LEED® for Homes Program
Pilot Rating System

for Homes

U.S. Green Building Council

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Introduction to LEED® for Homes

What are green homes?

The environmental impact of the residential sector is significant. There are more than 120 million homes in the United States, and about 2 million new homes are constructed each year. According to the U.S. Department of Energy, the residential sector accounts for 22% of the total energy consumed in the US and 74% of the water. Indoor air pollutants can often be four to five times higher than outdoor levels. Twenty-one percent of U.S. carbon dioxide emissions are contributed by the residential sector. The considerable impact on the environment created by homes necessitates a shift toward more sustainable residences.

Green home building addresses these issues by promoting the design and construction of homes that have much higher performance levels than conventional homes (i.e., homes that are built to the minimum building codes). Generally, green homes are healthier, more comfortable, more durable, and more energy efficient. And of course, they also have a much smaller environmental footprint than conventional homes.

Green homes rely upon established and proven design features and technologies that do not have a significantly large cost. Many green measures will reduce long term costs, particularly those features that involve energy and water efficiency. In many cases, these reductions in operating costs will more than offset the additional up-front costs of a green home. The home building industry is beginning to recognize the value of healthy homes, environmentally responsible projects. The LEED for Homes Rating System provides a basis for quantifying the benefits of green homes, thereby facilitating a wider adoption of this more sustainable approach to home building.

The LEED® Green Building Rating System

The U.S. Green Building Council (USGBC) established LEED (Leadership in Energy and Environmental Design) as a system to define and measure “green buildings.” The LEED™ Green Building Rating System is a voluntary, market-driven building rating system based on existing proven technology that derives market strength and credibility through industry-wide development of the LEED products. After the initial pilot launch of LEED in 1998, LEED has evolved and branched out to include: LEED for New Construction, LEED for Existing Buildings, LEED for Commercial Interiors, and LEED for Core & Shell. LEED for Homes is bringing the successes of the LEED Green Building Rating System to the residential market.

Overview of LEED for Homes

LEED for Homes is an initiative designed to actively promote the transformation of the mainstream home building industry towards more sustainable practices. LEED for Homes is targeting the top 25% of new homes with best practice environmental features. LEED for Homes is a collaborative initiative that actively works with all sectors of the home building industry.

By recognizing sustainable design, construction, and operations practices in homes nationwide, LEED for Homes helps home builders to differentiate their homes as some of the best homes in their markets, using a recognized national brand. Furthermore, home buyers will be able to readily identify high quality green homes, simply by selecting LEED Homes.

While there are already a number of local or regional green home building programs, LEED for Homes is attempting to provide national consistency in defining the features of a green home and to enable builders anywhere in the country to obtain a green rating on their homes. LEED for Homes represents a consensus standard for green home building developed and refined by a diverse cadre of national experts and experienced green builders. The LEED for Homes rating system is part of the comprehensive suite of LEED assessment tools offered by USGBC to promote sustainable design, construction, and operations practices in buildings nationwide.

The LEED for Homes rating system uses eight different resource categories to measure the overall performance of a home:

1. **Innovation and Design Process (ID) -** the category that includes several types of innovative measures including: special design methods, unique regionally credits, measures not currently addressed in the Rating System, and/or exemplary performance levels.
2. **Location and Linkages (LL) -** the placement of homes in socially and environmentally responsible ways in relation to the larger community.
3. **Sustainable Sites (SS) -** the use of the entire property so as to minimize the project's impact on the site.
4. **Water Efficiency (WE) -** the water conservation practices (both indoor and outdoor) built into the home.
5. **Energy and Atmosphere (EA) -** the improvement of energy efficiency particularly in the building envelope and heating and cooling design.
6. **Materials and Resources (MR) -** the efficient utilization of materials, selection of environmentally preferable materials, and minimization of waste during construction.
7. **Indoor Environmental Quality (IEQ) -** the improvement of indoor air quality by reducing possible air pollution.
8. **Awareness and Education (AE) -** the education of homeowner, tenant, and building manager (as appropriate in larger multifamily buildings) about the operations and maintenance of the green features of their LEED Home.

The LEED for Homes rating system works by awarding credits for different aspects of environmental design in each of the above categories. The level of performance achieved in the above categories is separated into four

performance tiers. LEED for Homes will rate qualified homes at the Certified, Silver, Gold and Platinum levels (presented in Exhibit 1) according to how many points the home achieves in the Rating System.

Exhibit 1
LEED for Homes Certification Levels

LEED for Homes Certification Levels	Number of LEED for Homes Points Required
Certified	45-59
Silver	60-74
Gold	75-89
Platinum	90-128
Total Available Points	129

The rating system is designed to guarantee minimum levels of sustainable practices through 18 Prerequisites (or Mandatory Measures) in eight different credit categories. At the same time, the rating system also ensures flexibility for the builders with the wide variety of optional credits available to achieve the four LEED for Homes certification levels. Credit Interpretation Requests (CIRs) are also available to projects that need clarification or special consideration on specific credits.

Does LEED for Homes include affordable and multifamily homes?

LEED for Homes includes both affordable single family and low-rise multifamily projects of three floors and below. Exactly how mid-rise multifamily projects will ultimately be addressed by LEED for Homes will be examined during a separate pilot phase for this housing type, scheduled to run through the end of 2007. Mid-rise multifamily housing structures between four and six stories may be eligible to participate in this pilot phase, and project managers should contact USGBC at (202) 828-7422 for further information. Also, multifamily housing structures that are over three stories are currently eligible to participate in LEED for New Construction (LEED-NC).

Does LEED for Homes include the renovation of existing homes?

LEED for Homes was designed to assess and label newly constructed homes. It cannot be used to assess or label a portion of a home. Only substantial or “gut”

rehab project may be included in LEED for Homes at this time. Partially renovated homes cannot be rated under LEED for Homes.

Where can I find out more about green home building?

There are many green home building resources available on the internet. For more information about LEED for Homes, please contact leedinfo@usgbc.org, or visit the U.S. Green Building Council website at www.usgbc.org/leed/homes

How to Participate in LEED for Homes

The strength of the LEED for Homes program is its third-party verification through the LEED for Homes Providers. Currently, the pilot LEED for Homes initiative is open to participation by builders in locations served by our 12 pilot LEED for Homes Providers. Home builders outside of these 12 service areas may contact their nearest LEED for Homes Provider to discuss participation in LEED for Homes. In the short-term, not every home builder will have local access to a Provider. However, in the coming year, USGBC plans to establish 10-20 new Providers in new markets.

The LEED for Homes Providers are local and regional organizations that have been chosen by USGBC to provide certification services to all LEED for Homes projects in their local markets. These Providers were selected based on their demonstrated abilities to manage a team of green raters. A Provider is under contract to the USGBC to perform the following specific services:

- Recruiting and registering builders for LEED for Homes,
- Coordination of green raters,
- Certification of LEED Homes,
- Quality assurance for the certifications,
- Facilitation of trainings for all stakeholders in their local market, and
- Coordination with USGBC and the local USGBC chapters.

A green rater is an individual that works as a part of the LEED for Homes Provider team (and may be in-house staff or a sub-contractor) to perform field inspections, HERS-related software analyses, and performance testing. Raters may work closely with the individual project teams to assist the design and construction professionals in meeting their sustainability goals.

Green designers and consultants are also critical members of a project team. To date, one of the primary lessons learned in the pilot is that the success of a green home building project is tied to how effectively the green measures are integrated into a home's design, and how well the sub-contractors understand how to properly install these green measures..

While the Providers offer verification and certification services for LEED for Homes projects, many builders may need additional support to effectively integrate additional green measures into their home designs, and to ensure that these designs are appropriately constructed by each sub-contractor. In recognition of the vital role of these other stakeholders, USGBC is developing an advanced training course for green home designers and consultants. USGBC expects to offer this course beginning in the second half of 2007.

Five Steps to Participate

There are five basic steps for a builder[1] to follow in participating in LEED for Homes:

1. Contact a LEED for Homes Provider and join the program
2. Identify a Project Team
3. Build the home to the stated goals
4. Certify the project as a LEED Home
5. Market and sell the LEED Home

These roles are shown graphically in Exhibit 2, and briefly described below.

Step 1: Contact a LEED for Homes Provider and Join the Program

Every participating builder (or project manager) must start by selecting a LEED for Homes Provider. Through a Provider, builders (or project managers) may register for participation in LEED for Homes. The Providers can also provide an orientation and up-front technical assistance to builders. A list of available Providers is included in Exhibit 3 or on the LEED for Homes website at http://www.usgbc.org/leed/homes.

Once the builder (or project manager) and the Provider have agreed to work in partnership on the project, the builder will submit a Builder Registration form to the Provider for sign-off by the Provider and subsequent submission to USGBC. At this time, the builder pays USGBC a *one-time* registration fee of $150. A copy of the Builder Agreement form is included in Attachment B.

Step 2: Identify a Project Team

After registering, it is critical to identify a project team to plan, design and build the home. The team should include professionals with both knowledge and experience in each of the eight LEED for Homes resource categories. These professionals should work together as a team to develop the project goals, to identify potential challenges ahead, and to understand how they can each best contribute to the success of the project.

The project team should start by laying out the sustainability goals of the project and determining the specific strategies and systems integration required to successfully meet those objectives.

The LEED for Homes Provider will assist the project team with a preliminary rating of the home. This pre,iminary rating is a detailed review of the home's current design and determine how it currently scores on this LEED for Homes Rating System. As part of this design review, the following steps should be completed:

- Performance testing of a typical example of builder's home design

[1] The party that registers to participate in LEED for Homes may be the home builder, or the person with primary responsibility for the design ***and*** construction of homes that are expected to meet the LEED for Homes program requirements, **hereafter referred to as "the Builder**."

- Completion of preliminary project documentation file (including suggested additional measures that may be needed to achieve a LEED rating)

Exhibit 2
Builder Participation Roadmap

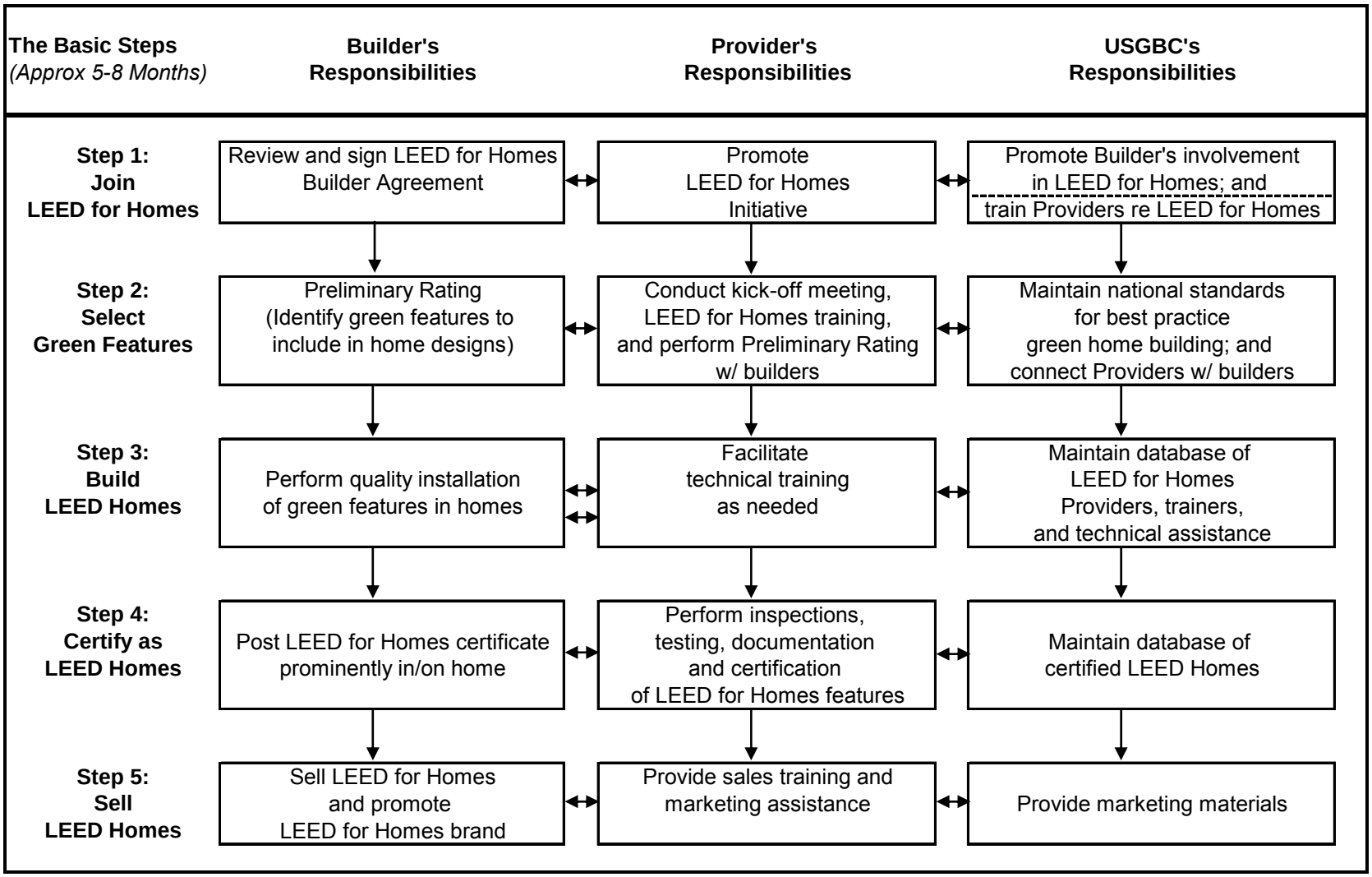


Exhibit 3
List of USGBC Approved Pilot LEED for Homes Providers

Name Title / Organization	Contact Information
Arizona (Scottsdale and Metro Phoenix) *Anthony Floyd, Green Building Program Manager, City of Scottsdale Green Building Program*	*(480)312-4202* *afloyd@scottsdaleaz.gov*
California (Statewide) *Mark Berman Principal, Davis Energy Group, Inc.*	*(530)753-1100* *mjberm@davisenergy.com*
Colorado (Statewide) *Kristin Shewfelt, Program Development Officer, E-Star Colorado*	*(303)459-4449* *kshewfelt@e-star.com*
Florida (Statewide) *Eric Martin, Senior Research Engineer, Florida Solar Energy Center / University of Central Florida*	*(321)638-1450* *martin@fsec.ucf.edu*
Georgia (Statewide, and AL, SC and VA) *Laura Uhde, Southface Energy Institute*	*404-872-3549 x129* *laura@southface.org*
Michigan (Central and Western MI) *Jeannine Reynolds, Executive Director, The Alliance for Environmental Sustainability*	*(616)458-6733* *jeannine.reynolds@comcast.net*
New Jersey (Statewide, and Eastern PA) *Rob Wisniewski, Green Building Consultant, MaGrann Associates*	*(856)722-9799* *RobertWisniewski@magrann.com*
Northeast Team (CT, MA, ME, NH, RI, and VT) *Richard Faesy, Senior Project Manager, Vermont Energy Investment Corporation (until Feb. 28)* *Peter Schneider, Project Manager, VEIC (starting March 1)*	*(802) 453-5100 x19* *rfaesy@veic.org* *(802) 658-6060 x1141* *PSchneider@veic.org*
Oklahoma (Statewide and Northern TX) *Donney Dorton, Guaranteed Watt Saver Systems, Inc.*	*405-946-0206* *ddorton@gwssi.com*
Oregon (Statewide and Southern WA) *Randy Hansell, Green Building Specialist, Earth Advantage*	*(503)968-7160 x16* *rhansell@earthadvantage.org*
Pennsylvania (Eastern PA and DE) *David Bone, Program Manager, Energy Coordinating Agency of Philadelphia*	*(215) 988-0929 x 236* *davidb@ecasavesenergy.org*
Texas (San Antonio) *Chip Henderson, President, Contects Consultants and Architects*	*(210)824-8758* *chip@contects.com*

- Preliminary LEED for Homes score/rating

Depending on how the current home design scores, the project team will need to decide if additional green measures must be added to the home's design.

To appropriately introduce new green measures into the home design, an integrated design approach should be followed. Each change may introduce both expected and unexpected challenges. With an integrated design process, all project team members are given an opportunity to weigh-in on potential challenges and solutions. Design charrettes are often used on larger projects to bring together stakeholders with strong interests in the potential impacts of a given project. Also, it may be beneficial to bring in consultants that specialize in aspects of green home building that are critical to a given project.

Step 3: Build the Home

The LEED for Homes initiative is intended to provide project teams with guidance on both green design and green construction practices. Green home building often will require that the trades learn new ways of doing things. Subcontractors that are new to green construction practices will need to be trained to make sure they understand proper installation practices for these green measures. The builder is encouraged to work with green consultants who specialize in training trades in the practice areas where training may be needed.

Also, the Provider will designate a green rater to be on-site at different phases of the construction process to verify compliance with the following LEED for Homes credits:

- Durability Inspections (ID 2)
- Erosion controls (SS 1.1)
- Thermal bypass inspection (EA 1, and/or EA 2).

The Provider and rater will work with the construction team and trades to schedule and complete these interim inspections. Also, during the construction process, it is important to remain in contact with the green rater if questions, problems, or changes arise. The rater may need to re-score the project if major changes are made during construction.

Step 4: Certify the home

After the construction of the home is completed, the following certification process must be completed.

i. In–field inspection and performance testing.

The green rater must conduct an in-field final inspection of each of the green measures selected on the LEED for Homes Checklist. They must also conduct all of the performance tests selected on the checklist. A list of all of the possible performance tests is presented in Exhibit 4.

Exhibit 4
List of Performance Tests

Category	List of Measures	Resp.	Prerequisite or Credit	
			Mandatory	Optional
EA	1 ENERGY STAR Home, including	Rater	X	
	3 Envelope Leakage	Rater		
	5 Duct Leakage	Rater		
	6.1 Refrigerant Charge Test	HVAC	X	
IEQ	4.3 Outdoor Air Flow Test	Rater		X
	5.3 Local Exhaust	Rater		X
	6.2 Supply Air Flow Test	Rater		X

At the completion of these inspections and performance tests, the green rater will then complete *the project documentation package. The project documentation package includes:*

1. Completed and signed LEED for Homes Checklist .
2. Completed and signed Accountability Form(s) (see more info below).
3. Completed and signed Durability Checklist.
4. Reports for Completed Performance Tests for each of four mandatory tests, and for up to three additional optional tests, as applicable.
5. A check for USGBC's $50 certification fee

The green rater submits this package to the LEED for Homes Provider for approval.

ii. Approval by LEED for Homes Provider

The LEED for Homes Provider must review the project documentation package submitted by the rater. Upon approval by the Provider (the successful certification of the home), the Provider will notify both the builder and USGBC. USGBC will then send out the official notification and LEED for Homes certificate to the builder.

