, gas-fired models without continuously burning pilot lights are available. Such systems save water *and* energy, providing even more bang for the buck.

Resources

Energy Guide labels are not required on demand-type water heaters. For an evaluation of their energy-conserving features, see the *Consumer Guide to Home Energy Savings*, by Alex Wilson and John Morrill, pp. 146-147, 160-164 (listed under Action item 6-1, *A building owners’ manual is provided*.)

- See fact sheet on demand (tankless) water heaters by the US Department of Energy, Energy Efficiency and Renewable Energy Network (EREN) at www.eren.doe.gov/consumerinfo/refbriefs/bc1.html.

Manufacturers include:

- Rinnai America, LaGrange, GA, 800-621-9419 or www.rinnaiamerica.com. The Rinnai Continuum 2424 designed for exterior mounting, which keeps all combustion outdoors, eliminating risk of combustion gas spillage and saving valuable indoor space. It is one of the few gas-fired demand water heaters with electronic ignition instead of a pilot light, one of the features that enables it to achieve its high 82% AFUE efficiency. See “New Demand Water Heater from Rinnai,” *Environmental Building News*, Volume 9, Number 2, February 2000. (*Environmental Building News*, Brattleboro, VT, 802-257-7300, www.buildinggreen.com.)
AquaStar, distributed in the U.S. by Controlled Energy Corporation (CEC) of Waitsfield, Vermont.
- The AquaStar 125-EI demand water heater has a pilot light, but it is usually unlit. When hot water is called for, two integral D-cell batteries ignite the pilot, which in turn ignites the water heater burner. It uses just a tiny amount of electricity, as evidenced by the two D-cell batteries, and is almost instantaneous, according to CEC marketing vice president Kyle Murray. Contact R. Kyle Murray, Controlled Energy Corporation, 800-642-3111 or www.cehot.com. See “A New Generation of Demand Water Heaters,” *Environmental Building News*, Volume 7, No. 4, April 1998 and “An Update on Demand Water Heaters,” *Environmental Building News*, Volume 8, No. 2, February 1999. (*Environmental Building News*, Brattleboro, VT, 802-257-7300, www.buildinggreen.com.)
- Low Energy Systems (distributor of various demand water heaters), Englewood, CO, 303-781-9437, palomawaterheaters.com.

Other manufacturers are listed in *GreenSpec* and the *REDI Guide*.

3-63

Install electric water heater efficiency to EF of 0.93 or higher

NOT APPLICABLE IF CLAIMING UNDER WSECTABLE 406.2

3 POINTS

Be careful to avoid heat loss (through heat traps) when you have a hot water tank on lower floors feeding upper stories.

3-64

Upgrade gas or propane water heater efficiency to EF 0.62, 0.83, or 0.90

NOT APPLICABLE IF CLAIMING UNDER WSECTABLE 406.2

1 POINT FOR EF 0.62

3 POINTS FOR EF 0.83

5 POINTS FOR EF 0.90

A heater's efficiency is rated by the Energy Factor (EF), which is based on recovery efficiency (i.e., how efficiently the heat from the energy source is transferred to the water), standby losses (i.e., the percentage of heat lost per hour from the stored water compared to the heat content of the water), and cycling losses. The higher the EF, the more efficient the water heater. Typically, gas storage tank water heaters have an EF between 0.55 and 0.67, 0.58 is typical. Gas tankless systems range from 0.69 to .92, with 0.84 typical. Some high-efficiency models are designed to use propane, which may be up to 30 percent less expensive to operate than electric heaters.

Current code requires domestic hot water systems meet the requirements of the 1987 National Appliance Energy Conservation Act (NAECA). Upgrading gas water heater efficiency from an EF of .55 to .60, for instance will save 18 therms per year. Household operational savings will support an additional cost of about \$38. Upgrading a propane water heater from an EF of .55 to .60 will save 16 gallons of propane per year. Household operational savings will support an additional cost of about \$50. Be careful to avoid heat loss (through heat traps) when you have a hot water tank on lower floors feeding upper stories.

Resources

The best source for efficiency information for water heaters is the GAMA (Gas Appliance Manufacturers Association) guide. 703-525-7060, www.gamanet.org. GAMA will answer questions on residential gas appliances and equipment, and electric and oil-fired water heaters.

- *How to Buy an Energy-Efficient Gas Water Heater*, US Department of Energy, FEMP. Available online at www.eren.doe.gov/femp/procurement/gwh.pdf. A publication of the Federal Emergency Management Program, this two-page fact sheet is primarily for federal agencies, but provides good general information for residential builders as well.

See also:

- "Conventional Water Heating Efficiency" by U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy, Building Technologies Program, www.eere.energy.gov/buildings/info/components/waterheating/conventional.html.
- "Consumer Guide to Home Energy Savings – Water Heating" by American Council for an Energy-Efficient Economy, <http://www.aceee.org/consumerguide/topwater.htm>.

3-65

Install water heater inside the heated space (electric, direct vent, or sealed venting only)

2 POINTS

By installing the water heater inside the heated space, you minimize heat loss to the environment.

Combustion water heaters located inside the living area must be sealed combustion type. They will have outside combustion air ducted to the firebox. They also must be directly vented to the outside with no possibility of combustion products mixing with indoor air.

Direct vent hot water heaters help protect indoor air quality by venting combustion by-products outside. They also draw combustion air from outside instead of using treated indoor air.

3-66

Upgrade electric water heater to exhaust air heat pump water heater or de-superheater: EF 2.0

6 POINTS

NOT APPLICABLE IF CLAIMING UNDER WSECTABLE 406.2

The exhaust air heat pump is a good option for families who require lots of hot water. A unit with an EF of 2.0 will yield 50% savings in energy use compared to a conventional system.

Resources

Talk to your plumbing contractor and see products and manufacturers listed in *GreenSpec* and the *REDI Guide*.

3-67

Use indirect water heater for domestic hot water (DHW)

2 POINTS

LIGHTING

Lighting accounts for 5 to 10% of total energy use in U.S. homes, costing \$50 to \$150 directly per year. While this amount is relatively small, lighting choices can also affect the amount of energy used to heat and cool the home. More efficient lighting can also mean better lighting, such as when daylighting and task lighting is specifically considered as part of the design.

Natural Light

3-68

Light-colored interior finishes

1 POINT

Light colored interior finishes naturally reflect both natural and artificial light, reducing the demand for additional artificial lighting.

3-69

Use clerestory for natural lighting

2 POINTS

Careful design and specification of windows is a cost-effective way to save energy. Further savings are achieved by shading techniques and north-facing clerestory windows (any window with sill above eye level) that admit natural light without direct solar gain.

3-70

Use light tubes for natural lighting and to reduce electric lighting

2 POINTS

Well-placed windows, small skylights, and light-colored surfaces can make for a sunny, cheerful, inviting interior while saving energy. Light tubes are a new type of "skylight" on the market. These devices are tested to be very effective at transmitting light, generally do not suffer condensation problems, and when compared to conventional skylights, allow less heat loss during winter and less solar heat gain in summer. They also provide significant location flexibility and are fairly easy to install. Basic components include a clear plastic dome on the roof that admits sunlight; a reflective tube that carries light down into the home; and a ceiling-mounted light diffuser that distributes light into the target room. Also available are light tube options with a vent (for bath) or recessed can (for illumination at night).

Resources

Your local supplier can probably source these products for you. Some light tubes to consider are:

- *Solatube*, distributed by Northwest Natural Lighting, Lynnwood, WA, 800-773-SOLA (800-773-7652) or www.solatube.com.
- *Sun Pipe*, first light pipe sold for homes in North America. Sunpipe Co., Northbrook, IL, 800-844-4786, www.sunpipe.com.
- *EZ Light*, manufactured and distributed by "odl" Inc, Zeeland, MI, 800-288-1800.
- *Sun Tunnel* with flexible tubing, distributed by The Sun Tunnel Skylights, 800-369-3664 or www.suntunnel.com.

3-71

Create more shared light with glass interior doors and windows

1 POINT

Efficient Lighting

3-72

Solar-powered walkway or outdoor area lighting

1 POINT

Solar powered outdoor lighting uses a photovoltaic (PV) panel to generate electricity during the daytime, which is then stored in a battery. At night, that stored electricity is used to power the light. Some models are manual, while others are turned on automatically by light-sensing controls or activated by motion-sensing devices. Most of these walkway or security lights require no wiring or installation other than pushing the stake into the ground, or screwing the fixture to a garage wall.

Most of the widely marketed solar walkway lights do not put out a lot of light, but they are useful for lighting the path to the door so guests can find their way. Also available are larger solar lights that *do* provide a lot of light, but these can be expensive.

Solar-powered outdoor lights can be found in many hardware or department stores, or purchased through catalog retailers of alternative energy and stand-alone power equipment.

Resources

- *Outdoor Lighting Pattern Book*, by Lighting Research Center. Available from Iris Communications, Eugene, OR, 800-346-0104 or www.oikos.com (Item #7562, \$50.00).

3-73

Use compact fluorescent bulbs, ballast, or fixtures in three high-use locations (kitchen, porch/outdoors, and one other location)

2 POINTS

This Action item is required for credit in the program if you are installing screw-in compacts for conventional fixtures. If you don't provide additional bulbs, the homeowner may go back to incandescent bulbs when replacements are needed.

If you provide dedicated fixtures AND replacement bulbs, you receive 1 point.

Compact fluorescent lights (CFL) have a higher first cost (up to \$10 to \$12 more), but advanced technology enables CFLs to use 75% less energy than a standard incandescent bulb and last up to 10 times longer. This means

that over the life of one CFL, a consumer can avoid replacing up to 13 incandescent bulbs! The super efficient performance of CFLs also means a consumer can save at least \$25.00 in energy costs over the life of each CFL that replaces an incandescent bulb. Modular compact fluorescent lights can save the customer even more, because as lamps fail, only the lamp itself, and not the ballast, has to be replaced.

Furthermore, earlier objections to the quality of fluorescent lights no longer holds merit because newer bulbs produce a warm light with good color rendering similar to incandescents, while electronic ballasts eliminate the hum, flicker, and delayed illumination time, which were common with older models.

Fluorescent bulbs that meet ISO 9000 standards are low-mercury or mercury-free.

3-74

Install hard-wired fluorescent- or LED-lighting

**1 POINT FOR EACH 5% OF LIGHTING BEYOND REQUIRED CODE
5 POINTS MAXIMUM**

The purpose of hard-wiring fluorescent fixtures is to guarantee they will stay as dedicated fluorescent fixtures without the possibility of reverting to incandescent bulbs that do not offer the same energy efficiencies. New systems are available with a twist-lock ballast which makes it very compact and makes it possible to easily switch the ballast for replacement or the change the wattage of the fixture.

3-75

Install fluorescents or LED lights on dimmer

**1 POINT PER INSTALLED DIMMER
3 POINTS MAXIMUM**

Dimmable fixtures allow adjustment of lighting levels to meet user requirements and increase occupant comfort. Dimmable compact fluorescent lamps are available for modular ballast that can be hard-wired within a fixture.

Resources

- "Dimmable Compact Fluorescent Lamps" by Washington State University Cooperative Extension Energy Program. Fact Sheet is available online at www.energy.wsu.edu/documents/building/light/compact_fluor.pdf.

3-76

Use interior occupancy sensors, e.g. timers, motions detectors

**1 POINT PER ITEM
3 POINTS MAXIMUM**

Occupancy sensors for closets, pantries, and utility rooms provide a convenient way to turn on and off lights. This reduces the chances of accidentally leaving lights turned on.

3-77

Install photo cells, timers, motion detectors (exterior)(beyond Energy Code requirements)

1 POINT

Dimmers allow you to use one light for many purposes, and can save energy and extend the life of most bulbs when used at lower levels. Look for full-range dimmers that vary the light continuously from off to full brightness. Dimmers can be used with incandescent lights, including low voltage systems, and with compact fluorescents. There are several choices of wall-mounted dimmers: toggle, rotary, sliding, solid-state touch, and new integrated systems with remote controls that can recall previous lighting levels. If several high-wattage incandescent lamps are to be controlled at one point, add a hard-wired dimmer.

Photo Cells, thin-film devices that work by generating a current when exposed to light, thus this technology can be used as a light sensor for lighting devices.

Timers can be located at a light switch, a plug, or in a socket, and are available as both mechanical and solid-state. Some offer the option of a manual override. Some screw-base compact fluorescent bulbs cannot be used with timers; check manufacturer's recommendations.

Motion detectors or occupancy sensors can result in significant energy savings, especially in bathrooms and bedrooms where lights are frequently left on. Sensors can have manual on/off switches or can operate entirely automatically. Motion detectors should not be used with some compact fluorescents, or with high intensity discharge lights because of their inability to relight quickly. Some models feature dimmers that reduce light to a preset level rather than turn completely off; others come with photosensors that turn lights on only when the light level is below a preset point and motion is detected.

Light-sensing controls are increasingly being used to control outdoor lights along driveways and walkways. Consider motion detectors and photosensors for energy efficiency. Consult with your lighting supplier for optimal placement.

Resources

See your local lighting supplier for suggestions.

3-78

Install LED lighting in high-use location

1 POINT

If you think fluorescent light is energy-efficient, take a look at new LED (light emitting diode) lighting options. LED lights consume less than a quarter of the electricity that fluorescents do and less than 90% compared to incandescent bulbs. The lighting quality is comparable to that of cool white compact fluorescent lamps. Currently, there are a limited number of manufacturers, but that is expected to change. In the meantime, light bulbs, bars and strips, task lighting, floodlights, and controls for interior and exterior applications.

Resources

- See also the NAHB Research Center's ToolBase TechSpecs on LED Lighting, available online at: www.toolbase.org/Technology-Inventory/Electrical-Electronics/white-LED-lighting.

3-79

Install switches for wall outlets (phantom load switches)

2 POINTS

3-80

Install no recessed can lights that penetrate the building's thermal envelope

5 POINTS

Appliances

All appliances installed in the home should be as energy efficient as possible. The reduced electrical costs for operating energy efficient appliances rapidly offset slightly higher initial costs, if any.

The “Energy Guide” or ENERGY STAR labels found on many appliances identifies energy efficiency. Also, look for the following energy-saving characteristics:

- Refrigerator/Freezer—Energy-efficient characteristics include freezer-on-top arrangement (rather than side-by-side), manual defrost, and absence of through-the-door dispensers and automatic icemakers. In general, the larger the refrigerator, the more energy it takes to run. However, newer models with some of these features compensate for the energy penalty with advanced insulation systems.
- Dishwasher—The primary cost of running a dishwasher is the cost of heating the water. Energy saving features include light load options and air circulation for drying. Also, the smaller the machine the less energy required to run a load. If you are building a home for a large family, though, it will be better to install a larger machine that can be run fewer times a day.
- Washing Machine—Similar to the dishwasher, the primary energy cost is in heating the water. Energy saving features include options for cold water wash and small loads. In general, front-loading washing machines use one-third less water than top-loading machines, and research shows they do a better job of cleaning the clothes.
- Dryer—The primary energy saving feature is automatic shut-off when the clothes are dry.

3-81

Provide an outdoor clothesline

1 POINT

A permanent clothesline can save energy and help reduce air pollution by reducing use of the clothes dryer (frequency and/or load volume). An outdoor location avoids moisture problems in the home. Using only a clothesline, instead of electric or gas dryer saves an average of 1,000 kWh of electricity a year.

3-82

Install gas clothes dryer

1 POINT

In new construction, installation of a gas clothes dryer in lieu of an electric one will result in cost savings to the homeowner, even considering installation of the additional gas piping. Typically gas clothes dryers cost \$40 more than electric models. Cost for fuel piping when installed during construction is minimal.

Resources

Clothes dryers are not required to display Energy Guide labels. Unlike most other types of appliances, energy consumption does not vary significantly among comparable models of clothes dryers. Here are some consumer buying tips from the US Department of Energy:

- Look for a clothes dryer with a moisture sensor that automatically shuts off the machine when your clothes are dry. Not only will this save energy, it will reduce the wear and tear on clothes from over-drying.
- The best dryers have moisture sensors in the drum for sensing dryness, while most only infer dryness by sensing the temperature of the exhaust air. Compared with timed drying, you can save about 10% with a temperature sensing control, and 15% with a moisture sensing control.
- Look for a dryer with a cycle that includes a cool-down period, sometimes known as a “perma-press” cycle. In the last few minutes of the cycle, cool air, rather than heated air, is blown through the tumbling clothes to complete the drying process.

3-83

Install front loading or ENERGY STAR washing machine

2 POINTS

Front loading or horizontal-axis (H-axis) clothes washers offer significant water and energy efficiencies (up to 30% less) compared to vertical-axis machines. Additionally, clothes coming out of the H-axis washer at the end of the wash cycle contain less water compared to conventional washers. This reduces *dryer* energy use as well. Finally, H-axis washers are gentler on clothes so they last longer. All these benefits are features you can “sell” to your clients.

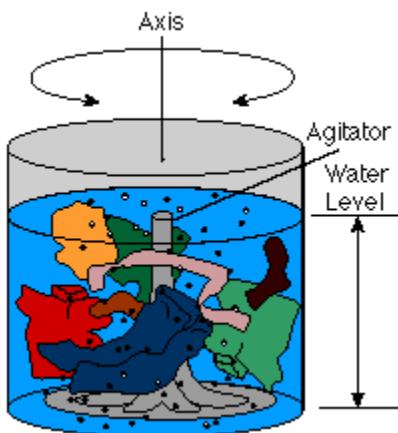


Figure 3-10 Clothes Washer Vertical Axis Configuration

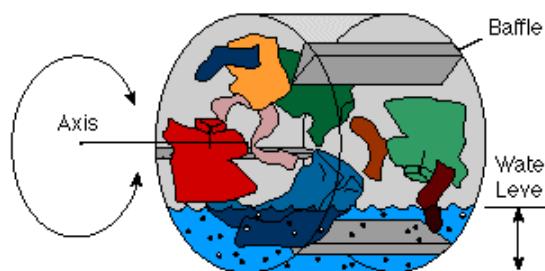


Figure 3-11 Clothes Washer Horizontal Axis Configuration

(Source: City of Santa Barbara, CA Public Works Department)

Resources

The EPA lists online products that currently qualify for the ENERGY STAR label and a store locator, see www.epa.gov/appdstar/estar/products.html. Or e-mail labeling@energystar.gov or call the ENERGY STAR hotline at 1-888-STAR-YES. The ENERGY STAR database provides a calculation of the annual energy use based on the number of loads washed per week. Savings to the homeowner depend on the cost of heating hot water and the number of loads washed per week.

- "A New Spin On Clothes Washers," *Consumer Reports*, July 1998, pp. 50-53. A good comparison of front-loading versus top-loading washing machines. *Consumer Reports* also periodically reviews clothes washers; check the most recent index, www.consumerreports.com.
- *Consumer Guide to Home Energy Savings*, by Alex Wilson and John Morrill, is updated annually (See General Resources above). For the washers listed as "Top-Rated Energy-Efficient," see www.aceee.org/consumerguide/topwash.htm.
- WSU Cooperative Extension Energy Program can provide you with consumer fact sheets on energy-efficient appliances, 360-956-2000, or www.energy.wsu.edu. You can include these fact sheets in the Homeowner's Kit (see below).
- "New Generation of Horizontal-Axis Washing Machines on the Way," *Environmental Building News* Volume 6, Number 4, April 1997. Available online at www.buildinggreen.com/products/washers.html.

3-84

Install an ENERGY STAR dishwasher

1 POINT

As with other home appliances, national energy standards have spurred the development of more efficient dishwashers. Energy- and water-efficiency are closely related in dishwashers except for booster heating and drying cycles. The most water-efficient dishwashers use as little as 3.9 gallons per cycle at the economy setting. Energy savings range from 80 kWh per year to 364 kWh per year. Some of the most efficient dishwashers also operate significantly more quietly than conventional dishwashers.

You can market your selection of an extra-efficient dishwasher to the homeowner from several perspectives—performance, water and energy efficiency, ease of use, total features, quiet operation, and reliability.

Resources

Dishwashers with increased efficiency are most easily identified by the ENERGY STAR® label. The EPA lists online products that currently qualify for the ENERGY STAR® label and a store locator, see www.epa.gov/appdstar/estar/products.html. Or e-mail labeling@energystar.gov or call the ENERGY STAR® hotline at 1-888-STAR-YES.

- "Clean Enough for You?" *Consumer Reports*, March 2000, pages 47-50, www.consumerreports.com.
- "Dishing it Out," *Consumer Reports*, March 1999, pages 50-53.
- *Consumer Guide to Home Energy Savings*, by Alex Wilson and John Morrill, is updated annually (See General Resources above). For the dishwashers listed as "Top-Rated Energy-Efficient," see www.aceee.org/consumerguide/topwash.htm.

See also *GreenSpec* and the REDI Guide for more information.

3-85

Install ENERGY STAR refrigerator

1 POINT

ENERGY STAR refrigerators are at least 20% more efficient than the current federal minimum standard. Energy savings range from 125 kWh per year to 320 kWh per year, depending on size, style, and features. A cost effective consumer investment ranges from \$25 to \$125.

Resources

Refrigerators with increased efficiency are most easily identified by the ENERGY STAR® label. The EPA lists online products that currently qualify for the ENERGY STAR® label and a store locator, see www.energystar.gov/index.cfm?c=refrig.pr_refrigerators. Or e-mail labeling@energystar.gov or call the ENERGY STAR® hotline at 1-888-STAR-YES.

3-86

Install ENERGY STAR exhaust fan vented to outside

1 POINT

ENERGY STAR rated exhaust fans are available that will use less energy for the same amount of ventilation than non-Energy Star units.

Resources

- "An Introduction to IAQ" is provided by U.S. Environmental Protection Agency, www.epa.gov/iaq/co.html.

3-87

Install induction range

2 POINTS

3-88

Install energy monitoring device in home

3 POINTS

3-89 Enroll the residence in the local utility's electricity program for renewable electricity sources

BUILDER ENROLLED: 2 POINTS

ENROLLMENT TRANSITIONED TO OWNER: 3 POINTS

Currently, it costs more to build wind, solar and biomass generating facilities. By signing up for your local utility's voluntary green power program which supports renewable energy production, electricity producers are given the necessary backing to promote more environmentally friendly resources. As more renewable energy is used, less air and water pollution are produced. Support your utilities' voluntary renewable energy programs through a simple sign-up process. Suggested initial participation lengths are one year for builders, two years for homeowner.

3-90 Pre-pipe for solarwater heater

2 POINTS

If installing a solar water heating system (see 3-91, *Solar Water Heating System Sized to Provide a Minimum of 40% Hot Water Designed Energy Use* above) is not a part of the new construction budget, you can pre-pipe the house during construction to allow for the owner/tenant to install solar water heat at a later date. As energy prices rise and fuel availability becomes uncertain, pre-piping the house for adding solar water heating make remodeling so much easier – a real selling points to your customers.

Resources

See General Resources, particularly the field guides.

3-91 Solar water heating system sized to provide a minimum of 40% hot water designed energy use

10 POINTS

NOT APPLICABLE IF CLAIMING UNDER WSECTABLE 406.2

Solar energy can meet part or all of a home's domestic hot water needs. Geographic location, system design, collector orientation, and collector size will determine how much energy can be provided for domestic hot water heating. A solar water heating system may result in immediate positive cash flow if the monthly cost of financing the system is less than the net savings.

Limitations include the need for regular maintenance, a relatively high initial cost, and a long payback period. Solar panels may be aesthetically unacceptable to some. Lastly there is potential for freezing with passive systems. Check local building codes to determine codes related to the installation of solar water heaters. The Solar Ratings and Certification Corporation runs a certification program for solar water heating systems.

To receive this credit the Solar Water Heating System must be sized to provide a minimum of 40% hot water designed energy use.

Resources

See the *REDI Guide* and *GreenSpec* (See General Resources above) for solar water heating systems product information.

3-92 Percentage or all of home powered by renewable energy source

**5 POINTS PER KW
25 POINTS MAXIMUM**

Photovoltaic (PV) modules convert sunlight directly into electricity. Some systems have been poorly accepted because homeowners consider the structure unattractive. However, newer PV modules can be integrated into roofing materials, replacing traditional PV modules that are mounted on rooftop racks. Once installed, PV roofing produces free electricity from sunlight that can power certain home functions or supply the entire electrical needs of a home and eliminate the need to connect to the utility grid.

PV roofing products provide environmental benefits because they do not produce pollution or carbon dioxide emissions like fossil fuel-based utility power. They are also more attractive than many other solar systems, which increases consumer acceptance.

The cost for PV installations is dropping. For homes not in proximity of electric power lines, PV systems may be less costly than extending power lines to the home. Unlike generators, they operate silently and require little maintenance.

Non-solar renewable power systems that could add to the houses' total energy production include wind power, waterpower, or biofuel.

Small wind systems are available for residential applications. A wind turbine typically lowers a household electricity bill by 50% to 90%. The amount of money a small wind turbine saves you in the long run will depend upon its cost, the amount of electricity you use, the average wind speed at your site, and other factors.

3-93

Provide designated location on south roof area and rough-in conduit for wiring and controls for future solar thermal and photovoltaics

4 POINTS

Consumer interest in renewable energy is high. Pre-wiring and/or plumbing for a future PV solar energy or solar hot water system installation is a cost-effective way for builders to provide a future renewable energy option for new home owners. This installation allows the homeowners to add a solar energy system to their home, and the option of easy future PV becomes a selling point for builders. Using this Action item is a great way to "future-proof" a house. A retrofit system after construction costs more than the pre-wire option.

Extra Credit for Energy Efficiency

3-94

Extra credit for innovation in Energy Efficiency

1-10 POINTS

You may submit an energy saving strategy or system, not specifically called out in this Section, for consideration for an Extra Credit for Innovation. All extra credits will be approved by the Program Director. If approved, add up to 10 points to your Section total.

Section 4 HEATH & INDOOR AIR QUALITY

General Resources

- For Washington State Ventilation and Indoor Air Quality Code resources, see Section One Resources: Build to "Green" Codes/Regulations and Program Requirements.

- For specialists in healthy design and construction, see listings in Green Pages for Architects, Builders and General Contractors, Building Design, Building Materials and Supplies, Healthcare and Enviro-Illness, and Indoor Air Quality (see Green Pages under General Resources, below.)
- Washington State Energy Code Builder's Field Guide, 6th edition, 2004. Available through WSU Cooperative Extension, Educational Materials. This guide is available in PDF for free on the Internet at www.energy.wsu.edu/documents/code/bfg/2004/BFG_Full_2004.pdf
- "Energy Ideas Clearinghouse." The EIC is your library for information on energy efficient construction. EIC will provide customized responses to specific questions about energy efficiency, moisture control, ventilation, and green building. 800-872-3568 or e-mail EnergyLine@energy.wsu.edu. Or you can browse for resources yourself online at www.energycideas.org. The EIC is funded by the Northwest Energy Alliance, Olympia, WA, www.nwalliance.org.
- NAHB Research Center's "ToolBase Hotline" is available to answer builder questions, 800-898-2842, www.nahbcrc.org/ToolBase.
- Building Science Corporation website, www.buildingscience.com. Offers useful information regarding frequently found problems in buildings and how to avoid them. Moisture control is emphasized. Also available from this site is Joe Lstiburek's Builder's Guide, published by Building Science Corporation, Westford, MA, 978-589-5100.
- Environmental Building News, Brattleboro, VT, 802-257-7300, www.buildinggreen.com.
- Building Concerns Newsletter, by Building Concerns, Mill Valley, CA, 415-389-8049, www.interiorconcerns.com.
- PATH, A Public-Private Partnership for Advancing Housing Technology, dedicated to accelerating the development and use of technologies that radically improve the quality, durability, energy efficiency, environmental performance, and affordability of America's housing, <http://pathnet.org/>.

Product Information

- *GreenSpec—The Environmental Building News Product Directory and Guideline Specifications*, E Build, Inc., Brattleboro, VT, 1999. *GreenSpec* is organized in standard CSI Divisions. *Environmental Building News* also offers product reviews, information, and also posts some journal articles at www.buildinggreen.com/products/productslist.html.
- *REDI Guide (Resources for Environmental Design Index)*, web database, diskette, or printed handbook; a good resource for energy-efficient products. Available from Iris Communications, Eugene, OR, 800-346-0104, or online at data.oikos.com/products.

Technical Books and Guides

- *Builder's Guide*, by Joe Lstiburek. Published for four climate versions (For Pacific Northwest, appropriate climate type is "Mixed-Humid.") The guide includes illustrations and resources for such subjects as house layout and design, foundations, framing, HVAC, insulation, drywall, plumbing, electrical systems, painting, sheathings, and windows all with respect to moisture control, energy efficiency, and proper ventilation. Published by and available from Building Science Corporation, 70 Main Street, Westford, MA, 978-589-5100, or www.buildingscience.com/books.html. Cost is \$40.00 plus S&H. Also available from the *Journal of Light Construction* Bookstore: phone 800-859-3669 or online at www.jlconline.com/bookstore.
- *Healthy by Design: Building and Remodeling Solutions for Creating Healthy Homes*, by David Rousseau and James Wasley, Hartley & Marks Publishers, Point Roberts, WA. Available from IRIS Communications, Eugene, OR, 800-346-104, shop.oikos.com/catalog.
- *Healthy House Building for the New Millennium*, John Bower, The Healthy House Institute, Bloomington, IN, 812-332-5073, www.hhinst.com. Good information on optimizing air distribution and ventilation.
- Moisture Control Handbook: Principles and Practices for Residential and Small Commercial Buildings, by Joseph Lstiburek and John Carmody, published by John Wiley & Sons. Deals almost exclusively with moisture and water management. Some of the areas covered, including illustrations, are moisture movement, wall assemblies in various climates, moisture control practices in various climates, case studies/moisture problems that create mold, odor, roof decay, and condensation, peeling paint on wood trim, and hardboard panel problems. Available from Building Science Corporation, Westford, MA, 978-589-5100 or shop.oikos.com/catalog.

- *Prescriptions for a Healthy House, A Practical Guide for Architects, Builders, and Homeowners*, Paul Baker, AIA, Eric Elliott, MD, and John Banta, InWord Press, Santa Fe, NM. Identifies the full range of potential indoor health problems and then offers solutions. Organized by CSI Divisions and includes specification language for construction documents. Available from Iris Communications in Eugene, OR, 800-346-0104 or www.oikos.com/catalog.
- *Sustainable Building Technical Manual: Green Building Design, Construction, and Operations*, produced by Public Technology, Inc., U.S. Green Building Council (USGBC), and U.S. Department of Energy, with support from EPA, 1996. Useful for multi-family projects. Available from USGBC, San Francisco, CA. 415-445-9500 or order online at www.usgbc.org/resource (\$68).