Note that LEED for Homes Provider must designate a *LEED for Homes Certifier for this task*. This Certifier must participate in an internship process, whereby USGBC oversees the Certifier until they have demonstrated competency as a Certifier (approx. the first 25 LEED Homes). Upon completion

What is the Accountability Form?

Many of the measures in the LEED for Homes Rating System have a substantial design component. These measures are very difficult for a rater to visually verify in the field. If the rater is to fully understand how these measures were installed, it would require a great deal of the rater's time to retrace the design steps.

An Accountability Form is intended to shift the responsibility for the verification from the rater to the design professional responsible for designing that specific LEED measure. The form is to be signed by the responsible party (e.g., the builder, the engineer, the architect, the landscape architects, etc.) that actually completed the design. With this form, they formally attest to the completion of LEED measures/credits and their compliance with the LEED requirements.

Credits that require an Accountability Form signature are noted on the project checklist by the "  " symbol. A list of the credits that require an accountability form is provided in Exhibit 6.

Step 5: Market and Sell the LEED Home

Builders registered with LEED for Homes may market their LEED certified homes with USGBC-approved press releases, signage, and collateral pieces that highlight the LEED brand. Please contact USGBC for more information.

Exhibit 6
List of LEED for Homes Measures that Require the Use of an Accountability Form
(indicated by the "✎" symbol on the Checklist)

List of Measures		Responsible Party		
Resource Category	Credit # and Name		Prerequisite (Mandatory)	Credit (Optional)
Innovation And Design Process	1.2 Integrated Project Team	Builder		✎
	1.3 Design Charrette	Builder		✎
	2.1 Durability Planning	Builder	✎	
	3 Innovative / Regional Design			✎
Location & Linkages	2. Site Selection	Builder		✎
Sustainable Sites	2.1 Landscaping; Basic Design	Landscaper	✎	
	2.2 Basic Landscape Design	Landscaper		✎
	2.3 Limit Turf	Landscaper		✎
	2.4 Drought Tolerant Plants	Landscaper		✎
	3. Shading of Hardscapes	Landscaper		✎
	4.1 Maintain Permeable Area >= 65%	Builder		✎
	6.1 Housing Density > 7 Units/Acre	Builder		✎
	6.2 Housing Density > 10 Units/Acre	Builder		✎
	6.3 Housing Density > 20 Units/Acre	Builder		✎
Water Efficiency	1.1 Water Re-Use - Rainwater	Irrigation		✎
	1.2 Water Re-Use – Grey Water	Irrigation		✎
	2.1 Irrigation System	Irrigation		✎
	2.3 Professional Design	Irrigation		✎
Energy and Atmosphere	6.1 HVAC Meets ENERGY STAR	HVAC	✎	
	7.1 Hot Water Distribution	Plumber		✎
	11. Refrigerant Management	HVAC		✎
Materials & Resources	1.1 Waste Factor < 10%	Builder	✎	
	2.1 Env. Preferable Products	Builder	✎	
	2.2 Env. Preferable Products	Builder		✎
	3.1 Waste Management Plan	Builder	✎	
Indoor Environmental Quality	3 Humidity Control	HVAC		✎
	4.1 Outdoor Air Ventilation	HVAC	✎	
	5.1 Local Exhaust	HVAC	✎	
	6.1 Supply Air Distribution	HVAC	✎	
	8.3 Fresh Air Flush	Builder		✎
	9.1 Radon Protection, EPA Zone 1	Builder	✎	
	9.2 Radon Protection, not Zone 1	Builder		✎
Awareness & Education	1.1 Basic Manual/Training	Builder	✎	
	1.2 Comprehensive Manual/Training	Builder		✎
	1.3 Public Awareness	Builder		✎
	2.1 Building Manager	Builder		✎

Quality Assurance

The level of rigor and consistency of LEED for Homes ratings is assured through three sequential QA processes:

1. Third Party Verification Process

As explained in Step 4 above, the LEED for Homes Provider serves as a second set of eyes in the certification process for every LEED Home. The field rater inspects each LEED Home and prepares a documentation file for each Home. Then, the Provider reviews the project file for each Home and officially certifies the home as LEED for Homes compliant.

There are two additional levels of quality assurance required for certified LEED Homes. These are summarized below.

2. Auditing of Raters by Provider

The Provider is responsible for the hiring, training, and quality assurance of its raters. USGBC requires that each Provider has a quality assurance protocol in place for all of its raters. This protocol should include at a minimum:

1 Ten percent paper review (including project documentation files) of all LEED Home ratings ***for each rater***, conducted by a third party on an annual basis.

2 One percent in-field re-rating (including performance testing) of all LEED Home ratings ***for each rater***, conducted by a third party on an annual basis.

3. Auditing of Provider by USGBC

The Provider must maintain records for each rater, including training completed, LEED ratings completed, builder or home buyer complaints, all project files, and results of quality assurance checking. USGBC will spot-check these records for each rater on an annual basis.

These QA procedures are similar to those recently adopted by the Home Energy Rating (HERS) industry. Additional information on the HERS Enhanced Rater QA Procedures can be found on page 18 of the "Adopted Enhancements to the Mortgage Industry National Home Energy Rating Standards", located on RESNET's website at:

http://natresnet.org/standards/enhancements.htm

Overview of the Rating System

Basic Structure of the Rating System

Credits and Intents

There are 36 topic areas included in the LEED for Homes Rating System. Each topic area has a unique intent or goal. Under the requirements section of each topic area, specific measures are identified that may be included in the home by the builder. Typically, these topic areas are structured as follows:

1.1 Good Practice	Usually a prerequisite (i.e., mandatory measure)
1.2 Better Practice	Usually worth 1 point
1.3 Best Practice	Usually worth 2 points

Prerequisites (or Mandatory Measures)

There are 18 mandatory measures that must be completed in every LEED certified home. These mandatory measures are itemized in Exhibit 7.

Exhibit 7
List of Prerequisites (or Mandatory Measures)

Innovation and Design Process

1.1 Preliminary Rating
2.1 Durability Planning - Pre-Construction
2.2 Wet Room Measures
2.3 Quality Management

Sustainable Sites

1.1 Site Stewardship - Erosion Controls (During Construction)
2.1 Landscaping - No Invasive Plants

Energy And Atmosphere

1.1 ENERGY STAR Home - Meets ENERGY STAR for Homes Requirements

Materials and Resources

1.1 Material Efficient Framing - Overall framing waste factor </= 10%.
2.1 Environmentally Preferable - Tropical Hardwoods, if used, must be FSC
3.1 Waste Management - Recycle cardboard; and document overall rate of diversion

Indoor Environmental Quality

2.1 Combustion Venting - Space Heating & DHW Equip w/ Closed/Power-Exhaust
4.1 Outdoor Air Ventilation - Meets ASHRAE Std 62.2
5.1 Local Exhaust - Meets ASHRAE Std 62.2
6.1 Room by Room Load Calculations per ACCA Manual J and D
7.1 >/= MERV 8 Filters
9.1 Radon Protection – Install Radon Resistant Construction if in EPA Zone 1
10.1 No Air Handling Equipment in Garage

Awareness and Education

1.1 Education for Homeowner - Basic Owner's Manual and Walkthrough

Credits (or Optional Measures)

The remaining 61 credits in the rating system are optional. However, a minimum number of points must be accrued in some of the resource categories. The resource categories with minimum point floors are show in bold in Exhibit 8. These minimum point floors (or requirements) are also shown in the gray bars in the LEED for Homes Checklist.

Exhibit 8
Summary of Prerequisite (Mandatory) and Credits (Optional) Point Requirements for the LEED for Homes Program

Resource Category	No. of Prerequisite (Mandatory) Measures	Minimum No. of Points Required	Maximum No. of Points Available
Innovation and Design Process	4	0	9
Location and Linkages	0	0	10
Sustainable Sites	2	5	21
Water Efficiency	0	3	15
Energy and Atmosphere	1	0	38
Materials and Resources	3	2	14
Indoor Environmental Quality	7	6	20
Awareness and Education	1	0	3
Total	18	18	130

Special Features of the Rating System

The LEED for Homes Rating System is a set of industry best practices that may help to guide a builder to build better homes. The actual performance of the finished home relates directly to the process that the builder uses to design and construct a LEED Home. The Rating System identifies specific measures that the builder may choose to design into his homes.

In fact, a high performance home involves the following attributes:

1. Design strategies that result in improved resource efficiency;
2. Selection of environmentally responsible and high performance materials, equipment, and systems; and
3. Construction practices that ensure that the each of the measures above are installed properly.

A builder should pay close attention to each of these steps to ensure a high quality outcome. One of the early lessons learned in the Pilot is that it is critical to incorporate LEED measures into the home's design at the earliest phase of

design. Failure to do so, may result in many unexpected challenges, including delays and mistakes.

With the basic intent to promote good design, the LEED for Homes Rating System includes the following design related features.

Innovation and Design Process Category at the Front of the Rating System

The Innovation and Design Process category was brought to the front of the LEED for Homes Rating System to highlight the importance of design in a LEED Home. The two credits below are vital parts of the design process.

Integrated Design Process Credit

The credit for an Integrated Design Process (ID1) requires the builder to participate in a builder orientation, and encourages the builder to include all of his design and construction team in regular project meetings. Establishing measurable goals up front and effectively integrating green measures into a home's design will help to ensure that the project goals are successfully met.

Durability Planning Credit

The credit for a Durability Planning (ID 2.2) requires that the builder address durability explicitly in the home design. The mandatory part of the credit requires the builder to identify specific "durability risk factors", and to identify specific measures included in the home's design to address each of these risk factors.

Other Design-Related Credits

As explained above, many of the measures in the LEED for Homes Rating System have a substantial design component. These measures are very difficult for a rater to visually verify in the field. Credits that have a design component are designated with the " " symbol. The builder's designer (or responsible party) must sign the Accountability Form to affirm that these measures have been completed per the requirements of this Rating System.

Special Cases: Credit Interpretations and Innovative Design Credits

As stated above, the 79 measures in the LEED for Homes Rating System are worth a total of 130 possible points. Aside from the requirements stated for each credit, there are two alternative methods of acquiring points using this Rating System:

Credit Interpretation —a credit interpretation is an alternative way of achieving the same intent as an existing LEED credit. It is achieved by requesting permission to meet the "intent" of a credit using an approach that is different form the stated "requirements." These requests are called credit interpretation requests (CIRs).

Innovative Design (ID)—an innovative design credit is a way of earning one or more LEED points for technologies or strategies that are not included in the Rating System but offers substantial environmental benefits. It is achieved by requesting permission for a credit / measure that is not included in the current rating system. These requests are called Innovative Design Requests (IDRs).

Guidelines for Submitting CIRs and IDRs

Both CIRs and IDRs are handled using the following process:

1. ***Provider Submits a Request to USGBC***. On behalf of a builder, a Provider may submit a Credit Interpretation Request (CIR) or an Innovative Design Request (IDR) to USGBC in order to request approval. The request/proposal should be structured like a LEED credit; that is, it should include a title, intent, rationale, requirements, and documentation/verification requirements.
2. ***USGBC Provides a Preliminary Response***. After reviewing the CIR / IDR, USGBC will respond to the Provider by indicating that the approach proposed is:
   a. Appropriate, and is eligible to earn the desired point(s),
   b. Ineligible to earn the requested point(s), or
   c. Appropriate and likely to earn the desired point(s) with some indicated modifications (e.g., additional documentation or increased performance threshold).
   In case "c," the USGBC ruling is preliminary, subject to the receipt of the indicated modifications from the Provider.
3. ***Final Rating***. At the time of the final rating, the Provider can include the credit interpretation and/or ID credits in the final scoring for that builder's LEED Home(s).

Both CIRs and IDRs must be submitted during the Preliminary Rating, and may be submitted only by the Provider on behalf of the builder.

Home Size Adjuster

Overview

The Home Size Adjuster compensates for the overarching effect of home size on resource consumption by adjusting the award level point thresholds (for certified, silver, gold, and platinum) based on home size. The adjustments are based on material and energy impacts as described below under ***Rationale***. The LEED for Homes Checklist automatically makes this adjustment when the home size and number of bedrooms are entered.

The effect of the adjuster on the award thresholds can also be determined by consulting Exhibits 10 through 12, as described below under "***Instructions***". For multifamily buildings, see ***Multifamily Adjustment*** that follows.

Instructions

1. Calculate the area of the home in square feet.[2] Include all conditioned space, whether finished or not, that meets building code requirements for living space (e.g., head room, egress, etc.).
2. Determine the number of bedrooms in the home. A "bedroom", for purposes of this adjuster, is any space that provides reasonable sleeping privacy and meets local fire and building code requirements. It is advantageous to count as bedrooms all rooms that meet this definition. When in doubt, consider whether the room in question might be used as a bedroom if another member were added the household (new baby, nanny, grandparent, exchange student, etc.); if the answer is "yes," count the room as a bedroom.
3. If there are 5 bedrooms or fewer, find the size of the home in the appropriate column in Exhibit 10. Read across the row to find the number of points in the right-hand column ("Point Added to or Subtracted from Each Threshold"). If the home is larger than the size shown in the bottom row of the applicable column, refer to Exhibit 11 to estimate the threshold adjustment, or to Exhibit 12 to calculate the adjustment.
4. If there are 6 or more bedrooms, use Exhibit 12 to calculate the adjustment.
5. Add the adjustment to the number of points needed to earn the desired award level (Certified, Silver, Gold, or Platinum). In the case of a negative adjustment (homes that are smaller than average), this will reduce the threshold for each award level (make it easier to reach); positive adjustments will increase the thresholds.

Definition

A **"bedroom"**, for purposes of this adjuster, is any space that reasonably can be used as a bedroom and meets local fire and building code requirements. (It is advantageous to count as many rooms as bedrooms as can reasonably be used for sleeping quarters.)

Rationale

All things being otherwise equal, a larger home consumes more materials and energy than a small home over its lifecycle (including pre-construction, construction, use, and demolition or deconstruction). The Threshold Adjuster compensates for these impacts by making it easier or harder to reach each LEED for homes award level. There is no impact on award thresholds for average-sized homes, whereas thresholds for smaller-than-

[2] House size is to be calculated using ANSI Standard Z765.

Exhibit 10
Threshold Adjustment Table
(Point Range: -10 to +10)

Maximum home size[3] (ft^2) by number of bedrooms						Adjustment (Points to Add to Award Thresholds*)
0 Bedrooms	1 Bedroom	2 Bedrooms	3 Bedrooms	4 Bedrooms	5 Bedrooms	
420	510	840	1140	1410	1530	-10
450	540	890	1210	1490	1610	-9
470	570	930	1270	1570	1700	-8
500	600	990	1340	1650	1790	-7
520	630	1040	1420	1740	1890	-6
550	670	1100	1490	1840	1990	-5
580	700	1160	1580	1940	2100	-4
610	740	1220	1660	2050	2220	-3
650	780	1290	1750	2160	2340	-2
680	830	1360	1850	2280	2470	-1
720	**870**	**1430**	**1950**	**2400**	**2600**	**0 ("neutral")[4]**
760	920	1510	2060	2530	2740	+1
800	970	1590	2170	2670	2890	+2
840	1020	1680	2290	2820	3050	+3
890	1080	1770	2410	2970	3220	+4
940	1140	1870	2550	3130	3390	+5
990	1200	1970	2690	3300	3580	+6
1050	1260	2080	2830	3490	3780	+7
1100	1330	2190	2990	3680	3980	+8
1160	1410	2310	3150	3880	4200	+-9
1230	1480	2440	3320	4090	4430	+10
For larger homes, or homes with more bedrooms, see below.						

Note: As an example, an Adjustment of -5 means that the threshold for a "Certified" LEED Home is 40 points (rather than the 45 points for an averaged sized home). Similarly, Silver would require a minimum of 55 points rather than 60 points; Gold would require a minimum of 70; and Platinum would require a minimum of 85 points.

Exhibit 11
Threshold Adjustment Equation

Threshold adjustment = 13 * *log* (actual home size / neutral home size) / *log* (2)

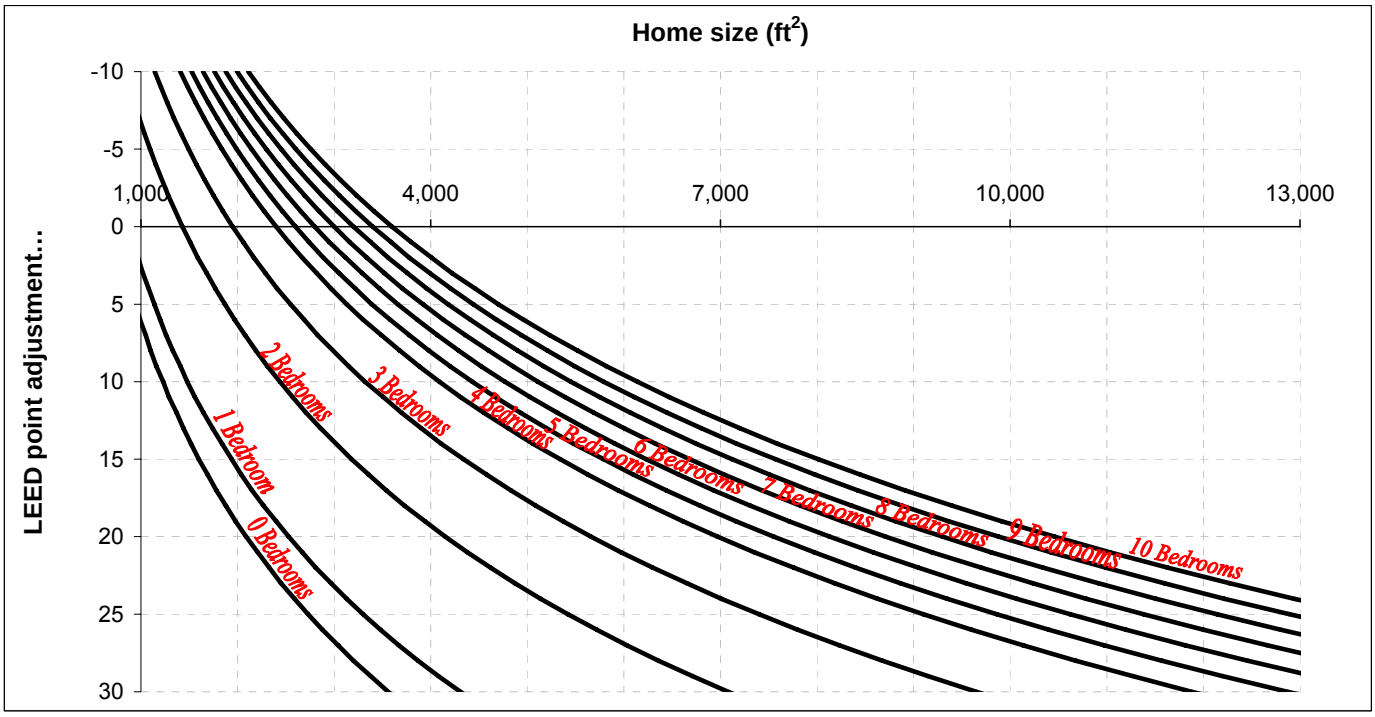
Where: the "neutral" home size can be determined from the following chart:

Number of bedrooms	0	1	2	3	4	5	Greater than 5
Neutral home size (ft^2)	720	870	1430	1950	2400	2600	200 ft^2 more for each additional bedroom (2800 for 6 bedrooms, etc.)

Note: For homes with more that 5 bedrooms, "neutral home size" is defined as follows:
2600 + [200 * (number of bedrooms – 5)]

[3] House size is to be calculated using ANSI Z765, where only the conditioned floor area of the home is to be included. Conditioned basements that meet other code requirements for living space (e.g., head room, egress, etc.) are to be included in the floor area calculation.
[4] Based on national average home sizes; data provided by NAHB.

Exhibit 12
Threshold Adjustment Curves
(Point Range: -10 and above)



average homes are reduced and thresholds for larger-than-average homes are raised. Data published by the US Census Bureau in the *American Housing Survey for 2005* shows a strong correlation between number of bedrooms and number of occupants. While a home may serve many different households over its lifespan, in general, a home with more bedrooms will serve more people. The Threshold Adjuster therefore categorizes homes by the number of bedrooms.

The relationship between home size and LEED points is based on estimated energy and materials impacts within the context of the LEED for homes rating system. Available published data and informal studies of energy and materials usage in homes revealed two key relationships:

- A 100% increase in home size yields an increase in annual energy usage of 15% to 50%, depending on the design, location, and occupants of the home.
- A 100% increase in home size yields an increase in materials usage of 40% to 90%, depending on the design and location of the home.

These data were simplified and generalized to the assumption that as home size doubles, energy consumption increases by *roughly* one-quarter and material consumption increases by *roughly* one-half; combined, these amount to an increase in impact of *roughly one-third with each doubling in home size*. Thus the point adjustment equates to one-third of the points available in the MR and EA categories combined for each doubling in home size. The equation in Exhibit C expresses this relationship.

Home Size Adjustment for Multifamily Buildings

Calculate the home size adjustment to the LEED for Homes award thresholds for the following example project:

For each unit type (0, 1, 2, 3 bedroom, etc.), respectively:

Weighted Average Home Size Adjustment for Building

= [$\sum_{\text{by unit type}}$ (home size adjustment for unit * number of units of that type in project)]
/ total number of units in project

Where:

Home size adjustment for unit

= point adjustment from Exhibit 10 or Exhibit 12 above, based on the average floor area for all units of that type

Average floor area

= total floor area in project for units of that type
/ number of units of that type

Example

1 Bedroom Units

Number of Units:	10
Total Floor Area for 1BR Units:	8,250 SF
Average Area/Unit:	825 SF
Home Size Adjustment (1 Bedroom):	-1 Point

2 Bedroom Units

Number of Units:	10
Total Floor Area for 2BR Units:	14,000 SF
Average Area/ Unit:	1,400 SF
Home Size Adjustment (2 bedroom):	0 Points

3 Bedroom Units

Number of Units:	30
Total Floor Area for 3BR Units:	51,000 SF
Avg Area/ Unit:	1,700 SF
Home Size Adjustment (3 bedroom):	-2 Points

Overall Home Size Adjustment

Weighted Average Home Size Adjustment
= [(1BR score * 1BR units)
+ (2BR score * 2BR units)
+ (3BR score * 3BR units)] / Total Units
= [(-1 * 10) + (0 * 10) +(-2 * 30)] / 50
= -1.4 (round to -1.0)

Thus, the LEED for Homes award thresholds for this multifamily building are:

Certified:	44 Points	Gold:	74 Points
Silver:	59 Points	Platinum:	89 Points

LEED for Homes Checklist

Project Checklist

LEED for Homes

Builder Name:	
Home Address (Street/City/State):	

Input Values: No of Bedrooms: *4* Floor Area (SF): *2400*

Minimum No. of Points Required: Certified: *45* Silver: *60* Gold: *75* Platinum: *90*

Detailed information on the measures below are provided in the companion document "LEED for Homes Rating System"

Y / Pts	No	N/A						Max Points Available
			Innovation and Design Process (ID)		(Minimum of 0 ID Points Required)			9
			1.1	**Integrated Project Planning**	Preliminary Rating			Prerequisite
			1.2		Integrated Project Team			1
			1.3		Design Charrette			1
			2.1	**Quality Management for**	Durability Planning; (Pre-Construction)			Prerequisite
			2.2	**Durability**	Wet Room Measures			Prerequisite
			2.3		Quality Management			Prerequisite
			2.4		Third-Party Durability Inspection			3
			3.1	**Innovative / Regional Design**	Provide Description and Justification for Specific Measure			1
			3.2		Provide Description and Justification for Specific Measure			1
			3.3		Provide Description and Justification for Specific Measure			1
			3.4		Provide Description and Justification for Specific Measure			1
0			Sub-Total					
Y / Pts	No	N/A						
			Location and Linkages (LL)		(Minimum of 0 LL Points Required)		OR	10
HOLD			1	**LEED-ND Neighborhood**			**LL2-5**	10
			2	**Site Selection**	Avoid Environmentally Sensitive Sites and Farmland		**LL1**	2
			3.1	***Preferred Locations***	Select an Edge Development Site		**LL1**	1
			3.2		***OR*** Select an Infill Site		**LL1**	2
			3.3		Select a Previously Developed Site		**LL1**	1
			4	**Infrastructure**	Site within 1/2 Mile of Existing Water and Sewer		**LL1**	1
			5.1	**Community Resources**	Basic Community Resources / Public Transportation		**LL1**	1
			5.2	**& Public Transit**	***OR*** Extensive Community Resources / Public Transportation		**LL1**	2
			5.3		***OR*** Outstanding Community Resources / Public Transportation		**LL1**	3
			6	***Access to Open Space***	Publicly Accessible Green Spaces		**LL1**	1
0			Sub-Total					
Y / Pts	No	N/A						
			Sustainable Sites (SS)		(Minimum of 5 SS Points Required)		OR	21
			1.1	**Site Stewardship**	Erosion Controls (During Construction)			Prerequisite
			1.2		Minimize Disturbed Area of Site			1
			2.1	**Landscaping**	No Invasive Plants			Prerequisite
			2.2		Basic Landscaping Design			2
			2.3		Limit Turf			3
			2.4		Drought Tolerant Plants			2
			3	**Shading of Hardscapes**	Locate and Plant Trees to Shade Hardscapes			1
			4.1	**Surface Water Management**	Design Permeable Site			4
			4.2		Design and Install Permanent Erosion Controls			2
			5	**Non-Toxic Pest Control**	Select Insect and Pest Control Alternatives from List			2
			6.1	**Compact Development**	Average Housing Density ≥ Units / Acre		**LL1**	2
			6.1		***OR*** Average Housing Density ≥ 10 Units / Acre		**LL1**	3
			6.3		***OR*** Average Housing Density ≥ 20 Units / Acre		**LL1**	4
0			Sub-Total					
Y / Pts	No	N/A						
			Water Efficiency (WE)		(Minimum of 3 WE Points Required)		OR	15
			1.1	**Water Reuse**	Rainwater Harvesting System			4
			1.2		Grey Water Re-Use System			1
			2.1	**Irrigation System**	Select High Efficiency Measures from List			3
			2.2		Third Party Verification			1
			2.3		***OR*** Install Landscape Designed by Licensed or Certified Professional		**WE 2.2**	4
			3.1	**Indoor Water Use**	High Efficiency Fixtures (Toilets, Showers, and Faucets)			3
			3.2		**OR** Very High Efficiency Fixtures (Toilets, Showers, and Faucets)		**WE 3.1**	6
0			Sub-Total					

Project Checklist (cont'd)

HERS Index Value Achieved: 80
IECC Climate Zone: 6

EA 1.2 Pts Achieved: 0.0

Y / Pts	No	N/A							
Energy and Atmosphere (EA)						(Minimum of 0 EA Points Required)	OR	**38**
				1.1	**ENERGY STAR Home**	Meets ENERGY STAR for Homes with Third-Party Testing		Prerequisite
				1.2		Exceeds ENERGY STAR for Homes	**EA 2-10**	34
			✎	7.1	**Water Heating**	Improved Hot Water Distribution System		2
				7.2		Pipe Insulation		1
			✎	11	**Refrigerant Management**	Minimize Ozone Depletion and Global Warming Contributions		1
0					Sub-Total (or Sub-Total from Adendum A - Prescriptive EA Credits)			
Y / Pts	No	N/A						
Materials and Resources (MR)						(Minimum of 2 MR Points Required)		**14**
			✎	1.1	**Material Efficient Framing**	Overall Waste Factor for Framing Order Shall be No More than 10%.		Prerequisite
				1.2		Advanced Framing Techniques		3
				1.3	***OR***	Structurally Insulated Panels	**MR 1.2**	2
			✎	2.1	**Environmentally Preferable**	Tropical Woods, if Used, Must be FSC		Prerequisite
			✎	2.2	**Products**	Select Environmentally Preferable Products from List		8
			✎	3.1	**Waste Management**	Document Overall Rate of Diversion		Prerequisite
				3.2		Reduce Waste Sent to Landfill by 25% to 100%		3
0					Sub-Total			
Y / Pts	No	N/A						
Indoor Environmental Quality (IEQ)						(Minimum of 6 IEQ Points Required)	OR	**20**
				1	**ENERGY STAR with IAP**	Meets ENERGY STAR w/ Indoor Air Package (IAP)	**IEQ2-10**	11
				2.1	**Combustion Venting**	Space Heating & DHW Equip w/ Closed/Power-Exhaust	**IEQ 1**	Prerequisite
				2.2		Install High Performance Fireplace	**IEQ 1**	2
			✎	3	**Moisture Control**	Analyze Moisture Loads AND Install Central System (if Needed)	**IEQ 1**	1
			✎	4.1	**Outdoor Air Ventilation**	Meets ASHRAE Std 62.2	**IEQ 1**	Prerequisite
				4.2		Dedicated Outdoor Air System (w/ Heat Recovery)	**IEQ 1**	2
				4.3		Third-Party Testing of Outdoor Air Flow Rate into Home		1
			✎	5.1	**Local Exhaust**	Meets ASHRAE Std 62.2	**IEQ 1**	Prerequisite
				5.2		Timer / Automatic Controls for Bathroom Exhaust Fans	**IEQ 1**	1
				5.3		Third-Party Testing of Exhaust Air Flow Rate Out of Home		1
			✎	6.1	**Supply Air Distribution**	Meets ACCA Manual D	**IEQ 1**	Prerequisite
				6.2		Third-Party Testing of Supply Air Flow into Each Room in Home		2
				7.1	**Supply Air Filtering**	≥ 8 MERV Filters, w/ Adequate System Air Flow	**IEQ 1**	Prerequisite
				7.2	***OR***	≥ 10 MERV Filters, w/ Adequate System Air Flow		1
				7.3	***OR***	≥ 13 MERV Filters, w/ Adequate System Air Flow		2
				8.1	**Contaminant Control**	Seal-Off Ducts During Construction	**IEQ 1**	1
				8.2		Permanent Walk-Off Mats *OR* Shoe Storage *OR* Central Vacuum		2
			✎	8.3		Flush Home Continuously for 1 Week with Windows Open		1
			✎	9.1	**Radon Protection**	Install Radon Resistant Construction if Home is in EPA Zone 1	**IEQ 1**	Prerequisite
			✎	9.2		Install Radon Resistant Construction if Home is not in EPA Zone 1	**IEQ 1**	1
				10.1	**Garage Pollutant Protection**	No Air Handling Equipment OR Return Ducts in Garage	**IEQ 1**	Prerequisite
				10.2		Tightly Seal Shared Surfaces between Garage and Home	**IEQ 1**	2
				10.3		Exhaust Fan in Garage		1
				10.4	***OR***	Detached Garage or No Garage	**IEQ 1**	3
0					Sub-Total			
Y / Pts	No	N/A						
Awareness and Education (AE)						(Minimum of 0 AE Points Required)		**3**
			✎	1.1	**Education for Homeowner**	Basic Occupant's Manual and Walkthrough of LEED Home		Prerequisite
			✎	1.2	**and/or Tenants**	Comprehensive Occupant's Manual and Multiple Walkthroughs / Trainings		1
			✎	1.3		Public Awareness of LEED Home		1
			✎	2.1	**Education for Building Mgrs**	Basic Building Manager's Manual and Walkthrough of LEED Home		1
0					Sub-Total			
0					**Project Totals (pre-certification estimates)**			***130***

Detailed information on the measures below are provided in the companion document "LEED for Homes Rating System"

Y / Pts	No	N/A			Energy and Atmosphere (EA)	(Minimum of 0 EA Points Required)	OR	Max Points Available
				2.1	**Insulation**	Third-Party Inspection of Insulation, At Least HERS Grade II	**EA 1**	Prerequisite
			✎	2.2		Third-Party Inspection of Insulation, Grade I AND 5% above code	**EA 1**	2
				3.1	**Air Infiltration**	Third-Party Envelope Air Leakage Tested </= 7.0 ACH50 (CZ 1-2)	**EA 1**	Prerequisite
				3.2		Third-Party Envelope Air Leakage Tested </= 5.0 ACH50 (CZ 1-2)	**EA 1**	2
				3.3		***OR*** Third-Party Envelope Air Leakage Tested </= 3.0 ACH50	**EA 1**	3
				4.1	**Windows**	Windows Meet ENERGY STAR for Windows (See Table)	**EA 1**	Prerequisite
				4.2		Windows Exceed ENERGY STAR for Windows (See Table)	**EA 1**	2
				4.3		***OR*** Windows Exceed ENERGY STAR for Windows (See Table)	**EA 1**	3
				5.1	**Duct Tightness**	Third-Party Duct Leakage Tested </= 4.0 CFM25 / 100 SF to Outside	**EA 1**	Prerequisite
				5		Third-Party Duct Leakage Tested </= 3.0 CFM25 / 100 SF to Outside	**EA 1**	2
				5.3		***OR*** Third-Party Duct Leakage Tested </= 1.0 CFM25 / 100 SF to Outside	**EA 1**	3
			✎	6.1	**Space Heating and Cooling**	Meets ENERGY STAR for HVAC w/ Manual J & refrigerant charge test	**EA 1**	Prerequisite
				6.2		HVAC is Better than ENERGY STAR	**EA 1**	2
				6.3		***OR*** HVAC Substantially Exceeds ENERGY STAR	**EA 1**	4
			✎	7.1	**Water Heating**	Improved Hot Water Distribution System		2
				7.2		Pipe Insulation		1
				7.3	**Water Heating**	Improved Water Heating Equipment	**EA 1**	3
				8.1	**Lighting**	Install at Least Three ENERGY STAR labeled Light Fixtures (or CFLS)	**EA 1**	Prerequisite
				8.2		Energy Efficient Fixtures and Controls	**EA 1**	2
			✎	8.3		***OR*** ENERGY STAR Advanced Lighting Package	**EA 1**	3
				9.1	**Appliances**	Select Appliances from List	**EA 1**	2
				9.2		Very Efficient Clothes Washer (MEF > 1.8, *AND* WF< 5.5)	**EA 1**	1
			✎	10	**Renewable Energy**	Renewable Electric Generation System (1 Point / 5% Reduction)	**EA 1**	10
			✎	11	**Refrigerant Management**	Minimize Ozone Depletion and Global Warming Contributions		1
0					Sub-Total			

By affixing my signature below, the undersigned does hereby declare and affirm to the USGBC that the LEED for Homes requirements, as specified in the LEED for Homes Rating System, have been met for the indicated credits and will, if audited, provide the necessary supporting documents.

Builder's Name _____ Company _____

Signature _____ Date _____

By affixing my signature below, the undersigned does hereby declare and affirm to the USGBC that the required inspections and performance testing for the LEED for Homes requirements, as specified in the LEED for Homes Rating System, have been completed, and will provide the project documentation file, if requested.

Rater's Name _____ Company _____

Signature _____ Date _____

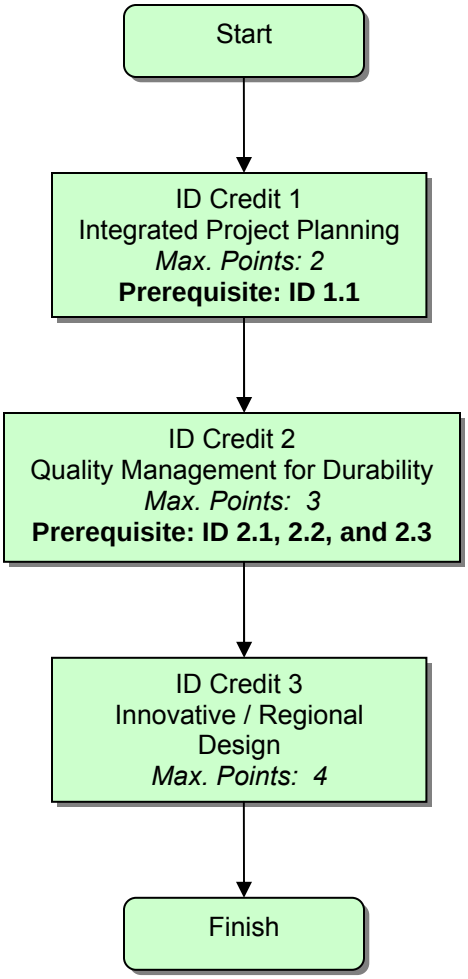
By affixing my signature below, the undersigned does hereby declare and affirm to the USGBC that the required inspections and performance testing for the LEED for Homes requirements, as specified in the LEED for Homes Rating System, have been completed, and will provide the project documentation file, if requested.

Provider's Name _____ Company _____

Signature _____ Date _____

Detailed Description of the Credits in the LEED For Homes Rating System

Innovation and Design Process (ID)



ID 1. Integrated Project Planning

Maximum Points: 2

Intent

Maximize opportunities for integrated, cost-effective adoption of green design and construction strategies.

Requirements

Prerequisite (Mandatory Measure)

1.1 ***Preliminary Rating.*** Prior to construction, conduct a Preliminary LEED for Homes Rating meeting including participation from the builder, the Provider, and key members of the project team. As part of the meeting, create an action plan that identifies:

- The targeted LEED award level (Certified, Silver, Gold, or Platinum);
- The LEED for Homes credits that have been selected to meet the targeted award level; and
- The party accountable for meeting the LEED for Homes requirements for each selected credit.