OVERALL

4-1 Interact w/ homeowner early in design/construction process to identify chemical sensitivities and preferred IAQ measures and finishes

4 POINTS

THIS CREDIT IS ONLY AVAILABLE TO CUSTOM OR PRE-SOLD PROJECTS WITH CHEMICALLY-SENSITIVE CLIENTS.

If your client suspects they have chemical sensitivities, recommend that they be assessed by a medical professional with training in diagnosing chemical sensitivities. If they are chemically sensitive, allergic, or have asthma they will probably require special measures. Pay close attention to information your client provides you about their medical conditions/sensitivities, and work closely with them and their medical professional to identify required measures. Considerations should include:

- Specific building materials to be avoided.
- Required thresholds for moisture level control (below 50% is best to minimize molds and dust mites).
- Optimum ventilation system.
- Optimum filtration for heating and/or ventilation systems.

If you do not specialize in building for chemically sensitive clients, you should recommend including a specialist on your building team. You may be called upon to provide building materials for tests.

4-2 Project team member to have taken American Lung Association (ALA) of Washington "Healthy House Professional Training" course or other IAQ class with 8 hours of curriculum minimum

5 POINTS

The American Lung Association offers training, which provides an in-depth focus on indoor air quality issues in residential construction. Topics covered include indoor air quality and health, design and energy issues, material selection, dust and moisture control, ventilation and filtration methods, and pesticide and chemical usage. The course is open to the public, but is targeted to building professionals, including architects, builders, industrial hygienists, engineers, interior designers, and others.

This credit is available to project team members who take this course or other Indoor Air Quality (IAQ) class with 8 hours of curriculum minimum.

Resources

The American Lung Association Health House Builder Program provides training see <http://www.healthhouse.org/build/index.asp> or contact the local office.

4-3

Certify the home to a third-party verified program emphasizing indoor air quality (e.g., EPA Indoor airPLUS, American Lung Association Health House)

15 POINTS

Certify House under ALA or other Program approved by the BUILT GREEN Director

The American Lung Association developed the HealthHouse Project in 1993 and today, Health House is nationally recognized for raising the standards of residential air quality and energy efficiency.



The Health House (HHA) program is a comprehensive “whole house” program for nationwide use to reduce illness in the home due to poor indoor air quality. The Health House is built to climate-specific construction and product criteria established by the national Health House Technical Review Committee. The criteria include house tightness, air handler and ductwork tightness, zonal pressure balance, whole-house filtration and mechanical ventilation, sealed combustion heating, ventilation and cooling (HVAC) appliances, and humidity control. The Health House undergoes a series of performance tests to determine if it has been built to meet or exceed these standards. A team of diagnosticians tests the house to evaluate its overall performance in the areas of energy efficiency, house pressurization, air infiltration, and indoor air quality. Some houses are selected for monitoring over a period of time to determine ongoing performance.

Individual contractors wishing to certify the home through the HHA program will need to contact the American Lung Association to confirm current qualifying requirements, such as technical measures that must be taken in design and construction, training, and inspection(s). Technical assistance and education are part of the certification process. This approach is likely to add cost to the home package and represents an extra effort in terms of time working closely with the ALA, including attending a two-day training session. Hence the significant credit of 15 points for obtaining this certification.

The American Lung Association of Minnesota Health House Program, St. Paul, MN 651-223-9568 or 651-268-7587, certifies homes and builders. For a database listing all Health House certified builders across the US, see www.healthhouse.org or e-mail info@healthhouse.org. The Builder Guidelines are available at www.healthhouse.org/build/guidelines.asp.

4-4

Design for soundproof area in home

3 POINTS

JOB SITE OPERATIONS

4-5

Use less-toxic cleaners

1 POINT

Cleaners and solvents can be sources of hundreds of potentially harmful chemicals. Review manufacturer’s Material Safety Data Sheets (MSDS) before you buy. Avoid products that are given a health hazards rating higher than “1.” In addition, avoid as much as possible products with ingredients that the MSDS classifies as *toxic* (poisonous), *flammable*, *caustic* (causes burns), or chemically *reactive*. Leftovers of these products will be hazardous waste. (For proper hazardous waste handling and disposal procedures, see Action items, 2-50 (*Establish and Post Cleanup Procedures for Spills to Prevent Illegal Discharges*), and 2-51 (*Reduce Hazardous Waste through Good Jobsite Housekeeping*).).

Use environmentally friendly alternatives, including biodegradable products and those that are zero-VOC or low-VOC (no- to low-volatile organic compounds).

Resources

- *Citra-Solv* from Shadow Lake Inc., Ridgefield, CT, 800-343-6588 is sold in concentrated form in many local grocery or department stores (such as Fred Meyer) and hardware stores. Lists of vendors are available on the website www.citra-solv.com. Do not use on vinyl as the product will dissolve it.
- *Red Devil TSP/go Heavy Duty Cleaner* from Red Devil, Inc., Union, NJ, 800-4-A-Devil. Red Devil also has a phosphate-free product, which is sold in most paint and hardware stores, www.reddevil.com.

Also see *GreenSpec*, listed under Resources, Product Information above.

4-6

Require workers to use VOC-safe masks when applying VOC containing wet products, and N-95 dust masks when generating dust

1 POINT

For small projects with short exposures to VOCs, a gray carbon-impregnated dust mask manufactured by 3M or equivalent should suffice. These masks are readily available at most lumberyards and run about \$4 to \$5 each.

Whenever workers are exposed to off-gassing or fine particulates (for example, from paints, solvents, adhesives, molds or finishes), a flexible half-mask equipped with two or three straps to ensure a tight fit should be worn. Filter cartridges are used to complete the mask. They are color-coded to identify the kind of contaminant they are designed to capture. Cartridges designed to capture VOCs are black and filled with activated charcoal. When the charcoal becomes saturated (end of life), the operator will begin to smell the vapor, signifying that it is time to change the filter. To extend the life of the filter, store in a plastic bag between uses. The mask usually costs under \$30; a set of filters can run from \$30 to \$50.

Note: Filtration through a mask is actually the *least* effective method of reducing worker exposure to volatile organic compounds (VOCs) resulting from applying paints, thinners, and solvents. The best method is to eliminate or reduce the problem in the first place by choosing low- or non-toxic alternatives and keeping the work area thoroughly ventilated (see Action items 4-30, *Inside the House, Use Only Low-VOC, Low-Toxic, Water-Based, Solvent-Free Sealers, Grouts, Mortars, Caulks, Adhesives, Stains, Pigments, and Additives*, and 4-42, *Use Only Low-VOC/Low-Toxic Interior Paints and Finishes for Large Surface Areas*).

For dust generating activities, specify N95 particulate masks to help filter out fine airborne particles including pollens, dander, mite allergen, mold spores, and microorganisms by using advanced electrostatically charged microfibers. This mask can be worn for long periods of time until it becomes damaged, soiled, or breathing becomes difficult. NIOSH government-approved N95 Respirator provides at least 95% filtration against non-oil particles.

Resources

Dust and paint masks for limited exposure are manufactured by 3M. These gray carbon- impregnated masks cost around \$4 to \$5 each. For more information see:

- "Suit Up, OSHA-Style," *Journal of Light Construction*, July 1995, 800-859-3669 or www.jlconline.com.
- "Protecting Your Lungs on the Job," *Fine Home Building*, April/May 1994, 800-888-8286, www.taunton.com/fh. Or call the National Institute for Occupational Safety and Health (NIOSH) at 800-356-4674, www.cdc.gov/niosh.
- *General Occupational Health Standards*, WAC Chapter 296-62, Part C: "Hazard Communication," www.lni.wa.gov/wisha/regs/wasindex.htm. (Requirements for notifying workers of jobsite hazards.)

4-7

Take measures during construction operations to avoid moisture problems later

1 POINT PER 4 MEASURES

3 POINTS MAXIMUM

Moisture problems in today's "tight" buildings are always a concern. Measures to take during construction operations to avoid moisture problems down the road are worth the investment for the air quality and building structure considerations.

- Keep stored materials dry with tarps or in a protected place, or use just in time delivery to avoid problems with stored materials.
- Use a moisture meter to make sure moisture content of underlayment, sheathing, and framing materials does not exceed 15%. If readings exceed 15%, dehumidify before installing insulation and drywall.
- Protect woodwork from moisture damage during transit, delivery, storage, and handling.
- Expanded Requirements include Basic plus
- Pump or drain standing water out of the structure after major rainstorms.
- Hook up installed rain gutters to temporary pipes to draw water away from foundation.
- Install dimpled drainage mats at foundation walls.
- Use flashing instead of caulking to seal above doors, windows, and other openings.
- Properly counterflash chimneys and build a cricket above chimney to divert water.
- Properly flash all roof to wall intersections.
- Avoid flat roofs.
- Use quiet fans (1.5 sonos or less) bathrooms with a 60 minute timer. Noisy fans will not get used.
- During construction, remove unwanted moisture with a dehumidifier, not combustion heaters, which only bring more moisture into the home.

Resources

- *Builder's Guide* (listed in Resources, Technical Books and Guides, above).
- Moisture Control Handbook: Principles and Practices for Residential and Small Commercial Buildings by Joseph Lstiburek and John Carmody. (listed in Resources, Technical Books and Guides, above.)
- "Energy Ideas Clearinghouse." The EIC will provide customized responses to specific questions moisture control. (See General Resources, above.)
- The Building Science Corporation website www.buildingscience.com. This website site offers useful information, emphasizing moisture control. (See General Resources, above.)

4-8

Take measures to avoid problems due to construction dust

2 POINTS

MUST PERFORM ALL MEASURES TO GET POINTS

Ideally, the HVAC system should not be used during construction to void potential contamination of the system. Using temporary space heaters is feasible and generally doesn't cost more. Other preventive measures to avoid subsequent problems resulting from construction dust include:

- Seal all ductwork to protect from dust and other contaminants during construction
- Mask floor registers or use temporary screens or protective boxes to prevent debris from accumulating during construction (see Resources section for product information)
- If using the HVAC system, install construction filters—Change them after construction is done, then flush and change them again (mechanical contractor can do this). A MERV of 8 at each return air grill if handlers must be used during construction

- Clean/vacuum up dirt, dust, and wood shavings as you go
- Vacuum stud bays before sheet-rocking
- Vacuum the floors before final flooring installation
- Isolate areas of work to avoid contamination of clean spaces

Resources

- *Zip Wall* is a temporary dust barrier that is both easy to install and does not damage ceiling, wall, or floor finishes. Telescopic poles friction-seal plastic, canvas, or dropcloth material against ceiling and floor. Zipwall, Stamford, CT, 800-718-2255 or www.zipwall.com.
- FEIN Power Tools Inc. claims its FEIN Sander with Fein Turbo II Vacuum eliminates 98% of the dust created by sanding. 800-441-9878.
- Mechanical contractors provide services or check your yellow pages for duct-cleaning services.

4-9

Implement comprehensive dust control plan as described in handbook

3 POINTS

Dust is an increasing concern in this area. Dust is generated by the landscape & wind to some extent, but exacerbated by soil disturbance, grading, creating wind tunnels, or declining habitat & vegetation. A comprehensive dust control plan address dust concerns both during construction and after the occupant has moved in. To earn points for this Action item, each of the following must be completed:

- Do not use diesel fuel for dust control on the construction site and roads. Green alternatives exist, such as road coat (a vegetable oil) and envi-rox 2000. (Refer to Part II, Resources for more information about these products.)
- Do not install any woodburning fireplaces
- Implement Action item 2-25, *Set aside a % of the site to be left undisturbed*, emphasizing protection of critical areas, wildlife habitat, and dust control, for at least 25% of the site
- Implement Action item 2-33: *Limit grading to 15 feet around structures, septic, ground-source heat pump fields, except for driveway access*.
- Limit grading to an average of 20ft outside building footprint
- Apply a green dust control joint compound (Refer to Part II, Resources for more information about these products.)
- Implement Action item 2-44, *Use pervious materials for driveways, parking areas, walkways, and patios*
- Install a Merv 12 or better filter

Resources

Check with local jurisdiction for dust control requirements for construction projects.

- *Techniques for Dust Prevention and Suppression* (Publication #96-433, March 2003). Washington Department of Ecology publication to assist in dust prevention strategies, <http://www.ecy.wa.gov/pubs/96433.pdf>.

4-10

Use moisture meter to ensure moisture levels are 19% or less in walls, 12% or less in floors before closing up, installing drywall, and finish floors

2 POINTS

Moisture problems in today's "tight" buildings are always a concern.

Use a moisture meter to make sure moisture content of sheathing and framing materials does not exceed 19% or less in walls, sub-floors should be below 12% or less in floors before closing up, installing drywall, and finish floors are installed.

If readings exceed these levels, dehumidify before installing insulation and drywall (See Action item 4-12, *No use of unvented combustion-type heaters during construction*)

4-11

Ventilate with box fans in windows blowing out during drywall sanding and new wet finish applications

3 POINTS

Each new finish (for example, paints, stains, and floor finishes) will off-gas for a time after it is applied. Emissions are highest immediately after the finish is applied. It is important to ventilate the house with fans (several box fans in windows work best) so that gases will be exhausted outside. Venting out should continue for at least two and up to seven days after each application, depending on the amount of surface covered and the toxicity of the finish. (For toxic finishes applied over large areas, vent for seven days.) Use construction filters and change them out before occupancy. If the house is not properly ventilated during this phase, the emitted gases will adhere to surfaces in the house and later re-release into the indoor environment.

4-12

No use of unvented combustion-type heaters during construction

3 POINTS

The use of unvented combustion heaters produces excess moisture that can become trapped inside framing members during construction, leading to subsequent moisture damage. In addition, they produce fumes that can be hazardous to workers. Instead use a vented heater or portable electric heater.

Also, do not use the home's heating system during construction. Instead, start up the heating system for testing and balancing just before the owners move in.

Note: Often heaters are used to "dry out" the building following a rainstorm.

Heating options includes using a dehumidifier or an electric heater.

4-13

Block all duct ports upon installation and no use of ducted HVAC

2 POINTS

During construction, debris often enters through the registers to collect in the ducting. Unless removed, fine particles from the debris, which can be respiratory irritants, can circulate within the ducts and re-enter the spaces through the registers, and can lead to reduced HVAC system life. To prevent contamination, do not use the ducted HVAC during construction. Should any contaminants make their way into the duct work, they should be removed by a professional duct cleaning company in the final stages of construction before owners move in. A professional duct cleaning company should thoroughly clean and vacuum ducts, and also replace filters from construction.

4-14

Clean duct and furnace thoroughly just before owners/tenants move-in

3 POINTS

During construction, debris often enters through the registers to collect in the ducting. Unless removed, fine particles from the debris, which can be respiratory irritants, can circulate within the ducts and re-enter the spaces through the registers.

To receive points you must meet Action item 4-10, Do Not Use the Ducted HVAC System During Construction.

In the final stages of construction and before owners move in, thoroughly clean and vacuum ducts to remove any particles that may have entered during construction.

Resources

Mechanical contractors provide services or check your yellow pages for duct-cleaning services.

4-15

No smoking inside of any building or within 25 ft. (or more) radius of exterior of any building

2 POINTS

4-16

Train subs in implementing a healthy building jobsite plan for the project and contractually require compliance

4 POINTS TO TRAIN SUBS IN IMPLEMENTING A HEALTHY BUILDING JOBSITE PLAN FOR THE PROJECT
+4 POINTS IF CONTRACTUALLY REQUIRE COMPLIANCE

To implement healthy building jobsite plan, it is important to enlist the support and cooperation of your subcontractors, especially painters, floor finishers, cabinet maker, as well as any others that will be applying adhesives and caulk indoors (for example, flooring installers, countertop installers, finish carpenters, framers, plumbers, and HVAC contractors). Before the job begins and during on-site work, coordinate with them about:

- Using low toxic materials (See Action items 4-30, Inside the House, Use Only Low-VOC, Low-Toxic, Water-Based, Solvent-Free Sealers, Grouts, Mortars, Caulks, Adhesives, Stains, Pigments, and Additives, and 4-32, Use Only Low-VOC/Low-Toxic Interior Paints and Finishes for Large Surface Areas).
- Venting out the building during and after each finish is applied
- Preventing moisture accumulation and entrapment in the structure during construction that could cause mold growth or other damage during the life of the structure (See Action item 4-7, *Take measures during construction operations to avoid moisture problems later.*)
- Using only electric or vented heaters during construction (See Action 4-12, No use of unvented combustion-type heaters during construction. Use dehumidifiers, if needed, to dry out the building during construction)
- Prohibiting smoking in the structure enclosure.
- Coordinating closely with HVAC and electrical contractors for installation of whole house ventilation and quiet spot ventilation in wet areas.
- Making sure any toxic materials such as asbestos, or lead are handled properly. (See Action items 2-50, *Establish and post clean up procedures for spills to prevent illegal discharges* and 2-51(*Reduce Hazardous Waste through Good Jobsite Housekeeping*)..

4-17

Implement a “no-idle zone policy” for equipment and vehicles not in active use

2 POINTS

The No-Idle Zone Policy simply put is centered on a turn of the wrist: shutting off your car when stopped for 30 seconds or longer. The policy will reduce tailpipe emissions and save on fuel costs. Post signage and involve and train subs.

LAYOUT & MATERIAL SELECTION

How we finish and furnish our homes can impact the quality of the home's indoor environment. This means selecting products that are environmentally friendly, healthy, and low in formaldehyde and volatile organic compounds. It also means using less carpet and other textiles and installing more flooring and other surfaces that are smooth and easy to clean.

4-18

Use pre-finished flooring

1 POINT

A pre-finished floor is finished at the factory, often providing a tougher and more durable finish than can be obtained with site-applied finishes and they will also have completed most of its off-gassing. Usually, pre-finished flooring also offers the added benefits of not generating dust and odors associated with on-site sanding and finishing of an unfinished product, but also can save time on installation.

Resources

Ask your local supplier for pre-finished flooring finished with durable, plant-based, water-based, and/or low toxic finishes. Combine this Action item with others from the section, or see Chapter Five, Third-Party Certified Wood credits.

4-19

No carpet

10 POINTS

Synthetic carpet off-gases when it is new. In addition, carpeting acts as a highly effective reservoir for allergens such as dirt, pollen, mold spores, dust mites and other microbes. Moreover, as carpet wears out, the surface yarn breaks down and becomes house dust. For that reason, this program encourages eliminating carpet (see Action items, 4-24 *If Using Carpet, Specify Products certified*, 4-21, *Install Low Pile or Less Allergen-Attracting Carpet and Pad*, and 4-23, *Limit Use of Carpet to One-Third of Home's Square Footage*).

Resources

See *GreenSpec*, listed under Resources, Product Information, above, for environmentally friendly alternatives to carpet.

Also see Section Five Resources, Action item 5-70, *Use Natural Linoleum*

4-20

If using carpet, specify products certified by third-party for indoor air quality

2 POINTS

New carpet can emit volatile organic compounds (VOCs) when first installed. Several labeling options are available to help identify carpets that minimize the impact on indoor air quality.

The Carpet and Rug Institute has developed testing and labeling programs to aid in the selection of low-emitting carpet, adhesives, and cushion materials.

Carpet bearing the CRI Green Label Plus indicates that:

The manufacturer voluntarily participates in these programs and is identified by an assigned number in the label.



The manufacturer is committed to developing ways to minimize any adverse effects on indoor air quality.

A representative sample of the product type is tested by an independent laboratory and meets stringent requirements for low chemical emissions. For specific requirements see Resource Section for link to requirement criteria.

Greenguard Environmental Institute also offers a third-party certification program for Indoor Air Quality that qualifies products as low emitting interior building materials. See the Resources Section for more information.

Resources

Most local suppliers are familiar with the CRI IAQ and Greenguard labels, www.greenguard.org/.

4-21

Install low-pile or less allergen-attracting carpet and pad

2 POINTS

Carpet off-gases when it is new. In addition, carpeting acts as a highly effective reservoir for allergens such as dirt, pollen, mold spores, dust mites, and other toxins carried into the house by shoes. Moreover, as carpet wears out, the surface yarn breaks down and becomes house dust. For that reason, this program encourages limiting or eliminating carpet (see Action item 4-19, *No Carpet*).

However, if you do select carpet for the home, protect air quality by choosing a low pile type and installing it with urethane padding. Preferably, select a carpet made from natural fibers, primarily wool (see Action item 4-30, *Install Natural Fiber Carpet, e.g. Wool*) or an all-nylon carpet, which is less attractive to dust mites and mold. Also look for recycled-content carpets (see Action item 5-68, *If installing carpet, use recycled-content or renewed carpet*); the processed materials used in them tend to be less toxic than virgin synthetics. Finally, avoid dark colors; these carpets contain more toxins than light carpets because more dye is needed to create the dark color.

Also, carpet should never be applied to a concrete slab unless provisions for a moisture/vapor retarder or insulation have been incorporated in the slab that will allow the carpet to remain warm and dry. If not, moisture can migrate through the floor and cause mold growth under the carpet.

Resources

Ask your supplier. Low-emission carpet/pad alternatives include:

- *Nature's Carpet*, 100% natural wool carpet and pads manufactured without toxic chemicals., Colin Campbell and Sons, Vancouver, BC, 800-667-5001, www.colcam.com
- *Bellbridge* natural fiber carpets and pads, made by Bellbridge in Concord, CA: 800-227-3408.
- *Bentley Mills* low-VOC carpets, City of Industry, CA, 800-423-4709, www.bentleymills.com.
- *Collins & Aikman* low-VOC carpets, Dalton, GA, 706-259-9711, www.powerbond.com. Or, call Collins & Aikman's Bellevue office, 425-641-1958.
- *Harbinger* carpet, Mohawk Industries, Dublin, GA, 800-241-4216, www.mohawkindustries.com. Harbinger is actively involved in developing a conventional synthetic carpet with reduced rates of chemical off-gassing.
- *Homasote 440 Carpet Board*, contains no asbestos or formaldehyde, and is made from recycled paper. Homasote Company, West Trenton, NJ, 800-257-9491, www.homasote.com.
- *Sustainable Lifestyles* markets sisal floor coverings and sisal broadloom and area mats. Excelsior, MN, 800-287-3144.

See also resources for Action items 5-66, Use Recycled-Content Carpet Pad, and 5-68, If installing carpet, use recycled-content or renewed carpet.

4-22

Install natural fiber carpet (e.g. jute, sisal, wool)

1 POINT

Today, 97% of all manufactured carpets consist of synthetic fibers. These synthetic components off-gas and the glues that bind the fibers to the backing may contain chemical compounds, a number of which are known to be toxic. Several companies make carpets with natural fibers, such as wool or cotton. However, these natural fiber alternatives tend to cost more than synthetics. (Note: Even natural carpets can be a source of noxious gases if treated with chemicals. For example, wool carpet is often moth-proofed.) Even natural fiber carpets may cause allergic reactions in a very small percentage of the population.

An acceptable, cost-effective alternative is a low-pile, all nylon carpet (see Action item 4-21, *Install Low Pile or Less Allergen-Attracting Carpet and Pad*).

Wool provides many benefits: it is soil and stain resistant, has long-term appearance retention, color retention and texture recovery, is flame-resistant, mildew resistant, and water repellent. Wool is non-allergenic and has been proven hygienically safe in medically sensitive areas. Wool does not promote the growth of dust mites or bacteria and actually contributes to air purity in buildings by absorbing polluting gases. (Note: Even natural carpets can be a source of noxious gases if treated with chemicals. For example, wool carpet is often moth-proofed; wool carpets are available without moth proofing.)

4-23

Limit use of carpet to one-third of home's square footage

3 POINTS

The program recognizes carpet's popularity and function, but suggests the amount of carpeting can be limited. The healthiest floor choices are smooth surfaces, such as tile, linoleum, and wood, which do not harbor dust and other allergy-causing particles. Solid surfaces are easier to clean than carpet and they keep vacuuming to a minimum. (Vacuuming stirs up dust, even under ideal conditions.) Wood and tile floors are also more durable than carpet, so they cost less per year of use. (See *Section Five: Materials Efficiency*.)

Resources

See *GreenSpec* (listed under Resources, Product Information, above) for environmentally friendly alternatives to carpet.

4-24

If using carpet, install by dry method

1 POINT

Adhesives used to install the carpet to the floor are a significant source of odor and air pollution. Tack strips eliminate this problem.

Resources

- TacFast is a velcro-like system for installing carpets to the floor without adhesives or tack strips. TacFast Systems, Richmond Hill, Ontario, Canada, 800-216-0662.

If you use an adhesive, choose a low-odor, water-based product. Never use solvent-based carpet adhesive. Options include:

- Envirotec Healthguard adhesives by W.F. Taylor, Fontana, CA, 800-397-4583, www.wftaylor.com.

4-25

Optimize air quality in family bedrooms to basic or advanced level

3 POINTS BASIC

5 POINTS ADVANCED

Program Note: HRV (see Action item 3-50, Install a Heat Recovery Ventilator) does not qualify as an alternative to cross-ventilation. Also requirements only apply to family bedrooms, not the whole house.

Basic Level Requirements

- No carpets
- Low VOC/low toxic paints & finishes
- Low toxicity cleaners (construction).

Advanced Level Requirements:

- Install operable windows for cross ventilation
- Install hygrometer/thermometer
- Reduce chances of exposure to EM fields (electronic panels, timers, generators, PV inverters, refrigerators, large wire chasers)
- Install damp-proof ledges or alcoves
- Provide return ducts or air communication vents to hallways;
- No materials with added urea formaldehyde within bedroom.

Resources

- Neil Kelly Naturals Collection is a line of manufactured cabinets that uses certified woods and veneers as well as environmentally friendly finishes and case materials. Neil Kelly Signature Cabinets, Portland, OR, 503-288-6345 or www.neilkelly.com.

4-26

Garage air-sealed from house with automatic exhaust fan

5 POINTS

Studies show that carbon monoxide, sometimes produced in significant levels when automobiles are started, can enter the home from the attached garage. This Action item eliminates this potential source of indoor air pollution by eliminating the garage altogether or air sealing it from the house with an automatic exhaust fan in the garage. (Also see Action item 4-77, *Install exhaust fans in rooms where office equipment is used*).

Air sealing the garage from the house involves:

- Using caulk or foam to seal all holes in walls and the ceiling between the house and garage.
- Using the Airtight Drywall Approach (ADA) in the walls and ceiling shared by house and garage. ADA is an advanced sealing package that goes beyond basic practice (see Action item 3-15, Airtight Drywall Approach for Framed Structures).
- Making sure that the door between the house and garage is weather-stripped and is fitted with a threshold that creates a tight seal with the door.

4-27

Detached or no garage

10 POINTS

Studies show that carbon monoxide, sometimes produced in significant levels when automobiles are started, can enter the home from the attached garage. This Action item eliminates this potential source of indoor air pollution by eliminating the garage altogether.

4-28

Fully insulate attached garage to minimize condensation-based mold growth

2 POINTS

Insulate to R-9 (R-19 if space is heated) and install insulated garage doors. Garages are typically not insulated because, unless the space is heated, the cost and materials use will offset any energy and comfort benefits. However, sources of heat and moist air (refrigerators, freezers, washer and dryer, automobiles, etc.) are often found in garages. During cool seasons, the temperature differential across an uninsulated envelope may be sufficient to produce condensation. This might lead to mold growth, potentially resulting in degraded air quality in the garage and, if attached to the house without proper air sealing, in the home.

4-29

Use urea formaldehyde-free insulation or GreenGuard Certified product

3 POINTS

Standard fiberglass batt insulation, the most common for new houses, has up to 14% formaldehyde, which can contribute to poor indoor air quality. Look for urea formaldehyde-free fiberglass insulation, or a Greenguard certified product, preferably one with recycled content (Action item 5-115, *All Insulation to have a Minimum 40% Recycled-Content*). If you use rigid insulation, make sure it is formaldehyde-free, CFC-free, and HCFC-free (See Action item 5-116, *Use Environmentally Friendly Foam Building Products*) CFCs and HCFCs are not an indoor air quality problem, but should be avoided because they are believed to cause deterioration of the earth's ozone layer, certainly a general threat to the environment and human safety.

Check conventional product for their claim that the insulation has no added urea formaldehyde or look for a Greenguard certified product.

Resources

Some environmentally friendly alternatives include:

- Insulsafe II and III fiberglass insulation, Certainteed Corporation, Valley Forge, PA, 800-523-7844, or www.certainteed.com. Can be purchased through your local supplier.
- Grid-Shield Rx formaldehyde-free fiberglass batts. For information, contact Johns Manville, Inc., Product Information Center, Denver, CO, 800-654-3103 or www.johnsmanville.com.

For more information about insulation products, see:

- "Insulation Materials: Environmental Comparisons," Environmental Building News, Jan/Feb 1995, 800-861-0954, www.buildinggreen.com.

Also, see resources for Action item 5-116, Use Environmentally Friendly Foam Building Products (formaldehyde-free, CFC-free, HCFC-free).

Inside the house, use only low-VOC, low-toxic, water-based, solvent-free sealers, grouts, mortars, caulk, adhesives, stains, pigments, and additives for:

Conventional construction adhesives, grouts, and mortars used to bond structural components may off-gas large amounts of toxic VOCs (including solvents and aromatic hydrocarbons). Choose healthier low-VOC options. This will reduce potential harmful impacts on the health of the occupants as well as installers.

An accepted industry standard for "low-VOC," is the State of California, South Coast Air Quality Management District Rule #1168. Based on these guidelines, Table 4-1 provides recommended limits for VOCs in adhesives

**Table 4-1 Recommended Limits for VOC's in Adhesives
(in grams per liter, less water and Exempt compounds)**

(Source: State of California, South Coast Air Quality Management District Rule #1168, Amended January 2005)

Current VOC Limit

Indoor Carpet Adhesives	50
Carpet Pad Adhesives	50
Outdoor Carpet Adhesives	150
Wood Flooring Adhesive	100
Rubber Floor Adhesives	60
Subfloor Adhesives	50
Ceramic Tile Adhesives	65
VCT and Asphalt Tile Adhesives	50
Dry Wall and Panel Adhesives	50

**Table 4-2 Recommended Limits for VOC's in Sealants
(in grams per liter, less water and Exempt compounds)**

(Source: State of California, South Coast Air Quality Management District Rule #1168 Amended January 2005)

Sealants	Current VOC Limit
Architectural*	250
Nonmembrane Roof	300
Single-Ply Roof Membrane	450
Other	420

*Architectural Sealants refer to the use of an adhesive, sealant, or adhesive or sealant primer on stationary structures and their appurtenances, including, but are not limited to: hand railings, cabinets, bathroom and kitchen fixtures, fences, rain gutters and downspouts, and windows.