Credits (Optional Measures)

1.2 ***Integrated Project Team*** (1 Point.) Assemble and involve a project team to meet the three criteria below:

i. Engage individuals or organizations whose capabilities include at least three of the follow skill sets:
   - Architecture or residential building design
   - Mechanical or energy engineering
   - Building science or performance testing
   - Green building or sustainable design
   - Civil engineering, landscape architecture, habitat restoration, or land planning

ii. Actively involve all team members referenced above in at least three of the following phases of the home design and construction process:
   - Conceptual/schematic design
   - LEED planning
   - Preliminary design
   - Energy/envelope systems analysis or design
   - Design development
   - Final design, working drawings, or specifications
   - Construction

iii. Conduct meetings with the project team at least monthly to review project status, introduce new team members to project goals, discuss problems encountered, formulate solutions, review responsibilities, and identify next steps.

1.3 ***Design Charrette*** (1 Point.) No later than the design development phase and preferably during schematic design, conduct at least one full-day integrated design workshop with the project team as defined in ID1.2 above. The goal of the workshop shall be to optimize the integration of green strategies across all aspects of the building design, drawing on the expertise of all participants.

Verification / Submittals

The Provider's third-party rater shall:

Prerequisite 1.1: Preliminary Rating

- ✓ Confirm with the Provider that the Preliminary Rating was completed; and
- ✓ Check the appropriate box on the LEED for Homes checklist.

Credit 1.2: Integrated Project Team

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the builder or responsible party, declaring that the project team meets the 3 criteria above,
- ✓ Place the completed Accountability Form in Project Documentation File; and
- ✓ Check the appropriate box on the LEED for Homes checklist.

Credit 1.3: Design Charrette

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the builder or responsible party, declaring that the requirements for the charrette above have been met,
- ✓ Place the completed Accountability Form in Project Documentation File; and
- ✓ Check the appropriate box on the LEED for Homes checklist.

Synergies and Trade-Offs

This credit is intended to promote an integrated, systems-oriented, approach to green project design and development.

Completion of ID 1.1 and 1.3 corresponds to the Green Development Plan, a mandatory measure in the Enterprise Foundation's Green Communities Initiative.

Affordable housing projects that participate in LEED for Homes and also complete the mandatory components of the Green Communities Initiative may be eligible for financial and technical assistance from the Enterprise Foundation. Contact Enterprise Community Partners for further information at www.enterprise.org.

Additional Information

Rationale

Green building experts now commonly acknowledge that the most cost-effective and successful green projects result from early and frequent interactions among all key team members.

Technologies & Strategies

TBD

Resources and References

National Charrette Institute

TBD

ID 2. Quality Management for Durability *Maximum Points: 3*

Intent

Promote durability and high performance of the building enclosure and its components and systems through appropriate design, materials selection, and construction practices.

Requirements

Prerequisites (Mandatory Measures)

2.1 ***Durability Planning***. Prior to construction, the builder shall:

- Complete a ***Durability Evaluation*** (see Exhibit ID2-A) to identify all moderate and high risk durability issues for the building enclosure;
- Develop strategies to respond to those issues; ***and***
- Incorporate those strategies into project documentation.

See ***Technologies & Strategies*** below and the electronic ***Durability Guidelines*** (available from Provider) for specific guidance on completing these steps.

2.2 ***Indoor Moisture Control.*** All applicable wet room strategies listed below shall be incorporated in the home:

- Use non-paper-faced backer board on walls of tub, shower, and spa areas.
- Use water-resistant flooring in kitchens, bathrooms, and spa areas and within 3 feet of exterior doors. Do not install carpet in these areas.
- For any water heater installed in or over living space, install a drain and drain pan. Tankless heaters are exempt.
- For any washer installed in or over living space, install a drain and drain pan or install an accessible, single-throw supply valve.

2.3 ***Quality Management.*** Prior to construction, the builder shall have a quality management program in place to ensure implementation of the durability strategies during construction.

Credits (Optional Measures)

2.4 ***Third Party Durability Inspection***. (3 Points.) The builder shall complete a Durability Inspection Checklist (see Attachment D), which the Provider shall use to verify implementation of the builder's durability strategies.

Verification / Submittals

The Provider's third-party rater shall:

Prerequisite 2.1: Durability Plan

- ✓ Receive a copy of the durability plan, and place it in:
  - The home owner's manual, and
  - The project documentation file.
- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the builder or responsible party (declaring that a durability plan exists), and place the completed Accountability Form in Project Documentation File; and
- ✓ Check the appropriate box on the LEED for Homes checklist.

Exhibit ID2-A
Durability Evaluation

Issue Type	Degree of Risk (l/m/h)	Protection Systems	Related Credits
Exterior water		Bulk water: Weatherlap drainage plane; design vapor profile with designated drying potential. Capillary action: include capillary breaks.	
Interior water / "wet" rooms		Room-specific strategies	IEQ
Air infiltration		Air barrier	IEQ
Interstitial condensation		Vapor profile that prevents interstitial condensation	IEQ, EA
Heat loss		Thermal barrier	EA
Ultraviolet radiation		Site storage of UV-sensitive materials and strategy for priming and finishing in one week or less	
Pests		Insect and rodent protection systems	SS5
Natural disaster (Hurricane, tornado, earthquake, flood, wildfire, etc.) Types:		See Resources sheet for specific guidance.	
Other:			

Prerequisite 2.2: Requirements for Wet Rooms

- ✓ Visually inspect that the 3 criteria above, have been satisfied; and
- ✓ Check the appropriate box on the LEED for Homes checklist.

Prerequisite 2.3: Third Party Inspection.

- ✓ Prepare a Durability Inspection Checklist and inspection schedule for each measure in the durability plan;
- ✓ Visually inspect that all measures listed on the Durability Inspection Checklist have been installed;
- ✓ Complete the Durability Inspection Checklist (see Exhibit ID 2-B) and include it in the project documentation file; and
- ✓ Check the appropriate box on the LEED for Homes checklist.

Synergies and Trade-Offs

This credit is intended to promote an integrated, systems-oriented, approach to quality management of building enclosure durability issues. A number of other credits in LEED for Homes address related issues, including:

- IEQ 5 (mechanical ventilation);
- EA 3 (air leakage);
- EA 2 and EA 4 (heat flow);
- EA 1, EA 4, and MR 5 (protection from ultraviolet radiation);
- IEQ 3, 4, and 6 (mechanical ventilation systems); and
- SS 5 (pest management).

Many durability strategies worth considering as part of a quality management program are mandatory and/or earn credit in programs that take a more prescriptive approach to moisture management, durability, indoor air quality, and related issues. Such programs include Energy Star for Homes with Indoor Air Package (IAP – see IEQ 1), Enterprise Foundation's Green Communities Initiative, Vermont Builds Greener, Masco's Environments for Living program, and the California Green Builder program. The Durability Inspection Checklist includes a list of strategies that are required or rewarded in other programs.

Builders with robust quality management programs often experience reductions in callbacks, warranty claims, and litigation, and also may have access to more attractive insurance options.

Additional Information

Rationale

Quality problems can substantially shorten the life of the assemblies, systems, and/or materials in a home and indeed the home itself. While quality management programs can not *guarantee* improved quality, there are precedents – in the insurance industry in particular – supporting the premise that a program explicitly aimed at improving quality can indeed correlate to improved performance, as measured by decreases in warranty claims for quality-related defects and failures. Development and implementation of strategies as prescribed herein will help to ensure that appropriate attention is paid to critical quality-related measures.

This credit places emphasis on the building enclosure (envelope) because the enclosure is most frequently affected by quality problems and also because interior surfaces and finishes are often removed or remodeled due to matters of taste rather than due to quality problems.

There is great interest in developing more prescriptive approaches to the management of durability issues. However, the variables that affect the choice of durability strategies are too numerous and diverse to catalog; hence the project team must analyze and select the most appropriate strategies for each unique project. The only universal requirements – those for indoor moisture control – relate to moisture conditions that occur in all homes, independent of building type or location specifics.

Technologies & Strategies

There are eight key durability risk areas that should be assessed in every home:

i. Exterior water
ii. Interior water (including wet rooms)
iii. Interstitial condensation
iv. Uncontrolled heat flow
v. Uncontrolled air flow
vi. Ultraviolet radiation
vii. Pests
viii. Natural Disasters (hurricane, tornado, earthquake, flood, wildfire, etc.

Depending on the location and general type of construction of the home, some of these factors may be more important than others. The builder should assess the relative importance of these risk factors (i.e., high, medium, or low risk). If any of these risk factors is medium or high, the builder should identify explicit strategies and measures (i.e., technologies and /or practices) that are to be designed into the homes to address these risks.

Effective durability strategies should take into consideration all applicable building systems, assemblies, components, and areas, including:

- Foundations (i.e., slabs, basements, crawl spaces)
- Framing (i.e., structural members, flooring, walls, roof)
- Exterior wall systems (i.e., insulation, air sealing, sheathing, drainage planes, exterior materials and finishes)
- Openings (windows and doors)
- HVAC systems (i.e., air conditioning, outdoor ventilation, local exhaust, heat/energy recovery, dehumidification)
- Moisture-generating rooms – baths, kitchens, laundry rooms

A robust quality management program should explicitly require that each durability strategy be drawn and/or described in the relevant project documents, as outlined below, *addressing all key components and systems and their connections, intersections, and interactions*.

- *Construction Details.* Develop and record construction methods in detailed architectural drawings as needed to effectively communicate details of assembly.
- *Component and System Specifications.* Select components and systems based on each durability strategy. Record selections as needed in drawings, specifications, and/or scopes of work.
- *Scopes of Work.* Develop construction/installation scopes of work for each trade contractor based on the enclosure management strategies. [Note: We recommend that builders pursuing ID 2.3 incorporate in each scope of work, by reference, the ***Verification Checklist***, and require completion of the relevant portions of the checklist by the applicable trade contractor.]
- *Testing Requirements.* Work with the Provider, third-party rater, or other qualified party to identify and specify any testing that will be needed to verify the performance of installed quality measures (e.g., hosing down window walls to test resistance to moisture penetration). (Provider will perform testing.)

If the development (or refinement) of a comprehensive quality management program for a durable building enclosure is a new or challenging task, it may be helpful to engage a qualified third-party expert in quality, durability, and/or building science to conduct a detailed review of drawings, specifications, and scopes of work.

Resources and References

The Durability Inspection Checklist includes Durability Evaluation Information, the Inspection Checklist, Durability Strategies, and Resources (i.e., links to numerous helpful information sources and tools).

The USGBC is indebted to the following for their expertise and invaluable contributions to this credit.

- The Building Science Consortium of the U.S. Department of Energy's Building America program, www.buildingscience.com
- MASCO Corporation, www.masco.com
- 3-D Building Solutions, LLC, http://www.3-d-buildingsolutions.com

ID 3. Innovative / Regional Design **Maximum *Points: 4***

Intent

Minimize the environmental impact of the home through incorporating additional green design and construction measures that have tangible and demonstrable benefits beyond those contained in the LEED for Homes Rating System.

Requirement

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

3.1 Innovation #1. (1 Point.) The builder shall prepare a written submittal to USGBC / LEED for Homes that explains:

- The intent of the credit; and
- The proposed requirement for compliance; and
- The proposed documentation to demonstrate compliance; and
- A description and an estimate of the benefit / impact provided by the proposed measure.

3.2 Innovation #2 (1 Point)

3.3 Innovation #3 (1 Point)

3.4 Innovation #4 (1 Point)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Request approval from Provider for this credit during the preliminary rating. USGBC will record all ID requests.
- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the innovative measure installed meets the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Additional Information

Rationale

To be provided by the builder.

Potential Technologies and Strategies

Suggested uses include:

- Exceptional performance (e.g., achieving twice the required threshold) in another LEED for Homes credit;

- Innovative design strategies; or
- Emerging technologies, materials, or construction practices.

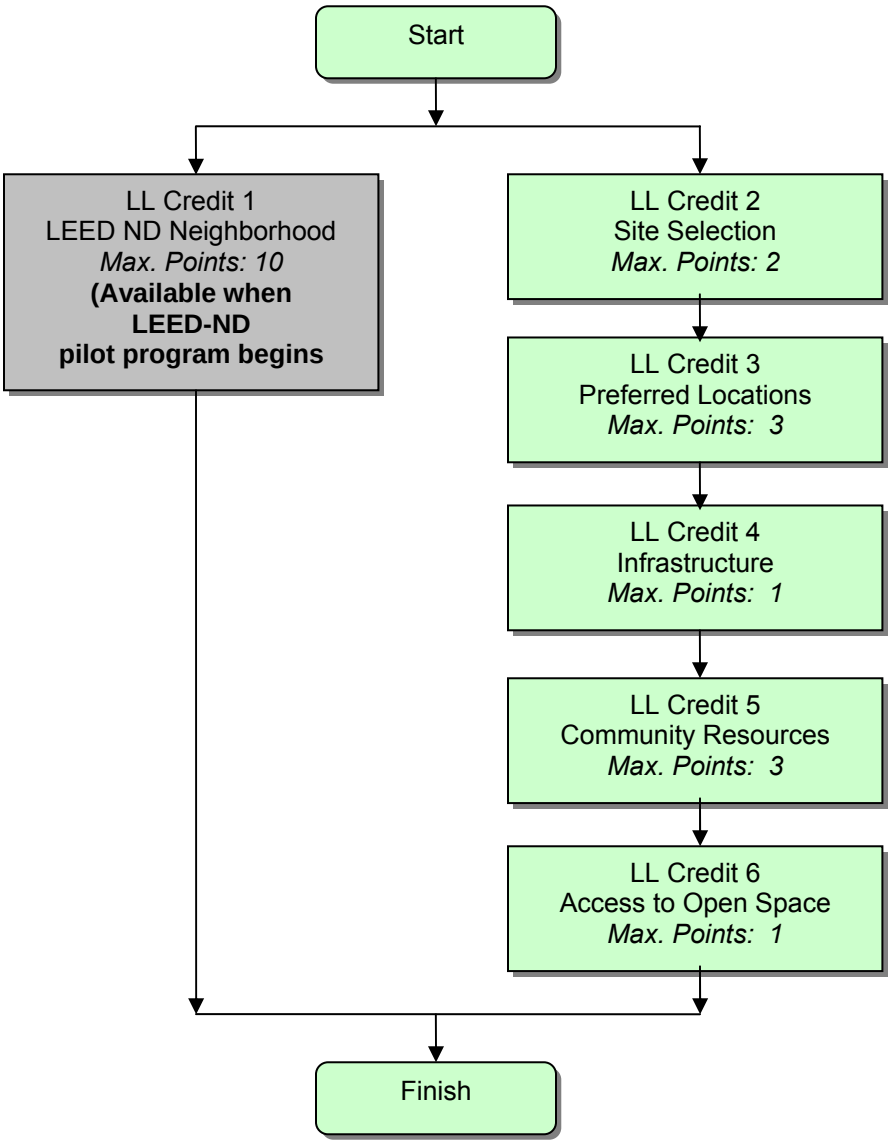
Resources and References

TBD

Location and Linkages (LL)

Optional Pathways Through LL Credits

Note: LL1 will become applicable when the LEED for Neighborhood Development pilot program begins; check www.usgbc.org/leed/nd for the latest on LEED-ND.



LL 1. LEED–ND Neighborhood

Maximum *Points: 10*

Note: LL1 will be applicable once the LEED-ND pilot program begins and/or LEED-ND final balloted LEED-ND rating system is available.

Intent

Encourage the building of LEED Homes in LEED-ND certified developments, thereby minimizing the environmental impact of land development practices.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

1. ***LEED–ND Neighborhood***. (10 Points.) Complete the requirements of the LEED for Neighborhood Development (LEED-ND) certification program.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Include a copy of the LEED-ND certification for the community in the project documentation file; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using LL1, then must skip credits LL2-6.

Additional Information

Rationale

LEED-ND certified neighborhood developments, which will incorporate the principles of smart growth and pedestrian-oriented design, offer many benefits over conventional developments, including: more efficient use of land, reduced development and fragmentation of farmland and wilderness, reduced need for infrastructure extension, and a wider and more sustainable range of transportation options—including walking, biking, or access to mass transit.

Potential Technologies and Strategies

Choose to build on sites that promote smart and effective growth management and do not contribute to sprawl.

Resources and References

The LEED-ND Rating System (pilot version, and later the final balloted version)

LL 2. Site Selection

Maximum *Points: 2*

Intent

Avoid development on environmentally sensitive sites.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

2. ***Site Selection***. (2 Points.) Do not develop buildings, built structures, roads, or parking areas on portions of sites that meet any one of the following criteria:
   - Land whose elevation is lower than the 100-year flood as defined by FEMA.
   - Land which is specifically identified as habitat for any species on Federal or State threatened or endangered lists.
   - Within 100 feet of any water including wetlands as defined by United States Code of Federal Regulations 40 CFR, Parts 230-233 and Part 22, and isolated wetlands or areas of special concern identified by state or local rule, OR within distances given in applicable state or local regulations, whichever is more stringent.
   - Land which prior to acquisition for the project was public parkland, unless land of equal or greater value as parkland is accepted in trade by the public landowner (Park Authority projects are exempt).
   - Land defined as prime farmland by the United States Department of Agriculture in the United States Code of Federal Regulations, Title 7, Volume 6, Parts 400 to 699, Section 657.5 (citation 7CFR657.5).

Notes: 1. New wetlands constructed as part of stormwater mitigation, or other site restoration efforts, are excluded from the above definitions.

2. "Prime Farmland" is defined as land that meets both of the following criteria:

Land Use: Has been used for irrigated agricultural production at some time during the four years prior to the Important Farmland Map date. Irrigated land use is determined by FMMP staff during examination of current aerial photos, local comment letters and field verification; and

Soil: The soil must meet the physical and chemical criteria for Prime Farmland or Farmland of Statewide Importance as determined by the USDA Natural Resources Conservation Service (NRCS). NRCS compiles lists of which soils in each survey area meet the quality criteria.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment C) is signed by the civil engineer or responsible party, declaring that the project site meets the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using credit LL1, then must skip this credit.

Additional Information

Rationale

"Green" homes should be built in locations that are safe for inhabitants and the surrounding community, both human and ecological, and should not contribute to the degradation or loss of our agricultural and natural resource lands. Avoid building on sites that are environmentally sensitive or precious resources.

Potential Technologies and Strategies

Evaluate potential building sites for these criteria prior to purchasing the land, and/or ensure that these criteria are addressed by the designer during the conceptual design phase. Utilize landscape architects, ecologists, environmental engineers, civil engineers, and similar professionals for the screening process. New wetlands constructed as part of storm water mitigation or other site restoration efforts are not affected by the restrictions of this credit.

Resources and References

TBD

LL 3. Preferred Locations

Maximum *Points: 2*

Intent

Encourage the building of LEED Homes near or within existing communities.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

3.1 ***Edge Development Site***. (1 Point.) Select an edge development site such that at least 25% of the perimeter of the development site (the area where new homes are being built) borders existing development.