Resources

General Information on alternatives:

- Greenguard Environmental Institute, Indoor Airy Quality Certified third-party certification program, listing low emitting interior building materials, furnishings, and finish systems. On-line product search available at www.greenguard.org, 800-427-9681 or email info@greenguard.org.
- Austin Energy Green Building Program, 2006, Sustainable Building Sourcebook Chapter: Health and Safety, has a good listing of product suppliers,
<http://www.austinenergy.com/Energy%20Efficiency/Programs/Green%20Building/Sourcebook/index.htm>

Options include:

- Auro Cold Casein Wood Glue, Sinan Company, Davis, CA, 530-753-3104, or www.dcn.davis.ca.us/go/sinan/productguide.html. Also make a line of natural, all-purpose floor adhesives.
- Envirotec, a line of low-toxic flooring and multi-purpose adhesives, W.F. Taylor, Fontana, California, 800-397-4583, www.wftaylor.com.
- D-50 Plus Mortar and D-40 Latex Fortified Mortar, low-toxic mortars from DAP, Inc., Baltimore, MD, 1-888-DAP-TIPS.
- Latapoxy SP-100 low toxic grout, epoxy grouts, and thin-set mortars, Laticrete International, Bethany, CT, 800-243-4788, www.laticrete.com.
- PL Premium Wood Glue and other low-toxic adhesives, ChemRex (makers of Sonneborn Products), Shakopee, MN, 800-433-9517, www.chemrex.com.
- Safe-Set, a line of solvent-free, low odor, professional quality adhesives by CHAPCO (Chicago Adhesive Products Co.), 800-621-0220.
- Safecoat Grout Sealer, 3-in-1 Adhesive, Tile Grout and Caulking Compound, AFM Enterprises, San Diego, CA, 619-239-0321, www.afmsafecoat.com.
- Titebond Solvent-Free Construction Adhesive, Franklin International, Columbus, OH, 800-669-4583, www.titebond.com

- Miracle, Kingco water-based duct sealants used for permanently sealing the fabricated joints and seams of air duct system, are Greenguard Indoor Air Quality Certified, <http://www.itwtacc.com/hvac.html>.
- Murco, a joint compound formulated with inert fillers and natural binders; no preservatives or slow releasing compounds www.murcowall.com

4-30 Tile and grout

2 POINTS

Thin-set adhesives and mortars are available with Greenguard certifications. Also anti-microbial grout admix, and sanded and unsanded cement grout come with Greenguard Indoor Air Quality certifications

4-31 Framing

2 POINTS

For framing products, such as caulk and adhesives, choose low VOC and/or low-toxic alternatives.

4-32 Flooring

4 POINTS

If you choose to finish materials on site, make sure the adhesives, sealers, stains, and finishes are all low-VOC, low-toxic, water-based, and/or solvent-free. Pre-Finished floors DO NOT qualify for this credit. This credit only applies to site-applied finishes.

4-33 Plumbing

2 POINTS

When installing plumbing fixtures, choose credit-compliant sealers and caulk.

4-34 HVAC

2 POINTS

The HVAC system requires duct sealants and caulk; choose credit compliant mastic and caulk.

4-35 Insulation

2 POINTS

Credit for this Action items refers to insulation in the building envelope, not for duct work – credit for duct work is given above. To prevent air infiltration using rigid foam insulation, you will need to seal the seams with caulk or tape. Use credit compliant caulk for the best in indoor air quality and envelope sealing.

4-36 Drywall

2 POINTS

For drywall mud, look for products that do not add biocides. Biocides include pesticides, poisonous heavy metals, and other preservatives that prevent materials from spoiling. Some biocides may off-gas just as VOCs do, and can cause reactions in chemically sensitive people. Use credit-compliant sealers, caulk, and pigments in any finish paints

4-37

Use materials without added urea-formaldehyde for finish work, including shelving, window and door trim, and base molding

2 POINTS

Formaldehyde in the indoor environment can cause health problems for occupants, including headaches and flu like symptoms, and sick building syndrome. Some shelving, window trims, door trim, base molding, and other interior trim and wood products may also use urea-formaldehyde glue as a binder. With an off-gassing half-life of about 10 years, urea-formaldehyde continues to off-gas formaldehyde for a long time after application.

A series of specialty MDF products are certified by Scientific Certification Services (SCS) for up to 100% recovered and recycled wood fiber content and for having no added formaldehyde (lab tested to 0.05 ppm). The products, Medex, Medex NC, Medite II and Medite FR, are manufactured using polyurea resin in place of the urea-formaldehyde resin commonly used in MDF and particleboard, and can be used for these applications. Some finish contractors do not like working with MDF products for trim and molding applications because it is so brittle. Consider MDF for flat trim areas such as mantles, wall panels, and wainscoting. Plaster options are also available.

4-38

Use plywood and composites of exterior grade or with no added urea formaldehyde (for interior use)

3 POINTS

Particleboard, interior grade medium density fiberboard (MDF), and other interior use, glue-containing products use urea-formaldehyde glue as a binder. With an off-gassing half-life of about 10 years, urea-formaldehyde continues to off-gas formaldehyde for a long time after application. Formaldehyde in the indoor environment can cause several health problems for the occupants, including headaches and flu like symptoms, and can be a cause of sick building syndrome.

Instead, use materials containing no formaldehyde, such as Medex grade MDF, whenever possible. Or use products with exterior grade glue, which use phenyl formaldehyde glue. Phenyl formaldehyde glue off-gases quickly, and most formaldehyde is gone before the product reaches the jobsite. Exterior grade products include most plywoods and OSB currently available.

Resources

- SkyBlend, SCS and EPP certified to be 100% pre-consumer recycled wood fiber particleboard with no Urea Formaldehyde added during the manufacturing process. For use in any particleboard application such as, shelving, countertops, cabinets, millwork, furniture. Roseburg Forest Products, Dillard, OR, 800-245-1115, www.rfpc.com/particleboard/skyblend.htm
- Medex and Medite II MDF, formaldehyde-free alternatives for underlayment, cabinet frames, countertops, interior door and window casings, and trim. Medex is water-resistant, Medite Corporation, Medford, OR, 541-826-2671. Available through local suppliers.
- FIBEROCK Brand Gypsum Fiber Underlayment is a fiber-reinforced gypsum panel specially designed for use in residential construction as an underlayment for vinyl, carpeting, hardwood flooring, and ceramic tile (dry areas only). Manufactured by U.S. Gypsum Co., 800-874-4968, www.usg.com.

4-39

Install cabinets made w/ no-added urea formaldehyde board and low-toxic finish

3 POINTS

Cabinets are often built from particleboard, which off-gasses formaldehyde for a long time (See Action item 4-38, *Use Plywood and Composites of Exterior Grade or with No Added Urea Formaldehyde (for Interior Use)*.) Instead, purchase cabinets made from a material with no added urea formaldehyde, such as Medex grade MDF, solid

wood, or plywood, which adds very little additional cost to the overall cabinet budget. Cabinets should be finished with a low toxic finish.

Resources

- Neil Kelly Naturals Collection is a line of manufactured cabinets that uses certified woods and veneers as well as environmentally friendly finishes and case materials. Neil Kelly Signature Cabinets, Portland, OR, 503-288-6345 or www.neilkelly.com.

4-40

Use ceramic tile for 5% or more of flooring

2 POINTS

For a typical 2000 sf house, 5% = about 100 sf. Considering that typically one bathroom is 25 sf, this is an easy credit to add to any house design.

Ceramic tile floors usually pose very little health risk on a day-to-day basis. Because they are more durable than carpet, they also cost less per year of use. During installation, make sure you use low-toxic grout (Action item 4-30, *Inside the House, Use Only Low-VOC, Low-Toxic, Water-Based, Solvent-Free...*) and keep the workspace well-ventilated.

Note: Avoid the use of imported tile. The glazing used on imported tiles can contain lead. Recycled content tiles are also available. See Action item 5-69, *Use 40% Recycled-Content Hard Surface Tile, 100 Square Feet Minimum*, for recycled-content credit.

Resources

Consult with local suppliers. See also resources for Action item 5-69, *Use 40% Recycled-Content Hard Surface Tile*.

4-41

Use polyethylene piping for plumbing and electrical conduit. No PVC piping

3 POINTS

Some studies indicate that use of PVC plastics in the home is related to increased incidence of bronchial obstruction (asthma) in children (source: *American Journal of Public Health*. 1999; 89:188 & SHY;192). Also, in the event of a fire, PVC can release toxic smoke. If the water is slightly acidic or alkaline, copper plumbing can release copper ions into drinking water, which is potentially harmful to health.

Instead, use polyethylene piping for plumbing.

Resources

- AQUAPEX polyethylene tubing, WIRSBO, Apple Valley, MN, 800-321-4739 or www.wirsbo.com.

4-42

Use low- or non-VOC and non-toxic interior paints and finishes on large surface areas or all interior surfaces

3 POINTS FOR LARGE SURFACE AREAS

5 POINTS FOR ALL INTERIOR SURFACES

Solvent-based paints are traditionally considered the most durable, but they produce toxic emissions when curing and require the use of hazardous solvents for cleanup. In addition, they off-gas trace amounts of volatiles (gases) for months following application, which can cause upper respiratory irritation to the occupants.

"Zero-VOC" or low-VOC water based paints are generally safer to handle, can be cleaned up with water, and produce little or no off-gassing. For most indoor applications, there is almost no difference in performance

between solvent-based and water-based paints. Many low-VOC paints are comparable in price to conventional paint.

Paints and Finishes VOC Limits:

The VOC concentrations of the product shall not exceed

- 150 (VOC weight in grams/liter of product minus water) for Non-Flat paint,
- 50 (VOC weight in grams/liter of product minus water) for Flat paint for interior paints.

You must use paints and finishes that meet these requirements, note that GreenSeal products meet these standards.

Choose your colors carefully, as well, since darker colors inherently have higher VOC content because of the pigments added.

Low-VOC, water-based paints may still contain toxic ingredients, however. Although these toxic ingredients are not generally an *air quality* problem for occupants, they may be hazardous to painters and those involved in manufacture of the paint. In addition, hazardous ingredients can degrade the natural environment during production and after disposal. They may also leave an odor for a much longer period. Fortunately, several locally available, water-based paints perform well *and* are low-toxic, that is they do not contain heavy metals or organic compounds. These paints tend to cost 5% to 20% more than most conventional paints.



Low-toxic, clear sealers are also available to use as finishes for woodwork. Water-based varnishes, polyurethanes, and other finishes for hardwood floors are very durable and much safer to handle than traditional products. Low-toxic solvents, water-based strippers, and all-natural thinners are also locally available.

Resources

Most suppliers have a good selection of low-VOC products. You have to ensure the low-VOC paint is also low toxic.

- GreenSeal, Green Seal follows the Guiding Principles and Procedures for Type I Environmental Labeling adopted by the International Organization for Standardization (ISO 14024), <http://greenseal.org/index.cfm>.

Some product alternatives to look at include:

- Safecoat line of paints and finishes from AFM, San Diego, CA, 619-239-0321. They also offer enamels, exterior stains, and interior transparent finishes.
- American Pride line of paints GreenSeal Certified, from Southern Diversified, Hattiesburg, MS, 601-264-0442. They also offer enamels, exterior stains, and interior transparent finishes.
- Best Paints, low-toxic latex paints from Best Paint Company, Seattle, WA, 206-783-9938. www.bestpaintco.com.
- Concure, a clear, environmentally safe concrete sealer, Edgemont, PA, 800-925-7746.
- CURATOR Commercial Waterborne Finish. Preferred Products, Inc., Seattle, WA, 800-774-0034. It is an easy-to-use, two-component, 100% urethane waterborne finish designed especially for high wear residential and commercial applications.
- Enviro-Cote by Kelly-Moore. Available from Kelly-Moore in Seattle, 206-763-0300, www.kellymoore.com. The website has a store locator.
- Interior Health Spec, zero-VOC paint, Sherwin Williams Co., Cleveland, OH, 800-336-1110, www.sherwinwilliams.com.

- Miller Low-Biocide Paint, with preservatives and fungicides removed. Miller Paints, 503-255-0190, www.millerpaint.com
- Pristine, from Benjamin Moore & Co., Montvale, NJ, 888-236-6667, www.benjaminmoore.com.
- *Horizon Clean Air Select* paints from Rodda Paints, LLC.
- Spread 2000 and Lifemaster 2000, zero-VOC paints, ICI Dulux Paints, (formerly Glidden), 800-984-5444, www.gliddenpaints.com. Available at ICI Paint stores, in over 70 colors.
- Tried & True, an old-fashioned, boiled linseed oil waterproof finish that is all natural and food-safe, New York, 607-387-9280.
- 3-M Safe Strip is one of the least toxic strippers available.

MOISTURE CONTROL

Moisture that enters the home through the foundation walls and floor can lead to problems such as mold growth and can contribute to a variety of health problems for the homeowner. Specific construction techniques and materials can eliminate moisture.

The following provide resources for multiple aspects of moisture control in residential construction:

Resources

- *Builder's Guide*, by Joe Lstiburek (listed in Resources, Technical Books and Guides, above).
- Moisture Control Handbook: Principles and Practices for Residential and Small Commercial Buildings by Joseph Lstiburek and John Carmody (listed in Resources, Technical Books and Guides, above).
- "Energy Ideas Clearinghouse." The EIC will provide customized responses to specific questions moisture control. (See General Resources, above.)
- www.buildingscience.com -- This site offers useful information regarding moisture control is emphasized. (See General Resources, above.)

4-43

Slope crawlspace and foundation grade toward perimeter for drainage, supply drainage lines out to exterior footing drains, and install polyfilm vapor barrier sealed to stem walls

1 POINT

Stormwater that stands or seeps around crawlspace, slab, foundation, or basement can lead to moisture damage, dampness, and mold growth. Backfilled dirt around the footprint of a building should slope down and away for a distance of at least 5 feet to ensure surface runoff away from structure. Down spouts should feed into infiltration trenches or other drainage systems that convey water away from footings. Garage floor and driveway are sloped to drain out. See Action item 2-7, *Use an alternative foundation system that minimizes volume of foundation material and disturbance to soil and/or to water flow, for at least 50% of the foundation.*

4-44

Verify seal at doors, windows, and plumbing and electrical penetrations against moisture and air leaks

1 POINT

Sealing these penetrations is required by code but often difficult to enforce. As part of quality control, ensure your crew seals *all* penetrations at doors, windows, plumbing and electrical penetrations.

Pay special attention to plumbing stacks that run from the crawlspace to the attic, adjacent to baths and kitchen. Leaky pathways in these locations act as chimneys, continuously drawing cool air from the crawlspace to the attic.

During winter months especially, the cold air drawn through rooms with high relative humidity cools interior surfaces and promotes condensation and mold growth.

Even better, use the Airtight Drywall Approach (ADA), an advanced sealing package that goes beyond basic practice (see Action item 3-15, *Airtight Drywall Approach for Framed Structures*). See the Resources section for a reference the *Energy & Environmental Building Association Builder's Guide for Mixes Humid Climate Type* for extensive information on air sealing techniques.

Resources

See resources listed for *Moisture Control* above.

4-45

Envelope inspection at pre-insulation by a qualified professional

3 POINTS

A pre-Insulation Inspection is designed to ensure that all air leakage elements of the building shell have been addressed. The inspection should cover air sealing, such as, air tight recessed cans, building envelope penetrations are sealed, chases are capped and sealed; insulation and windows, such as basement walls insulated properly, roof vented properly, windows sealed; heating and cooling systems, such as ducts are supported and run properly, ducts stay out of insulated cavities; and moisture management and IAQ, such as having all fireplaces with flues and inlets.

A Qualified Professional is someone who specializes in air sealing inspections. See the Resources Section for more information.

4-46

Slab on grade, upgrade under slab moisture barrier beyond code to 10 mil minimum; minimum of 10 mil poly in crawl spaces with sealed seams and sealed perimeter

2 POINTS

If a slab is installed, use gravel fill beneath the foundation slab with a poly membrane (min. thickness of 10 mm) or vapor retarder, sealed over the gravel prior to pouring the basement floor. Seal the poly at the edges and seams to prevent moisture from migrating into the home. Taped and sealed foam under the entire slab also applies for this credit. (Note: The poly barrier also protects against radon and other soil gases. However, soil gases are generally not a problem in western Washington.)

If no slab is used, bottom of floor structure should be at least 12 inches (1 foot) above backfilled dirt.

Resources

See resources listed for *Moisture Control* above.

4-47

Install approved ice and water shield membrane for roofs pitched under 4-in-12

1 POINT

4-48

Roof overhangs are at least 24" inches

3 POINTS

Appropriately sized roof overhangs provide an energy benefit, see Action item 3-30, *Passive Solar Design, Basic Features*. They also provide a moisture control benefit in that they help protect the home from moisture damage caused by precipitation. When designing the structure take both the energy and moisture control benefits into account to obtain the best results.

For our climate, minimum roof overhangs are recommended to be 18", however, this recommendation does not account for wind-driven rain, a condition that varies with local climate or site exposure. Specifying 24" overhangs affords more protection for the wall system.

Resources

See General Resources above for PATH, <http://pathnet.org/>, search roof overhangs.

4-49

Protect windows and doors on tall walls with additional overhang protection

2 POINTS

Consider using larger overhangs, over 24 inches, for overhangs protecting more than two stories of walls with exposed windows and doors. Beyond contributing to reducing the moisture penetration on exterior and foundation walls, this strategy also protects the door's finish from moisture around jambs, trim, and thresholds. Success of the larger overhangs is dependent on having the walls properly constructed with a weather barrier, roofs that are adequately guttered, and a maintenance plan for the exterior.

Resources

See resources listed for *Moisture Control* above.

4-50

Use a nontoxic foundation, dampproofing treatment and perimeter drain to protect walls against moisture

2 POINTS

4-51

Install a drainable house wrap under exterior siding to promote wall drainage.

1 POINT

Drainable House Wrap: A Drainable House Wrap is defined as any properly installed house wrap that is engineered to have a minimum drainage efficiency of 90% measured in accordance to ASTM E2273 – Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies. Because this is the criteria used to establish drainage by ICC-ES (International Code Counsel – Evaluation Service) Acceptance Criteria AC-24 – Interim Criteria for Exterior Insulation and Finish Systems, house wraps with a code report showing this evaluation are acceptable.

A Drainable House Wrap should not be confused with a "Rain Screen" system. A properly installed "Rain Screen" system, will fir your exterior cladding a minimum of 3/8" away from the exterior sheathing. The benefits of a "Rain Screen" System are: Drainage, Depressurization of the wall and Ventilation of the wall cavity. A Drainable Housewrap does not ventilate or depressurize a wall, but it will provide Drainage. Drainage is particularly important when working in High Wind Pressure areas or when installing Cedar, Manufactured Stone, EIFS or Stucco claddings. In order to achieve drainage with manufactured stone and stucco claddings a secondary, sacrificial water resistive barrier must be installed.

Points can not be combined for having a Drainable House Wrap and a Rain Screen system.

4-52

Full exterior drainage plane integrated shingle-style with pan-flashed and face-flashed door and window openings, as designated in EEBA's "Water Management Guide", or equivalent

5 POINTS

4-53

Install a sloped sill pan with end dams and back dams for all windows, and back dams for all exterior doors exposed to the weather

5 POINTS

Window perimeters should have flashings (sill, jambs and head) that are integrated with the waterproofing at adjacent walls. Self adhered membrane flashing as well as metal flashing are acceptable strategies for preventing water ingress. Slope head and sill flashings to the exterior for prompt drainage. Many windows leak at sill-to-jamb corners. To collect this leakage and drain it to the exterior, sill flashings with a panned up interior leg and end dams are required. Do not penetrate the horizontal portion of the sill flashing with window fasteners. Instead, where attachment of the sill frame is required, provide an attachment angle inboard of the window sill and fasten through the upturned leg of the sill flashing into back of the sill frame.

New products are also available that offer greater performance than traditional entry door and window flashing. Sloped sill pans feature durable synthetic construction, sloped surface, integral drainage feature, lock-in end caps and are cuttable to desired lengths. Other products include a one-piece sill drain mat that installs under the windows on the rough opening.

Resources

- Pan Flashing/Sill Protection Installations Effective in Reducing Water Intrusion, April 2006, NAHB Research Center, Inc., 400 Prince George's Blvd., Upper Marlboro, MD, see Appendix E, Manufacturer/Product Survey Matrix, <http://www.toolbase.org/Newsletters/News/tbn-spring2006#2> or <http://www.toolbase.org/PDF/CaseStudies/PanFlashingReport.pdf>
- Suresill Sloped Sill Pan, www.suresill.com/home.html

4-54

Install metal flashing at all windows and all door heads exposed to the weather

1 POINT

Flashing must be durable, weather resistant, able to accommodate movement, and compatible with adjacent materials. The traditional overlapping assembly composed of multiple layers of flashing adjusts to movement like the scales of a fish and provides repetitive layers of resistant materials while covering the fasteners with each lap. Overlapping the material below prevents water from migrating in opposition to the forces of gravity when an unequal pressure condition exists, as in high wind storms. The longer the lap the greater the force required to draw the water upward.

Non-corrosive metals such as copper, aluminum, and lead are popular flashing materials because of their durability, malleability, and impervious nature. Sheet metal and vinyl flashing are appropriate for traditional assemblies of lapped materials. New continuous drainage barriers employ self-adhering membrane and tape materials to work in conjunction with doors and windows with integral nailing fins.

4-55

Hose-test installed windows, before siding, to verify resistance to wind driven rain

3 POINTS

This test is designed to verify the performance of the first installed window. Use the first installed window, once fully installed with all appropriate flashing and sealing into the wall system as the test case. The window is factory-tested, but job-site installation can lead to potential water and air leakage into the building assembly. For instance, joints between windows and walls may not have been properly sealed, nor may there have been proper sealing to the adjoining cladding.

4-56

The best site test available to check for watertightness is to take a hose and spray the first installed window and check for water penetration. Correct any improperly sealed areas and retest.

Where not required by code, install working radon type vent system to eliminate potential moisture, methane, and radon problems in crawl space or under slabs on grade

2 POINTS

THIS ACTION ITEM IS NOT APPLICABLE TO AREAS WHERE RADON SYSTEMS ARE ALREADY REQUIRED BY CODE.

WASHINGTON - EPA Map of Radon Zones

<http://www.epa.gov/radon/zonemap.html>

The purpose of this map is to assist National, State and local organizations to target their resources and to implement radon-resistant building codes.

This map is not intended to determine if a home in a given zone should be tested for radon. Homes with elevated levels of radon have been found in all three zones.

All homes should be tested, regardless of zone designation.

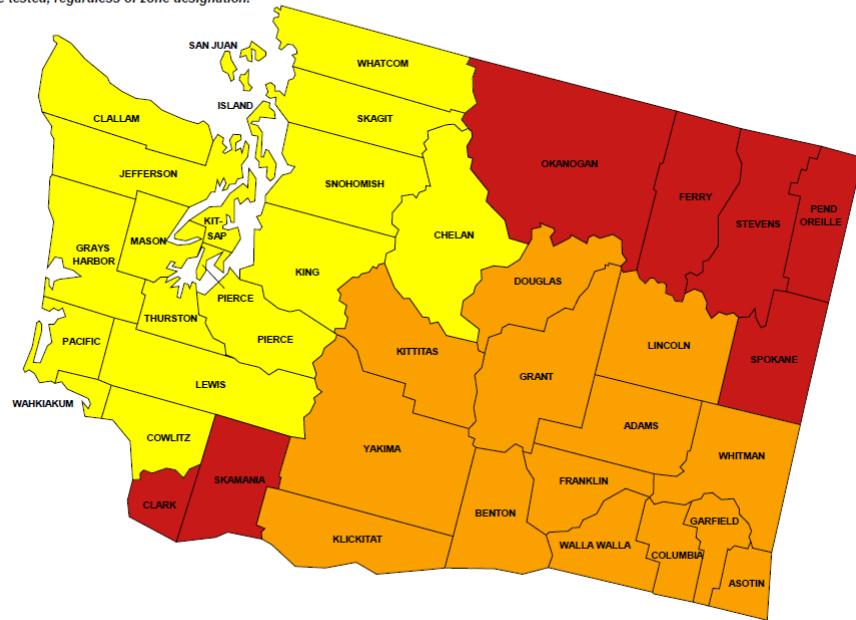


Figure 4-1 Washington State - EPA Map of Radon Zones

Zone 1 counties have a predicted average indoor radon screening level greater than 4 pCi/L (picocuries per liter) (red zones)	Highest Potential
Zone 2 counties have a predicted average indoor radon screening level between 2 and 4 pCi/L (orange zones)	Moderate Potential
Zone 3 counties have a predicted average indoor radon screening level less than 2 pCi/L (yellow zones)	Low Potential

IMPORTANT: Consult the publication entitled "Preliminary Geologic Radon Potential Assessment of Washington" (USGS Open-file Report 93-292-J) before using this map. <http://energy.cr.usgs.gov/radon/grpinfo.html> This document contains information on radon potential variations within counties. EPA also recommends that this map be supplemented with any available local data in order to further understand and predict the radon potential of a specific area.

There are two types of sub-slab depressurization radon systems: passive and active. A *passive* system prevents radon from entering the home by using barriers placed during construction, and it allows radon to leave the house using the home's own natural airflow and pressures and a carefully placed pipe. An *active* system uses the same barriers and pipe but also adds a mechanical fan to proactively remove radon from the home. The configuration of a radon system will vary with the design of the home — namely, the foundation type.

All passive systems, regardless of foundation type, should have the same basic features:

- A gas permeable layer under the home, such as a layer of gravel, to allow gas to move freely under the home
- Plastic sheeting installed over the gas permeable layer to prevent the gas from entering the home
- A vent pipe that directs gas up and out over the home, rather than into it
- Sealing and caulking around all openings in the foundation floor to prevent gas from leaking into the home
- A junction box in case an active system must be installed later

In addition to these features, an active system will have a small in-line fan at the end of the vent pipe to mechanically draw the gas out.

The same technology for mitigating radon exposure in homes, is used to keep moisture away from and out of the house. Depending upon type of foundation (basement, slab, or crawlspace), active system options include:

- *Mechanically Ventilated Crawlspace System*—The system uses a fan to increase ventilation within a crawlspace, achieve higher air pressure in the crawlspace relative to air pressure in the soil beneath the crawlspace or achieve lower air pressure in the crawlspace relative to air pressure in the living spaces.
- *Sub-Membrane Depressurization System*—This system vents air/moisture from under a soil-gas/moisture-retarder membrane by either using a fan-powered vent (active system) or vent pipe routed through the conditioned space of a building and connecting the sub-slab area with outdoor air (passive). The latter relies solely on the convective flow of air upward in the vent to draw air from beneath the slab.

Resources

- *Model Standards and Techniques for Control of Radon In New Residential Buildings*, a EPA publication available online at www.epa.gov/iedweboo/radon/pubs/newconst.html

4-57

Install a rigid perforated footing drain at foundation perimeter, not connected to roof drain system

1 POINT

Depending on the soil type, install perforated footing drainage along the foundation perimeter and tie them into an appropriate drainage at least 5' from the house to help control moisture in the house. Check with your local jurisdiction. Soils report identifies degree of backfill compaction plus minimum slope to achieve adequate drainage.

Perforations point down to allow water to enter the drainpipe. Drain discharges by gravity (preferable) or mechanical means into the approved drainage system.

Resources

- The Building Science Corporation website www.buildingscience.com. This website site offers useful information, emphasizing moisture control. (See General Resources, above.)

4-58

Show and build moisture management details for below grade walls beyond code, such as dimple drainage mat at exterior face and capillary breaks

3 POINTS

Detail a moisture management system for below grade walls that go beyond code.

Best practices indicate that there are six elements of waterproofing below grade walls:

- Slope surface soil away from the structure.
- Install roof water management system that keeps water away from basement walls.
- Install a waterproof barrier, either roll membrane or liquid-applied membrane from 6" above final grade down to and onto the die of the footing or slab.
- Install a perforated footing drain around perimeter of foundation, and cover with geotextile filter fabric.
- Install dimple drainage mat on exterior face of waterproofing membrane to provide protection for the membrane and over top of the footing drain and drain rock. The dimple drainage mat provides an air channel for water to be carried by gravity to the footing drain
- Finally, backfill with native soil if dimple board air barrier with a filter fabric has been installed.

Another practice in protecting the home from water moving up into the foundation is the use of capillary breaks. A capillary break is created using either an elastomeric asphalt coating or a polyethylene sheet. On the vertical face of the foundation (exterior walls) be sure to clean the surface and fill any cracks or gaps larger than 1/8" wide. Spray on a coat of elastomeric asphalt starting 4" from the ground and completely covering the surface to the top. Place a capillary break between the footing and the foundation wall. This can be done by spraying the footing with an elastomeric asphalt coating or by covering the footings with a polyethylene sheet.

Resources

- The Building Science Corporation website www.buildingscience.com. This website site offers useful information, emphasizing moisture control. (See General Resources, above.)

4-59

Perform calcium chloride moisture test on all slabs on grade prior to installing any finish flooring in conformance with product warranties

2 POINTS

The calcium chloride vapor emission test quantifies the volume of water vapor radiating from a concrete slab surface. Kits are available locally. Conducting this test can help prevent expensive callbacks and may be required by many warranties for floor covering installations.

Resources

- www.vaportest.com

4-60

Have crawl space, attic, and garage building performance tested for disconnection to the living space of house

3 POINTS

To ensure indoor air quality integrity of the living space, it is best to have the crawl space, attic, and most definitely, the garage, fully sealed from the living space for moisture and air.

Use Blower Door Test and/or Duct Blaster tests to verify performance. See Action items, 3-16, *Blower Door Test...*

4-61

Use an unvented, conditioned crawl space (not appropriate where flood venting is required)

3 POINTS

Unvented, conditioned crawl spaces perform better than vented crawl spaces in terms of safety, health, comfort, durability and energy consumption. Conditioned crawl spaces also do not cost more to construct than vented crawl spaces. (Unvented crawl spaces are not appropriate for flood zones, where flood venting is required).

The International Residential Code allows for the construction of "conditioned" crawl spaces. For further information on crawl space design and code requirements, review the technical article at:
http://www.buildingscience.com/resources/foundations/conditioned_crawl.pdf

Unvented, conditioned crawl spaces with insulation on the perimeter perform better in terms of safety and health (pest control), comfort (warm floors, uniform temperatures), durability (moisture) and energy consumption than passively vented crawl spaces with sub floor insulation.

Perimeter insulation, rather than floor insulation, performs better in all climates from an energy conservation perspective. The crawl space temperatures, dew points and relative humidity track that of the house. Crawl spaces insulated on the perimeter are warmer and drier than crawl spaces insulated between the crawl space and the house.

Crawl spaces should be designed and constructed as mini-basements, part of the house – within the conditioned space. They should be insulated on their perimeters and should have a continuous sealed ground cover such as taped polyethylene. They should have perimeter drainage just like a basement when the crawl space ground level is below the ground level of the surrounding grade.

4-62

No plumbing distribution lines in exterior walls

4 POINTS

4-63

Implement mold prevention measures such as antimicrobial treatment

4 POINTS

AIR DISTRIBUTION AND FILTRATION

Resources

- *Understanding Ventilation: How to Design, Select, and Install Residential Ventilation Systems*, by John Bower. Available from the *Journal of Light Construction Bookstore*, 800-859-3669 or www.constructionbookstore.com.
- *Healthy House Building: A Design and Construction Guide* (listed in Resources, Technical Books and Guides, above). Good information on optimizing air distribution and ventilation.

See your local building materials or heating supplier for improved filters. For quiet fan options, see resources listed under Action item 4-77, *Install Exhaust Fans in Rooms Where Office Equipment Is Used*.

4-64

Verify performance of ventilation systems; measuring supply and exhaust airflow, checking control activation and damper operation

3 POINTS

This Action item requires a third party to verify proper operation of ventilation systems by measuring the air flow of all supply and exhaust systems using a flow hood. Also check controls for proper activation. Check mechanical damper operation, if applicable.

4-65

Install return-air ducts or passive pressure-relief strategy in all bedrooms

3 POINTS FOR INSTALLING RETURN-AIR DUCTS IN ALL BEDROOMS

5 POINTS FOR PASSIVE-PRESSURE RELIEF STRATEGY IN ALL BEDROOMS

The most important area of the house to optimize the indoor air quality is in the bedrooms, by eliminating toxic finishes, dust, and/or moisture-prone surfaces in these rooms. This is because we spend the most time there. The installation of return air ducts to every bedroom ensures an adequate supply of fresh air to sleeping areas.

Optimizing air quality in sleeping areas is one example of “air quality zoning,” a strategy that recognizes that different rooms have different functions and air quality control requirements. Another example is isolating air distribution systems serving hobby rooms and office areas, which produce odors, from the rest of the home.

4-66

Use medium-efficiency pleated filter, MERV 10

1 POINT

When purchasing filters, look for the highest efficiency filter that works with your furnace. Filter efficiency is based on the Minimum Efficiency Reporting Value, or MERV. MERV ratings are usually listed on the product packaging. Look for the highest MERV ratings as possible, since this industry standard rating system measures the ability of the filter to trap particulates.

Medium efficiency pleated filters filter air through an extended surface area (pleating) to remove between 40% and 50% of all particulate matter. They are relatively inexpensive and sufficient for most home applications. Look for product with a minimum of 10 MERV rating.

Resources

Medium-efficiency pleated filters:

- Camfil Farr Company, http://www.camfiltfarr.com/cou_us/.
- Honeywell, Inc., Golden Valley, MN, 800-328-5111 or 800-345-6770, www.honeywell.com.
- Purolator Products Air Filtration Company, Henderson, NC, 252-492-1141, <http://www.purolatorair.com/>.
- General Filters, Inc., Novi, MI, 248-476-5100, www.generalfilters.com.
- Research Products Corporation, Madison, WI, 800-334-6011, www.resprod.com.
- Smith Filter Corporation, Moline, IL, 309-764-8324, www.smithfilter.com.
- Trion, Inc., Sanford, NC, 919-775-2201, www.trioninc.com.

4-67

Use high-efficiency pleated filter, MERV 12 or better, or HEPA

5 POINTS

High efficiency pleated filters with a MERV of 12 or better are available on the market. Since the MERV rating is higher, so is the filter efficiency.

More efficient filters, such as HEPA (high efficiency particulate air) filters, remove 99% or more of all particulate matter in the air. They are expensive, have high flow resistance and may require custom design for home applications. However, because of its high efficiency at filtering out tiny particulates, HEPA filtration is recommended for those individuals who suffer from allergies, asthma, or other respiratory problems. The filtration system connects in-line with the furnace ductwork and offers three stage filtration. An anti-microbial polyester pre-filter with a five pound, activated carbon filter is attached to the filtration system. For these reasons, they are not commonly used in residential filtration at this time.

Make sure you include information about the air filter system you choose (including filter size, type, quality, and the ideal replacement schedule) in the Homeowner's Kit so homeowner can properly maintain it (see Action item 6-1, A building owners' manual is provided).

Resources

HEPA filters:

- CWR Environmental Products, Inc., Glen Cove, NY, 800-444-3563 <http://www.cwrenviro.com/>.
- Honeywell, Inc., Golden Valley, MN, 800-328-5111 or 800-345-6770, www.honeywell.com.
- Purolator Products Air Filtration Company, Henderson, NC, 252-492-1141.
- Shelter Supply, Lakeville, MN, 800-762-8399, www.shelter-mn.com.
- Trion, Inc., Sanford, NC, 919-775-2201, www.trioninc.com.

4-68

Balance airflow system based on filter being used

2 POINTS

All filters pose added resistance to airflow. Make sure the filter is installed in the system *prior* to final ventilation system balancing, and ensure system is installed according to Air Conditioning Contractors of America (ACCA) manual J specifications.

4-69

Install central vacuum, exhausted to outside

3 POINTS

Central vacuum systems provide cleaner indoor air by efficiently removing particles without stirring up microscopic dust particles and re-emitting them into the home's interior. The vacuum receptacle is usually vented outside of the living space, so dust isn't blown about the house. They do not have particularly efficient filters, however, so make sure the outdoor exhaust isn't directed into a basement or located near a fresh air inlet.

If adding a central vacuum, locate it in the garage and exhaust it to outside (but not near a fresh air inlet). Make sure the garage is air sealed from the living spaces or other unconditioned space. (see Action items 4-27, *Detached or No Garage*, or 4-26, *Garage Air-Sealed from House with Automatic Exhaust Fan*).

Resources

Central vacuum manufacturers include:

- Beam Industries Inc. (makes one of the quietest central vacuums), Webster City, IA, 800-369-2326, www.beamvac.com.
- Broan-NuTone, Hartford, WI, 800-558-1711 or www.broan.com.
- Electrolux, Atlanta, GA, 800-243-5893, www.electrolux.com.

- HP Products, Inc. (manufacturer of the VACUFLO), Louisville, OH, 800-VACUFLO 800-822-8356, ext. 252 or www.vacuflo.com.
- M.D. Manufacturing Company, Bakersfield, CA, 800-525-2055 or www.builtinvacuum.com.

4-70

Provide for cross ventilation using operable windows

2 POINTS

Strategically placed operable windows promote indoor air quality by providing a means to bring fresh air into the home and exhaust stale air. Open floor plans with a minimum of interior partitions improve air circulation through the home.

Generally, natural cross ventilation is obtained by locating window openings in opposing walls and in line with each other. By having windows in both sides of a room, positive pressure on the inlet side and/or a vacuum on the outlet side of the building cause air movement provided that windows on both sides of the room are open. Use smaller window openings for the inlets and larger openings for the outlet. This increases the air speed and improves the cooling effect.

4-71

Install an operable skylight, clerestory or roof monitor (manual or automated) high up in the structure to aid natural ventilation. Use U-factor of 0.45 or below and solar gain co-efficient of 0.35 or below for skylight

2 POINTS

An operable skylight can be used to create controlled natural ventilation, allowing warm air that has risen to the top of the house to escape, and drawing up cool air from below. However, skylights can be a source of unwanted solar heat gain and/or thermal loss, so location should be carefully selected, and the benefits weighed against the disadvantages.

Operable clerestory windows in an upper wall or a roof monitor could also qualify.

4-72

Use ultraviolet light or equivalent new technologies for air purification

2 POINTS

4-73

A carbon monoxide (CO) alarm is installed in a central location outside of each separate sleeping area in the immediate vicinity of the bedrooms. The alarm is hardwired with a battery back-up.

3 POINTS

Carbon monoxide (CO) is produced by incomplete combustion of materials such as natural gas, wood, coal, oil, kerosene, gasoline, and even tobacco. Sources include wood or gas burning stoves and fireplaces, automobile exhaust from attached garages, and contamination from furnace flue leaks and backdrafting. At low levels, CO causes fatigue in healthy people and chest pains in those with heart disease. At higher levels, symptoms range from impaired vision and coordination, to headaches, dizziness, nausea, and death.

Home detectors warn occupants of unsafe CO levels and are relatively inexpensive and easy to install. A detector should be installed wherever there is a fuel-burning device and near the bedrooms. Check consumer testing results before buying.

Resources

Carbon monoxide detectors are available at hardware stores and home supply centers.

HVAC EQUIPMENT

Resources

For information about air exchangers or other ventilation systems:

- "Energy Ideas Clearinghouse." EIC will provide customized responses to specific questions about ventilation, 800-872-3568 or e-mail EnergyLine@energy.wsu.edu. Or you can browse for resources yourself online at www.energyideas.org (listed under General Resources, above).
- *Healthy House Building: A Design and Construction Guide* (listed in Resources, Technical Books and Guides, above).
- Understanding Ventilation: How to Design, Select, and Install Residential Ventilation Systems, by John Bower. Available from the Journal of Light Construction Bookstore, 800-859-3669 or www.jlconline.com/bookstore.

4-74

Limit kitchen exhaust fan to 300 CFM maximum

1 POINT

With respect to kitchen exhaust range hoods, bigger is not always better. Range hoods should be carefully sized and installed. If combustion appliances are present or the fan flows are high, provide make-up air to assure safe operation. In these situations, test to assure that pressure imbalance caused by the exhaust fans do not exceed minus 3 PA indoors to outdoors, or equivalently, the test meets PCTS performance criteria for controlling de-pressurization.

100 CFM is the minimum required by ASHRAE Standard 62, and it is generally adequate. The industry recommendation is for a minimum of 40 CFM per linear foot of cooktop, thus a 48" cooktop would only need a 160 CFM fan. So limit the kitchen fax to 300 CFM as a maximum.

4-75

Install timers, humidistat controls, or occupancy sensors for bath and laundry exhaust fans

2 POINTS PER DEVICE

4 POINTS MAXIMUM

Homeowners are more likely to use an exhaust fan with a crank or electronic timer switch, avoiding moisture buildup and eventual mildew problems in bathrooms. Ideally, a fan should run for up to one hour after a hot bath or shower to ensure complete moisture removal.

A humidistat control will automatically switch the fan on and off to maintain appropriate moisture content in the space. Look for low-sone fans to encourage use; the quietest fans can hardly be heard when you're in the same room.

4-76

Install quiet (<1.5 sone) bath fan with smooth ducting, minimum 4 inch or employ other quiet ventilation strategy or install ENERGY STAR, or equivalent fan operating =< 1 sone (3 pts)

1 POINT PER FAN

3 POINT MAXIMUM

Spot ventilation removed moisture, odors, and pollutants directly at the source. ASHRAE requires a ventilation rate of at least 50 cubic feet per minute for the bath fan. Manufacturers offer many options for quiet fans. In fact, Panasonic offers many fans rated at 0.5 to 1.0 sones. Make sure ducts are smooth (contain no fiberglass or insulation in the air stream), this provides better air flow. Using minimum 4" ducts are suitable for fans of less than 80 CFM.

Other quiet ventilation strategies include using a ducted central exhaust fan, it offers the quietest operation, introduces only one roof penetration, and the least wiring. Consider the roof penetration aspect of this strategy if you plan to go for credit 4—39, *Prepare a Roof Water Management Plan*. Spot ventilation designs that require mounting fans on walls and ceilings can be modified to use fans that can be mounted in-line in the duct between the living space and the exterior, or on the roof or outside wall and connected to the room by a duct. The space between the in-line or exterior-mounted fan and the interior reduces the noise level in the house. In-line units cost more for product and installation, but offer the quietest alternative. Additionally both single-point and multi-point fans offer credit compliant alternatives.

With any spot ventilation exhaust fans, be aware of back-drafting that may introduce elevated concentrations of pollutants back into the living space. In that case consider using sealed combustion appliances if using natural gas, and placing these appliances separate from the living space.

4-77

Install exhaust fans in rooms where office equipment is used

1 POINT

More and more residences include home offices or dens where computers, faxes, photocopiers, and other business machines are used. This office equipment and the supplies associated with it can emit VOCs and gases, including ozone, which is carcinogenic in high concentrations. A spot fan, installed in a home or commercial office, is an effective means of reducing health risks by dealing with the pollution at its source. Make sure you allow for fresh air intake elsewhere in the building to balance the system and ensure adequate ventilation. Look for "low-sone" fans to avoid distracting occupants; the quietest fans can hardly be heard when you're in the same room.

Resources

Spot fans are available from electrical and building material suppliers. Standard bathroom fans will work well, although you will want to select one that is quiet.

- Broan makes a variety of quiet bath, kitchen, and utility room fans. Look for their Solitaire Ultra Silent Series and Lo-Sone Ventilators. Broan Mfg. Co., Hartford, WI, 800-548-0790 or www.broan.com.
- American Aldes makes the quiet, efficient CMV(ceiling mounted ventilator) and SV-160 for large bathrooms. American Aldes Ventilation Corp., Sarasota, FL, 800-255-7749 or www.americanaldes.com.
- Panasonic makes some very quiet fans, Sacaucus, NJ, 201-348-7000, www.panasonic.com.

Also see *GreenSpec*, listed under Resources, Product Information, above.

4-78

Do not install naturally aspirated heating and hot water equipment

3 POINTS

4-79

No sound insulation or other fibrous materials installed inside ducting

1 POINT

Putting sound insulation or other fibrous materials inside the ducting is often done as a measure to reduce the noise coming from a particular room, such as a music studio or children's play area. Although this method is very effective, it also significantly reduces the air flow, which in turns compromises indoor air quality for these rooms.

To achieve desired sound insulation for these rooms consider additional wall, floor, and ceiling insulation rather than adding material to the ducts, or a double wall framing, see Action item, 3-26, *Innovative Stick Framing to Reduce Thermal Bridging*. Other ideas include: using foam gaskets under plates around receptacles and switches, caulking between baseboard (or drywall) and floor, use air-tight recessed cans.

4-80

Provide balanced or slightly positive indoor pressure using controlled ventilation

5 POINTS

Greater air tightness creates a need for mechanical ventilation to avoid potential indoor air quality problems. Balanced ventilation keeps outdoor pollutants from being drawn into the house, prevents backdrafting or spillage from combustion appliances (due to under-pressurization), and prevents moisture migration into structural cavities (due to over-pressurization).

It is a good idea to operate the home at a natural pressure (+ 1 Pascal pressure difference with respect to outdoors). If you accomplish this using supply ventilation only, you may be ignoring other critical factors involved in making the home energy efficient and healthy. These items need to accompany any attempts to balance a system.

The primary causes of negative pressure in the home are:

- Wind, natural convection or the stack effect
- Supply duct leaks
- Supply ducts isolated from return ducts by a closed door
- Excessive exhaust ventilation: Usually a large range hood or the clothes dryer.

The best way to bring a home into natural pressure, under normal operating conditions is:

- Caulk and seal the home
- Seal the heating system ducts with mastic
- Provide return air to isolated rooms with ductwork or bypass grille.

Once these items are addressed, the supply ventilation system may be used to balance exhaust ventilation de-pressurization or provide a slight positive pressure with a modest volume of fresh air. Ventilation can be provided by quiet fans with automatic controls or by heat recovery ventilators (HRVs) (see Action item 3-50, *Install a Heat Recovery Ventilator (HRV) or Energy Recovery Ventilator (ERV)*). The volume of air supplied should be provided as specified in the IRC.

Resources

See resources for Action item 3-50, *Install a Heat Recovery Ventilator*.

4-81

Install whole house radiant heating system (no ducted heating)

10 POINTS

Hydronic or radiant heating provides Indoor Air Quality benefits in that the ductless system avoids dust, particulates, chemicals, and germs, and the fans associated with ducted systems. Additionally, these systems provide comprehensive heating benefits; see Action items, 3-45, *Use ductless distribution system (e.g. hydronic, radiant, ductless minisplits)*

Hydronic heating uses hot water to distribute heat through baseboard convectors, free-standing radiators, or in-floor radiant coils. There are four primary components of the system, the boiler, the piping, the heat emitters, and the controls. See the Energy Action item noted above for more details on the actual system. Boilers can be run of biofuel.

Resources

- "Radiant Heating" by U.S. Department of Energy's Office, Energy Efficiency and Renewable Energy, a Consumer's Guide.... Available online at http://www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12590

4-82

If providing central heating and cooling, install whole house humidification and/or dehumidification

3 POINTS

INDOOR POLLUTANT CONTROL

4-83

Build a lockable storage closet for hazardous cleaning and maintenance products, separate from occupied space

1 POINT

A lockable storage closet in the garage is one way to (vented to the outside away from fresh air intakes such as windows) prevent fumes from getting into the living area, as well as toxic or otherwise dangerous chemicals from getting into the hands of curious children. Keep the storage closet small, to discourage homeowner from accumulating too many hazardous products, and locate it away from any source of ignition, such as a water heater. Provide a note in the Homeowner's Information Kit advising that all hazardous materials should be stored in original containers.

Program suggests constructing a non-combustible storage unit.

4-84

Install showerhead filter

1 POINT

Studies indicate that exposure to chlorine, absorbed through the skin during showering, can contribute to increased risk of health problems. Showerhead filters on the market today effectively remove 90% or more of chlorine from shower water. Some products have pop-in replaceable cartridges that install in seconds and last nine to twelve months and do not require backflushing.

Talk to your plumbing contractor or local suppliers for product recommendations.

4-85

Do not install gas-burning appliances inside house

1 POINT

Combustion appliances apply to any heating, cooking, clothes dryers, or decorative appliance using natural gas. Points are awarded in the Indoor Air Quality section to avoid using gas-burning appliances inside the house as a technique to improve indoor air quality, even though, points are awarded in the Energy Efficiency section for using these appliances because of the energy benefit.

Mostly these appliances are safe to run, thus their support in the Energy Efficiency section, however, under certain circumstances, these appliances can produce combustion pollutants that can degrade overall indoor air quality, often leading to damaging the occupants' health. Therefore, credit is given here to discourage the use of these potentially harmful off-gassing appliances inside the conditioned space.

Resources

- "What You Should Know About Combustion Appliances and Indoor Air Pollution – What are the health effects of combustion pollutants?" Environmental Protection Agency, Indoor Air Quality, publications, <http://www.epa.gov/iaq/pubs/combust.html>.

4-86

Fireplace, woodstoves, pellet stoves, or masonry heaters are not installed in the home

7 POINTS

See Above

4-87

Design a designated shoe-removal area and storage at primary entrance

2 POINTS

One of the single most important indoor air quality measures you can take is to minimize bringing pollutants into the house in the first place. The first line of defense is to remove shoes from the living space that can bring in pesticides, hydrocarbons, and pollen in from the outside.

Building a shoe removal vestibule at major entrances to the house will help improve indoor air quality and provide additional Energy Efficiency benefits.

You can build an exterior vestibule, as seen the Figure 4-1, or build one indoors in an underused over-designed foyer. Make sure the building envelope of the vestibule is tight. In particular, make sure the door is airtight. Good weatherstripping is essential.

For an exterior vestibule, consider installing a window for natural lighting, you can reuse salvaged single-pane window because the primary purpose of the vestibule is to create an air lock.

BUILDING ENTRANCE POLLUTANTS CONTROL:

Some studies indicate that up to 80% of indoor pollutants are tracked into the home on shoes. Providing track-off mats and shoe racks encourages shoe removal, which can go a long way to reducing this source of indoor pollution.

4-88

Install exterior grilles or mats

1 POINT

4-89

Install interior grilles or mats

1 POINT

4-90

Install floor drain or catch basin with drain under washing machine and/or water heater

**1 POINT FOR EACH APPLIANCE
3 POINTS MAXIMUM**

This measure helps to avoid additional moisture problems within the dwelling if either the washing machine or water heater flooded.

4-91

Install moisture alarms under sinks and dishwasher

1 POINT

Moisture alarms are small devices that you can place under sinks and the dishwasher with moisture sensors that activate with an audible alarm when excess moisture is present. They can be placed on the floor or wall mounted. They are inexpensive and may contribute to avoiding extensive moisture problems from malfunctioning equipment, however, they only work if someone is in the house to hear the alarm.

Resources

Ask for plumbing supplier.

ELECTROMAGNETIC FIELDS

4-92

Wire bedrooms so circuitry can be conveniently shut off at night to eliminate electric fields

2 POINTS

4-93

Design sleeping and sitting areas to be at least 12 feet from major appliances

2 POINTS

4-94

Use no CFLs

1 POINT

Extra Credit for Health and Indoor Air Quality

4-95

Extra credit for innovation in health and indoor air quality

1-10 POINTS

You may submit a health and indoor air quality strategy or system, not specifically called out in this Section, for consideration for an Extra Credit for Innovation. All extra credits will be approved by the Program Director. If approved, add up to 10 points to your Section total.

Section 5 MATERIALS EFFICIENCY

General Resources

- Look for your local recycling directory
- *Resource Conservation Research House Information Guide* (also Resource Conservation House Plans and Resource Conservation House Video), NAHB Research Center, Upper Marlboro, MD. 800-638-8556 or www.nahbcc.org.

Product Information

- *GreenSpec – The Environmental Building News Product Directory and Guidelines Specifications*, E Build, Inc., Brattleboro, VT, 1999. 802-257-7300 or www.buildinggreen.com. *GreenSpec* is organized in standard CSI divisions. *Environmental Building News* (EBN) also offers product reviews, information, and also lists some articles at the following website: www.buildinggreen.com/products/productslist.html.
- *Guide to Resource-Efficient Building Elements*, Center for Resourceful Building Technology, Missoula MT. 406-549-7678 or crbt@montana.com.
- *Green Building Resource Guide*, The Architectural Machine, Redwood City, CA. www.greenguide.com. Lists over 600 green building materials and products, available as CD-ROM database or reference manual.
- *Innovative Housing Products Newsletter*, NAHB Research Center, Upper Marlboro, MD. 800-638-8556 or www.nahbcc.org.
- *Iris Resource Catalog*, Iris Communications, Eugene, OR. 800-346-0104 or www.oikos.com/catalog. Publications, videos and software for green construction
- *REDI Guide (Resources for Environmental Design Index)*. Iris Communications, Eugene, OR. 800-346-0104. Also available free on the Oikos website: www.oikos.com. A database listing over 1,800 companies and 5,500 products as of 1998. Available in print or electronic form.

Technical Assistance Programs, Information and Services

- Energy Ideas Clearinghouse, Washington State University Cooperative Extension Energy Program. 800-872-3568, www.energyideas.org, or e-mail at EnergyLine@energy.wsu.edu. Offers customized responses on green building in addition to energy efficiency, ventilation, and moisture control.
- NAHB Research Center's "ToolBase Hotline" is available to answer builder questions, 800-898-2842, www.nahbcrc.org/ToolBase.
- "Fact Sheet, Jobsite Planning for IAQ, Construction Waste Management, and Site and Water Protection." O'Brien & Company, Inc., Bainbridge Island, WA. 206-842-8995 or info@obrienandco.com. (\$7.50).

Overall Design

5-1

Design and build for deconstruction concept

5 POINTS: 50% OF BUILDING MATERIALS CHOSEN FOR SIMPLIFYING DECONSTRUCTION

7 POINTS: 75% OF BUILDING MATERIALS CHOSEN FOR SIMPLIFYING DECONSTRUCTION

9 POINTS: 90% OF BUILDING MATERIALS CHOSEN FOR SIMPLIFYING DECONSTRUCTION

Deconstruction is an expanding alternative to traditional building demolition for removing existing structures. Deconstruction is a coordinated process of disassembling a building and salvaging materials. Deconstruction increases material life, reduces environmental impact on landfills and harvesting new materials, and saves money in dumping fees. The *Design and Build for Deconstruction* concept assimilates design, construction, and demolition, so as to maximize reusability and durability of building component throughout their functional and end-of-lifetime.

To qualify for this credit, demonstrate or assert that the minimum percentage required for each point range represents the amount of selectively chosen building components and design elements that contribute to simplified construction in preparation for future deconstruction.

Materials and system ideas include modular framing, prefabricated structural elements, precast panels for walls, nail-free paneling, windows that can be replaced without damaging adjacent finishes, mechanical fasteners for piping connections instead of soldered joints, and centralized accessible wiring and utilities.

If there are dwellings on your building site, see Action item 5-21, *Use Deconstruction to Dismantle and Reuse Existing Building(s) On Site*.

Resources

- "Design for Deconstruction", by Michael Pulaski, Christopher Hewitt, Michael Horman Ph.D. and Bradley Guy, 2003 (original article created for 2003 Green Build conference).
www.aisc.org/Template.cfm?Section=Technical_Answers&template=/ContentManagement/ContentDisplay.cfm&ContentID=26185

5-2

Use stacked floor plan

2 POINTS

Reduce the building size by stacking floor plans. Wet spaces can be located over mechanical areas, minimizing piping, vents, and chases. By building up versus out, efficiency of land use preserves open space, and tight floor plans reduce material consumption. Stacked plans also reduce construction costs for site and foundation work.

5-3

Use standard dimensions in design of structure

1 POINT

Incorporating standard sizes in the design will result in less wasted lumber, drywall, and other materials. It also requires less cutting—saving time and labor. For example:

- Use increments in floor and wall layout to correspond with the standard two- and four-foot increments of most materials.
- Pay close attention to door and window placement to avoid the need for extra studs or cutting materials to special sizes.
- Incorporate standard finish dimensions in design. For example, keep standard carpet sizes in mind when creating floor dimensions.

5-4

Avoid waste from structural over-design

2 POINTS

Reduce

"Reduce" means preventing waste *before* it happens. The following practices can help you realize significant reductions in waste and cost of materials on a construction project. Many of the Action items in this section require only slight modifications to standard procedures.

- *Avoid damage.* Train site crews to handle and store materials properly.
- *Use materials efficiently.* Encourage site crews to use scraps and use less materials overall.
- *Estimate as accurately as possible.* The more accurate, the less waste. Suppliers can often provide tips on estimating specific materials.

- Purchase precut and prefab components.
- Choose strong materials and exploit structural advantages.
- Purchase high-grade materials. These will get more usage and generate less waste in the long run.
- Limit framing waste to 3%. Use efficient framing.

5-5

Create detailed take-off and provide as cut list to framer

2 POINTS

Having a list identifying the intended location of each piece of lumber reduces the overall volume of lumber needed to construct the house as well as the volume of leftover cut unintentionally. Create a board-by-board take-off that can be used as a cut list for framers and an order list for your supplier. This list increases accountability of framers and suppliers and can result in significant savings.

5-6

Use central cutting area or cut packs

2 POINTS

A cut pack is a set of lumber that is pre-measured and pre-cut at the lumberyard to increase efficiency of lumber use and minimizes on-site waste.

Designating a centralized cutting area reduces wood waste, reduces the total amount of wood that must be supplied to the site, and saves time by making it convenient for carpenters to reuse cutoffs and scrap. It also makes the cutting process itself more efficient. Studies of construction sites with a centralized cutting area showed total waste reduction of as much as 15%.

A central cutting area also creates an ideal location for the wood scraps bin or pile, convenient for subcontractors to reuse the wood.

5-7

Use suppliers who offer reusable or recyclable packaging

2 POINTS

Cardboard, plastic shrink wrap, Kraft paper, wood pallets or frames, and metal bands are just some of the packaging materials that can show up on your jobsite. They comprise a significant portion of the typical construction waste stream, and add to your project cost.

Manufacturers are beginning to take back their own packaging for reuse. Encourage suppliers and manufacturers to take responsibility for their packaging:

- Request minimal packaging when placing a materials order
- Select products that are delivered with minimal, reusable, or recyclable packaging
- Purchase materials like fasteners, paints, caulking, and drywall mud in bulk containers

Some packaging will always be necessary to prevent materials damage, but the trick is to find the balance between necessary and excessive packaging. Let your suppliers know you recycle for economic and environmental reasons.

Items that can be reused cost-effectively include:

- Pallets
- Some corrugated cardboard packaging
- Plastic buckets

Reuse

"Reuse" (or salvage) means reusing materials removed during demolition or scraps generated during construction. Salvage or reuse prevents building materials from becoming waste, and transforms them from a builder liability and expense, to an asset. In addition, salvage often preserves unique materials not currently manufactured.

You can also encourage others to reuse by donating materials. Reusable items may be sold through classified ads or a yard/garage sale. Items can also be given away curbside or donated to a charitable organization, which may be tax deductible. Both for-profit and non-profit reuse centers are emerging which specifically handle used building materials and sell to either the general public or the low-income community. By donating reusable items, you add to the cost-effectiveness of your projects through reduced disposal fees and tax advantages, while also contributing to your community.

Use Salvaged Materials

Reusing materials can reduce project cost by avoiding disposal fees and reducing the need to purchase new materials. To make reuse easier in temporary structures, apply methods such as fastening with screws rather than nails to make dismantling convenient. If you have the storage space available, you may be able to store used materials for future projects.

When reusing structural materials, check with your local building authority regarding strength reductions or limits. They may be able to assist in determining the strength of various materials, such as reclaimed I-beams. Code may require some downgrading of structural capacity. In other cases, such as old timbers, structural capacity may actually be increased.

Note: Make sure when re-using any construction material that the material has been through the proper asbestos abatement process. For example mastic has been properly removed from flooring following local and federal asbestos regulations.

5-8

Purchase used building materials for your job

2 POINTS

5-9

Use salvaged doors

1 POINT PER DOOR

4 POINTS MAXIMUM

This credit is available if salvaged doors are purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. See Resources Section.

Consider this credit for interior doors so as to not compromise the integrity of the building envelope.

5-10

Use salvaged flooring

1 POINT FOR LESS THAN 250 SQUARE FEET

2 POINTS FOR MORE THAN 250 SQUARE FEET

Re-use flooring purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. Salvaged wood flooring can add an attractive feature to a home for example, that could add a rich historical appeal. Many salvaged woods come from original old-growth timbers, have fewer knots, longer lengths or widths, and come from species no longer available. Quality and availability can vary widely, but reusing wood flooring causes no new trees to be harvested.

5-11

Use salvaged windows

**1 POINT PER WINDOW
2 POINTS MAXIMUM**

This credit is available if salvaged windows are purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. See Resources Section. This provides opportunity to retain or reproduce architectural heritage.

Consider this credit also for reused windows that are placed on the interior where they will not compromise the integrity of the building envelope.

5-12

Use salvaged appliances

**1 POINT PER APPLIANCE
2 POINTS MAXIMUM**

This credit is available if salvaged appliances are purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. Ranges, furnaces, dishwashers, refrigerators and hot water tanks are examples of appliances that can be reused in suitable projects. Reusing appliances saves resources and reduces the environmental impact of the production of virgin materials.

5-13

Use salvaged fixtures

**1 POINT PER FIXTURE
2 POINTS MAXIMUM**

This credit is available if salvaged fixtures are purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. Many fixtures can provide an architectural element that can be incorporated into new designs.