OR

3.2 ***Infill Site***. (2 Points.) Select an infill site such that at least 75% of the perimeter of the development site (the area where new homes are being built) borders existing development.

3.3 ***Previously Developed Site***. (1 Point.) Build on a previously developed site.

Note: ***Previously developed sites*** are defined as having pre-existing paving, construction, or altered landscapes on at least 75% of the site area. (It does not refer to altered landscapes resulting from current agricultural use, forestry use, or use as a preserved natural area)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment C) is signed by the civil engineer or responsible party, declaring that the project site meets the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using credit LL1, then must skip this credit.

Additional Information

Rationale

TBD

Potential Technologies and Strategies

TBD

Resources and References

TBD

LL 4. Infrastructure

Maximum *Points: 1*

Intent

Encourage the building of LEED Homes in developments that are served by or are near existing infrastructure (i.e., sewers and water supply).

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

4. ***Existing Infrastructure***. (1 Point.) Select a site that is within ½ mile of existing water service lines and sewer service lines.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Inspect the selected sites, to affirm that the requirements have been met; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using credit LL1, then must skip this credit.

Additional Information

Rationale

To encourage the efficient use and reuse of land, and to minimize fragmentation of undeveloped land (and reduce other associated environmental impacts of infrastructure extension) by channeling development to locations immediately adjacent to existing development.

Potential Technologies and Strategies

During the site- selection process, give preference to previously developed sites with urban development potential.

Resources and References

TBD

LL 5. Community Resources

Maximum *Points: 3*

Intent

Encourage the building of LEED Homes in development patterns that allow for walking, biking, or transit as alternative means of transportation to necessary services (thereby minimizing dependency on personal automobiles and their associated environmental impacts).

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

Note: For developers of larger communities, the distances below can be measured from the center of the community, as long as the distance from the center of the community to the furthest home does not exceed ¼ mile. Using this approach, whole communities can be qualified for this credit. For any homes further than ¼ mile from the center of the community, distances must be recalculated for each home.

5.1 ***Basic Community Resources***. (1 Point.) Select a site with walkable access to four (within ¼ mile) or seven (within ½ mile) basic community resources (see list in Exhibit LL-4A) ***OR*** proximity to transit service (within ¼ mile for bus; ½ mile for train or ferry).

OR

5.2 ***Extensive Community Resources***. (2 Points.) Select a site within ¼ mile of seven basic community resources or within ½ mile of eleven basic community resources (see list in Exhibit LL4-A) ***OR*** select a site within ½ mile of transit services constituting 60 or more transit rides per weekday (combined bus, rail, and ferry).

OR

5.3 ***Outstanding Community Resources***. (3 Points.) Select a site within ¼ mile of eleven basic community resources or within ½ mile of fourteen basic community resources (see list in Exhibit LL4-A) ***OR*** select a site within ½ mile of transit services constituting 125 or more transit rides per weekday (combined bus, rail, and ferry).

"Transit rides per weekday" are to be calculated as follows: (1) within a ½ mile radius, count all the transit stops; (2) multiply each transit stop by the number of buses/trains/ferries that pass through that stop per day; (3) add the total number of rides available at each stop within ½ mile together. Example: if there are 4 bus stops, and at each bus stop the service frequency is half-hourly (48 times per day), the total transit rides per day would be 192. .

Exhibit LL5-A
List of Basic Community Resources

- ☐ Arts and Entertainment Centers
- ☐ Banks
- ☐ Community or Civic Center
- ☐ Convenience Store
- ☐ Daycare Center
- ☐ Fire Station
- ☐ Fitness Center /Gym
- ☐ Laundry or Dry Cleaner
- ☐ Library
- ☐ Medical or Dental Office Park
- ☐ Pharmacy
- ☐ Police Station
- ☐ Post Office
- ☐ Place of Worship
- ☐ Restaurant
- ☐ School
- ☐ Supermarket
- ☐ Other neighborhood-serving retail
- ☐ Other office building or major employment center

Note: Up to two of each type of community resource may be counted. For example, two restaurants may count for two of the four community resources (within ¼ mile) in LL 4.1.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Inspect the site and surrounding community (or site/community map if available), to affirm that the appropriate community resources are within the required distances; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using LL Credit LL1, then must skip this credit.

Additional Information

Rationale

Studies have shown that to minimize the number of daily auto trips, the home site(s) will have:

1. Transportation alternatives available (e.g., walking, bicycling, and transit), and
2. Close access to a variety of daily-needs destinations.

Benefits include reduced energy consumption (and other associated environmental impacts) from personal vehicle transportation and associated infrastructure. Neighborhoods with nearby services also encourage a more active lifestyle, correlating to reduced health risks due to heart disease, obesity, etc.

Potential Technologies and Strategies

Select sites near public transit and/or community services and amenities that are accessible by safe, convenient pedestrian pathways.

Resources and References

TBD

LL 6. Access to Open Space

Maximum *Points: 1*

Intent

Encourage the building of LEED Homes on land that has already been developed.

Requirements

Prerequisites (Mandatory Measures)

None

Optional Measures

6. ***Publicly Accessible Green Space***. (1 Point.) Select a site within ½ mile of a community-based open space that is at least ¾ acre in size.

Note: "Community-based open spaces" are defined as publicly accessible land that consists predominantly of unsealed, permeable surfaces such as soil, grass, shrubs, and trees. These include natural open spaces, city, county, and state parks, play areas, and other community open spaces specifically intended for recreational use. Ponds can be counted as open space if they border a walking or bicycle path. They also include private lands open to the public for passive recreation provided that there is 1) deeded public access, or 2) a history of allowable public use and anticipated continued future public use for at least 10 years.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Inspect the site and surrounding community (or site/community map if available), to affirm that the open space is within the required distance; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using LL Credit LL1, then must skip this credit.

Additional Information

Rationale

TBD

Potential Technologies and Strategies

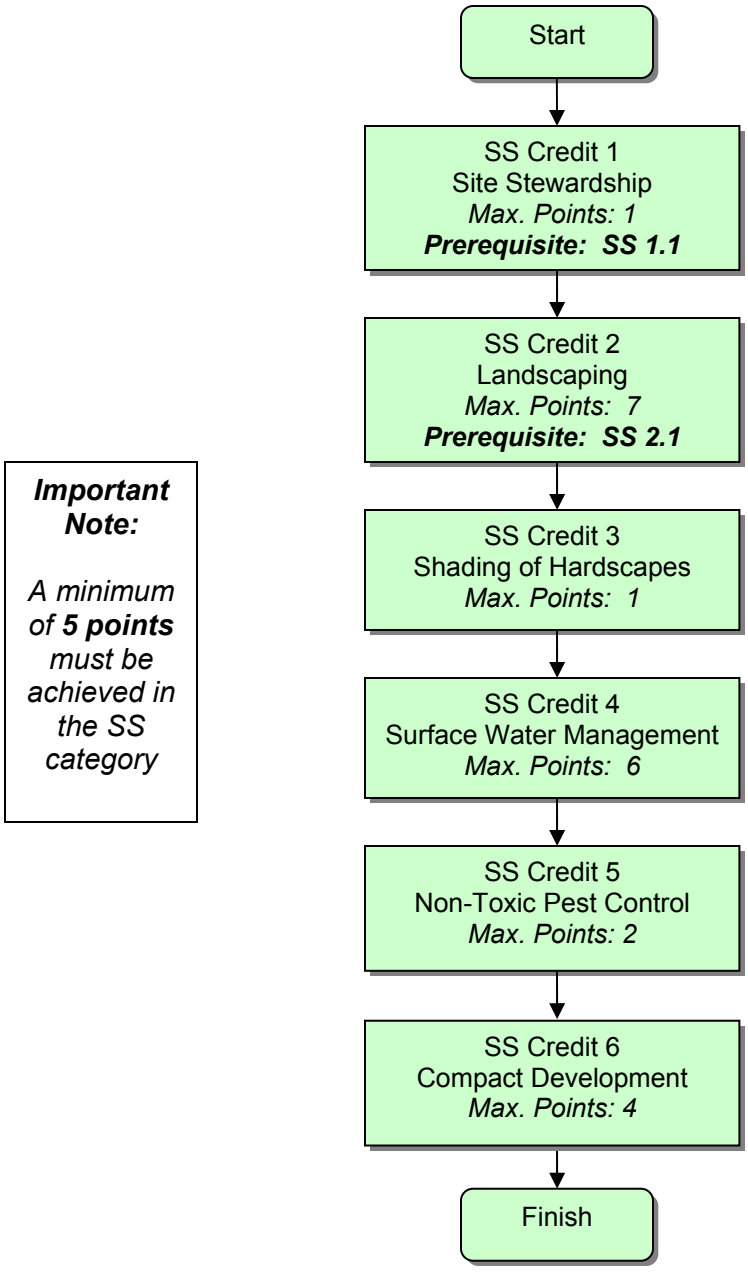
TBD

Resources and References

TBD

Sustainable Sites (SS)

Pathway Through SS Credits



Important Note:

*A minimum of **5 points** must be achieved in the SS category*

SS 1. Site Stewardship

Maximum *Points: 1*

Intent

Minimize long-term environmental damage to the building lot during the construction process.

Requirements

Prerequisites (Mandatory Measures)

1.1 ***Erosion Controls (During Construction).*** Design and implement erosion control measures during construction, including:

- Stockpile and protect disturbed topsoil from erosion (for reuse)
- Stabilize soils that have been or may be disturbed
- Control the path and velocity of runoff with silt fencing or comparable measures
- Provide swales to divert surface water from hillsides
- Protect on site storm sewer inlets with straw bales, silt fencing, silt sacks, or rock filters
- On steep slopes, use erosion control blankets where necessary

Credits (Optional Measures)

1.2 ***Minimize Disturbed Area of Site***. (1 Point.) Minimize disturbance to site by:

- Developing a tree / plant preservation plan with "no-disturbance zone" clearly delineated on drawings AND on the building lot; and
- Leaving undisturbed at least 40% of the lot area (i.e. site area, not including area under roof).

Notes: 1. Any "no disturbance zones" must also be protected from parked construction vehicles. Compacted soils from parked vehicles can cause major difficulties in establishing any new landscaping.

*2. Projects in which the total site is less than 1/8 acre, or the housing density for the project is equal to or greater than 8 units per acre, **automatically qualify for this credit.** For multifamily homes, the average lot size shall be calculated as the total lot size divided by the number of units. The lot size exemption is to be calculated based on the average lot size per unit.*

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Inspect these installed measures (during the site visit for the pre-drywall inspection AND at the final inspection), to affirm that all of the requirements above have been completed; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

As discussed in SS Credit 2, if the builder does not provide full landscaping, HOA or other rules must require homeowners to have the site fully landscaped within 1 year. Erosion controls and soil stabilization measures must be robust enough to function until landscaping is in place (i.e., up to 1 year).

SS 4.3 is an optional credit that rewards homes for the installation of permanent erosion controls.

Additional Information

Rationale

Site moving and earth clearing during construction often results in significant erosion problems because adequate environmental protection strategies are not employed. The loss of topsoil is the most significant on-site consequence of erosion. Loss of topsoil greatly reduces the soil's ability to support plant life, regulate water flow, and maintain the biodiversity of soil microbes and insects that control disease and pest outbreaks. The off-site consequences of erosion from developed sites include a variety of water quality issues. Runoff from developed sites carries pollutants, sediments and excess nutrients that disrupt aquatic habitats in the receiving waters. Also, the build-up of sedimentation in stream channels can lessen flow capacity, potentially leading to increased flooding.

The selection of the location of the home's footprint on the building lot also has a large, long-term impact on the natural drainage flows and may have adverse effects on the neighboring land. The home should be located to complement (not interfere with) the existing site features.

Potential Technologies and Strategies

Perform a site survey to identify site elements and adopt a master plan for development of the project site. Select a suitable building location and design the building with a minimal footprint (by tightening program needs and stacking floor plans). Note requirements on plans and in specifications.

Create contract language for the subcontractors to follow regarding reducing minimizing site disturbance. Establish contractual penalties for destruction of trees and disturbance of site areas noted for protection.

Establish clearly marked construction and disturbance boundaries. Delineate laydown, recycling, and disposal areas. Use areas to be paved as staging areas.

Resources and References

TBD

SS 2. Landscaping

Maximum *Points: 7*

Intent

Design landscape features to minimize demand for water and synthetic chemicals.

Requirements

Prerequisites (Mandatory Measures)

2.1 ***No Invasive Plants.*** Introduce no invasive plant species into the landscape. Regional invasive plant species can be identified by the local Agriculture Cooperative Extension Service.

Credits (Optional Measures)

Note: Points shown below are for landscaped front and back yards. If only the front yard is landscaped, then only half of the points are available. In this case, side and back yard landscaping still must be required by HOA or other rules within a specific time period, not to exceed one year after occupancy. Also, it is required that erosion controls and soil stabilization measures are robust enough to be effective until the homeowner has the side and back yard landscaped. The builder must also develop a landscaping plan that meets the requirements in SS 2 and provide this to the homeowner.

2.2 ***Basic Landscape Design***. (2 Points.) Landscape design must meet the three criteria below:

- Areas planted with turf shall use only drought-tolerant turf, and turf should be avoided in densely shaded areas.
- Areas planted with turf should not exceed a slope of 25 percent (i.e., a 4 to 1 slope).
- Add mulch or soil amendments as appropriate.

  Mulch is defined as a covering placed around plants to reduce erosion and water loss, and to help to regulate the soil temperature. In addition, upon decomposition (for organic mulches), mulches serve as soil amendments. The type of mulch you select can affect soil pH.

2.3 ***Limit Turf.*** (Max 3 Points.) Limit the use of turf on the site, as specified in Exhibit SS2-A.

Exhibit SS2-A
Points For Limited Turf

Limit Turf to __ % of Total Landscaped Area	LEED Points
60 %	1
40%	2
20 %	3

2.4 ***Drought Tolerant Plants***. (Max. 2 Points.) Install drought tolerant plants OR minimize water budget, as specified in Exhibit SS2-B.

Exhibit SS2-B
Points for Minimizing Water Demand

At Least __ % of Total Plants Are Drought Tolerant	Maximum Water Budget of ___ Gal/SF/Yr	LEED Points
45%	16	1
90%	5	2

Note 1. Water budget is to be calculated based on the landscaped area of the lot, in gallons per square foot per year.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (Attachment C) is signed by the landscape designer or responsible party, declaring that the landscape meets the credit requirements, and place in Project Documentation File;
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

The landscaping features at the home site are important considerations in the design of an irrigation system design (e.g., in WE 2). So, if this credit is used, the selected measures should be part of the irrigation system design required in WE credit 2. Outdoor water savings are provided by designing and installing water-efficient landscaping. LEED points for landscape-related water savings are included in this credit.

Also, grey water and rainwater reuse systems (see WE credit 1) should be included in landscaping designs.

Additional Information

Rationale

Some builders disturb more of the lot than needed and often only minimally attempt to restore the property. Conventional practice does not put ecological protection as a high priority. As a result, lots are frequently ecologically damaged. A great deal of additional effort is required to restore the lot. This credit rewards the builder's contribution to the landscape restoration process.

Potential Technologies and Strategies

Select mulch that will improve soil structure and provide nutrients as it decomposes.

Work with local cooperative extension services or native plant societies to select indigenous and well-adapted plant species for site restoration and landscaping.

Resources and References

Local drought tolerant lists of plants and grasses are available from local Agricultural Cooperative Extension Service offices, as well as through numerous Internet resources. For more information on local extension offices, go to: http://csrees.usda.gov/Extension/index.html

SS 3. Shading of Hardscapes

Maximum *Points: 1*

Intent

Design landscape features to reduce local heat island effects.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

3. ***Locate Trees to Shade Hardscapes***. (1 Point.) Design and install trees and shrubs (or preserve existing trees and shrubs) to shade at least 50% of sidewalks, patios, and driveways within 50 feet of house (based on noon on June 21 at 5 years' growth).

   OR

   Light Colored Hardscapes. (1 Point.) Install light-colored, high-albedo materials (reflectance of at least 0.3) for at least 50% of site's non-roof impervious surfaces.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (Attachment C) is signed by the landscape designer or responsible party, declaring that the plantings and hardscape materials (as applicable) meet the credit requirements;
- ✓ Place in signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

Shading hardscapes around the home can reduce irrigation needs as well as temper the home's outdoor environment.

Providing shade for the home/roof is addressed in two other credits:

EA prerequisite 1 - Energy Star roofs, using the HERS energy modeling credit

MR credit 2 - Environmentally Preferable Products - vegetated roofs

The LEED points for this credit partly reflect the energy-related benefits from this measure.

Locating trees, fences, shrubbery or other plantings appropriately can capture or deflect seasonal breezes.

Additional Information

Rationale

TBD

Potential Technologies and Strategies

Provide shade using native or climate-adapted trees and other exterior structures, such as trellises, supporting vegetation.

Resources and References

TBD

SS 4. Surface Water Management

Maximum *Points: 6*

Intent

Design site features to minimize erosion and run-off from the home site.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

4.1 ***Permeable Sites***. (Max. 4 Points, as specified in Exhibit SS4-A.) Design lot such that at least 70% of the site (not including area under roof) is permeable or designed to manage water run-off. Area that can be counted toward the minimum includes:

- Vegetative landscape (e.g. grass, trees, shrubs, etc.)
- Permeable paving, installed by an experienced professional. Permeable paving must include porous above-ground materials (e.g. open pavers, engineered products) and a porous 6" sub-base, and the base layer must designed to ensure proper drainage away from the house.
- Impermeable surfaces that are designed to ensure all run-off is directed toward an appropriate permanent infiltration feature (e.g. vegetated swale, on-site rain garden, dry well or rainwater cistern)

4.2 ***Permanent Erosion Controls***. (1 Point each, Max. 2 Points). Design and install one or more of the following permanent erosion control measures:

- Install permanent storm water control (i.e., vegetated swales, on-site rain garden, dry well or rainwater cistern, etc.) designed to manage run-off from the house.
- Reduce long term run-off effects through use of terracing and retaining walls.
- Plant one tree or four 5-gallon shrubs per 500 square feet of disturbed construction area (including home site). (Four large, 5 gallon, shrubs are equivalent to one tree.)

Exhibit SS4-A
Points for Permeable Sites (for SS 4.1)

Percentage of Site That is Permeable:[1]	LEED Points
≥ 70 %	1
≥ 80 %	2
≥ 90 %	3
100 %	4

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Inspect installed measures, to affirm that the requirements above have been met; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

TBD

Additional Information

Rationale

Erosion represents the loss of a valuable resource from the home site – topsoil – that can overload storm sewers, and may cause stream clouding and siltation, (with potential harm to wildlife). Permeable surfaces also assist in recharging local aquifers and may reduce irrigation needs.