5-14

Use salvaged hardware

**1 POINT PER SET OF HARDWARE
2 POINTS MAXIMUM**

This credit is available if salvaged hardware is purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. Many salvaged hardware items provide a period-authentic look that could be incorporated into new homes. Consider handles, drawer pulls, cabinet hardware, drapery hardware, registers, hooks and brackets.

5-15

Use salvaged cabinets

2 POINTS

This credit is available if salvaged cabinets are purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. Salvaged kitchen cabinets can be restored and reused in the home or for storage cabinetry in garage or workshop. Period-specific cabinetry can also be restored to add a distinctive look for bathrooms. These materials/components are available from building salvage and architectural salvage operations. See Resources Section.

5-16

Use salvaged siding

2 POINTS

This credit is available if salvaged siding is purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. Reuse siding in good condition. Be aware of building envelope considerations

when selecting any siding product/material. See Action item 4-51, Install a drainable house wrap under exterior siding to promote wall drainage.

5-17 Use salvaged decking

2 POINTS

This credit is available if salvaged decking is purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. Decking can be reused as part of new construction.

5-18 Use salvaged trim

2 POINTS

This credit is available if salvaged trim is purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. Trim and moldings can be easily salvaged and reused.

5-19 Use salvaged framing lumber

2 POINTS

This credit is available if salvaged framing lumber is purchased from salvage and reuse operations, re-used from other jobsites, or reclaimed in demolition. According to EPA statistics, a 2000 square foot home generates 127 tons of demolition debris. Ten percent of this is recoverable framing lumber, which averages 6,000 board feet or 33 mature trees.

5-20 Reuse spent solvent for cleaning

1 POINT

Spent petroleum-based solvents must be managed as hazardous waste. If you must use a solvent, consider one that's citrus-based. Regardless which solvent type you use, allow solids to settle out of spent solvents in a closed container. After settling, pour off the clear top layer and reuse. Solids can also be strained from spent solvent using many different types of paper or cloth filters. Although this technique significantly reduces the volume of material, settled and strained solids often need to be managed as hazardous waste.

Recycling

To "Recycle" means to separate recyclable materials from non-recyclable materials and supply them to a hauler or business so they can be processed and used to make new products. By choosing to recycle on your jobsite you will:

- Reduce disposal fees and overall construction costs.
- Provide "stock" for new materials to be manufactured.
- Keep valuable material from entering landfills.

Two recycling options are available: Source Separation Recycling or Commingle Recycling.

Source separation recycling is the process of sorting materials into separate on-site containers based on recycling categories. These containers are taken to specific facilities for recycling.

Commingle recycling is the process of collecting all recyclable materials in one on-site container. The container must have a minimum of 90% recyclable materials. This container is taken to a facility where materials are sorted for recycling.

In some cases, jobsite logistics may determine your recycling option selection. In confined jobsites, commingle recycling offers the benefit of a single container. In other cases, your crew may determine your choice. If a crew is committed to the environment and you can depend on them to manage the on-site recycling and complete separation of materials, you may choose source separated recycling.

Evaluate your waste stream, and target materials that have significant market value, that have local cost-effective recycling options, and can be conveniently source-separated. Typically this includes wood, cardboard, metal, drywall, concrete, and masonry. To assist in source separation, identify locations on site to collect these materials and use signs to clearly identify materials being collected in that location. (You may want to limit the number of bins by setting them up on a phased basis to correspond to the phases of construction and the typical waste streams generated during each phase.)

You can transport your recyclable materials to these facilities in a variety of ways. Consider the following methods:

- *Full-service recycling contractors.* They provide all bins, on-site sorting, and pick-up.
- *Garbage hauler.* Your hauler may provide bins and pick-up for certain materials.
- *In-house recycling.* Working with individual recyclers, you arrange bins, pick-up, and/or self-haul.
- *Subcontractors recycling.* Subs work with individual recyclers to arrange bins, pick-up, and/or self-haul.

Some companies, such as scrap metal dealers, will pay for recyclable material. Others charge to accept or pick up recyclables. Even if a fee is charged, however, it is generally less than fees paid for disposal. Recyclers have specifications for the quality, types, and grades of materials they can accept. To achieve the most benefit from your efforts, find out what these specifications are.

Resources

- *Residential Construction Waste: A Builder's Field Guide*, NAHB Research Center, Upper Marlboro, MD. 800-638-8556 or www.nahbrc.org.
- www.oikos.com/library/waste/index – Useful information about types and quantities of construction waste and disposal costs in the construction industry. Also available are helpful publications and brochures for builders developing jobsite waste management plans.

Source-Separated Recycling

5-21

Use deconstruction to dismantle and reuse existing building(s) on site

5 POINTS

ARCHITECTURAL ELEMENTS/FIXTURES: 2 POINTS

ARCHITECTURAL ELEMENTS/FIXTURES PLUS LARGE PIECES: 10 POINTS

EVERYTHING SALVAGEABLE FROM BUILDING WAS AT LEAST

20% OF TOTAL DECONSTRUCTION WASTE: 20 POINTS

This credit is designed to salvage reusable materials from existing buildings onsite through deconstruction. This credit is distinguished from others in this category through requirements of reusing materials specifically salvaged from the project site, not from other locations.

Architectural Elements/Fixtures include antique original lighting and hardware, mantels, timbers, tongue and groove paneling, flooring, window trim, faucets, shelving, bricks, and pavers.

Architectural elements/fixtures plus large pieces include cabinets, windows, (consider energy efficiency tradeoffs for windows and appliances) crown molding, sinks, bathtubs, built-in china hutches, wrought-iron railings.

Everything Salvageable includes all the above listed items plus reusing scrap wood to build shelves, shoe removal vestibule, roof shingles, bricks, slate, broken concrete.

Note: prior to beginning any renovation or demolition work, an asbestos survey must be performed by an accredited AHERA Building Inspector. In addition, a completed Notice of Intent must be submitted before any asbestos removal, and all asbestos-containing materials must be removed by asbestos workers prior to demolition. See your local jurisdictions to help you understand the asbestos rules.

The 85% rate is set because if more than 10% of the container is contaminated with non-recyclable materials, the recyclables materials will not be accepted.

5-22

Recycle cardboard by source separation, 85% minimum recycling rate

1 POINT

Cardboard is generated throughout most homebuilding and remodeling projects, but the largest volume occurs during the finish phase of the project when electrical and mechanical fixtures are being installed. Cardboard can often be recycled for free, either at drop-off sites or picked up by a hauler who may provide a bin. Wax, moisture, and metal banding can be considered contaminants. Check with cardboard recycler to identify any restrictions on the cardboard they accept.

5-23

Recycle metal scraps by source separation, 85% minimum recycling rate

3 POINTS

Copper scraps have been recycled for years because the metal has a high market value. As other metals (steel, iron, aluminum) have increased in value, it has become more beneficial to recycle them as well. Metal can be collected or accepted for free, with higher value metals providing revenues. Rebates available for recycled metals vary with market value. Separated metals have a higher value than mixed metals. Some recyclers will pay for sorted metals. Check with recycler for specifications.

5-24

Recycle clean scrap wood and broken pallets by source separation, 85% minimum recycling rate

5 POINTS

On average, about 25% of discarded construction materials is dimensional lumber and another 10% is waste from manufactured wood products. Wood scrap you can't reuse should be targeted for recycling. Clean wood scraps refer to unpainted and untreated materials. Wood processing technology has improved significantly, and more and more of the construction wood waste stream can be recycled. Check with wood recycler to identify any restrictions on the wood they accept. Depending on the final use of the material, the following *may* be considered unacceptable contaminants: paint, stain, pressure treatment, lamination, adhesives, and nails or other fasteners. Many of the region's wood recyclers also accept pallets as part of their wood waste stream. Consult the directories of services or contact your wood recycler first.

5-25

Recycle package wrap and pallet wrap by source separation, 85% minimum recycling rate

2 POINTS

Material packaging makes up a substantial percentage of construction material waste. Keeping material out of the waste stream helps preserve landfill space. Recycle packaging or have subcontractors make arrangements to take the packaging back to the supplier.

5-26

Recycle drywall by source separation, 85% minimum recycling rate

3 POINTS

Drywall generally makes up 11% by volume and 26% by weight of a residential home's waste stream or roughly 1-1.2 lbs. per square foot. Drywall is most often recycled as feedstock for more drywall. If your drywall subcontractor handles his or her own waste, work with the subcontractor to develop a recycling program.

Resources

- New West Gypsum, 1321–54th Ave. East, Fife (253-922-9343) or 3525 – 136th St., NE, Marysville (360-653-3494). Accepts gypsum drywall scraps and drywall related waste (mud boxes, tape, cornerboard). NO drywall with lead-based paints or asbestos laden material. Rents containers.

5-27

Recycle concrete/asphalt rubble, masonry materials, or porcelain by source separation, 85% minimum recycling rate

2 POINTS

Concrete, brick, and asphalt rubble can be collected on site and recycled for less money than it costs to be landfilled. On large demolition projects, where a significant amount of asphalt or concrete is being demolished as part of site preparation, the material can be ground to meet base or fill specifications and reused on site.

5-28

Recycle paint by source separation, 85% minimum recycling rate

1 POINT

Paints may be taken to the household hazardous waste areas. Check with your solid waste collector to see if full cans of paint are acceptable.

5-29

Recycle asphalt roofing by source separation, 85% minimum recycling rate

4 POINTS

Asphalt roofing is collected and recycled at several companies in the Eastern Washington area. See resource section for list of service providers.

5-30

Recycle carpet padding and upholstery foam by source separation, 85% minimum recycling rate

2 POINTS

Recycled Carpet pad is remanufactured back into new feedstock.

5-31

Recycle glass by source separation, 85% minimum recycling rate

1 POINT

Fluorescent bulbs and ballasts are recyclable and not allowed in landfills. See Resources for recycling options. Also, provide source separation glass recycling container to collect beverage containers and other non-reusable glass materials.

5-32 Recycle land clearing and yard waste, soil, and sod by source separation, 85% minimum recycling rate

3 POINTS

Many companies throughout Eastern Washington collect and process land clearing debris and yard waste. In addition, there are companies that offer mobile grinding services in which they will process land clearing debris at the jobsite. This reduces transportation cost and provides a material to use on your site for site protection activities.

5-33 Recycle fluorescent lights and ballasts

4 POINTS

5-34 Donate, give away, or sell reusable finish items

1 POINT

Rising raw materials costs and landfill tipping fees are making it more economical for builders to salvage materials for reuse than to pay for new materials and/or disposal costs. Donating materials to a registered 501c3 not only avoids the cost of disposal, but also provides a tax deduction.

Prior to the start of a demolition or a renovation project, the builder, designer, and owner should schedule a walk-through to identify materials that might be salvaged. If you intend to sell salvaged materials, a representative from the salvage business should be included in the initial walk-through to help identify salvageable materials that are in demand.

Products with consistent demand include:

- Hardwood flooring
- Windows that are in good condition (matching sets preferable)
- Kitchen cabinets and solid wood doors
- Architectural detailing, window and door hardware

King County, in cooperation with the City of Seattle, offers a construction recycling directory. The directory includes a section on "Reusable Building Materials, Salvage Services and Materials Exchanges." Companies and organizations that accept reusable building materials are listed. Snohomish County's directory also has a similar section. See the Part II, *Section Five Resources*, for details. You can also consult your local telephone book

Resources

See Action item 5-34, *Donate, Give Away or Sell Reusable Finish Items*, for a list of vendors who sell or accept used building materials.

5-35 Move leftover materials to next job or provide to owner

1 POINT

Many materials can be moved to the next job or left on site for the new owner at their request to use for repairs or expansions. Paint, for example, can be left with owners for touch-ups and repainting, or can be used as a primer on your next job. Decking material can be reused by the owner as part of a future expansion or for other landscaping applications. Also look for opportunities to donate materials to a reusable building materials facility.

Commingle Recycling

Many jobsites are not ideal for source separation recycling or the project team is focused on a simplified system. The ease of commingle (or mixed material) recycling maximizes the potential of overall diversion with the least amount of effort. There are several companies that offer services for commingle recycling. They can provide containers and haul recycling to appropriate facilities. See Section Five Resources.

The first three Action items in the category require that the project recycling rates meet a minimum of 85%. The distinction between the three items is based on the recovery rate of the recycling facility with whom you contract. More points are awarded for contracting with commingle recycling facilities that are diverting more material from the mixed material feedstock. See Section Five Resources for web sites that list the Facility Recycling Rates. For each of these Action items, the facility recycling rate is the "Appropriate for Processing Recycling Rate" list in column two of the table in the weblink.

- | | |
|------|---|
| 5-36 | Send at least 90% of jobsite waste (by weight, excluding concrete, brick and asphalt) to a commingle recycling facility with a recycling rate of 50 % |
| 5-37 | Send at least 90% of jobsite waste (by weight, excluding concrete, brick and asphalt) to a commingle recycling facility with a recycling rate of 75 % |
| 5-38 | Send at least 90% of jobsite waste (by weight, excluding concrete, brick and asphalt) to a commingle recycling facility with a recycling rate of 90% |

10 POINTS FOR 50% FACILITY RECYCLING RATE

18 FOR 75% FACILITY RECYCLING RATE

24 POINTS FOR 90% FACILITY RECYCLING RATE

To receive credit for this Action item, the project must divert at least 50% of the jobsite waste (by weight, excluding concrete) to a Commingle Recycling Facility with an "appropriate for processing recycling rate of 50%, 75, or 90%. See the Resources section for an on-line weblink and a phone number to get information on which commingled recycling facilities meet these criteria.

DESIGN AND MATERIAL SELECTION

This category includes Action items intended to help you make design and material selection choices, which benefit the environment while still providing the quality and performance you demand for your projects. In addition to promoting the purchase of materials that include recycled or "reworked" content, these Action items also suggest methods to reduce the use of limited resources.

Many standard construction materials that you are accustomed to using contain recycled-content and have for years. Furthermore, technology advancements have allowed the introduction of many new building products made with recycled-content that are also cost-effective and perform well.

By buying building products with recycled-content you reduce the use of "virgin" materials to produce construction products. Also, by specifying engineered products and waste-limiting framing options, you conserve materials which otherwise would have contributed to your site waste. All of these efforts conserve limited landfill capacity. In addition, you help encourage the market for recycled and engineered products. The end benefit will be competitive pricing for the finished products as well as better value for the recycled material used to make those products, including materials you recycle from your jobsite.

Recycled-content products can include two kinds of recycled material—*post-industrial* and *post-consumer*. *Post-industrial* recycled-content means the product includes waste material created as a by-product of an industrial process, such as sawdust produced in the milling process, or plastic "grinds" produced during the

manufacture of a plastic product. *Post-consumer recycled-content* means the product includes waste material created as a result of actual use by the consumer (such as carpet or wood waste). The higher the post -consumer content in a product the better. However, any recycled -content is better than none at all, when compared to using products with virgin materials that can require a lot of energy or other resources to produce.

When ordering building products from suppliers, it's important to let them know your preference for recycled-content alternatives. Manufacturers producing recycled-content building products typically produce an equivalent without recycled-content (often with no price differential), and if you don't specify recycled-content, you may not get it.

Another way to be a BUILT GREEN builder is to use products manufactured in the area, thus reducing the amount of energy used to get them to your site. The energy used to transport finished building products to their distribution site or directly to your site is one form of "embodied energy." Embodied energy is energy "contained" in materials that has been used in resource extraction, manufacture, transport, installation, and, after useful life is over, removal and disposal. Besides reducing energy use, using locally manufactured products reduces air pollution associated with that energy use and supports the local business community.

Finally, in this section, information is provided about resource-efficient products available as of this writing. Many products are readily available and are, for the most part, cost-competitive – see the Resources Section for specific product information.

Many Action items in this Section require choosing wood products that come from sustainably harvested forests. There are over 50 voluntary forestry standards programs worldwide at the time of this writing. Many of the programs are still evolving and others are emerging. Credit in the BUILT GREEN program will require that the wood products selected for the project can be independently certified to be coming from forests that meet one of the following two criteria:

Table 5-1 Wood Certification Guidelines

Certified Wood Products Tier 1 Requirements:

- Independently third-party audited chain of custody. Chain of custody refers to a certification that guarantees a wood product has been tracked from a certified forest to the final product to ensure it came from a sustainable forestry source. Tracking also guarantees that products will not be mixed with non-certified products during processing, manufacturing and distribution.
- No conversion of natural forest to plantation
- No mass harvest of old growth trees
- No GMO/Pesticides (GMO – genetically-modified organisms)
- Multi-stakeholder governance with transparent decision-making process
- Rules for control of non-certified components in certified products
- Supported by leading environmental and social organizations
- Policy of removal for non-compliance.

Certified Wood Products Tier 2 Requirements:

- Independently third-party audited chain of custody
- No conversion of natural forest to plantation
- No mass harvest of old growth trees
- Rules for control of non-certified components in certified products

-
- Policy of removal for non-compliance.
-

Resources

- "Material Selection: Tools, Resources, and Techniques for Choosing Green." *Environmental Building News*, January 1997, Volume 6, Number 1, Brattleboro, VT. 802-257-7300 or www.buildinggreen.com/products/productslist.html.
- "Designing for Disassembly," *Solplan Review*, July 1999. North Vancouver, BC. 604-689-1841 or e-mail at solplan@direct.ca.

Also see the General Recourses at the beginning of this section and refer to prerequisites, *Conform to the House Size Matrix*.

For wood certification guidelines, see Part 1, Section Five, Design and Material Selection, Table 5.1 for the list of requirements.

Overall

5-39 Install locally-produced materials

1 POINT PER ITEM

10 POINTS MAXIMUM

Supporting the use of indigenous resources reduces the environmental impacts resulting from transportation. "Locally produced" materials are generally considered to be produced, both manufactured and extracted, within a 500-mile radius.

See your local supplier and ask for information on the origin of the materials.

5-40 Use building salvaged lumber, minimum 200 board feet

1 POINT FOR EVERY 200 BOARD FEET

8 POINTS MAXIMUM

This credit does not apply to new wood from trees cut on site, but does apply to salvaged lumber from an existing on-site, deconstructed building or commercially salvaged and reused building material sources. See Action item 5-21, *Use Deconstruction to Dismantle and Reuse Existing Building(s) On Site*, for further information. Points for this credit are awarded for the quantity of salvaged lumber from deconstructed sources.

The most common commercially salvaged and reused building component is wood salvaged from beams in turn-of-the-century buildings or abandoned railroad trestles. Consequently, reclaimed wood is often available in species, coloration and wood quality not found in today's new material markets. Some companies offer original hand-hewn beams for reuse in their present form. Others provide salvaged wood re-milled into flooring, millwork, or paneling. Most companies grade the wood depending on its grain, the number and type of knots, and the number of nail holes left from its prior use.

5-41 Use urban or forest salvaged lumber, minimum 250 board feet

2 POINTS: ANY LUMBER SALVAGED FROM URBAN OR FOREST RESOURCES

3 POINTS: ANY LUMBER SALVAGED FROM BUILDING SITE*

THIS CREDIT APPLIES TO NEW WOOD RECOVERED FROM URBAN OR FOREST SALVAGE OPERATORS.

Many wood suppliers offer new wood products that are made from wood salvaged from urban or forest resources.

Urban salvage refers to trees removed from urban parks, campgrounds, and recreation areas, possibly damaged from disease or considered a hazard. Other sources include trees removed from construction sites for clearing and grading.

Forest salvage refers to trees recovered from forest restoration projects or removed from forestland to make way for roads, campgrounds, or utility lines. It may also refer to hazardous trees removed from campgrounds. Instead of being chipped or used as firewood, these trees are sent to a mill and processed into flooring, trim, and other finish materials.

This credit does not apply to burning salvaged materials.

* Over cutting on the site to achieve the points for this credit is not the intention of the credit. Only salvage trees that were originally planned for removal. (See Section Two: Site and Water, Protect Site's Natural Features Action items.)

Resources

- Healthy Forests Healthy Communities (HFHC). 620 SW Main, Suite 112, Portland. 503-221-6911 ext. 112. <http://www.hfhcp.org/products.php>. Resource for urban and forest salvaged materials.

5-42

Use rapidly renewable building materials and products made from plants harvested within a ten-year cycle or shorter in at least 2 substantial applications

3 POINTS

This credit does not apply to finish flooring or OSB. To achieve flooring credit, see Action items 5-65, *On more than 250 square feet, use rapidly renewable flooring products with a ten-year harvest cycle or shorter (excluding carpet)*.

Acceptable materials include cork, bamboo, agricultural panel board, strawboard, and plant-based finishes. Acceptable applications could include: cork as a wall finish, bamboo for countertops, paneling, or wall finish, agricultural panel boards as cabinets, countertops, wall and ceiling finish, and plant based finish on any wood surface.

Cork and bamboo are both renewable resources and natural materials. Cork is sustainable because the bark is harvested and the tree is left to regenerate more bark. The bark is harvested on an eight-year cycle. Cork flooring is durable, sound absorbing, and naturally moisture-, mold-, and rot-resistant. Bamboo is sustainable because it can be harvested on a six to eight year cycle. Bamboo flooring is a very durable and dimensionally stable material. Despite the long-distance transport of the products to the United States, the durability, hardness, and short regeneration time of bamboo provide justification for specifying bamboo flooring instead of wood. There are also indoor air quality advantages to using natural materials - they off-gas less due to fewer or no chemicals used in the manufacturing process.

Paneling made from reclaimed agricultural fibers is plant-based and sustainable because it is harvested on an annual or semi-annual cycle. The straw that makes up strawboard for example can be harvested every 2-3 years. Strawboard can be a substitute for wood particleboard and medium-density fiberboard. Seek out products that have no added formaldehyde in the bonding agents and finishes.

Plant-based finishes refer to products made from rapidly renewable vegetable oils, citrus oils, waxes and mineral oils. They often create a more natural looking final product.

5-43

Use environmentally preferable products with third-party certification, such as SCS, GreenGuard, and Floor Score (not applicable to carpet)

2 POINTS

Third-party certification is based on standards developed by an unaffiliated organization. Third-party certification standards establish criteria and verify manufacturer claims regarding the environmental, social and economic benefits of their products.

To receive credit for this Action item, use any certified products from any the following organizations, other than carpet (carpets are not applicable under this credit).

Science Certification Systems (SCS) is a third-party certifier that promotes sustainable development in the forms of environmental protection and social responsibility.



Greenguard Environmental Institute governs the Certification Program, another third-party certification organization that provides information related to Indoor Air Quality on insulation, airfilters, doors, floor finish, flooring, and wall finish.



Green Seal is a third-party certification organization that evaluates, tests and visits manufacturing facilities to identify a product as environmentally preferable.



The FloorScore program, developed by the Resilient Floor Covering Institute (RFCI) in conjunction with Scientific Certification Systems (SCS), tests and certifies flooring products for compliance with indoor air quality emission requirements. Flooring products include linoleum, laminate flooring, wood flooring, ceramic flooring, rubberflooring, wall base, vinyl, and associated sundries.



Resources

- "Forest Certification Test Project", USDA Forest Service. www.fs.fed.us/news/2005/releases/08/factsheets.pdf. Discusses four major forest certification programs.
- Forest Stewardship Council. www.fsc-info.org. Manufacturer and product search engine for chain of custody certificate holders.
- Green Seal. 1001 Connecticut Avenue, NW Suite 827, Washington, DC. 202-872-6400. www.greenseal.org/. Discusses standards of Green Seal product certification.
- Scientific Certification Systems. 510-452-8007. www.scscertified.com/forestry/forest_indie.html. Discusses SCS forest certification standards.
- Greenguard Environmental Institute. 1341 Capital Circle, Suite A, Atlanta. 800-427-9681 www.greenguard.org/. Discusses Greenguard's mission and certification programs.

5-44

Use recycled-content plastic lumber

2 POINTS

Framing

5-45

Use dimensional lumber that is third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook, 50% minimum

7 POINTS

To receive credit for this Action item, the dimensional lumber selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5.1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Two private companies in the U.S. are authorized to issue the FSC stamp of approval: Scientific Certification Systems (SCS) in Oakland, CA, and SMARTWOOD^{CM} Certified Forestry, based in Richmond, VT (with an affiliate in Oregon). By purchasing wood from certified forests, you ensure a given product comes from a well-managed forest and demonstrate support for sustainable forest stewardship practices worldwide. At the conception of the BUILT GREEN program (2000) 5 million acres of forestland had been certified by FSC. As of January 2006, there is 22 million acres of FSC certified forestland in the U.S. Many more retailers lately are certified in the chain-of-custody and supply FSC certified products. Also, the variety of materials available in FSC is also expanding.

Resources

Although there are several Certified Wood Distributors nationally listed in *GreenSpec* (see *Resources, Product Information*), several are located in the Pacific Northwest:

- Collins Wood, Portland OR. 800-329-1219. Offers plywood, particle board, and dimensional lumber.
- Edensaw Woods, 211 Seton Rd., Port Townsend, WA. 800-745-3336 or 360-385-7878. Website: www.edensaw.com. Offers selections of certified wood including ash, beech, birch, cherry, Honduras mahogany, fir, maple, poplar, red oak, and white oak. Some certified veneers available.
- Endura Hardwoods, 1303 SE 6th Ave., Portland, OR. 503-233-7090 or www.endurawood.com. Offers certified hardwood and softwood lumber and a range of wood products (including flooring and butcher block countertops) in the following species: red alder, ash, birch, cherry, Douglas fir, maple, red oak, white oak, redwood, and mahogany. Also antique and vintage (rediscovered) woods.
- Environmental Home Center, 4121 1st Ave. S., Seattle. 206-682-7332, 800-281-9785, or www.environmentalhomecenter.com. Offers framing lumber, flooring, custom order for trim, panel goods, shingles, and raw lumber.
- Dunn Lumber, multiple locations offer FSC-certified products, 206-632-2129, www.dunnlum.com
- Compton Lumber & Hardware, 3847 – 1st Avenue, Seattle, 206-623-5010, <http://www.comptonlbr.com/>
- Forest Stewardship Council. www.fscus.org/news/archive.php?article=433&. Provides statistics about FSC certified land.
- Forest Stewardship Council. www.fsccanada.org/chainofcustody2.htm. Explains “chain of custody” related to forest certification standards.
 - Forest Stewardship Council. www.fsc-info.org. Manufacturer and product search engine for chain of custody certificate holders.

For general information on certified lumber, contact:

- Certified Forest Service Council, Jeff Wartelle, 503-590-6600. Industry group provides information on distribution and other assistance.

5-46

Use dimensional lumber that is third-party certified sustainably harvested wood that meets the Tier 2 requirements outlined in the handbook

1 POINT

For credit for this Action item, use dimensional lumber that meets Certified Wood Products Tier 2 Requirements listed under Design and Material Selection, *Wood Certification Guidelines for Section Five*. (See Table 5.1, at the beginning of the Design and Material Selection section.)

Currently, there are no programs that meet these criteria, however, a few are expected to on-line soon.

Resources

As of February 2007, no certification program meets the Tier 2 requirements. Contact the BUILT GREEN program for updates.

A few programs may meet this criteria soon, information for these programs is included for future reference:

- Sustainable Forestry Initiative. 1655 North Fort Myer Drive, Suite 1300, Arlington, VA. www.aboutsfi.org/sfilabel.asp. Describes SFI's standards as a comprehensive forestry management program.
- Canadian Wood Council. 99 Bank Street, Suite 400, Ottawa, Ontario. 800-463-5091. www.cwc.ca/. Comprehensive listing and description of North America's forest certification standards and programs.
- The American Tree Farm System. 1111 Nineteenth Street, NW, Suite 780, Washington, D.C. 202-463-2462. www.treefarmsystem.org/. Describes the American Tree Farm System's sustainable forest management standards and guidelines.

5-47

Use sheathing that is third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook, 50% minimum

5 POINTS

To receive credit for this Action item, the sheathing selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5.1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Resources

See Resources listed for 5-45, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 1 Requirements Outlined in the Handbook, 50% Minimum

5-48

Use sheathing that is third-party certified sustainably harvested wood that meets the Tier 2 requirements outlined in the handbook

1 POINT

For credit for this Action item, use sheathing that meets Certified Wood Products Tier 2 Requirements listed under Design and Material Selection, *Wood Certification Guidelines for Section Five*.

Currently, there are no programs that meet these criteria, however, a few are expected to on-line soon.

Resources

See Resources listed for 5-46, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 2 Requirements Outlined in the Handbook.

5-49

Use beams that are third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook, 50% minimum

5 POINTS

To receive credit for this Action item, the beams selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5.1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Resources

See Resources listed for 5-45, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 1 Requirements Outlined in the Handbook, 50% Minimum

5-50

Use beams that are third-party certified sustainably harvested wood that meets the Tier 2 requirements outlined in the handbook

1 POINT

For credit for this Action item, use beams that meet Certified Wood Products Tier 2 Requirements listed under Design and Material Selection, *Wood Certification Guidelines for Section Five*.

Currently, there are no programs that meet these criteria, however, a few are expected to on-line soon.

Resources

See Resources listed for 5-46, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 2 Requirements Outlined in the Handbook.

5-51

Use factory framed wall panels (panelized wall construction), including SIPs and ICFs

2 points

Pre-fabricated wall panels are built in a factory based on individual building plans. Since the panels are manufactured in a quality-controlled environment, they are stronger, more dimensionally accurate, and more durable structures. They are built, labeled for assembly and shipped to the job site. Builders follow assembly procedures defined by factory specifications.

Although points are awarded in Section Three, *Energy Efficiency*, for using SIPs (see Action items 3-21, *Use structural insulated panels (SIPs)*, *insulated concrete forms (ICFs)* or *straw bale for exterior walls around conditioned space*.) Additional points are awarded here to recognize the material benefit in addition to the energy efficiency benefit of using this product.

Using structural insulated panel (SIP) systems for wall, roof, and flooring applications instead of traditional stick framing can be an effective way to reduce the amount of wood used in a building. Panel systems have been in use for over 30 years and a variety of systems are available. The most common system includes a foam core sandwiched between oriented strand board (OSB) skins. Avoid structural insulated panels produced with ozone-depleting HCFCs. EPS (expanded polystyrene) does not contain HCFCs or other ozone-depleting chemicals. Non-ozone-depleting polyurethane is now available

In order to get optimum performance and waste reduction out of a panel system, first carefully evaluate your building plans to see if panels are appropriate. A complex shell design with lots of window or door openings can make it more difficult to use panels resourcefully. If you decide to use panels, make sure your framer understands how to work with them. Improper installation can negate the benefits. (The manufacturer should be able to provide some assistance when you start using these products.)