Potential Technologies and Strategies

Significantly reduce impervious surfaces using pervious paving surfaces such as grass paving, non-driving gravel surfaces, and pavers with area for infiltration. Provide storm water treatment and infiltration best management practices (BMPs) per State of Maryland or Puget Sound Stormwater Management Manual. Utilize biologically based and innovative storm water management features for pollutant load reduction, such as constructed wetlands, storm water filtering systems, bioswales, bio-retention basins, and vegetated filterstrips.

Resources and References

The Center for Watershed Protection's Storm Water Center (http://www.stormwatercenter.net/)

The 2000 Storm Water Design Manual, State of Maryland (http://www.mde.state.md.us/environment/wma/stormwatermanual)

Puget Sound (WA) Storm Water Management Manual: (http://www.ecy.wa.gov/programs/wq/stormwater/index.html)

State of Washington Erosion and Sediment Control Standards (http://www.ecy.wa.gov/biblio/9912.html)

SS 5. Non-Toxic Pest Control

Maximum *Points: 2*

Intent

Design home features to minimize the need for poisons for insect and disease control.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

5. ***Pest Control Alternatives***. (0.5 Points each, Max. 2 Points.) Implement one or more of the measures below. All physical actions (for pest management practices) must be noted on construction plans.
   - o In those areas marked as “moderate to heavy” through “very heavy” on the termite infestation probability map (see Exhibit SS5-A), implement the following measures:
     - Treat all cellulosic material (e.g., wood framing) with a borate product to a minimum of 3 feet above the foundation OR place sand or diatomaceous earth or a steel mesh barrier termite control system OR use non-cellulosic (i.e., not wood or straw) wall structure;
     - Use solid concrete foundation walls OR masonry wall with top course of solid block bond beam or concrete filled block;
   - o Keep all wood used (i.e., siding, trim, structure) at least 12" above soil (code requires 8");
   - o Seal all cracks, joints, penetrations, edges, and entry points with caulking;
   - o Protect exposed foundation insulation with moisture-resistant, pest- proof cover (e.g., fiber cement board, galvanized insect screen);
   - o Install rodent- and corrosion- proof screens (e.g., copper or stainless steel mesh) on all openings that cannot be caulked or sealed;
   - o Separate any exterior wood-to-concrete connections (e.g., at posts, deck supports, stair stringers) with metal or plastic fasteners / dividers OR have no wood-to-concrete connections;
   - o Install landscaping so that all parts of mature plants will be at least 24" from house.
   - o Install termite bait system.

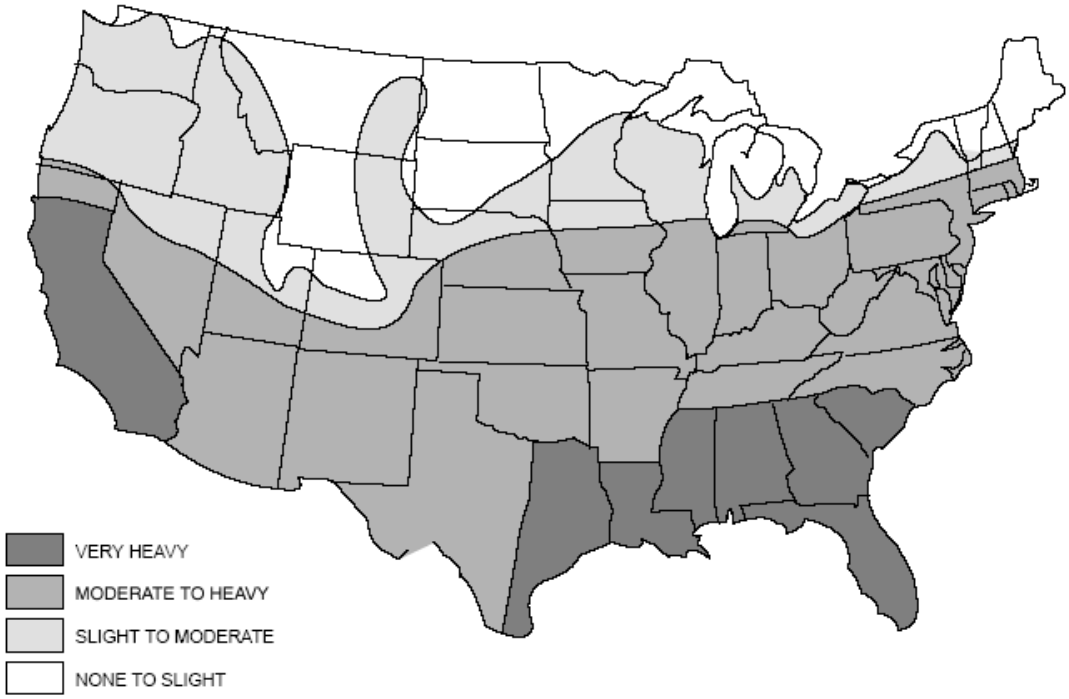
Verification / Submittals

The Provider’s third-party rater shall:

- ✓ Perform a visual inspection of this installed measure, to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Exhibit SS5-A

The following Termite Infestation Probability Map is excerpted from the current International Residential Building Code™, adopted for use by state and local jurisdictions around the county.



Note: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

FIGURE R301.2(6)
TERMITE INFESTATION PROBABILITY MAP

2000 INTERNATIONAL RESIDENTIAL CODE™

Synergies and Trade-Offs

Adopting turf limits and native plantings (as in SS credit 2) can help to reduce the need for other toxic chemicals such as fertilizers, pesticides, herbicides, etc. Keeping plants away from the house is also advisable, to avoid irrigating close to the house and thereby minimize the risk of moisture leaking into the home's foundation.

Additional Information

Rationale

Insect and disease problems can be effectively controlled without exposing occupants to harmful or hazardous chemical and practices.

Potential Technologies and Strategies

For areas known to be inhabited by termites, carpenter ants, and beetles, consider using pest-resistant building materials. Also consider termite barriers such as granite sand, stainless steel screening, and borate-treated lumber. (Note; borate-treated lumber has to be kept dry to be effective.)

Resources and References

Intergrated Pest Management (IPM) Practitioners Association:
http://www.efn.org/~ipmpa/keydocs.html
An emphasis on urban, non-agricultural applications.

Appropriate Technology Transfer for Rural Areas: Focuses on agricultural applications, but provides an exhaustive list of references, and definitions of key terms and practices.
http://www.attra.org/attra-pub/ipm.html

Common Sense Pest Control, William Olkowski, Shiela Daar, Helga Olkowski, Taunton Press, 1991

Bio-Integral Resource Center, www.birc.org

SS 6. Compact Development

Maximum *Points: 4*

Intent

Make use of compact development patterns in order to conserve land and promote community livability, transportation efficiency, and walkability.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

6.1 ***Moderate Density***. (2 Points.) Build homes with an average housing density of 7 or more dwelling units per acre of buildable land.

OR

6.2 ***High Density***. (3 Points.) Build homes with an average housing density of 10 or more dwelling units per acre of buildable land.

OR

6.3 ***Very High Density***. (4 Points.) Build homes with an average housing density of 20 or more dwelling units per acre of buildable land.

Note*: "Buildable land" area is to be calculated as follows:*

- *Do not include any of the following: public streets or public rights of way; land occupied by non-residential structures; or land excluded from residential development by law.*
- *Numerator should be the number of housing units in the project, and denominator should be buildable land area included in the project (subject to exclusions already mentioned in the credit description). Both relate only to the project, not the surrounding area.*

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment C) is signed by the civil engineer or responsible party, declaring that the average housing density meets the credit requirements,
- ✓ Place signed Accountability Form in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using credit LL1, then must skip this credit.

Optional Credit SS 1.2 is automatically granted to high-density homes because of the reduced impact that compact development has on land.

Additional Information

Rationale

Conserve land, promote pedestrian activity, and reduce vehicle miles traveled.

Potential Technologies and Strategies

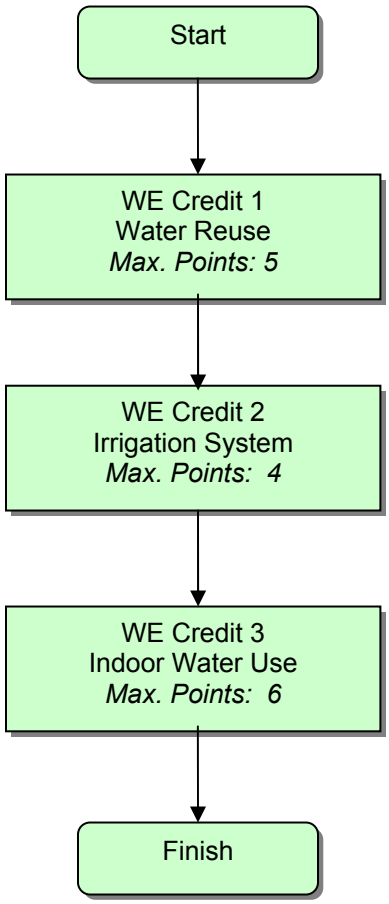
TDB

Resources and References

TBD

Water Efficiency (WE)

Pathway Through WE Credits



Important Note:

*A minimum of **3 points** must be achieved in the WE category*

WE 1. Water Reuse

Maximum *Points: 5*

Intent

Offset central water supply through the capture and controlled reuse of rainwater and/or grey water.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

1.1 ***Rainwater Harvesting System***. (Max. 4 Points, as specified in Exhibit WE1-A) Design and install a rainwater harvesting and storage system (including surface run-off and/or roof run-off) for landscape irrigation use or indoor water use. Storage system must be sized to hold all the water from a ¾ inch rainfall event, taking into consideration the size of the harvest system (e.g. 50% or 75% of total roof area, depending on the measure chosen from Exhibit WE1-A)..

Exhibit WE1-A
LEED Points Associated with Different Rainwater Capture Measures

Rainwater Harvesting System Size	Application	LEED Points
≥ 50% of roof area	Indoor	2 points
≥ 50% of roof area	Outdoor	3 points
≥ 75% of roof area	Indoor and Outdoor	4 points

1.2 ***Grey Water Reuse System*** (1 Point.) Design and install a grey water re-use system for landscape irrigation use (i.e., not a septic system) or indoor water use. System must be designed to collect the grey water from at least the clothes washer. Grey water system must include a storage tank that can be used as part of the irrigation system. *Note that grey water systems are subject to local codes and may require special permits.*

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment C) is signed by the design engineer or responsible party, declaring that the system(s) meet the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box(es) on signed LEED for Homes checklist.

Synergies and Trade-Offs

Install a grey water irrigation system and/or rainwater storage in combination with resource-efficient landscape (SS c2), and irrigation systems (WE c2).

Additional Information

Rationale

TBD

Potential Technologies and Strategies

Capture rainwater from roof or other impervious areas of the site for reuse.

Note that rainwater harvesting offers limited benefit in climates where the rainfall mainly occurs out of the growing season or is insufficient to supply a significant portion of landscape water needs.

Resources and References

Rainwater Harvesting:

City of Tucson
http://www.ci.tucson.az.us/water/conservation.htm

ARCSA
www.arcsa-usa.org

Texas Guide to Rainwater Harvesting
www.twdb.state.tx.us

Water Use it Wisely
www.wateruseitwisely.com/staging/toolslinks/#greywater

Grey Water Use:

Washington State grey water design guidelines
(http://www.doh.wa.gov/ehp/ts/WTRCON7Fr.PDF)

California Grey Water Guidelines at
(http://www.dpla.water.ca.gov/urban/land/revisedgwstand.html)

Other:

EPA Technology Assessment of Constructed Wetlands (EPA832R93008)

EPA Water Efficiency Technology Fact Sheet- Composting Toilets (EPA 832-F-99-066)

WE 2. Irrigation System

Maximum *Points: 4*

Intent

Minimize outdoor demand for water through water-efficient irrigation.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

Note: Points shown below are for irrigation systems for the front and back yards. If only the front yard is landscaped and irrigated, then only half of these points are available. Even if the back yard is not landscaped, the irrigation system must be stubbed to the back yard.

2.1 ***High Efficiency Irrigation System***. (1 Point each, Max. 3 Points.) Design and install high efficiency irrigation system (based on overall landscaping plans, including measures adopted in SS 2) with the following features:

- Install a central shut-off valve
- Install a sub-meter for the irrigation system
- At least 50% of landscape planting beds have a drip irrigation system to minimize evaporation
- Turf and each type of bedding area (based on watering needs) should be separately zoned
- A timer/controller that activates the valves for each watering zone at the best time of day to minimize evaporative losses while maintaining healthy plants and obeying local regulations and water-use guidance.
- Pressure regulating devices to maintain optimal pressure and prevent misting.
- High efficiency nozzles.
- Check valves in heads.
- Install a moisture sensor controller or rain delay controller. For example, “smart" ET controllers receive radio, pager, or internet signals with evapo-transpiration information to direct the irrigation system to replace only the moisture that the landscape has lost due to heat, humidity, and wind.

2.2 Third Party Inspection. (1 Point.) Perform a third-party visual inspection of installed irrigation system. Inspection to include observation that all spray heads are operating and delivering water to intended zones.

OR

2.3 ***Professional Landscape Design***. (4 Points.) Install landscape designed by a licensed or certified landscape design professional that needs no irrigation.

Note: "Temporary irrigation systems used for plant establishment are allowed, only if removed within 1 year."

Verification / Submittals

The Provider's third-party rater shall:

WE 2.1: High Efficiency Irrigation System.

- ✓ Confirm that the Accountability Form (in Attachment C) is signed by the engineer or responsible party, declaring that the irrigation system components meet the requirements above; and
- ✓ Place the signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

WE 2.2: Third Party Inspection

- ✓ Perform a visual inspection of installed measure(s) above, to affirm that the requirements above have been completed; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

WE 2.3: Professional Design

- ✓ Confirm that the Accountability Form (in Attachment C) is signed by the engineer or responsible party, declaring that the landscape design requires no irrigation.
- ✓ Place the signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

This irrigation system design must include all aspects of the landscape design, including the features adopted in SS 2.

Outdoor water savings are also provided by designing and installing water efficient landscaping. LEED points for landscape-related water savings are included in SS 2.

Also, grey water and/or rainwater reuse systems should be included in overall outdoor water use designs.

Additional Information

Rationale

TBD

Potential Technologies and Strategies

The irrigation system should be designed based on the needs of the landscape plan, and installed per that design. It is very important that the designer and the installer work closely together to ensure that the system performs as intended.

Resources and References

TBD

WE 3. Indoor Water Use

Maximum *Points: 6*

Intent

Minimize indoor demand for water through water efficient fixtures.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

3.1 ***High Efficiency Fixtures.*** (1 Point each, Max. 3 Points.) Meet one or more of the following requirements by installing high efficiency (low flow) fixtures:

- The average flow rate for all lavatory faucets must be ≤ 2.0 GPM
- The average flow rate for all shower heads must be ≤ 2.0 GPM [5]
- The average flow rate for all toilets, including dual-flush toilets, must be ≤ 1.3 GPF

OR

3.2 ***Very High Efficiency Fixtures***. (2 Points each, Max. 6 Points.) Meet one or more of the following requirements by installing very high efficiency fixtures:

- The average flow rate for all lavatory faucets must be ≤ 1.5 GPM
- The average flow rate for all shower heads must be ≤ 1.5 GPM [6]
- The average flow rate for all toilets, including dual-flush toilets, must be ≤ 1.1 GPF.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection of product manufacturer's info on installed measure(s), to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

[5] *Builders are strongly cautioned to investigate shower head manufacturer's information on the performance of the high efficiency shower heads (including testing for scalding and thermal shock at the respective low flow rate) before making selections and installing them.*

[6] *Builders are strongly cautioned to investigate the shower head manufacturer's information on the performance of very high efficiency shower heads, similar to the caution for credit 3.1 for high efficiency shower heads.*

Synergies and Trade-Offs

Indoor water savings also can be achieved with more efficient water distribution systems. LEED points for indoor water distribution-related savings are included in EA credit 7, improved hot water distribution systems.

Indoor water savings also can be achieved by selecting water efficient appliances. LEED points for appliance-related water savings are included in EA credit 9, ENERGY STAR labeled horizontal axis clothes washer.

Low flow shower heads may reduce demand for hot water and resulting energy use for water heating by up to 20 percent. Thus, the LEED points for this credit include the energy saving benefit of installing low flow shower heads.

Special Note. Care is needed to select low flow shower heads and diverter valves with pressure balancing capabilities to ensure that hot water scalding does not occur.

Additional Information

Rationale

Faucets, showers, baths, and toilets typically account for two thirds of indoor water use in a home, and one third of total water use. High-efficiency fixtures can reduce indoor water use by 30 to 40 percent.

Potential Technologies and Strategies

Specify water conserving plumbing fixtures that exceed Energy Policy Act of 1992 fixture requirements in combination with ultra high efficiency or dry fixture and control technologies.

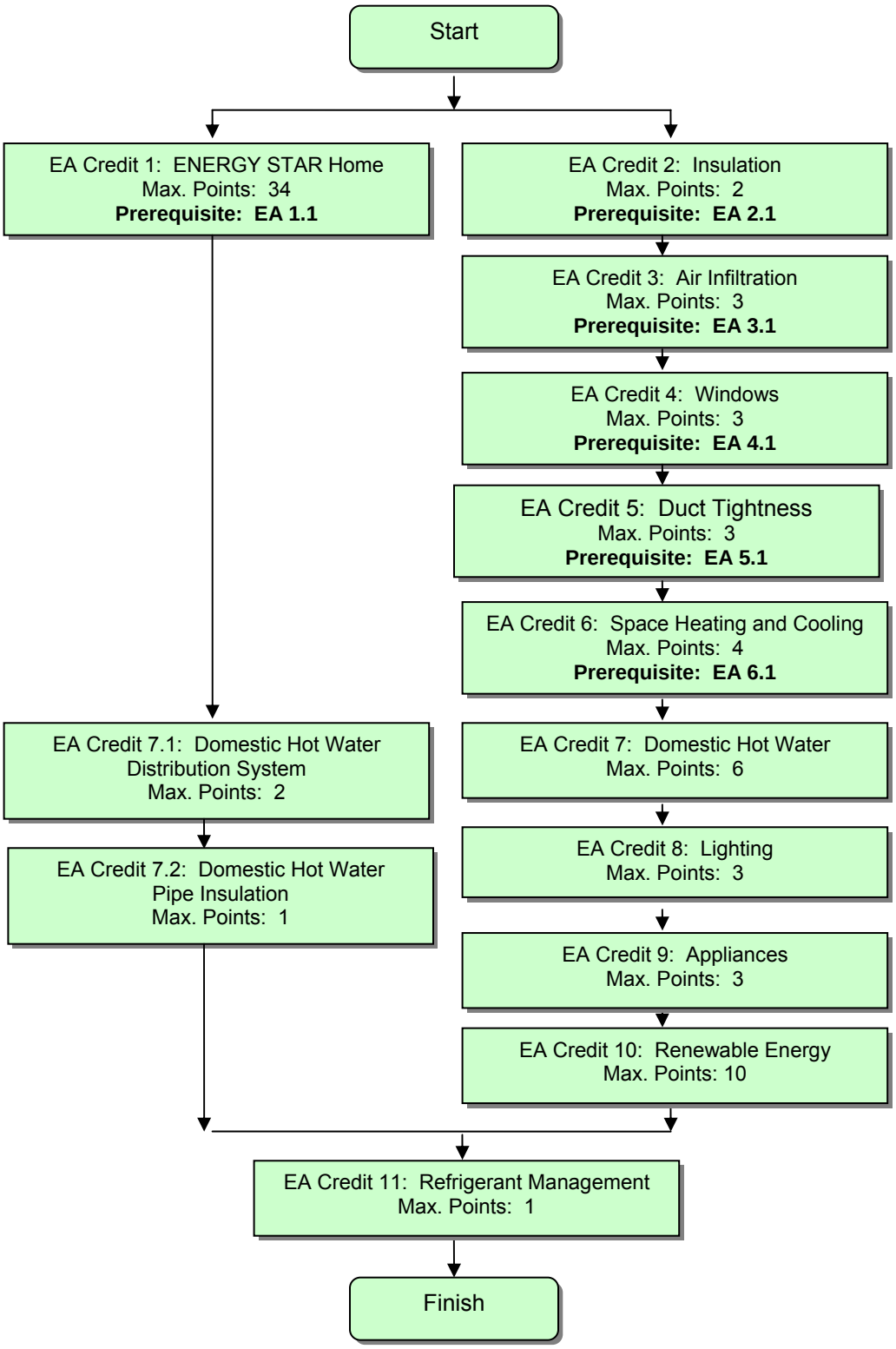
Water savings from faucets will be most likely from high efficiency (low flow) lavatory faucets, used for hand washing. Water savings from high efficiency kitchen faucets is less likely because these faucets are often used for filling.

Resources and References

TBD

Energy and Atmosphere (EA)

Optional Pathways Through EA Credits



EA 1. ENERGY STAR Labeled Home

Maximum *Points: 34*

Intent

Improve the overall energy performance of homes by designing and building a home that meets or exceeds the performance of an ENERGY STAR labeled home.

Requirements

Prerequisites (Mandatory Measures)

1.1 **ENERGY STAR for Homes.** Meet requirements of ENERGY STAR for Homes; home must be third-party inspected.

Credits (Optional Measures)

1.2 **Exceptional Energy Performance.** (Max. 34 Points.) Exceed requirements of ENERGY STAR for Homes; home must be third-party inspected. Use equations below, Exhibit EA1-A, or Exhibit EA1-B.

Equation:

South

LEED Pts ={ [Log (100 - HERS Index)] / 0.024 } - 48.3

North

LEED Pts = { [Log (100 - HERS Index)] / .021 } - 60.8

Exhibit EA1-A
LEED for Homes Points Based on HERS Index

Southern States (IECC Climate Zones 1-5)			Northern States (IECC Climate Zones 6-8)		
HERS Index	Percent Above IECC 2004	LEED for Homes Points	HERS Index	Percent Above IECC 2004	LEED for Homes Points
100	0		100	0	
95	5		95	5	
90	10		90	10	
85	15		85	15	
84	16	2.0	84	16	
83	17	3.0	83	17	
82	18	4.0	82	18	
81	19	5.0	81	19	
80	20	6.0	80	20	
79	21	7.0	79	21	2.0
78	22	7.5	78	22	3.0
77	23	8.5	77	23	4.0
76	24	9.0	76	24	5.0

Exhibit EA1-A (cont'd)
LEED for Homes Points Based on HERS Index

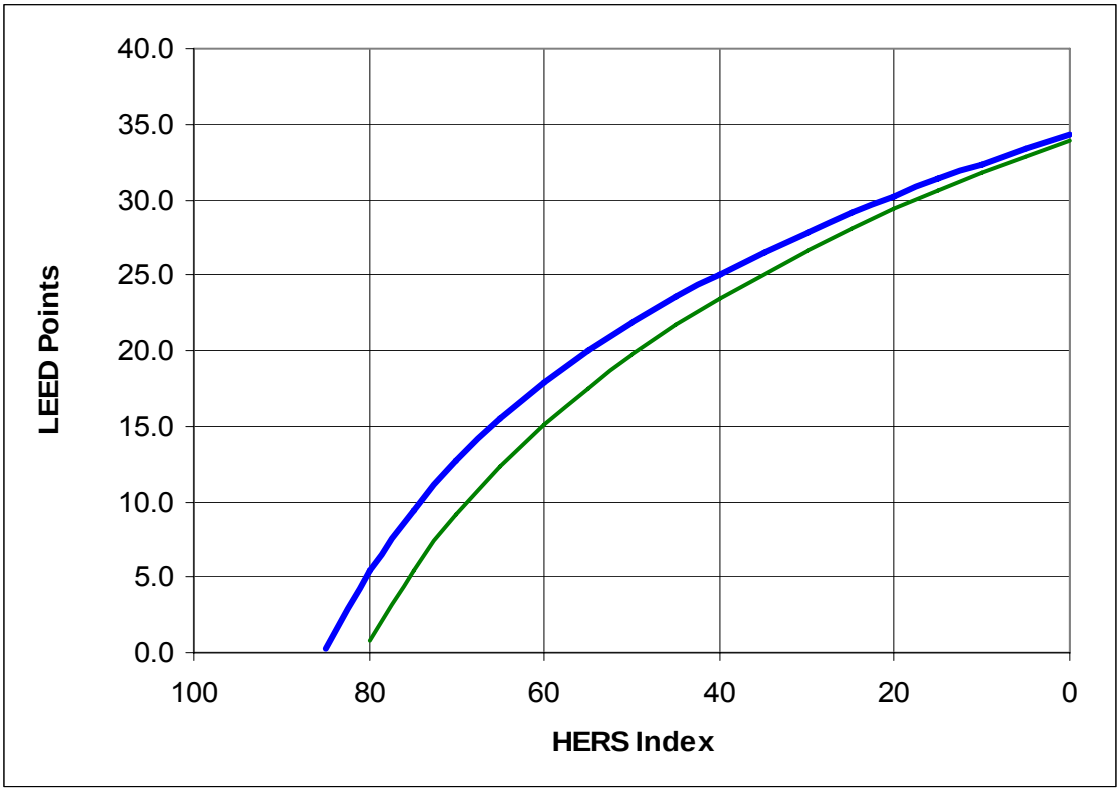
Southern States (IECC Climate Zones 1-5)			Northern States (IECC Climate Zones 6-8)		
HERS Index	Percent Above IECC 2004	LEED for Homes Points	HERS Index	Percent Above IECC 2004	LEED for Homes Points
75	25	10.0	75	25	6.0
74	26	10.5	74	26	6.5
73	27	11.5	73	27	7.5
72	28	12.0	72	28	8.0
71	29	12.5	71	29	9.0
70	30	13.0	70	30	9.5
69	31	14.0	69	31	10.0
68	32	14.5	68	32	11.0
67	33	15.0	67	33	11.5
66	34	15.5	66	34	12.0
65	35	16.0	65	35	12.5
64	36	16.5	64	36	13.5
63	37	17.0	63	37	14.0
62	38	17.5	62	38	14.5
61	39	18.0	61	39	15.0
60	40	18.5	60	40	15.5
55	45	20.5	55	45	18.0
50	50	22.5	50	50	20.0
45	55	24.2	45	55	22.0
40	60	26.0	40	60	24.0
35	65	27.0	35	65	25.5
30	70	28.5	30	70	27.0
25	75	30.0	25	75	28.5
20	80	31.0	20	80	30.0
15	85	32.0	15	85	31.0
10	90	33.0	10	90	32.0
5	95	33.5	5	95	33.0
0	100	34.0	0	100	34.0

Verification / Submittals

The Provider's third-party rater shall:

- Complete all of the verification requirements for an ENERGY STAR Home, including:
  - Perform a HERS rating on this house;
  - Thermal bypass (insulation) inspection;
  - Envelope air leakage testing with a blower door; and
  - Duct leakage testing with a duct pressurization fan.
- Place a copy of the HERS rating report in the project documentation file for this house, and
- Check the appropriate box on signed LEED for Homes checklist.

Exhibit EA1-B
LEED for Homes Points for Various HERS Index Values



Synergies and Trade-Offs

If this credit is used, then must skip credits EA 2 through 10.

Additional Information

Rationale

An ENERGY STAR qualified home is designed to use 15 to 20 percent less energy than a comparable home built to the 2004 International Energy Conservation Code (IECC). An ENERGY STAR home is also field tested, to ensure that the relevant measures designed to improve the energy performance of the home are installed properly.

Potential Technologies and Strategies

TBD

Resources and References

Information on the ENERGY STAR for Homes program can be found at EPA's website: www.energystar.gov/homes

EEBA "Builder Guides," Building Science Corp. / Taunton Press. Energy and Environmental Building Association.

EA 2. Insulation

Maximum *Points: 2*

Intent

Design and install insulation to minimize heat transfer and thermal bridging.

Requirements

Prerequisites (Mandatory Measures)

2.1 ***Basic Insulation***. Install insulation that meets or exceeds the requirements in the 2004 International Energy Conservation Code (IECC) and is designed to meet at least the Grade II specifications set by the National Home Energy Rating Standards (see Exhibit EA2-A)[7]; Provider's third-party rater to verify by performing pre-drywall / thermal bypass inspection of insulation as summarized in Exhibit EA2-A.

Note: Portion of house with SIPS/ ICFs does not need thermal bypass inspection. But, rater must still complete thermal bypass inspection for the rest of the house

Credits (Optional Measures)

2.2 ***Enhanced Insulation***. (2 Point.) Install above code insulation that exceeds the 2004 International Energy Conservation Code (IECC) requirements by at least 5%, as demonstrated using REScheck code compliance software ***AND*** *m*eet at least Grade I specifications (per National Home Energy Rating Standards, see Exhibit EA2-A).

OR

Demonstrate comparable above code performance for alternative wall/insulation system, such as structural insulated panels or insulated concrete forms.

Exhibit EA2-A
Definitions of HERS Installation Grades

HERS Installation Grade	Description
I	Very small gaps, and compression or incomplete fill amounts to 2% or less.
II	Moderate to frequent installation defects, gaps around wiring, electric outlets, etc., and incomplete fill amounts to 10% of less. Gaps running clear through the insulation amount to no more than 2% of the total surface area covered by the insulation. For Grade II, wall insulation must be enclosed on all six sides, and shall be insubstantial contact with the sheathing material on at least one side (interior or exterior) of the cavity.

[7] Additional information about the RESNET inspection and grading procedures can be found on page 33 of the "Adopted Enhancements to the Mortgage Industry National Home Energy Rating Standards", located on RESNET's website at: http://natresnet.org/standards/enhancements.htm

Verification / Submittals

The Provider's third-party rater shall:

EA 2.1: Basic Insulation

- ✓ Inspect of installation of insulation, per the checklist above, to affirm that the requirements above have been completed; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

EA 2.2: Enhanced Insulation

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the insulation meets the credit requirements;
- ✓ Place signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using credit EA 1, then must skip this credit.

Additional Information

Rationale

Thermal bridging and improper installation of insulation are common problems in new homes, resulting in inferior performance of the thermal envelope. The reduction in thermal bridging (by the addition of continuous insulation, and/or improved installation of insulation) will provide a substantial improvement in thermal performance.

Potential Technologies and Strategies

TBD

Resources and References

TBD

Exhibit EA2-B
ENERGY STAR Qualified Homes Thermal Bypass Inspection Checklist

Home Address:	City:	State:

Thermal Bypass	Inspection Guidelines	Corrections Needed	Builder Verified	Rater Verified	N/A
1. Air Barrier and Thermal Barrier Alignment	Insulation is installed in full contact with the air barrier to provide continuous alignment of the insulation with the air barrier	☐	☐	☐	☐
2. Shower / Tub at Exterior Wall	Exterior walls have been enclosed on all six sides	☐	☐	☐	☐
	Exterior walls have been fully insulated	☐	☐	☐	☐
3. Insulated Floor Above Garage	Air barrier is installed at any exposed edges of insulation	☐	☐	☐	☐
	Insulation is installed to maintain permanent contact with the underside of the sub-floor decking	☐	☐	☐	☐
4. Walls Adjoining Unconditioned Spaces	Continuous top and bottom plates are installed with an air barrier on the unconditioned side of insulated walls, including exposed edges of insulation at joists and rafters	☐	☐	☐	☐
	Insulation is completely aligned with interior wall finish and the air barrier on the unconditioned side	☐	☐	☐	☐
5. Attic Access Panel / Drop-Down Stair	Attic access panel or stair is fully gasketed for an air-tight fit	☐	☐	☐	☐
	Attic access panel or stair is covered with insulation that is attached and fits snugly in the framed opening	☐	☐	☐	☐
6. Cantilevered Floor	Air barrier spans cantilever and any exposed edges of insulation	☐	☐	☐	☐
	Floor framing is completely filled with insulation or insulation is installed to maintain permanent contact with the sub-floor decking	☐	☐	☐	☐
7. Duct Shaft / Piping Shaft and Penetrations	Openings to unconditioned space are sealed with solid blocking and any remaining gaps are sealed with caulk or foam	☐	☐	☐	☐
8. Flue Shaft	Opening around flue is fully sealed with flashing and any remaining gaps are sealed with fire-rated caulk or sealant	☐	☐	☐	☐
	Combustion clearance between flue and combustible materials (e.g., OSB) are properly closed with UL- approved metal collars	☐	☐	☐	☐
9. Attic Eaves	Solid baffles are provided at framing bays to avoid wind washing of attic insulation	☐	☐	☐	☐
10. Dropped Ceiling / Soffit	Air barrier is fully aligned with insulated framing and any gaps are fully sealed with caulk, foam, or tape	☐	☐	☐	☐
11. Fireplace Wall	Air barrier is fully aligned with insulated framing in framed shaft behind fireplace and any gaps are fully sealed with caulk, foam, or tape	☐	☐	☐	☐
12. Staircase Framing at Exterior Wall / Attic	Air barrier is fully aligned with insulated framing and any gaps are fully sealed with caulk or foam	☐	☐	☐	☐
13. Recessed Lighting	Recessed lighting fixtures to unconditioned attics shall be airtight IC-rated (ICAT) and sealed to drywall with gasket, caulk, or foam	☐	☐	☐	☐
14. Porch Roof	Air barrier is installed at the intersection of the porch roof and exterior wall	☐	☐	☐	☐
15. Whole-House Fan Penetration at Attic	An insulated cover is provided that is gasketed or sealed to opening from either the attic side or ceiling side of the fan	☐	☐	☐	☐
16. Common Walls Between Dwelling Units	Air barrier is installed to seal the gap between a gypsum shaft wall (i.e., common wall) and the structural framing between units in duplex and townhouse construction	☐	☐	☐	☐

Home Energy Rating Provider:	Builder Company:
Home Energy Rater Company:	Builder Employee Signature:
Home Energy Rater Signature:	Inspection Date:
Inspection Date:	Re-Inspection Date:

EA 3. Air Infiltration

Maximum *Points: 3*

Intent

Minimize energy consumption caused by uncontrolled air leakage into and out of conditioned spaces.

Requirements

Prerequisites (Mandatory Measures)

3.1 **Good Envelope.** Air leakage rate from envelope must meet the requirements shown in Exhibit EA3-A, verified by Provider's third party rater.[8]

Credits (Optional Measures)

3.2 **Better Envelope.** (2 Point.) Air leakage rate from envelope must meet the requirements shown in Exhibit EA3-A, verified by Provider's third party rater.

OR

3.3 **Best Envelope.** (3 Points.) Air leakage rate from envelope must meet the requirements shown in Exhibit EA3-A, verified by Provider's third party rater.

Exhibit EA3-A
Air Leakage Requirements (ACH50)

LEED Criteria	Performance Requirements			
	IECC Climate Zones 1-2	IECC Climate Zones 3-4	IECC Climate Zones 5-7	IECC Climate Zone 8
EA 3.1 Meets ENERGY STAR (mandatory)	7.0 ACH50	6.0 ACH50	5.0 ACH50	4.0 ACH50
EA 3.2 Exceeds ENERGY STAR (optional)	5.0 ACH50	4.25 ACH50	3.5 ACH50	2.75 ACH50
EA 3.3 Exceeds ENERGY STAR (optional)	3.0 ACH50	2.5 ACH50	2.0 ACH50	1.5 ACH50

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a blower door depressurization test on the home, to affirm that the requirements above have been completed;
- ✓ Place the blower door pressurization test report in the project documentation file;

[8] Refer to section 4.1.3 of ASHRAE Standard 62.2, to ensure that natural and mechanical ventilation are properly integrated (i.e., avoid under- and/or over-ventilating).

[1] Signature acknowledges that the builder verified checklist items comply with inspection guidelines.

and

- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using EA Credit 1, then must skip this credit.

Also, note that the natural air leakage through the envelope contributes to the overall ventilation rate of the home. From a health perspective, it is important to not "under-ventilate" a home. In IEQ 4.1-4.3, required mechanical ventilation may bring in up to 0.2 ACH of additional ventilation air into the home.

However, from an energy perspective, it is also important not to over-ventilate a home. In extreme hot or cold climates, it can cost up to 2 dollars per year to condition each additional cfm of outside air brought into a home.

In section 4.1.3 of ASHRAE Standard 62.2, specific guidance is provided on balancing mechanical and natural ventilation.

Additional Information

Rationale

Approximately one-third of heating and cooling loads are due to air leakage through the envelope. Substantial reductions in envelope leakage can be obtained using air sealing techniques. Blower door testing should be used to assess the level of air-tightness achieved.

Potential Technologies and Strategies

Air leakage happens through surfaces - it is not volume-based. The air changes per hour (ACH) basis is a 25-year-old approach that is based on the Grimsrud-Sherman Model.

The ACH approach penalizes small buildings that tend to have a higher surface area to volume ratio and encourages large buildings that are obviously more resource intensive. An alternative approach to measuring envelope air leakage is to normalize the leakage based on the surface area of all six sides of the cube or building enclosure. Comparable envelope leakage rates with this alternate metric, (similar but not identical to the ACH requirements above) are:

0.35 cfm/ft2 of building enclosure area @ 50 Pa
0.25 cfm/ft2 of building enclosure area @ 50 Pa
0.15 cfm/ft2 of building enclosure area @ 50 Pa

Resources and References

TBD

EA 4. Windows

Maximum *Points: 3*

Intent

Maximize energy performance of windows.

Requirements

Prerequisites (Mandatory Measures)

4.1 **Good Windows.** Design and install windows that meet or exceed requirements for ENERGY STAR labeled windows (or windows with equivalent performance specifications), per Exhibit EA4-A below.