See Energy Efficiency section Action item 3-21, *Use structural insulated panels (SIPs), insulated concrete forms (ICFs) or straw bale for exterior walls around conditioned space* for more information on the energy aspect of this building method. In addition to energy savings, this method also represents an opportunity to use a waste product, fly ash, in standard building material, which coincidentally offers superior performance. Flyash waste from coal burning has been shown to improve the strength of concrete (see Action item 5-57, *Use Flyash or Blast Furnace Slag For 25% by Weight of Cementitious Materials for All Concrete (20% for Flat Work)*).

In addition, some ICF systems are made with waste wood. The system offers significant savings in labor by combining framing, insulating, and sheathing. Less waste is produced because of the system's flexibility (the forms can be cut to any shape). Additionally, many systems have "studs" built in so there's something to nail or screw to, and sheetrock may be attached directly to the foam's interior surface. Exterior siding material, such as wood, vinyl, brick, or stucco, can be easily attached.

- Tool Base Services.

www.toolbase.org/TechInventory/TechDetails.aspx?ContentDetailID=977&BucketID=6&CategoryID=13. Provides technical information on structural insulated panels (SIPs).

Resources

See *Section Three: Energy Efficiency* Action item 3-15, *Airtight drywall approach for framed structures using thermal enclosure checklist*. For information on using flyash in concrete see Action item 5-57, *Use flyash or blast furnace slag for 25% by weight of cementitious materials for all concrete (20% for flat work)*.

5-52

Use truss roof system

3 POINTS

5-53

Use engineered structural products and use no dimensional 2xs larger than 2x8, and no 4xs larger than 4x8

3 POINTS

There are many engineered structural products, including laminated veneer lumber (LVL), wood I-beams and I-joists, and wood roof and floor trusses. These products combine efficient raw material use with improved strength and performance capabilities to produce a superior option to traditional materials. Engineered lumber manufacturers use fast-growing, small-diameter trees efficiently.

Combining wood veneer and fiber with adhesives produces LVL. The LVL manufacturing process allows more of the log (up to 80%) to end up as product. LVL lumber is very consistent and stable. Wood I-beams and I-joists also combine veneer and adhesives.

LVL headers and I-beams are accepted by all major building codes. They provide more load-bearing capacity than solid sawn lumber, and resist shrinking, twisting, splitting, warping, and crowning. They are capable of long spans, thereby increasing design flexibility. They can cost more than dimensional lumber, but in general are considered better products. The American Plywood Association estimated that in 1998 I-joists alone accounted for over a third of all residential floor joists installed in the U.S.

Wood, roof, and floor trusses are commonly used instead of cut rafters because they save both time and materials. They can also reduce wood waste because, ideally, you order only what you need, and because of efficiencies in the production process.

Prevent waste by making sure you and your truss supplier are “on the same page.” Supply a detailed building plan (calling out any unusual requirements due to an oddly shaped cathedral ceiling or an opening planned through the roof framing). Also, make sure trusses are stored flat to prevent warping.

Be aware of the indoor air quality issues associated with formaldehyde binders. Look for products that do not contain this type of binder or, at a minimum, use phenol formaldehyde in place of urea formaldehyde binders. Ask your supplier for more information. Also ask them about manufacturers who use certified wood in their engineered wood products.

Resources

- GreenSpec, see Resources, Product Information.
- Trus Joist MacMillan, Beaverton, OR. 800-391-2611. Distributes a variety of engineered structural products (including Parallam PSL and TimberStrand LSL) to local lumberyards. See your local supplier for other engineered structural materials as well.
- Willamette Industries in Oregon, 800-887-0748. Distributes engineered structural products (including StrucJoist, StrucLam LVL, and E--Z Frame System). For product information, contact the local distributor, CMI Northwest in Woodinville at 425-475-2320.

For more information see:

- *Building with Alternatives to Lumber and Plywood*, NAHB Research Center, Upper Marlboro, MD. 800-638-8556 or www.nahbrc.org.
- “Engineered Lumber Update,” *Journal of Light Construction*, March 1998. Williston, VT. 802-859-3669 or www.jlconline.com/bookstore. (Last page lists related articles as well as a number of manufacturers of engineered lumber.)
- “Setting Trusses: Tips from the Tracts,” *Journal of Light Construction*, April 1995. Williston, VT. 802-859-3669 or www.jlconline.com/bookstore.
- *Truss-Framed Construction*, NAHB Research Center, Upper Marlboro, MD. 800-638-8556 or www.nahbrc.org.
- “What’s The Difference? Structural Composite Lumber: LVL, PSL or LSL?” *Fine Homebuilding*, April/May 1998. Taunton Press, Newtown, CT. 800-888-8286

5-54

Use finger-jointed framing material (e.g. risers and studs) longitudinal compression loads only

3 POINTS

Finger-jointing or engineered studs (gluing short lengths of wood together) makes use of wood that traditionally would have been disposed of as waste. Finger-jointed products are generally straighter and stronger than solid wood; you won’t have to reject and waste warped or split boards. For structural use, they are acceptable for longitudinal compression loads only.

5-55

Use cementitious foam-formed walls with flyash concrete

3 POINTS

In addition to energy savings, this method also represents an opportunity to use a waste product, flyash, in standard building material, which coincidentally offers superior performance. Flyash waste from coal burning has

been shown to improve the strength of concrete (see Action item 5-57, *Use flyash or blast furnace slag for 25% by weight of cementitious materials for all concrete (20% for flat work)*).

In addition, some ICF systems are made with waste wood. The system offers significant savings in labor by combining framing, insulating, and sheathing. Less waste is produced because of the system's flexibility (the forms can be cut to any shape). Additionally, many systems have "studs" built in so there's something to nail or screw to, and sheetrock may be attached directly to the foam's interior surface. Exterior siding material, such as wood, vinyl, brick, or stucco, can be easily attached.

Foundation

5-56 Use regionally produced block

1 POINT

Locally produced materials are generally considered to be materials produced within the Pacific Northwest region, or within a 500 mile radius. Points are awarded for using locally produced block in recognition that this strategy reduces the amount of fuel used to transport material to the site.

Resources

Ask your local supplier and ask about the origin of the material.

5-57 Use flyash or blast furnace slag for 25% by weight of cementitious materials for all concrete (20% for flat work)

3-6 POINTS

Fly ash is a by-product of burning coal for electricity production. It can be added to concrete slabs and foundations mixes as a substitute for up to 60% of the Portland cement mixture. The general rule of thumb recommends 15-30%. It has been shown to improve the strength of concrete as well as increase its workability. Be advised that concrete with fly ash content sets up more slowly, but it is easy to work with and has a slightly smoother finish. It is readily available and involves no added cost.

Blast Furnace Slag is a coproduct of iron production, commonly used as feedstock for steel production. Pelletized blast furnace slag can be used as a lightweight mineral admixture in blended cement for durable concrete structures. Blast furnace slag reduces the risk of damage caused by Alkali-silica Reaction, reinforcement corrosion and sulfphate. This concrete material has extended the lifespan of buildings from 50 to 100 years. Using blast furnace slag also requires 1/5th of the energy needed to produce Portland cement and produces less than 1/10th the carbon dioxide emissions of Portland cement generation.

Resources

A major distributor of flyash is ISG Resources in Centralia: 888-333-5546. Check with your local ready-mix company for suppliers. Also contact, local supplier:

- ISG Resources, Inc., Mercer Island, WA. 800-426-5171 or www.flyash.com.

For more information about using flyash in concrete and its performance consult the following:

- "Fly Ash Improves Concrete, Reduces Pollution," *Journal of Light Construction*, July 1999. Available from the JLC Bookstore: 800-859-3669, fax 802-434-4467, or online at www.jlconline.com/bookstore.
- "The Fly Ash Revolution: Making Better Concrete with Less Cement," *Environmental Building News*, June 1999. Brattleboro, VT, 1999. 802-257-7300 or www.buildinggreen.com.

5-58

Use recycled concrete, asphalt, or glass cullet for base or fill

2 POINTS

When using this technique, grind concrete, asphalt, or glass cullet properly to meet base or fill specification. When ground to specs, the materials compact nicely to form a stable base. Get a sample from the supplier for your excavator crew to approve.

Resources

Depending on current supply and price, recycled concrete, asphalt, or glass cullet may be cost-effective options. Consult the Washington Department of Transportation (WADOT) specifications for using these materials (see BUILT GREEN Resource Library).

See your pavement supplier for recycled concrete and asphalt options. There are also mobile concrete crushers, see your local phone book for vendors. They can crush concrete on site to spec.

Glass cullet is an excellent alternative for fill. See the BUILT GREEN Resource Library for a copy of the WSDOT specifications. Post-consumer glass is primarily clear, amber, and green bottle glass. Post-industrial glass is a by-product of manufacturing activity. It is generally cleaner and more uniform in size.

Doors

5-59

Use doors that are recycled-content or certified as sustainably produced (FSC, CSA Intl., or American Tree Farms System)

1 POINT

For further information and comparison of certification systems, visit www.certifiedwood.org/search-modules/CompareCertSystems.asp.

5-60

Use domestically-grown and manufactured wood interior doors

2 POINTS

Domestically grown wood interior doors offer the same performance without compromising limited and endangered hardwood species stock. They also represent an opportunity to reduce embodied energy through minimizing the transportation impact.

Finish Floor

5-61

Hardwood flooring from third-party certified, sustainably harvested sources, locally harvested or re-used lumber

4 POINTS

5-62

Use recycled-content underlayment products

2 POINTS

Using underlayment products below wood, tile, resilient flooring, or carpet and carpet cushion provides a level surface, covers cracks, and helps insulate floors from sound transmission and some heat loss. Standard particleboards are traditionally used for the purpose of underlayment, even though they are known to be the

primary source of formaldehyde gas in new homes. Exterior grade plywood or no added urea formaldehyde wood fiberboard with recycled-content is a superior choice for underlayment. OSB does not apply unless it is certified with recycled content. Other environmentally preferable materials for flooring underlayment include natural cork and options made with recycled rubber, paper, jute hemp and/or agricultural fiber. (See Section Four, *Health and Indoor Air Quality*, Action item 4-38, Use plywood and composites of exterior grade or with no added urea formaldehyde (for interior use).

Resources

Ask your local flooring supplier. Some manufacturers to consider are:

- Homasote, West Trenton, NJ. 800-257-9491. 440 Sound Barrier, 440 Carpetboard and Comfort Base. The 440 materials are high-density fiberboard panels made from 100% recycled wastepaper and a formaldehyde-free paraffin binder. Comfort Base is specifically designed for use over a concrete slab.

Other brands offer further environmental benefits, consider:

- Medite Corporation, Medford, OR. 800-676-3339. Medex and Medite II MDF are formaldehyde-free alternatives for underlayment as well as cabinet frames, countertops, interior door and window casings, and trim. Available through your local supplier.
- U.S. Gypsum Co., 800-874-4968. Fiberock brand gypsum fiber underlayment is a fiber-reinforced gypsum panel specially designed for use in residential construction as an underlayment for vinyl, carpeting, hardwood flooring and ceramic tile (dry areas only).

5-63

Use recycled-content vinyl flooring

1 POINT

Vinyl flooring is a commonly used material and often preferred for economy and durability. It is not environmentally preferred, however, due to the manufacturing process that creates air pollution problems, impacts from VOCs off-gassing during construction and occupancy, and the fairly limited potential for recycling the material after it has been used as flooring.

Vinyl Composition Tile (VCT), on the other hand, contains recycled-content and is preferred over sheet vinyl because VCT contains fewer VOCs and other chemicals and damaged tiles can be replaced individually.

5-64

No vinyl flooring

4 POINTS

Vinyl flooring is a commonly used material and often preferred for economy and durability. It is not environmentally preferred, however, due to the manufacturing process that creates air pollution problems, impacts from VOCs off-gassing during construction and occupancy, and the fairly limited potential for recycling the material after it has been used as flooring.

As an alternative, Vinyl Composition Tile (VCT) contains recycled-content and is preferred over sheet vinyl because VCT contains fewer VOCs and other chemicals and damaged tiles can be replaced individually.

Resources

Ask your local flooring supplier for vinyl flooring with recycled content. Some manufacturers to consider are:

- Marmoleum, by Forbo
- Amtico. 800-268-4260. Stratica, a low VOC and chlorine-free, durable alternative to vinyl. For local information call 425-453-6190.

5-65

On more than 250 square feet, use rapidly renewable flooring products with a ten-year harvest cycle or shorter (excluding carpet)

3 POINTS

Cork and bamboo are examples of rapidly renewable flooring resources.

Cork is sustainable because the bark is harvested and the tree is left to regenerate more bark. The bark is harvested on an eight-year cycle. Cork flooring is durable, sound absorbing, and naturally moisture-, mold-, and rot-resistant.

Bamboo is sustainable because it can be harvested on a six to eight year cycle. Bamboo flooring is a very durable and dimensionally stable material. The short regeneration time of bamboo provide justification for specifying bamboo flooring instead of wood.

There can also be indoor air quality advantages to using natural materials, such as less off-gassing due to fewer or no chemicals used in the manufacturing process. Check product Material Safety Data Sheet (MSDS) to make sure adhesives and other flooring components do not contain hazardous materials, such as formaldehyde.

Resources

Ask your supplier for cork or bamboo flooring and/or plant-based finishes.

5-66

Use recycled-content carpet pad

1 POINT

A variety of options are available for cost-competitive, resource-efficient carpet padding. In general, these products have been found to be very resilient and possess good performance characteristics.

Carpet padding may be made from several recycled-content materials including nylon and polypropylene waste from carpet manufacturing and recycled tire rubber and rebound urethane, reprocessed from virgin prime urethane products.

5-67

If installing carpet, use recycled-content or renewed carpet

3 POINTS

A variety of cost-competitive resource-efficient carpet options are available. In general, these products have been found to be very resilient and possess good performance characteristics.

Recycled-content carpets may include plastic yarns produced from recycled pop bottles or recovered fibers from recycled textiles.

Renewed carpet is used carpet that has been cleaned and restamped. A variety of attractive renewed styles are available. Ask your supplier.

Wool carpet is another resource efficient option that is renewable, biodegradable, naturally fire and stain resistant, and colorfast; see Action item 4-22, *Install Natural Fiber Carpet (e.g. Wool)*.

Resources

Regardless of which carpet you select, make sure it has the Carpet and Rug Institute's (CRI) Green Label. Your local carpet suppliers or installers may have resource-efficient products they carry or have installed. Compare their suggestions with the products and information available through these resources:

- Mohawk Carpet by Mohawk Industries, Armuchee, GA. 800-241-7597. Carpets contain 100% recycled plastic fibers from used pop bottles (PET).

- Nature's Carpet, 100% natural wool carpet manufactured without toxic chemicals. Colin Campbell and Sons, Vancouver, BC: 800-667-5001.
- Shaw Industries, 800-833-9665. Manufactures Philadelphia Carpets and E & B Carpets, made from 50-70% post-consumer PET.

5-68

Use replaceable carpet tile

1 POINT

Carpet tiles are a sustainable material choice because they are often made of recycled fiber content. In addition, one or more tiles can be replaced if damaged without having to replace an entire wall-to-wall carpet. Carpet tiles allow easy access to wiring or plumbing located under the floor. They can be used in high and low traffic areas and require less time and fewer tools than traditional carpet. They can be installed using either special adhesive or double-faced tape or can be ordered with self-stick backing. Carpet tiles come in many thicknesses, patterns and colors.

Resources

- Patcraft recyclable carpet tiles
- Interface Flooring System. 800-281-FLOR. www.interfaceflor.com. Offers recyclable nylon, hemp and wool carpet tiles.

5-69

Use 40% recycled-content hard surface tile, 100 square feet minimum

3 POINTS

Several manufacturers make glass, ceramic, and porcelain tiles with recycled-content. These tend to be pricey, but are durable and offer an attractive opportunity to highlight (and market) the use of an environmentally friendly material to your client or market. Acceptable applications to qualify for this credit include: flooring, countertops, floors, shower surrounds.

Resources

Your local supplier may carry a recycled-content ceramic tile that meets your needs. Listed below are several manufacturers who make ceramic tile with recycled content:

- AMDEC, Portland, OR. 503-297-5933 or e-mail mfarrier@teleport.com. Manufactures Silica Select tiles from 100% recycled post consumer/post industrial glass. Indoor/outdoor applications.
- Stoneware
- Summitville Tiles, Summitville, OH. 330-223-1511. Makes Cobblestones, Imperva, Imperva Granite, and MorganMates from a by-product of feldspar mining. Indoor/outdoor use. The company also reuses 100% of its solid wastes.
- Terra Green Technologies, Richmond, IN. Manufactures Traffic Tile, made with 58% recycled auto windshield glass with some mirror and bottle glass. Pricey but very high quality; indoor/outdoor uses. Company also makes Terra Classic from recycled glass and ceramic tile, for residential floors, walls, and countertops. Both are available through E-Spec in Oakland, CA. 510-536-2600.
- Tile Cera, Clarksville, TN. Makes tiles for floor and wall applications that include a small amount of in-house scrap and cull tile. Company is notable for its closed-loop manufacturing system, which eliminates tile solid waste and recycles water used in the manufacturing process within the plant. Tiles can be sourced from the distributor, Santa Catalina Inc. California: 510-351-7095.
- Versatile and Master Tile Products, Canton, OH. Sells Enviroquarry tiles made with recycled content. 330-493-1272.

5-70

Use natural linoleum

3 POINTS

Linoleum is made from all-natural materials and is a durable, low-maintenance flooring made of linseed oil, pine resin, sawdust, cork dust, limestone, natural pigments, and jute backing. Linoleum does not contain significant petroleum-based products or chlorinated chemicals, as does vinyl flooring, which is often mistakenly referred to as linoleum. From a raw materials standpoint, linoleum is an outstanding product. All of its ingredients are minimally processed and commonly available and it is biodegradable.

Resources

Check with your local flooring supplier.

- Forbo Marmoleum

5-71

Use recycled-content glass, ceramic, or porcelain tile for 10% of total floor area

3 POINTS

5-72

Use flooring that is third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook, 50% minimum

5 POINTS

To receive credit for this Action item, the flooring selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5-1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Resources

See Resources listed for 5-45, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 1 Requirements Outlined in the Handbook, 50% Minimum

5-73

Use flooring that is third-party certified sustainably harvested wood that meets the Tier 2 requirements outlined in the handbook

1 POINT

For credit for this Action item, use flooring that meets Certified Wood Products Tier 2 Requirements listed under Design and Material Selection, *Wood Certification Guidelines for Section Five*.

Currently, there are no programs that meet these criteria, however, a few are expected to on-line soon.

Resources

See Resources listed for 5-46, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 2 Requirements Outlined in the Handbook.

5-74

Use durable/spot repairable floor finish

1 POINT

Spot repairable floor finishes, also known as penetrating oil or wax finishes, penetrate into wood fibers unlike products like polyurethane, which coat the floor with a plastic film. As polyurethane wears down over time, everything must be removed from the floor so screening and recoating can be done. This inconvenient process prevents many floors from being properly maintained, sacrificing the life span of the wood floor. If a polyurethane finish wears down too far, the floors need to be sanded down to bare wood. Most wood floors can only be sanded 3 or 4 times. In contrast, a spot repairable finish can be touched-up in only areas that need it. This is more convenient for the homeowner and also minimizes the need for sanding.

Resources

- OSMO Polyx Oil

5-75

Use concrete slab or sub-floor as a finished floor in living space

2 POINTS

If you have already poured a concrete slab or sub-floor, the embodied energy of this material has already been incorporated into the project. Consider using this as a finished floor for a very durable and stylish look while greatly minimizing additional material use.

5-76

A minimum of 85 percent of installed hard-surface flooring is in accordance with the emission concentration limits of CDPH 01350 as certified by a third-party program, such as the Resilient Floor Covering Institute, or GREENGUARD

6 POINTS

Interior Walls

5-77

Use drywall with at least 30% recycled-content gypsum

1 POINT

Drywall manufactured with recycled gypsum or flue gas substitute is commonly available at most building material suppliers and is cost-competitive with conventional drywall. However, it must be specified if you want to use it (in other words, it is not automatic).

Resources

Check with your local supplier to see if they carry drywall with recycled-content gypsum (including post-consumer gypsum collected from construction and demolition projects and processed locally). If they do not, they should be able to source the following two products:

- G-P GyProc (formerly made by Domtar), manufactured and distributed by GP Gypsum, Tacoma. 800-366-8276 or 253-627-2100. Contains up to 12% of recycled scrap wallboard and byproduct gypsum.
- HardiRock, manufactured and distributed by James Hardie Gypsum. 800-426-3669. Includes 7-10% post-consumer gypsum.

The Walls and Ceilings Association in Portland should also be able to help you locate a supplier of recycled-content gypsum drywall. 503-295-0333.

5-78

Use recycled or “reworked” paint and finishes

2 POINTS

Companies are marketing recycled paint on a regional basis. Recycled paint was formerly offered only in limited colors and styles, but the selection is expanding, and recycled paint is usually cheaper than its virgin counterpart. Keep in mind that you will not want to use these paints in frequently occupied living spaces, such as bedrooms, children’s playrooms, or in home for individuals with chemical sensitivities. (See Action item 4-25, *Optimize Air Quality in Family Bedrooms to Basic or Advanced Level (Perform All Measures Listed in Handbook for Basic or Advanced Level)*, and Action item 4-42, *Use Only Low-VOC/Low-Toxic Interior Paints and Finishes for Large Surface Areas*.

Resources

Your local paint supplier may carry recycled or reworked paints. Also see:

- *Builders Guide to Paints and Coatings*, NAHB Research Center, Upper Marlboro, MD. 800-638-8556 or www.nahbrc.org.

5-79

Use recycled newspaper or cork expansion joint filler

1 POINT

Cork expansion joint filler is strong, light weight, flexible, acid-resistant, waterproof and regains up to 95% as joint expansion takes place. This material is made from cork, a rapidly renewable material. It is preformed from granulated cork particles, bonded with an insoluble phenolic resin, and molded under heat and pressure.

100% recycled newsprint is being used to manufacture pre-molded wood fiber strips for use in concrete and masonry joints. Suitable for any building construction application where non-bituminous contraction joint is applicable, concrete floors, walls, retaining walls, gutters, curbs, pavement, and swimming pool aprons. The natural grey color blends with concrete to further enhance the appearance of the finished job.

Resources

- Homex 300 Expansion Joint Fillers, Homasote Company. 100% recycled newsprint joint filler. www.sweets.construction.com/mfg/1558/P9720.htm.
- Cork Expansion Joint Filler, available from several suppliers on the web, or ask your local supplier.

5-80

Use natural wall finishes, e.g. lime paint, clay

2 POINTS

Natural finishes refer to lime paints, milk paints and clays free of plastics and acrylics and low in solvents and VOCs.

Lime paint is an interior or exterior finish that contains slaked lime, clay, marble dust, earth pigments, natural glue and water. Lime paint can be applied to a variety of surfaces including wood, drywall and masonry.

Milk paint is a durable, economical, matte finish made of milk protein, lime and clay. Milk paint dries quickly without the solvents and VOCs of traditional paint.

Natural clay plaster is an interior, trowel-on finish that comes in a wide variety of colors and can be highly polished or heavily textured. It contains clay, marble dust, borax and earth pigments. Clay plaster is mold resistant, hypoallergenic and low toxic.

5-81

Reduce interior walls through open plan for kitchen, dining, and living areas

2 POINTS

This strategy reduces material use and cost for walls, and creates an adaptable space that allows for maximum daylighting, occupant interaction, and natural ventilation. It's frequently used, but not necessarily known as a green building technique.

Exterior Walls

5-82

Use recycled-content sheathing

1 POINT

Sheathing can comprise a significant portion of the material used in a project. Therefore, choosing a sheathing product made with a minimum of 50% pre- or post-consumer recycled-content can have a significant impact on resource conservation. Many options are available including products made from certified sustainable wood.

5-83

Use siding with reclaimed or at least 15% recycled material on at least 75% of solid wall surface

1 POINT

Three types of siding currently include recycled-content: metal, vinyl (to a small degree), and fiber cement composites. These products also offer durable and low-maintenance alternatives to wood siding. Metal offers the greatest opportunity to use post-consumer recycled-content in your project. Aluminum or steel siding products contain high percentages of recycled metal—up to 100%. The scrap is also recyclable.

Vinyl siding can include a small percentage of post-industrial scrap in the manufacturing process. However, PVC is difficult to recycle, and there are no vinyl siding products with post-consumer vinyl at this time.

Fiber-cement composites are also resource efficient and offer a very good fire rating when compared to wood or metal siding. In addition to durability and low maintenance benefits, the wood fiber in these products is reclaimed from wood processing waste. It can also be harvested from small diameter fast-growing tree species.

Other reclaimed options include building salvage materials.

Resources

Ask your local supplier or try:

Reclaimed:

- Blue Log Lumber, Mendocino, CA. 707-937-0918. They salvage and remill redwood into siding, dimensional lumber, and decking.

Reclaimed: Composite

- James Hardie Building Products, Fontana, CA. 800-426-4051. Hardiplank Lap Siding and Hardipanel Vertical Siding are manufactured with Portland cement, ground sand, and cellulose fiber. Available from local suppliers.
- FCP, Inc, Blandon, PA, 877-CEMPLANK (236-7526). Cemplank fiber-cement plank siding is low maintenance and comes with a limited lifetime warranty.

Recycled:

- Cladwood, Oregon City, OR. 800-547-6633. Cladwood siding panels have a phenol-formaldehyde-bonded particleboard core with resin-impregnated recycled paper overlays. Recycled content ranges from 16-26% by weight with roughly 10% post-consumer content. 20 year warranty.
- AmeriMark, Inc., Olive Branch, MS. 800-345-3390 or www.Amerimark.com. Alisco Siding has a recycled plastic substrate and a virgin vinyl exterior finish layer.

5-84

No vinyl siding or exterior trim

2 POINTS

Vinyl siding or exterior trim is a commonly used material and often preferred for economy and presumed durability. It is not environmentally preferred, however, due to the toxic manufacturing process required and limited potential for recycling the material after it has been used as siding or trim.

5-85

Wood siding is 100% FSC-certified or locally harvested or milled

6 POINTS

5-86

Use 50-year warranted siding product

2 POINTS

Minimizing the need to replace any siding product offers a maximum consumer benefit to the homeowner, in addition to the obvious environmental impact. Many of the fiber-cement composites offer a 50-year warranty. Ask your local supplier for this and other options.

Resources

- James Hardie Building Products, Fontana, CA. 800-426-4051. Hardiplank Lap Siding and Hardipanel Vertical Siding are manufactured with Portland cement, ground sand, and cellulose fiber. Available from local suppliers.
- FCP, Inc, Blandon, PA, 877-CEMPLANK (236-7526). Cemplank fiber-cement plank siding is low maintenance and comes with a limited lifetime warranty.

For metal and vinyl siding, talk to your local supplier/installer to make sure you get the highest amount of recycled-content available.

5-87

Use wood siding that is third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook, on at least 20% of solid wall surface

5 POINTS

To receive credit for this Action item, the wood siding selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5-1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Resources

See Resources listed for 5-45, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 1 Requirements Outlined in the Handbook, 50% Minimum

5-88

Use wood siding that is third-party certified sustainably harvested wood that meets the Tier 2 requirements outlined in the handbook, on at least 20% of solid wall surface

1 POINT

For credit for this Action item, use wood siding that meets Certified Wood Products Tier 2 Requirements listed under Design and Material Selection, *Wood Certification Guidelines for Section Five*.

Currently, there are no programs that meet these criteria, however, a few are expected to on-line soon.

Resources

See Resources listed for 5-46, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 2 Requirements Outlined in the Handbook.

5-89

Use salvaged masonry brick or block, 50% minimum

2 POINTS

Several private suppliers offer salvaged brick and block. Check the resources section for a list of suppliers. Also consider establishing a reuse policy for the masonry brick or block you generate during construction.

Resources

See your local supplier of brick masonry or block and ask for reclaimed materials. Also look at jobsites for discards. Salvage yards may also stock these materials, including:

- Reusable Building Materials Exchange: www.rbme.com, (see the Participating Jurisdictions). An online, user-driven website. Features descriptions of items, contact name, telephone number, e-mail address, and any costs or delivery information. Listings are free.

5-90

Use regionally-produced stone or brick

2 POINTS

"Regionally produced" materials are generally considered to be produced within the Pacific Northwest region, ideally in WA, OR, or ID.

Use locally quarried, indigenous stone that is cut and polished locally. Use of regional materials helps keep material transport costs down, reinforces a regional aesthetic, and supports the local economy.

Resources

Ask your local supplier and ask about the origin of the material.

Windows

5-91

Use wood / fiberglass / finger jointed / composite wood windows

5 POINTS

Manufacturers have developed new window frame materials from a composite of recycled polyvinylchloride (PVC) or high-density polyethylene (HPDE) plastics and waste wood fiber. Combining the two materials creates a product that has important advantages over both wood and vinyl windows: the dimensional stability and thermal performance of wood, and the uniformity and decay resistance of plastics. The cost of wood/plastic composite windows is often less than that of wood or vinyl.

Wood/plastic composites consist primarily of waste sawdust and scrap PVC generated in the production of wood and vinyl windows, or with PVC, from post-consumer bottle waste. Wood content ranges from 40 to 70%, depending on the manufacturer. According to recent tests, the frames have roughly the same energy performance as solid wood, but perform slightly better than vinyl window frames.

Wood fiber increases the dimensional stability of the composite material. Dimensional stability is commonly a problem with PVC plastic frame materials. The composite coefficient of expansion more closely matches glass than vinyl and helps keep the seal between the frame and glass intact for long-term performance. Further, the composite does not absorb moisture and will not swell like wood.

Windows made of fiberglass produce the highest energy efficiency and minimal environmental impact. Fiberglass requires less energy to produce into a final product than PVC or aluminum. It reduces condensation, won't contract or expand like wood, and is least likely to crack, corrode, rot, or leak.

Traditionally, the finest clear-grained wood has been used for doors and window frames. However, the availability of stable, clear, mature wood has declined. As a result, the industry has responded by developing finger-jointed wood products—taking smaller scraps of lower value wood and edge gluing them together, covered by top-quality wood veneers on the finish surface.

Look for window manufacturers that offer windows that qualify for the ENERGY STAR program.

Resources

Ask your local supplier and consider the following manufacturers:

- Andersen Windows, Cottage Grove, MN. 800-426-7691 or www.andersenwindows.com. Their Renewal™ line of windows features frames and sashes made of Fibrex, a post-industrial wood-and-PVC-waste composite with a coextruded virgin PVC exterior coating. Low-e (2) is offered standard in all products.
- Pella Corporation, Pella, IA. 800-847-3552 or www.pella.com/frontDoor. Pella's SmartSash® wood windows and doors are made from ponderosa pine, eastern white pine, sugar pine, and some white fir. The exterior is clad with recycled aluminum finished with a baked-on EnduraClad™ coating.

5-92

Use locally-produced windows

1 POINT

5-93

Use wood windows that are third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook

5 POINTS

To receive credit for this Action item, the windows selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5-1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards

for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Resources

See Resources listed for 5-45, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 1 Requirements Outlined in the Handbook, 50% Minimum

5-94

Use wood windows that are third-party certified sustainably harvested wood that meets the Tier 2 requirements outlined in the handbook

1 POINT

For credit for this Action item, use dimensional lumber that meets Certified Wood Products Tier 2 Requirements listed under Design and Material Selection, *Wood Certification Guidelines for Section Five*.

Currently, there are no programs that meet these criteria, however, a few are expected to on-line soon.

Resources

See Resources listed for 5-46, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 2 Requirements Outlined in the Handbook.

- Window & Door. www.windowanddoor.net/pastarticles.php?id=372. Materials sourcing and information website of Window & Door Magazine.

Cabinetry and Trim

Resources

- Window & Door. www.windowanddoor.net/pastarticles.php?id=372. Materials sourcing and information website of Window & Door Magazine. Lists green fenestration products made with certified wood.

Trim:

Although commonly used MDF trim materials may be less costly, they require stringent protection from fluctuations in heat and humidity during transit between manufacturing facility and the job site. This can be difficult to control and may result in excessive shrinkage, cracking and bowing that creates difficult installs and product waste. MDF trim pieces also lack lateral strength, offgas if bonded with urea formaldehyde, and create noxious dust during cutting.

Solid wood and urethane trim products are proving to be the highest quality, durable and long lasting trim option.

5-95

Use regional trim products, 50% minimum

1 POINT

"Regionally" materials are generally considered to be produced within the Pacific Northwest region, ideally in WA, OR, or ID.

Use of regional materials helps keep material transport costs down, reinforces a regional aesthetic, and supports the local economy.

Resources

See local suppliers and ask about origin of materials.

5-96

Use trim that is third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook, 50% minimum

3 POINTS

To receive credit for this Action item, the trim selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5-1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Resources

See Resources listed for 5-45, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 1 Requirements Outlined in the Handbook, 50% Minimum

5-97

Use trim that is third-party certified sustainably harvested wood that meets the Tier 2 requirements outlined in the handbook, 50% minimum

1 POINT

Select trim from certified or sustainable sources. Although there may be a slight cost premium associated with this choice, it allows you to contribute to a sustainable enterprise and ensure protection of endangered hardwood forests.

For credit for this Action item, use dimensional lumber that meets Certified Wood Products Tier 2 Requirements listed under Design and Material Selection, *Wood Certification Guidelines for Section Five*.

Currently, there are no programs that meet these criteria, however, a few are expected to on-line soon.

Resources

See Resources listed for 5-46, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 2 Requirements Outlined in the Handbook.

5-98

Use finger-jointed or MDF trim with no added urea formaldehyde, 90% minimum

3 POINTS

Since the availability of stable, clear, mature wood has declined, any application, which requires straight, knot-free wood is affected. As a result, the industry has responded by developing finger-jointed wood products—taking smaller scraps of lower value wood and edge-gluing them together, covered by top-quality wood veneers on the finish surface. Interior trim is an excellent application for this new product; it offers improved product consistency and durability, while at the same time uses harvested wood fiber more efficiently.

MDF is commonly bonded with urea formaldehyde adhesives. These materials can off-gas in the home and create noxious dust during cutting. Choose products with no added urea formaldehyde.

Resources

- Builder News. 2105 C Street, Vancouver, WA 98663. 360-906-0793.
www.buildernewsmag.com/viewnews.pl?id=123. Website for building trade magazine. Technical information on high quality molding and millwork.

- Toolbase Services. 400 Prince George's Blvd., Upper Marlboro, MD 20774. www.toolbase.org/Best-Practices/Failure-Prevention/fiberboard-trim-shrinkage. Technical information website for building materials. Technical information on fiberboard trim.

See your local supplier.

5-99

Use wood veneers that are third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook, 50% minimum

1 POINT

To receive credit for this Action item, the wood veneers selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5.1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Resources

See Resources listed for 5-45, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 1 Requirements Outlined in the Handbook, 50% Minimum

Cabinets:

Select cabinet materials from certified or sustainable sources. Although there may be a slight cost premium associated with this choice, it allows you to contribute to a sustainable enterprise and ensure protection of endangered hardwood forests.

5-100

Use cabinetry made of a rapidly-renewable product

2 POINTS

5-101

Use regional products, 90% minimum

2 POINTS

Resources

- Neil Kelly Cabinets, offers FSC-certified cabinet doors upon request, see their website for a list of authorized dealers, <http://www.neilkellycabinets.com/coverage.htm> or contact (503) 335-9207. Portland, OR.
- Breathe Easy Cabinetry, a division of Greenway Cabinetry, Inc. has introduced its new line of healthy, green cabinetry

5-102

Use wood that is third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook, 50% minimum

3 POINTS

Select wood from certified or sustainable sources. Although there may be a slight cost premium associated with this choice, it allows you to contribute to a sustainable enterprise and ensure protection of endangered hardwood forests.

To receive credit for this Action item, the wood selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5-1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Resources

- Neil Kelly Cabinets, offers FSC-certified cabinet doors upon request, see their website for a list of authorized dealers, <http://www.neilkellycabinets.com/coverage.htm> or contact (503)335-9207. Portland. OR.

5-103

Use wood that is third-party certified sustainably harvested wood that meets the Tier 2 requirements outlined in the handbook, 50% minimum

1 POINT

For credit for this Action item, use dimensional lumber that meets Certified Wood Products Tier 2 Requirements listed under Design and Material Selection, *Wood Certification Guidelines for Section Five*.

Currently, there are no programs that meet these criteria, however, a few are expected to on-line soon.

Resources

See Resources listed for 5-46, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 2 Requirements Outlined in the Handbook.

5-104

Alternative materials used for cabinetry with low or no VOCs - recycled content stainless steel, solid wood, glass, etc, or construction methods - pantry use, open shelves, etc.

4 POINTS FOR USING ALTERNATIVE MATERIALS

+3 POINTS FOR USING DESIGN AND CONSTRUCTION METHODS, E.G. PANTRY USE, OPEN SHELVES

5-105

Use cabinet casework and shelving constructed of agricultural fiber with no-added urea formaldehyde

2 POINTS 50%

3 POINTS 90%

Strawboard and wheatboard are suitable material choices for this credit. These materials are readily available and provide a good alternative choice, without off-gassing concerns or the use of toxic chemicals in its manufacturing process.

Countertops:

5-106

Use countertops that are third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook

2 POINTS

Use countertops salvaged from projects or those made of untreated salvaged woods such as reclaimed butcher-block products. These are minimally processed, natural and can be reused at the end of their lifespan. Look for products with no added urea formaldehyde.

Third party certified wood countertops are also an option. Look for untreated wood products certified through organizations such as FSC or SCS.

There are many countertop options available in recycled materials. Paper composite countertops are made of paper pressed in a resin binder and can be found with high recycled content and low-VOC resins. Products come in a variety of colors and thicknesses and are easy to maintain and repair. Recycled glass countertops come in the form of tiles and crushed glass set in cement binders. One hundred percent recycled aluminum tiles are also on the market.

5-107

Countertops of concrete, domestic stone, tile with recycled content, recycled paper products and cabinets and countertop underlayment of wheatboard or non-formaldehyde particle board

4 POINTS

Roof

5-108

Use recycled-content roofing material

2 POINTS

Traditional cedar shakes, although appealing for their textural qualities, only offer a 10-15 year life span in most climates. Several new composite options are available that provide lower maintenance along with durability. Many of these options include recycled-content or reclaimed materials: fiber-cement composites, asphalt shingles, plastic shakes, ridged sheet material made with fiber and asphalt, and metal shingles.

Fiber-cement composite slates are lightweight, long lasting, and fireproof. They offer an efficient use of wood fiber and can be used on standard roof structures. Asphalt shingles contain recycled "mixed" waste paper or reclaimed mineral slag resulting in 20% to 25% recycled-content. Roof panels made from recycled plastic resins provide a lightweight roofing alternative in addition to recycled aluminum shingles which may contain up to 100% recycled-content.

Resources

Ask your local supplier and consider the following manufacturers:

- Ondura Corporation, Fredericksburg, VA 800-777-7663 or www.ondura.com. Their corrugated asphalt roofing is composed of 50% asphalt and 50% cellulose fiber (by weight). The cellulose fiber is 100% post-consumer mixed paper wastes.
- Crowe Building Products, Ltd., Hamilton, ON, Canada. 905-529-6818 or www.authentic-roof.com. Authentic Roof is a slate lookalike with recycled polymers and rubber.
- EcoStar, Chicago, IL. 800-572-7672 or www.ecostarinc.com. Majestic Slate is a 100% recycled and recyclable lightweight slate tile made of industrial rubber and plastics.

- Re-New Wood, Inc., Wagoner, OK. 800-420-7576. Eco-shake is a 100% recycled PVC(vinyl) and reclaimed wood roofing product. It has the look of a wood shake in four colors.
- Zappone Manufacturing, Spokane, WA. 800-285-2677 or www.zappone.com. Recycled Metal Shingles are made from either 85% recycled copper (75% post-consumer) or 100% post-consumer recycled aluminum.

5-109

Use 40-year warranted roofing material

2 POINTS

Using durable materials with long-lasting value helps prevent the need for replacement – an asset to the homeowner – which add to the value of any home.

Varieties of organic felt-based shingles are available with up to 40-year warranties. Some brands of aluminum or steel shingles have a 40-year limited warranty and in addition, come with a coating approved by HUD, which allows the roof to be used for collecting rainwater. Fiberboard shakes, a durable product, which can be nailed and sawn, similar to wood shakes, come with a 30 to 50 year warranty.

Resources

See your local supplier.

5-110

Use 50-year warranted roofing material

3 POINTS

Using durable materials with long-lasting value helps prevent the need for replacement – an asset to the homeowner – which add to the value of any home.

Some brands of aluminum or steel shingles have a 50-year limited warranty and in addition, come with a coating approved by HUD, which allows the roof to be used for collecting rainwater. Fiberboard shakes, a durable product that can be nailed and sawn similar to wood shakes, generally come with a 30 to 50 year warranty.

5-111

Use solar shingles

5 POINTS

Solar photovoltaic (PV) cells are now being incorporated into rooftop shingles. They are available in the same patterns of traditional asphalt shingles, are exceptionally durable, and are wind and water tight. Using solar shingles can lower electricity bills and increase home value.

Installation involves nailing PV shingles in place on roof decking over 30 lb. felt sheeting.

Resources

- OkSolar. 347-624-5693. www.oksolar.com/roof/. Online solar materials information and product website.
- U.S. Department of Energy Building Toolbox. www.eere.energy.gov/buildings/info/components/envelope/roofing/solar.html. Energy efficiency and renewable energy website. Includes specifics on solar shingles.
- Solar Components Corporation. 121 Valley Street, Manchester, NH 03103. 603-668-8186. www.solar-components.com/pvshingl.htm. Sells solar roofing components.

5-112

Install a metal, concrete, slate, tile, or clay roof

8 POINTS

Metal roofs are made of recycled material and are 100% recyclable at the end of their lifecycle. They come with warranties ranging from 30 to 50 years compared to 15 to 20 year life expectancies of asphalt shingles. Metal roofs will not decompose under sun exposure, are noncombustible, can fit over existing roofing materials, are less than 1/3 the weight of asphalt and can withstand winds up to 140 mph.

Metal is naturally heat and light reflective and can reduce energy costs by as much as 25%. Metal roofs are a better choice for rain water collection for irrigation, see Action item 2-68, *Install Rainwater Collection System (Cistern) for Reuse*.

Resources

- Expert Village. <http://homegarden.expertvillage.com/experts/metal-roofing-advantages.htm>. Article discussing the advantages of metal roofing.
- Englert. 1200 Amboy Ave., Perth Amboy, New Jersey 08861. 732-826-8614. www.englertinc.com/roofing-whymetal.aspx?Page=1. Website discusses advantages of commercial and residential metal roofing.
- Mueller, Inc. 1915 Hutchins Ave., Ballinger, TX 76821. 877-268-3553. www.muellerinc.com/roofing/benefits.php. Offers metal roofing products and technical information.

5-113

Install self-adhering underlayment on eves, valleys & penetrations

3 POINTS

5-114

Install self-adhering underlayment on entire roof

3 POINTS

Insulation

5-115

All insulation to have a minimum of 40% recycled-content

2 POINTS

There are several commonly available types of recycled content insulation:

- *Cellulose insulation* is made from 100% post-consumer recycled newspapers or telephone books. The insulation can be dry-blown or poured loose-fill into enclosed cavities, but is most commonly wet-sprayed.
- Several brands of *fiberglass insulation batts* are manufactured using recycled glass, including post-consumer glass collected in curbside recycling programs.
- *Mineral wool insulation* is another option and is available in loose-fill or batts. It has, on average, 75% post-industrial recycled-content.
- *Cotton insulation* contains up to 85% post-industrial recycled fibers, such as blue jean material. It contains no VOCs, and no chemical irritants. Cotton insulation is Class-A fire rated, rot, and pest proof.

Resources

Ask your supplier or installer about locally available options. The Cellulose Manufacturers Association in Dayton, Ohio is an additional resource for product information: 888-881-2462 or www.cellulose.org.

Regional retailer of recycled cotton insulation:

- Environmental Home Center, 4121 1st Ave. S., Seattle. 206-682-7332, 800-281-9785, or www.environmentalhomecenter.com. Offers Ultra Touch recycled cotton insulation in R₁₃, R₁₉ and R₂₁.

Regional manufacturers of recycled-content cellulose insulation include:

- Thermaguard, Spokane, WA. 509-535-4500.
- Hamilton Manufacturing, Twin Falls, ID. 208-733-9689.
- Greenstone, Portland, OR. 503-286-9987.

Insulation products with recycled-content fiberglass or mineral wool include:

- GoldLine fiberglass insulation manufactured and distributed by Johns Mansville International, Denver, CO. 800-644-4013. Contains 25% recycled glass, including 18% post-consumer remelted bottle glass. (They also make formaldehyde-free insulation see Action item 4-29, *Use urea formaldehyde-free insulation or GreenGuard Certified product*.)
- Thermafiber loose-fill mineral fiber made with rock wool, manufactured by USG Interiors, Tacoma: 253-627-0379.

5-116

Use environmentally friendly foam building products (formaldehyde-free, CFC-free, HCFC-free)

3 POINTS

Building an environmentally friendly home means eliminating the use of foam building materials that are manufactured using chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs).

CFCs are known to contribute significantly to ozone depletion and global warming, two of our most serious environmental concerns. HCFCs are considerably less damaging than CFCs, but should also be avoided if at all possible. In addition, avoid products that include formaldehyde, because indoor formaldehyde is gaining recognition as a severe health hazard causing reactions ranging from flu-like symptoms to death in individuals that become sensitized through exposure.

Options to consider include:

- Beadboard or EPS (expanded polystyrene) rigid foam insulation can be used for interior or below grade uses. However, it doesn't insulate as well (R-3.6 to R-4.4 per inch), but it is less damaging to the environment because pentane is used in its production rather than HCFC.
- Polyurethane insulation (e.g. polyisocyanurate) made with pentane instead of HCFCs as the blowing agent is now available. Unlike, EPS, however, there are few outlets for polyurethane foam as a recycled product.
- Blown-in cellulose (100% recycled newspaper content) or formaldehyde-free fiberglass.
- Soy, cotton, denim, or foam

Resources

- Atlas Roofing, Atlanta, GA. 800-388-6134 or www.atlasroofing.com. ACUltra (ozone-safe polyisocyanurate foam)
- Palmer Industries, Inc., Frederick, MD, 301-898-7848. Air Krete, inorganic, cementitious foam produced from magnesium oxide. It's nontoxic, inert, and non-combustible, and can be the insulation of choice for people with high sensitivity to common household pollutants. Foamed in place in closed wall or masonry block cavities, or behind mesh in open cavities. Lightweight and rigid, but friable foam.
- The Icynene Insulation System. A plastic, formaldehyde-free, foam insulation material similar in chemical composition to the material used in pillows and mattresses. It is created on the jobsite by mixing two liquid components that can be either sprayed or injected into the cavity. It contains no ozone-destroying

gas. Locally provided and installed by Progressive Insulation Company, Doug Utt, V.P., 2161 N Northlake Wy, Seattle, WA 98103. 206-547-8706, e-mail: progsyst@aol.com, or website: www.asg1.com/progressive

- Insealation, Icynene, Inc., Mississauga, Ontario, Canada, 800-758-7325. A modified urethane spray-in-place insulation that uses MDI but is water-blown rather than CFC-blown. Foamed into wall cavities like polyurethane.
- AFM Corporation, Excelsior, MN, 800-255-0176. Perform Guard EPS, pentane is generally used in the manufacture of this rigid foam insulation. A low-pentane formulation is used by AFM, the largest expanded polystyrene (EPS or beadboard) producer, and several EPS manufacturers recover 95% of the pentane used in production. Multiple suppliers.
- Foam Tech Inc., North Thetford, VT, 802-333-4333. Polyurethane SuperGreen uses a less ozone-depleting HFC in its insulation, which is foamed into wall cavities. (The product costs slightly more than conventional polyurethane.)
- C.P. Chemical Company, White Plains, NY. 914-428-2517. Tri-Polymer Foam, Phenolic foam with good fire resistance foamed into primarily masonry block walls. Shrinkage over time reduces thermal performance.

For more information about insulation products, see:

- Cellulose Insulation Manufacturers Association, Dayton, OH. 888-881-2462 or www.cellulose.org.
- Expanded Polystyrene (EPS) Molder's Association, Glenview IL. 800-607-3772 or www.epsmolders.org.
- "Insulation Materials: Environmental Comparisons," *Environmental Building News*, Jan/Feb 1995. Brattleboro, VT, 1999. 802-257-7300 or www.buildinggreen.com.

Other Exterior

5-117

Use reclaimed or salvaged material for landscaping walls

2 POINTS

Using discarded stone, brick, masonry, or wood materials to construct the landscaping walls not only saves resources, but also can provide a unique appearance to match the style of the home.

Resources

See your local supplier of brick masonry for broken or reclaimed materials. Also, look at jobsites for discards.

5-118

Use lumber that is third-party certified sustainably harvested wood that meets the Tier 1 requirements outlined in the handbook for decking and porches

3 POINTS

Select wood from certified or sustainable sources. Although there may be a slight cost premium associated with this choice, it allows you to contribute to a sustainable enterprise and ensure protection of endangered hardwood forests.

To receive credit for this Action item, the wood selected for the project must meet Certified Wood Products Tier 1 Requirements listed under Design and Material Selection, *Wood Certification Guideline for Section Five*. (See Table 5-1, at the beginning of the Design and Material Selection section.)

Currently, only the Forest Stewardship Council (FSC), a voluntary, market-based, certification organization, meets Tier 1 requirements. It is one of few programs that require a chain of custody for certification. FSC sets standards for sustainable forestry practices and depends on independent companies for third-party certification of forestlands. It evaluates and monitors certifiers to ensure public credibility.

Resources

Ask your local supplier

See Resources listed for 5-45, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood that Meets the Tier 1 Requirements Outlined in the Handbook, 50% Minimum

5-119

Use 100% recycled-content plastic or wood polymer lumber for decks and porches, or third party certified wood products

3 POINTS

There are many manufacturers of plastic lumber nationwide. Recycled plastic lumber or plastic/wood composite lumber provide durable alternatives to solid wood for exterior applications such as fences, benches, decking, docks, retaining walls, picnic tables, and landscape borders. Due to its weather- and insect-resistant nature, plastic lumber can readily substitute for treated wood in non-structural applications. Plastic lumber is also rot and corrosion-proof, and will not crack, splinter, or chip. It has a long life expectancy in exposed, sub-grade or marine applications, and does not leach chemicals into ground or surface water or soil as treated wood can.

Plastic lumber resists vandalism and does not require painting. It is available in a variety of colors, including white, although many companies have a standard color of either brown or black.

These products can be nailed, screwed, sanded, glued, or turned on a lathe with standard woodworking tools. One challenging aspect of working with plastic lumber is its high expansion coefficient, which must be considered during installation. Expansion issue is not a problem for wood polymers lumber product. Check with the manufacturer regarding structural support specifications.

5-120

Use no-pressure treated lumber

4 POINTS

Naturally rot-resistant wood species are an option. Choose materials from certified, well-managed forests, see Action item 5-45, Use Dimensional Lumber that is Third-Party Certified Sustainably Harvested Wood with an Independently Audited Chain of Custody, 50% Minimum.

Recycled Plastic lumber is an alternative for some applications, 100% and plastic/wood composites are acceptable for this credit.

Resources

- Fine Homebuilding Magazine. www.taunton.com/finehomebuilding/pages/hoo127.asp. Article on alternatives to pressure-treated lumber.

5-121

Use low-toxic pressure-treated wood

1 POINT

There are several types of low-toxic pressure treated wood products available, which, while providing the same quality characteristics, represent minimized health risks or disposal dilemmas because of the different chemicals used in their manufacture. When treated wood must be used, select one of the newer, copper-based products, such as ACQ (Ammoniacal Copper Quaternary), CBA (Copper Boron Azole), or a Borate based preservative.

ACQ preservative may be preferred where long-term weather resistance is required in addition to protection from termites and other pests. (PLEASE NOTE: ACQ treatment is corrosive to some fixing materials. Ensure that appropriate nails, screws and other hardware are used with ACQ treated lumber; stainless steel screws are recommended).

CBA is sold under the trade name Wolmanized Natural Select. Provides long-term resistance to termites and fungal decay in ground contact and aboveground applications. Also can be used in fresh-, but not saltwater applications.

Borate preservatives (such as Hi-Bor) are much less toxic than CCA, but will leach out of wood in wet conditions. They are effective for treatment against termites when wood will not be exposed to weather.

As the industry transitions to alternatives, there may be price fluctuations. Initially, alternative products may cost more than CCA-treated products, but some suppliers, in anticipation of the phase-out, are offering ACQ and CBA products at competitive prices.

Naturally rot-resistant species, such as cedar and redwood, are an option, especially if any are available from certified, well-managed forests. Recycled Plastic lumber and wood polymer lumber are other alternatives that are cost-effective, durable, and can be used in low-load structural applications, including decks and docks, playground equipment, benches, and tables.

What happened to CCA? In the past, the majority was treated using chromated copper arsenate (CCA), an inorganic, waterborne preservative. Some of the chemicals used in this treatment process, however, pose a certain health risk. There are health risk concerns about prolonged exposure after installation due to splinters or wet wood creating a route for skin absorption. Another major concern is the resulting disposal problem it creates. CCA treated wood is not recommended for burn facilities, so therefore, it becomes a landfill waste problem.

Since January 2004, the Environmental Protection Agency has banned the use of CCA treated dimensional lumber in any residential applications. CCA-treated lumber is still available for nonresidential applications. To obtain points for this Action item, you must select a product that does not contain CCA.

5-122

B2o biodiesel or better equipment

5 POINTS FOR 100% EXCAVATION EQUIPMENT ON BIODIESEL

1 POINT FOR EACH ADDITIONAL BIODIESEL VEHICLE FREQUENTLY ON SITE, 3 POINTS MAXIMUM

TO RECEIVE CREDIT FOR THIS ACTION ITEM THE FUEL MUST CONTAIN A MINIMUM OF 20% OR BETTER OF BIODIESEL.

Biodiesel is a renewable fuel made from a mixture of alcohol and vegetable or animal oils. Incorporating biodiesel into the fuel mix reduces particulate matter and carbon monoxide emitted from the engine. Biodiesel reduces the amount of petroleum, a non-renewable fuel, thereby reducing the risk of harming sensitive environments during extraction and transportation, and sends less particulate matter into the atmosphere.

Biodiesel does not require major engine modifications. This makes it the least-costly option when converting to more energy efficient and less air polluting vehicles and machinery

Resources

- The Official Site of the National Biodiesel Board. www.biodiesel.org/resources/faqs/. General and technical resource for Biodiesel and related products.

Recycling

5-123

Provide built-in kitchen or utility room recycling center

3 POINTS

One way to encourage recycling is to build a space for recycling containers in or near the kitchen, where 80% of a home's waste is generated.

Most millwork manufacturers now design cabinetry lines with storage areas geared to hold recycling bins. For new cabinetry that includes factory installed pull-out bins, the estimated cost range is \$30 to \$40 per linear foot. There may be additional costs associated with extra floor space, if required. Installing bins in existing base cabinets or closets can be done fairly inexpensively.

Resources

The Green House, an “environmentally friendly home” exhibited annually at the Puyallup Fair, has demonstrated several options, including:

- In-wall recycling system, LHRS (Leland Home Recycling Systems), 528 N. Bozeman, Bozeman, MT 59715. 406-587-0011.
- Under-counter recycling system, Feeney (by Feeney Manufacturing Co.) or Rev-a-Shelf; both are available from E.B. Bradley Co., 3314 S. 116th St, Seattle, WA 98168. 206-248-5250.

Some other currently available options include:

- Blanco Box System, Blanco America, Inc., Cinnaminson, NJ, 800-451-5782, fax: 800-213-1963 or www.blanco-americacom. The Blanco Box System uses plastic boxes on metal tracks below the kitchen sink to store and aid in sorting of household recyclables.
- Recycling Receptacles, Doty and Sons Concrete Products, Inc., Sycamore, IL, 800-233-3907, www.dotyconcrete.com, Dotyand Sons Concrete Products uses recycled plastic lumber in its precast concrete recycling and waste receptacles.
- The Fibrex Group, Inc., Chesapeake, VA, 800-346-4458 or www.fibrexbgroup.com, Supplies recycling and trash receptacles in many style and sizes including used motor oil collection containers and curbside recycling collection bins. Many of these products are made of recycled-content plastics.

5-124

Provide garage sorting bins for recyclable materials

1 POINT

Most communities in Whatcom County offer town- or city-sponsored recycling collection programs. Some the programs provide two or more collection bins for pre-sorted recyclables, and some programs provide one or two bins for mixed recyclables. Check with your municipality to see whether the bins offered by the program are suitable to meet the daily collection needs of the family in the home. As an added service to your clients who pre-sort, you can offer additional bins for the garage to make the daily collection of recyclable materials more convenient, allowing municipal containers to remain outside for weekly or bi-weekly collection.

Universal Design

5-125

Stepless front entry

2 POINTS

Promotes social sustainability by allowing homeowners to live in their home and communities longer and it encourages visitability by a broader ranges of friends and family who might otherwise not be “able” to visit your home.

Improves resale value and marketability (i.e., economic sustainability), as your home will be considered for purchase by a broader population that is only getting bigger by the day (e.g. Boomers).

Promotes environmental sustainability and the design will **never need to be changed** to accommodate lifecycle changes by current, temporary or future occupants of the home.

5-126

Stepless other entry (rear or side door, door from garage)

1 POINT

Stepless (Other/Alternate) Entry (e.g. rear, garage or side door)

5-127

Hard-surface stepless grade changes at exterior to allow access to essential maintenance locations, like garbage cans, etc.

1 POINT

Promotes social sustainability by encouraging visitability by a broader range of friends and family participating in your hosted outdoor events (e.g. BBQ) that might otherwise not be "able" to navigate your outdoor *living* spaces.

Promotes healthier lifestyles, by extending the years that people continue to remain active and busy nurturing their yards, gardens, and socializing with family and friends in their *lifespan designed* outdoor spaces.

Promotes smarter and more functional outdoor spaces that better accommodate the many things on wheels that are found in most of our homes, such as:

- Shop Vac
- BBQ
- Lawnmower
- Generator
- Wheelbarrow
- Furniture dolly
- Garbage bin
- Recycle bin
- Yard waste bin
- Yard cart
- Pressure washer
- Strollers
- Bikes, trikes, wagon, scooter
- Luggag
- Wheelchair
- Other

5-128

Install exterior accessible hard-surface gathering area

1 POINT

REQUIRES ACTION ITEM 128, HARD-SURFACE STEPLESS GRADE CHANGES AT EXTERIOR TO ALLOW ACCESS TO ESSENTIAL MAINTENANCE LOCATIONS, LIKE GARBAGE CANS, ETC.

Landscape hard-surface gathering areas (e.g., paved at-grade patio areas) should be considered as an upgrade and compliment to stepless grade changes throughout and considered for additional earned checklist point value.

5-129

Provide accessible guest bathroom on main floor of home

2 POINTS

REQUIRES STEPLESS ACCESS TO HOUSE, EITHER 5-125 OR 5-126

Promotes social sustainability by encouraging visitability by a broader range of friends and family who might otherwise not be "able" to visit your home.

Improves resale value and marketability (i.e., economic sustainability), as your home will be considered for purchase by a broader population that may consider visitability as a "value-added" feature that will serve to strengthen the longevity of their social circles of both friends and family.

Promotes environmental sustainability and the design will **never need to be changed** to accommodate lifecycle changes by current, temporary or future occupants of the home.

5-130

Accessible bathroom with curbless shower, (grab-bar blocking required in all bathrooms)

3 POINTS

Promotes social sustainability by allowing homeowners to live in their home and communities longer.

Improves resale value and marketability (i.e., economic sustainability), as your home will be considered for purchase by a broader population that is only getting bigger by the day (e.g. Boomers).

Promotes environmental sustainability and the design will **never need to be changed** to accommodate lifecycle changes by current, temporary or future occupants of the home.

5-131

Locate closets or other spaces directly above each other on all floors that can be used for future elevator installation.

3 POINTS STACKING CLOSETS ENGINEERED TO RECEIVE A FUTURE ELEVATOR

5 POINTS IF ADEQUATE ELECTRICAL CIRCUIT IS PROVIDED IN ATTIC

Promotes social sustainability by allowing homeowners to live in their home and communities longer.

Improves resale value and marketability (i.e., economic sustainability), as your home will be considered for purchase by a broader population that is only getting bigger by the day (e.g. Boomers).

Promotes environmental sustainability and the design will **never need to be SIGNIFICANTLY changed** to accommodate lifecycle changes by current or future occupants of the home.

Requires that the rooms have been sized according to manufacturers data to assure that a residential elevator will fit in the space designated.

Requires a concrete slab, with a drain, at the bottom.

Requires 38" rough-opening door framing width, door openings lined up from floor to floor.

5-132

Minimum door width 2'-10" for all rooms requiring entry (small closets excepted)

3 POINTS

Rooms not requiring entry by homeowners are exempted from this requirement

Promotes social sustainability by allowing homeowners to live in their home and communities longer.

Rooms requiring entry means any room that a person would need to enter in order to use the room. Only small, shallow closets, where reach-in access is the normal way to use the room, and special equipment rooms for furnaces or similar equipment normally only accessed by qualified technicians would be exempted from this requirement.

Improves resale value and marketability (i.e., economic sustainability), as your home will be considered for purchase by a broader population that is only getting bigger by the day (e.g. Boomers).

Promotes environmental sustainability and the design will *never need to be changed* to accommodate lifecycle changes by current, temporary or future occupants of the home.

5-133

Install smart technology (e.g. electronic blinds, programmed environmental controls, etc.)

1 POINT PER INSTALLED ITEM

3 POINTS MAXIMUM

(e.g., electronic blinds & programmed environmental controls, one point for each installed system up to 3)

Promotes social sustainability by allowing homeowners to live in their home and communities longer.

Improves resale value and marketability (i.e., economic sustainability), as your home will be considered for purchase by a broader population that is only getting bigger by the day (e.g. Boomers).

Promotes environmental sustainability and the design will *never need to be changed* to accommodate lifecycle changes by current, temporary or future occupants of the home.

5-134

Install cabinets with removable or slide-away lower doors for roll-up access to kitchen sink, upper cabinets that lower to counter top height for access, etc.

1 POINT PER FEATURE

3 POINTS MAXIMUM

Customized cabinetry with special features such as: upper cabinets that lower to counter level for access to a wheelchair user or person of short stature, or sink-base doors that slide away with no cabinet bottom shelf for roll-up access to the kitchen sink.

5-135

Special work and forethought, innovative universal design features, see Homebuilder Guide for more information.

1 POINT PER UNIVERSAL DESIGN FEATURE

3 POINT MAXIMUM

Example #1: An open "header-free" seamless passage between a Master Bedroom and its privately adjoining bathroom with curbless shower would accommodate a future continuous overhead track ceiling-mount lift system). This pre-planning would also want to include associated backing in the ceiling framing.

Example #2: Bathroom vanity with detached pull-away base cabinet assembly, making ready for a future wheelchair accessible self-supporting sink vanity counter. The pre-planned casework unit would require NO future modifications including the concealed floor finishes and base that would be instantly exposed and ready "as-is."

Promotes social sustainability by allowing homeowners to live in their home and communities longer.

Improves resale value and marketability (i.e., economic sustainability), as your home will be considered for purchase by a broader population that is only getting bigger by the day (e.g. Boomers).

Promotes environmental sustainability and the design will never need to be changed to accommodate lifecycle changes by current, temporary or future occupants of the home.

Extra Credit for Materials Efficiency

5-136

Extra credit for innovation in Materials Efficiency

1-10 POINTS

You may submit a materials efficiency strategy or system, not specifically called out in this Section, for consideration for an Extra Credit for Innovation. All extra credits will be approved by the Program Director. If approved, add up to 10 points to your Section total.

Section 6 OPERATION, MAINTENANCE & HOMEOWNER EDUCATION

The purpose of this section is to promote responsible homeowner operation and maintenance throughout the life of the home, by equipping your clients to continue the good work you have begun. Whether your client initiated using green features, or it is part of your standard business practices, it is important to educate your clients in using and maintaining the products, equipment, or other features installed as part of the project. Studies show that most individuals care about the environment and are willing to take certain actions to protect it, as long as those actions are not expensive, time-consuming, or inconvenient. You can take steps to provide useful information and practical products to help your clients maintain their new green home.

Your Homeowner's Kit may simply include the required information or it may also include environmentally friendly "gifts." We encourage you to be creative with this Action item. In addition to the kit's educational value, you'll benefit from showing your client that you care. It will reinforce your reputation as a "Green Builder" serving the community.

Personalize the Homeowner's Kit by labeling it with the owner's name and address and be sure to include any specific information requested by owner. Obtain owner's signature on a "sign-off" sheet indicating information in the kit has been received. Let owner know the information should be read carefully in order to optimize the environmentally friendly features you have taken extra effort to incorporate.

Information on:

- Local mass transit opportunities
- Environmentally friendly landscaping operations and maintenance practices
- Pervious surfacing products for outdoor projects / surfaces (to avoid increasing stormwater runoff)
- Pest resistant and disease resistant plants, including native plants, provide a list
- Optimally operating and maintaining irrigation equipment
- Site critical areas, such as buffer zones, that should be protected (if applicable)
- Protecting and caring for valuable site features, including mature trees if applicable (Encourage protection and retention of existing arboreal overstory where possible)
- Integrated pest management as an alternative to chemical landscape pest treatments
- Operating and maintaining water-using fixtures and equipment to avoid long-term leaks and optimize use
- Energy efficient appliances, including fact sheets, or a list of options (if appliances are not included)
- Energy-efficient lighting fixtures
- Operating and maintaining the home for good indoor air quality

Gifts could include:

- Non- or low-toxic cleaning supplies, such as environmentally friendly laundry or dish detergent, or paper products with recycled-content
- Environmentally friendly furnace filter(s)
- Native species flower seeds
- Environmentally friendly gardening supplies.

Some useful resources for *homeowners* are:

- *Consumer Guide to Home Energy Savings*, 7th Edition, by Alex Wilson, Jennifer Thorne, and John Morrill. Updated annually and has good product recommendations. Available in bookstores, from the American Council for an Energy-Efficient Economy (ACEEE), Washington, DC, www.aceee.org.
- *Home Water-Saving Methods*, by Ronald E. Hermanson, Publication #EB0732, WSU Cooperative Extension.

- *Consumer Reports*, August 1998. A thorough and informative report for consumers on buying carpets, including a section on carpet and indoor air quality. Copies of the issue (\$5) can be obtained by writing: Back Issue Dept., Consumer Reports, PO Box 53016, Boulder, CO www.consumerreports.com.
- *LightWise Compact Fluorescent Bulbs: More Value for Your Energy Dollar*, Puget Sound Energy publication. Includes a list of stores offering compact fluorescents at discount prices. Puget Sound Energy.
- *Indoor Air Quality and Your Home and Homeowner's Guide to Ventilation*, from New York State Energy Research and Development Authority (NYSERDA), www.nyserda.org.
- *How to be a Salmon-Friendly Gardener*, a publication of Seattle Public Utilities. Also online at www.ci.Seattle.wa.us/util/RESCONS/plantNaturally/salmonfriendly.htm.
- The Washington chapter of the American Lung Association (ALA), for questions relating to ventilation, insulation, or pollutant source control, www.alaw.org.
- WSU Cooperative Extension Energy Program can provide you with consumer fact sheets on energy-efficient appliances: www.energy.wsu.edu.

6-1

A building owners' manual is provided:

3 POINTS FOR 4 ITEMS

5 POINTS FOR ALL ITEMS

- Information on local recycling programs
- Information about available local utility programs that purchase a portion of energy from renewable energy providers
- Explanation of the benefits of using energy efficient lighting systems (e.g., compact fluorescent light bulbs, light emitting diode (LED) in high usage areas
- A list of practices to conserve water and energy
- Local public transportation options
- List of common hazardous materials often used around the building and instructions for proper handling and disposal of these materials
- Information about organic pest control, fertilizers, de-icers, and cleaning products
- Information about native landscape materials and/or those that have low-water requirements

6-2

Building owners/occupants are familiarized with the green building goals and strategies implemented and the impacts of the occupants' practices on the costs of operating the building. Training is provided on the equipment operation and control systems

6 POINTS

6-3

A diagram showing the location of safety valves and controls for major building systems

0.5 POINTS

6-4 Where frost protected shallow foundations are used, notify owner of precautions, including instructions not to remove or damage insulation when modifying landscaping, to provide heat to the home as required by the irc/ibc, and to keep base materials beneath and around the home free from moisture due to broken water pipes or other water sources

0.5 POINTS

6-5 A list of local service providers that offer regularly scheduled service and maintenance contracts to assure proper performance of equipment and the structure (e.g., HVAC, water heating equipment, sealants, caulk, gutter and downspout system, shower/tub surrounds, irrigation system.)

0.5 POINTS

6-6 a photo record of framing with utilities installed. photos taken prior to installing insulation, clearly labeled, and included as part of the homeowner's binder

0.5 POINTS

6-7 Maintenance checklist

0.5 POINTS

6-8 Information about methods of maintaining the building's relative humidity in the rate of 30-60%

0.5 POINTS

6-9 Instructions for maintaining gutters, downspouts, raingardens and other infiltration devices and importance of diverting water at least five feet away from foundation

0.5 POINTS

6-10 Instructions for inspecting the building for termite infestation

0.5 POINTS

6-11

A narrative detailing the importance of maintenance and operation retaining the attributes of a Built Green home

0.5 POINTS

6-12

Educate owners/tenants about fish-friendly moss control

1 POINT

Moss is a natural part of the Pacific Northwest. It thrives in lawns, on roofs, and in crevices in sidewalks and drives. There are various chemical treatments available on the market for control of moss and other growth. However, several have adverse environmental impacts. For this reason, homeowners (and builders) should avoid all zinc and copper products including zinc sulfate, monohydrate, copper sulfate (also called blue stone), galvanized ridge caps, copper flashing, and copper wires. In addition, homeowners should avoid the use of table salt to kill moss and algae. It is corrosive to metal and is not very effective.

Instead, homeowners should remove moss from roofs and other areas using a stiff brush, broom, or power washer for hard-to-reach areas. As a last result, moss can be killed by spraying it with hot water (use a utility or other sink with hot water supply and connect a hose).

Provide information about environmentally friendly moss control to the homeowner as part of the Homeowners Kits (see Action item 6-1, *A building owners' manual is provided*).

Section 7 BUILT GREEN BRAND PROMOTION

7-1

Extra credit for innovation in marketing for Built Green brand

1-10 POINTS

FOR INCLUDING THE BUILT GREEN LOGO IN SHOWROOM OR WEBSITE 5 POINTS

FOR THE BUILT GREEN LOGO, ETC.... 10 POINTS

APPENDIX

Contents:

- Housing Size Matrix
- Seasonal Land clearing Worksheet
- Energy Benchmarks to meet Built Green 3-Star, 4-Star and 5-Star Requirements
- Chart 3-A: Built Green Component Performance Method
- Chart 3-B: Built Green Prescriptive Scoring Method
- Built Green Job Site Recycling Plan
- Contractor's Short Guide to Waste Prevention and Recycling

Table 0-1 House Size Matrix

		Bedrooms						Multiplier	min. points req in energy section**	min. points req in materials section**
		1	2	3	4	5	6			
SF	<500	<700	<900	<1300	<1900	<2400		1.20	N/A	N/A
	501- 800	701-1000	901-1200	1301-1750	1901-2350	2401-2700		1.15	N/A	N/A
	801-1200	1001-1400	1201-1800	1751-2350	2351-2950	2701-3500		1.10	N/A	N/A
	1201-1600	1401-1800	1801-2400	2351-3000	2951-3600	3501-4300		1.05	N/A	N/A
	1600	1800	2400	3000	3600	4300		1.00	0	0
	1601-1800	1801-2000	2401-2700	3001-3400	3601-4000	4301-4700		1.00	25*	25
	1801-2000	2001-2200	2701-3000	3401-3800	4001-4400	4701-5100		1.00	35*+	35+
	2001-2200	2201-2400	3001-3300	3801-4200	4401-4800	5101-5500		1.00	45*+	45+
	>2200	>2400	>3300	>4200	>4800	>5500		1.00	55*+	55+

= 2005 avg. home size in WA State

SEASONAL LANDCLEARING WORKSHEET

Use this Checklist to evaluate the Erosion and Sediment Control measures needed for wet season landclearing (October 1- April 30)

Date of Evaluation: _____ Proposed Start Month for Project: _____

Site/Lot#: _____ Address: _____

Total Points By Month (see thresholds below to determine which month to legally begin project)

TIME OF YEAR – Weighted by average monthly rainfall:

October	POINTS	5	_____
November	POINTS	20	_____
December, January, February, March	POINTS	25	_____
April	POINTS	10	_____

HYDROLOGIC SOIL GROUPS -

Group A: High Infiltration Rate	POINTS	5	_____
Group B: Moderate Infiltration Rate	POINTS	10	_____
Group C: Slow Infiltration Rate	POINTS	15	_____
Group D: Very Slow Infiltration Rate	POINTS	20	_____

SLOPE - Steepest portion of the footprint of the area proposed for clearing activity, prior to land disturbance:

0% to 2% slope	POINTS	0	_____
3% to 8% slope	POINTS	5	_____
9% to 14% slope	POINTS	10	_____
15% to 34% slope	POINTS	20	_____
Over 35% slope	POINTS	30	_____

CLEARING ACTIVITY SIZE -

500 to 5,000 square ft.	POINTS	5	_____
5,001 square ft. to .99 acre	POINTS	10	_____
1 to 5 acres	POINTS	30	_____
Over 5 acres	POINTS	50	_____

PROXIMITY TO WETLAND OR WATER BODY- Cumulative (20' wide driveway across drainage ditch =0):

Less than 10 feet from drainage ditch or storm drain, other than a driveway crossing.	POINTS	20	_____
Less than 100 feet from a wetland or stream (subject to the Critical Area Ordinance)	POINTS	20	_____
Less than 200 feet from a lake or marine shoreline	POINTS	20	_____

Evaluator Name/Contact _____

Subtotal:

ACTION:

- ◆ **40 OR LESS:** Standard Erosion and Sediment Control BMPs
- ◆ **GREATER THAN 40 AND LESS THAN 75:** Winter Clearing Plan developed, applied and monitored by a certified ESC installer. Current certification and contact information must be included with BuiltGreen submittal.
- ◆ **75 OR GREATER:** Do not clear site during wet season start (October 1- April 30).

Table 0-2 Energy Benchmarks to meet Built Green 3-Star, 4-Star and 5-Star Requirements

- 3-Star- Independently verified to be at least 15% more efficient than Washington State Energy Code
- 4-Star- Independently verified to be at least 20% more efficient than Washington State Energy Code
- 5-Star- Independently verified to be at least 30% more efficient than Washington State Energy Code

Certification Path: Energy Star certification

Modeling Path: Demonstrate 30%(3-Star) 35%(4-Star) or 45%(5-Star) improved efficiency over 2004 International Energy Code via UA Calculator.

Approved Modeling Software:

- WSU UA Alternative Worksheet
- REM Rate
- Energy Gauge
- TREAT
- ResCheck
- *Other software may be allowed upon prior approval*

Chart 3-A. BUILT GREEN Component Performance Method

For buildings that qualify for the Washington State Energy Code using the component trade-off method. Improvement represents a reduction in heat loss compared to the code reference house. (Total UA of the proposed building / UA of the WSEC code reference building. Based on minimum performance to qualify the home, using the WSU UA Alternative Worksheet or equivalent.) Score 1 point for each percentage reduction in energy use.

_____ Total heat loss reduction for home.

To document what you have done for the client, please record U values below.

<i>Building Component</i>	<i>Upgrade</i>
Window	Upgrade U-Value to _____
Skylight/Vault	Upgrade U-Value to _____
Floor Over Crawl	Upgrade R-Value to _____
Wall	Upgrade R-Value to _____
Attic	Upgrade R-Value to _____
Vault	Upgrade R-Value to _____
Slab on Grade	Upgrade R-Value to _____
Below Grade Slab	Upgrade R-Value to _____
Below Grade Wall	Upgrade R-Value to _____
Other	Upgrade U- or R-Value to _____
Improve heating (AFUE or HSPF)	_____

Chart 3-B. BUILT GREEN Prescriptive Scoring Method; Upgrades for all Fuel Types (See Note 1)

Envelope Component	2012 WSEC Code Baseline/Improvement Description,	Target Level	H/L Ratio	U-Value	Points Allowed	Points Taken
Doors			0.045	U-.30	0	
	1-Star			U-.28	0	
	2-Star			U-.27	0	
	3-Star			U-.25	0.5	
	4-Star			U-.24	1	
	5-Star			U-.21	1.5	
Skylights*	2gl, low-e temp/lam		0.015	U-.50	0	
	*If no skylights, take 1 point	1-Star		U-.47	0	
	**If more than 1 5-star level skylight, take 1 point	2-Star		U-.45	0	
		3-Star		U-.42	0	
		4-Star		U-.40	0	
		5-Star**		U-.35	0.5	
Windows	2-gl, low-e/argon/ss		0.33	U-.30	0	
		1-Star		U-.28	2	
		2-Star		U-.27	4	
		3-Star		U-.25	6	
		4-Star		U-.24	7	
		5-Star		U-.21	10	
Ceiling/Roof	R-38 (raised heel truss)		0.098	U-.026	0	
	R-49 (standard heel truss)			U-.027	0	
	R-60 (standard heel truss)	1-Star		U-.025	0.5	
	R-49 w/R10 foam sheathing	2-Star		U-.024	1	
	R-49 w/R15 foam sheathing	3-Star		U-.023	1.5	
	11.25" core supported SIPS	4-Star		U-.022	2	
	R-49 (raised heel truss)	5-Star		U-.020	3	
Walls (above grade)	R-21 Std. cavity only		0.398	U-.056	0	
	R-21 Adv. Framing	1-Star		U-.053	2	
	R-23 Adv. Framing	2-Star		U-.050	4	
	5.5" core SIPS (EPS)	3-Star		U-.048	6	
	3.5" core SIPS (Polyurethane)	4-Star		U-.045	8	
	R-21 Adv. + R-5 Foam	5-Star		U-.040	11.5	

Floor (over crawl)		0.11		
	R-30 vented joist	U-.029	0	
	9.25" core SIPS	1-Star	U-.028	0.5
	R-25 joist w/R10 foam	2-Star	U-.026	1
	R-38 vented joist	3-Star	U-.025	1.5
	11.25" core SIPS	4-Star	U-.023	2
	R-49 vented joist	5-Star	U-.020	3.5
Floor (slab-on-grade)	R-10 2' vertical	0.11	F-0.540	0
	R-10 fully insulated/heated		F-0.550	0
	R-15 2' vertical	1-Star	F-0.522	0.5
	R-10 4' vertical	2-Star	F-0.495	1
	R-5 fully insulated	3-Star	F-0.467	1.5
	R-10 2', R-5 center	4-Star	F-0.440	2
	R-15 fully insulated	4-Star	F-0.440	2
	R-10 fully insulated	5-Star	F-0.385	3.5
	R-20 fully insulated/heated	5-Star	F-0.330	3.5
Below Grade Slabs & Walls	R-10 exterior <u>or</u> R-21 interior w/thermal break	0.165	Wall U-.042, Slab F-0.570	0
	R-5 foam w/R15 interior	1-Star	U-.040/F-0.54	1
	R-10 foam w/R13 interior	2-Star	U-.038/F-0.51	2
	R-15 exterior	3-Star	U-.036/F-0.48	3
	R-10 foam w/R-15 interior	4-Star	U-.034/F-.46	4
	R-20 exterior	5-Star	U-.029/F-0.40	6

Chart 3-B Notes:

- The prescriptive path is the simplest, but also the least flexible, method for estimating heat loss reduction. It does not provide credit for reductions in glazing areas. You may (or may not) have a higher score if you use the component performance method (Chart 3-A).
- U-Value: Calculated U-value for the described building component. If you select a component that is not described in the text, use the Reference U-value of the product to score it.
- Heat Loss Reduction: Estimated reduction in total UA of the structure. Based on two prototypical structures. Note: This is NOT equivalent to energy savings. WATTSUN can provide you with estimated fuel savings.
- Assigned Point Value: based on 1 point for each percentage point in heat loss reduction.
- Score: Record your score based on assigned point values for the measures you implement. For example, if you use windows with U equal to 0.50, the estimated heat loss reduction is 10%, so your score for this item is 10 points. If you use more than one component per category (wall, attic, etc.), average the scores for all components. Your total score is the sum of all scores for individual items. Max. score is 32 points.
- Code Baseline: WSEC target Prescriptive Path for "other fuels." Minimum requirements must be met for all components.



Identifies those products that provide wood savings as well as energy savings.

BUILT GREEN Jobsite Recycling Plan

Recyclable Materials

What material will you target?	Condition of material*	How will it be handled on site?	Who will haul it?	Where will it be taken?
<input type="checkbox"/> Wood				
<input type="checkbox"/> Cardboard				
<input type="checkbox"/> Ferrous				
<input type="checkbox"/> Non-ferrous metal				
<input type="checkbox"/> Drywall				
<input type="checkbox"/> Asphalt Roofing				
<input type="checkbox"/> Concrete / Asphalt Rubble				
<input type="checkbox"/> Other				

*Check with your recycler or hauler to see if any specifications or conditions exist regarding the material being recycled. Examples include size restrictions and non-acceptable materials (for example, treatments, finishes, or fasteners).

Action items

- Complete this Jobsite Recycling Plan and post on site.
- Commit subcontractors to recycle in Subcontractor Agreement.
- Keep subcontractors and workers aware and informed of Recycling Program.
- Require individuals to properly sort recyclables and hold them responsible for mis-sorted loads.
- Track and promote recycling results.

Contractors' Waste Reduction Resource Sheet

Introduction

This short guide contains information condensed from the "Contractor's Guide to Waste Prevention and Recycling." If you need more information on a given topic, you can find it there. The guide provides recycling and waste prevention how-to's for all builders, from handyman/remodelers to large commercial contractors, who want to save money. Both Counties and several Cities can provide assistance on reducing, reusing and recycling construction wastes. Other resources are listed in this guide under "*Where to Get More Information.*"

Preventing Waste in the First Place

Waste prevention is even more beneficial than recycling. Why? Activities that prevent the production of waste, such as reusing building materials not only cuts garbage and recycling collection costs but also reduces materials expenses. Small changes to building practices and extra attention to detail can add up to significant savings for the builder and the environment.

Design To Prevent Waste

- Design with standard sizes for all building materials
- Specify materials and assemblies that can be easily disassembled at the end of their useful life
- Choose durable interior finishes or materials that can be easily removed and recycled when worn or damaged
- Consider reusing materials (on-site) or installing salvaged materials from off-site sources.

Construction Methods that Prevent Waste

- For wood construction, use advanced framing techniques (e.g. 24" on center, and insulated headers), trusses for roof or floor framing, finger jointed studs and trim, and engineered wood products.
- Consider using wood frame wall panels prefabricated off site
- For concrete construction, use precast concrete members.

Prevent Waste On-Site

- Set up central cutting areas for wood and other materials. Make sure the crew uses all the reusable pieces before cutting a new piece.
- Reuse concrete forms on the job and on other jobs. Wood forms can frequently be used up to 15 times. Alternatively, use reusable metal or fiberglass forms.
- Practice material storage and handling procedures that prevent loss from weather and other damage.

Purchase to Prevent Waste

- Consider the purchase of good-quality, previously used items such as cabinets, doors, and equipment.
- Re-evaluate estimating procedures to make sure the correct amount of each material is delivered to the site.
- Choose products that come with minimal or no packaging.
- Replace toxic materials with less toxic or non-toxic alternatives to reduce hazardous waste disposal fees.
- Ask suppliers to deliver supplies using sturdy, returnable pallets and containers. Have them pick up the empty containers when delivering new supplies. Also, require suppliers to take back or buy-back substandard, rejected, or unused items.

Salvage and Reuse Of Building Materials

By reusing items on-site, donating and/or selling salvageable items, you can cut waste and reduce supply costs. If you are using a demolition contractor, specify reuse and salvage in the contract. Deconstruction services are offered locally by ReStore

- Before demolition/deconstruction, identify potentially reusable or salvageable items.
- Determine the savings and cost of reusing, donating, and/or selling the salvageable items.
- Inform the demolition crew of the salvage procedures and expectations. Careful removal of these items is the key to their marketability.

Other Reuse Options

Many companies have had success with less formal reuse options. Consider the following ideas:

- Advertise reusable items in the newspaper.
- Conduct a "yard sale" on the job-site to sell reusable items.
- Allow workers to remove wood or other salvageable items for their own use.
- Set out "free wood" signs.
- Ask some subcontractors (such as electricians and pipe fitters) to reuse or recycle their own materials. Consider asking for or requiring documentation to verify reuse or recycling.

The following are just a few of the materials that can be salvaged, and donated or sold locally:

Appliances	Bathroom Fixtures
Bricks	Cabinets
Carpeting	Dimensional Lumber
Doors	Ductwork
Flooring	Insulation
Lighting Fixtures	Marble
Metal Framing	Paneling
Pipes	OSB &Plywood
Shelving	Siding
Tile	Trim
Windows	Wood Beams

Setting Up a Job-Site Recycling Program

Recycling construction materials helps save money by cutting disposal costs. It also reduces waste going to the landfill and attracts clients who value environmental responsibility. Other benefits include a cleaner, safer site and improved community relations. Follow these steps to set up a successful, cost-effective recycling program for your job-site.

Start Early

Incorporating recycling up front will ensure that opportunities are not missed and that the program is successful.

Analyze Project Waste

- Estimate the types and quantities (tons or cubic yards) of waste the project will generate. Include demolition phase volumes

- Determine when the project will generate each waste.

Identify Recyclables and Research Recycling Options

- Landclearing debris, wood, drywall, concrete, rock, asphalt, brick, carpet and asphalt roofing and other construction wastes may be recyclable in the Skagit and Island Counties area. Consult Skagit and Skagit County Solid Waste Divisions for more information.

- Remember that chipping land clearing debris to use for mulch or erosion control, and grinding concrete and asphalt for fill are inexpensive, on-site recycling options.
- Decide whether to self-haul recyclables to the recycling facility or to contract with a recycling hauler.
- For recycling haulers, determine whether you will co-mingle recyclables or source separate them for collection.

Select the Recyclers

- Contact SICBA for referral to recycler(s) of the materials you will be generating on your site.

Determine the Savings

- Compare the cost of normal construction waste disposal practices with the cost of recycling to determine if recycling is feasible.
- Use the economics worksheets in the Appendix to determine potential costs and savings for recycling.

Develop a Waste Management Plan

A Waste Management Plan identifies materials to be recycled on a project; including materials subcontractors will be responsible for recycling. The plan outlines recycling procedures, expectations, and results.

- Filling out the Recycling Checklist will give you a good start on the basics of a Waste Management Plan.

Set Up the Site

Work with your recycler and crew to determine the most effective way to set up the site for maximum recycling. Some suggestions include the following:

Making Your Program Work

The small effort needed to prevent waste and recycle on a job-site usually pays off in disposal and supply cost savings. Here are solutions to some of the challenges faced when developing and implementing a waste management plan.

- Designate a person to manage the details of creating and implementing the program. On residential projects, this might be the contractor, site supervisor, or crew chief.
- Require subs to use the recycling and disposal bins on-site. This allows the most control of recycling

- Clearly designate the recycling bins. Post lists of what is and what is not recyclable.
- Place garbage and recycling bins near each other, and close to the point of waste generation but out of the traffic pattern.

Communicate the Plan

It is important to educate everyone on the job-site about the waste management program.

- Discuss waste handling requirements with crew and subcontractors prior to beginning a project.
- Post easy to read signs and provide written information about the recycling program.

Monitor the Program

An effective recycling program includes occasional monitoring.

- Check bins regularly for contamination.
- Periodically check the wastes in the garbage dumpsters to see if recyclables are being thrown away or if there are additional materials that could be recycled.
- Call the recycler before bins are full to arrange for pick up.

Track Your Success

Tracking the quantities and cost savings of diverted materials is important for future estimating. It is also required for BUILT GREEN certification.

- Once construction has started, keep the receipts from recycling and garbage disposal. Furnish receipts to your company's estimating department for planning future waste management budgets.

- activities. Be sure to provide recycling for the variety of wastes the subs generate.
- Alternatively, ask the subs to recycle their own waste, but require written reports. Since many subs wastes are homogeneous, it is easy to separate the wastes for recycling.

Space Constrained Sites

- Choose smaller bins and more frequent collection. There are a variety of container sizes and service options available through recycling service providers.
- Use scrap lumber to divide one dumpster into separate compartments for storing recyclables and trash on-site instead of having multiple dumpsters.
- Use smaller containers that are collected at the end of the day and dumped into a larger container for pick up.
- If self-hauling, build custom containers to fit the space requirements using scrap or damaged plywood, concrete forms, or barrier fencing.

Promotion and Education

- Include waste handling requirements in all project documents. This makes it clear from the beginning that waste prevention and recycling is expected from all crew members and subs.
- Treat waste management like a safety program. Integrate recycling training into the safety education, or design a separate recycling education program.
- Share the success. Let subcontractors and crew know how well they are doing by regularly posting volumes of materials reused/recycled.

Preventing Contamination of Recyclables

- Clearly designate the recycling bins. Post lists of what is and what is not recyclable.
- Place recycling and trash bins near each other so trash is not thrown in the recycling bin.
- Provide enough trash bins to collect unrecyclable items. Have them emptied regularly so the overflow does not end up in the recycling bin.
- Dump out contaminated loads and have the subcontractors and/or crew pull out the contaminants themselves. It takes some time, but contamination probably won't happen again.
- Place small recycling bins on the work floor and use the crane or laborers to empty the bin on a regular basis.

Using Recycled-content Building Materials

Many common building products like drywall and blown-in cellulose insulation have contained recycled materials for years. New products utilizing recycled materials, such as carpet, concrete, and plastic lumber, are being developed every day.

How to Buy Recycled

- Obtain information on recycled products. Locally, there are several excellent free or low-cost resources available. Refer to "Where to Get More Information" for help.
- Consistently communicate your interest in recycled-content building materials in your specifications, policies and in your job-site meetings.
- Contact manufacturers for product specifications and samples. Look for products with the highest post consumer content that meets your strength and durability specifications.
- Look for recycled content products for your office or job shack. Copy paper, toner cartridges, and desk supplies are readily available with recycled content.

Examples of Recycled-Content Building Products

BUILDING MATERIALS

Bathroom Partitions
Benches
Bike Racks
Carpet/Carpet Pad
Ceiling Tiles
Cellulose Insulation
Copper Shingles
Counter Tops
Ductwork
Exterior Sheathing
Fences/Posts
Fiberboard
Fiberglass Insulation
Floor Joists
Flooring
Lumber
Pilings
Roof
Structural Steel
Wallboard

SITE WORK

Asphalt
Base Coarse
Building Blocks
Building Panels
Compost
Concrete
Concrete Masonry Units
Fill Material
Glassphalt
Parking Stops
Recycling Containers

Where to Get More Information

Technical Assistance

- Other Washington State projects – call the Washington State Department of Ecology at (360) 407-6300 for referrals.
www.wa.gov/swfa/cdl/cdlframe.html

Reuse and Recycling Resources

- 1-800-RECYCLE, Washington State Department of Ecology's statewide recycling services information hotline – call 1-800-RECYCLE or visit their website at: www.180orecycle.wa.gov

Used Building Materials Suppliers

- Reusable Building Materials Exchange – an interactive web page for exchanging all types of used or surplus building materials: www.rbme.com/wa/pierceco/

Using Recycled-content Building Materials

- Recycled Content Building Materials Guide is available on the internet at
http://dnr.metrokc.gov/swd/bizprog/sus_build/RCBMG.pdf