Credits (Optional Measures)

4.2 **Better Windows.** (2 Point.) Design and install windows that exceed requirements for ENERGY STAR labeled windows by 10%, per Exhibit EA4-A below.

OR

4.3 **Best Windows.** (3 Points) Design and install windows that exceed requirements for ENERGY STAR labeled windows by 20%, per Exhibit EA4-A below.

Exhibit EA4-A
U Values and SHGC Values for ENERGY STAR Labeled Windows
Determine Credits Earned Below Based on NFRC Ratings for Installed Windows
(Select applicable climate region using Exhibit EA4-B).

List of Envelope Credits		Metric	IECC / IRC Climate Region			
			Northern CZ 5-8 (Note 1)	North Central CZ 4 (Note1)	South Central CZ 3 (Note 2)	Southern CZ 1-2 (Note 2)
EA 4.1	ENERGY STAR *(Prerequisite)*	U-Factor SHGC	≤ 0.35 Any	≤ 0.4 ≤ 0.45	≤ 0.4 ≤ 0.4	≤ 0.55 ≤ 0.35
EA 4.2	10% > ENERGY STAR *(1 Point)*	U-Factor SHGC	≤ 0.32 Any	≤ 0.35 ≤ 0.40	≤ 0.35 ≤ 0.35	≤ 0.55 ≤ 0.33
EA 4.3	20% > ENERGY STAR *(2 Points)*	U-Factor SHGC	≤ 0.30 Any	≤ 0.32 ≤ 0.40	≤ 0.32 ≤ 0.30	≤ 0.55 ≤ 0.30

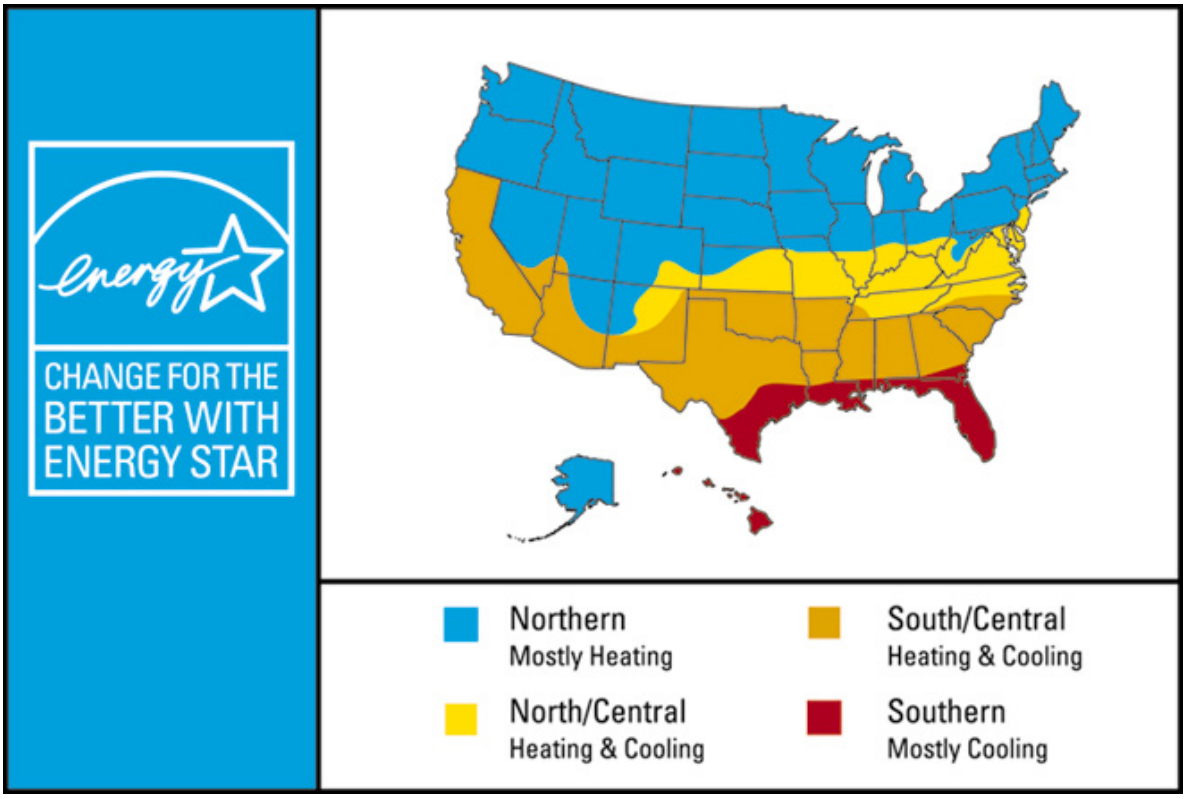
Note 1: For homes with a window to floor area (WFA) ratio >= 18% in cold climates, the following additional requirement applies:

Required U-Value = [0.18 / WFA] * [ENERGY STAR U-Value shown in EA4-A]

Note 2: For homes with a window to floor area (WFA) ratio >= 18% in hot climates, the following additional requirement applies:

Required SHGC = [0.18 / WFA] * [ENERGY STAR SHGC shown in EA4-A]

Exhibit EA4-B
Climate Zone Map for ENERGY STAR Windows



Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection of installed measure and review relevant documents (e.g., purchasing invoices and window labels), to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using credit EA 1, then must skip this credit.

The following special conditions are allowed:

1) Up to 5% of total window area may be used for windows with decorative glass or skylights (i.e., glass does not meet U-value or SHGC requirements).

2) Solar window screens may be used to meet SHGC requirements. The overall SHGC for a window unit with solar screen is determined by the following equation:

[(window SHGC) x (solar screen SHGC) x (percent of area covered)]

+ [window SHGC x percent of area not covered].

For example, a window with a SHGC of 0.5, using a solar screen that provides 70% shading (the equivalent of 0.3 solar heat gain coefficient) and covers 60% of the window has an overall solar heat gain coefficient of [0.5 x 0.3 x 0.6] + [0.5 x 0.4] = 0.09 + 0.20 = 0.29.

Additional Information

Rationale

Approximately one-third of heat losses and gains are through the windows of a home. ENERGY STAR Windows assure better window performance.

Potential Technologies and Strategies

Glass doors and skylights are included in this requirement.

Resources and References

Additional information on ENERGY STAR labeled windows can be found at EPA's website:
http://www.energystar.gov/index.cfm?c=windows_doors.pr_windows

EA 5. Heating and Cooling Distribution System **Maximum *Points: 3***

Intent

Minimize energy consumption due to thermal bridges and/or leaks in heating and cooling distribution systems.

Requirements

a. Forced Air Systems

Prerequisites (Mandatory Measures)

5.1 **Reduced Distribution Losses.** Limit the air leakage rate from ducts to outdoors to ≤ 4.0 CFM at 25 Pascals per 100 square feet of conditioned floor area (for each installed system), verified by Provider's third-party rater.

AND

Do not install ducts in exterior walls, unless additional insulation is added to maintain the overall UA for an exterior wall without ducts. Ducts may be run inside of interior wall cavities but they must be fully ducted (i.e., cannot use wall cavity as the duct).

AND

Use at least R-6 insulation around ducts in unconditioned spaces.

Credits (Optional Measures)

5.2 **Greatly Reduced Distribution Losses**. (2 Point.) Limit the air leakage rate from air ducts to outdoors to ≤ 3.0 CFM at 25 Pascals per 100 square feet of conditioned floor area (for each installed system), verified by Provider's third-party rater.

OR

5.3 **Minimal Distribution Losses.** (3 Points.) Limit the air leakage rate from air ducts to outdoors to ≤ 1.0 CFM at 25 Pascals per 100 square feet of conditioned floor area, (including systems with all ducts in conditioned space), verified by Provider's third-party rater.

b. Non-Ducted HVAC Systems (e.g., Hydronic Systems)

Prerequisites (Mandatory Measures)

5.1 **Reduced Distribution Losses.** Use at least R-3 insulation around distribution pipes in unconditioned spaces.

Credits (Optional Measures)

5.2 **Greatly Reduced Distribution Losses**. (2 Point.) Keep system (including boiler and distribution pipes) entirely within conditioned envelope.

5.3 **Minimal Distribution Losses.** (1 Point.) Install outdoor reset control (i.e. controls that modulate distribution water temperature based on outdoor air temperature).

Verification / Submittals

The Provider's third-party rater shall:

a. Forced Air Systems

- ✓ Perform duct leakage testing (with a duct pressurization fan) that the ducts meet the requirements above.
- ✓ Place a copy of the duct leakage test report in the project documentation file for this house, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

b. Non-Ducted HVAC Systems (e.g., Hydronic Systems)

- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using EA 1, then must skip this credit.

Additional Information

Rationale

In typical new homes, duct leakage may account for 15 to 25 percent of HVAC energy use. Tighter ducts provide substantial energy savings.

Potential Technologies and Strategies

There are two metrics used to measure duct leakage:

a. Air leakage in cfm per SF of floor area of the home; and
b. Percent air leakage as a fraction of the total air flow rate in the HVAC system.

Both methods require a measurement of the total duct leakage in cfm. The first metric then links this measurement to the floor area of the home, and assumes that the equipment size is linked to the size of the home. However, to size HVAC equipment correctly, requires an ACCA Manual J calculation. The second metric should be based on the air flow in an HVAC system that is properly sized.

Comparable duct leakage rates with the first metric, (similar but not identical to the cfm at 25 Pascals per 100 square feet requirements above) are:

6% of total flow
4% of total flow
2% of total flow

Resources and References

CEE. 2000. "Supplementary Document, Duct Installation and Sealing."

http://216.92.197.51/resid/rs-ac/hvac.php3

ACCA Manual D – Residential Duct Systems

EA 6. Space Heating and Cooling Equipment **Maximum *Points: 4***

Intent

Reduce energy consumption associated with heating and cooling systems.

Requirements

Special Note: Both the space heating and cooling equipment must meet the requirements of this credit. If only one type of equipment qualifies, then half the points should be taken. Homes that do not need or use air conditioning should be modeled under EA 1, using the default (minimum efficiency allowed) in both the reference and rated homes.

Prerequisites (Mandatory Measures)

6.1 **HVAC Design and Installation.** Design (using ACCA Manual J, ASHRAE 2001 Handbook of Fundamentals, or an equivalent computation procedure) and install HVAC equipment that at least meets requirements for ENERGY STAR labeled HVAC, per Exhibit EA6-A below.

AND

Install ENERGY STAR labeled programmable thermostat (except heat pumps and hydronic systems),

AND

Provide proof of proper refrigerant charge (unless home has no mechanical cooling system)

Credits (Optional Measures)

6.2 **High-Efficiency HVAC.** (2 Points) Design and install HVAC equipment that is better than ENERGY STAR labeled HVAC, per Exhibit EA6-A below.

OR

6.3 **Very High-Efficiency HVAC.** (Max. 4 Points, see Exhibit EA6-A.) Design and install HVAC equipment that is substantially better than ENERGY STAR labeled HVAC systems..

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Visually inspect and confirm that the performance specifications of the installed equipment meet the requirements above.
- ✓ Verify that HVAC contractor has installed proper refrigerant charge with Evaporator Superheat Test, Subcooling Test, or Weigh-in Refrigerant Test.
- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the HVAC system meets the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using EA 1, then must skip this credit.

Each cubic foot per minute of outdoor air bought into a home represents about two dollars per year of conditioning costs. A substantial energy savings can be achieved by using heat recovery equipment for the outdoor air brought into a home. The LEED points for the energy savings from heat recovery have been included in IEQ 4, Outdoor Air Ventilation System.

Additional Information

Rationale

Substantial energy savings (20 to 30 percent) can be achieved by installing space heating and cooling equipment with the ENERGY STAR for HVAC label. This equipment is designed with performance characteristics that greatly exceed the federal minimum performance requirements.

Potential Technologies and Strategies

TBD.

Resources and References

ACCA Manual J - HVAC Residential Load Calculation, 8th Edition

Additional information on ENERGY STAR labeled HVAC equipment can be found at EPA's website:
http://www.energystar.gov/index.cfm?c=heat_cool.pr_hvac

Exhibit EA6-A

HVAC Requirements for Northern and North Central Climates: Select from credits below (see climate map in Exhibit EA4-B).

	List of HVAC Credits		End-Use	Requirements for HVAC Equipment in IECC/IRC Climate Zones 4-8					
				Central AC & Air Source Heat Pumps	Furnaces	Boilers (Gas or Oil)	Geothermal Heat Pumps: Open Loop	Geothermal Heat Pumps: Closed Loop	Geothermal Heat Pumps: Direct Expansion
0	*EA 6.1 (Mandatory)*	ENERGY STAR	Cooling Heating	≥ 13 SEER ≥ 8.2 HSPF	≥ 90 AFUE	≥ 85 AFUE	≥ 16.2 EER ≥ 3.6 COP	≥ 14.1 EER ≥ 3.3 COP	≥ 15 EER ≥ 3.5 COP
☐	*EA 6.2 (2 Points)*	Better than ENERGY STAR	Cooling Heating	≥ 14 SEER ≥ 8.6 HSPF	≥ 92 AFUE	≥ 87 AFUE	≥ 17.8 EER ≥ 4.0 COP	≥ 15.5 EER ≥ 3.6 COP	≥ 16.5 EER ≥ 3.9 COP
☐	*EA 6.3 (HP 4 Pts, Other 3 Pts)*	Substantially better than ENERGY STAR	Cooling Heating	≥ 15 SEER ≥ 9.0 HSPF	≥ 94 AFUE*	≥ 90 AFUE	≥ 19.4 EER ≥ 4.3 COP	≥ 17 EER ≥ 4.0 COP	≥ 18 EER ≥ 4.2 COP

	Total # of LEED HOMES Points

*Note: * designates furnace with low electric energy use*

HVAC Requirements for Southern and South Central Climates: Select from credits below (see climate map in Exhibit EA-4B).

	List of HVAC Credits		End-Use	Requirements for HVAC Equipment in IECC/IRC Climate Zones 1-3					
				Central AC & Air Source Heat Pumps	Furnaces	Boilers (Gas or Oil)	Geothermal Heat Pumps: Open Loop	Geothermal Heat Pumps: Closed Loop	Geothermal Heat Pumps: Direct Expansion
0	*EA 6.1 (Mandatory)*	ENERGY STAR	Cooling Heating	≥ 14 SEER ≥ 8.2 HSPF	≥ 80 AFUE	≥ 80 AFUE	≥ 16.2 EER ≥ 3.6 COP	≥ 14.1 EER ≥ 3.3 COP	≥ 15 EER ≥ 3.5 COP
☐	*EA 6.2 (2 Points)*	Better than ENERGY STAR	Cooling Heating	≥ 15 SEER ≥ 8.6 HSPF	≥ 90 AFUE	≥ 85 AFUE	≥ 17.8 EER ≥ 4.0 COP	≥ 15.5 EER ≥ 3.6 COP	≥ 16.5 EER ≥ 3.9 COP
☐	*EA 6.3 (HP 4 Pts, Other 3 Pts)*	Substantially better than ENERGY STAR	Cooling Heating	≥ 16 SEER ≥ 9.0 HSPF	≥ 92 AFUE*	≥ 87 AFUE	≥ 19.4 EER ≥ 4.3 COP	≥ 17 EER ≥ 4.0 COP	≥ 18 EER ≥ 4.2 COP

	Total # of LEED HOMES Points

*Note: * designates furnace with low electric energy use*

EA 7. Water Heating

Maximum *Points: 6*

Intent

Reduce energy consumption associated with domestic hot water system, including improving the efficiency of both the hot water system design and the layout of the fixtures in the home.

Requirements

Prerequisites (Mandatory Measures)

N/A

Credits (Optional Measures)

7.1 ***Efficient Distribution System***. (2 Points, see Exhibit EA 7-A.) Design and install energy-efficient water distribution system shown schematically in Exhibit EA 7-A). Design should reduce hot water waste by minimizing the length of plumbing runs, including minimizing the distance between the fixtures within the home. Select only one measure:

Structured plumbing system. The system design must include a circulation loop that is within 10 feet of every fixture, and has a demand controlled circulation pump. The total length of the recirculation loop must be less than 30 linear feet of plumbing. Branch lines run from the loop to each fixture and are no longer than 10 feet, and a maximum of ½" in diameter. Only push button controls can be used to receive the credit. A push button must be installed in each full bathroom and the kitchen.

Central manifold distribution system. The system design must include an R4 insulated trunk line (maximum 10 foot length) from the water heater to the central manifold. The maximum branch line from the central manifold to the fixtures is 20 feet in one-story homes and 30 feet in two-story homes Branch lines run from the manifold to each fixture are of maximum ½" nominal diameter.

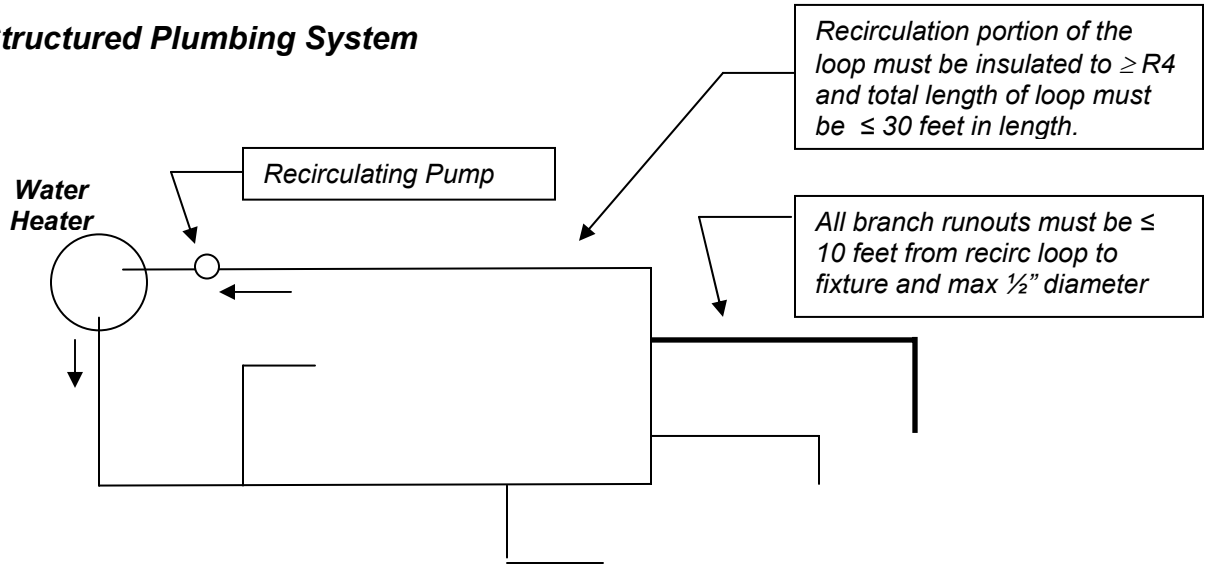
Compact design of conventional system. The water heater must be centrally located to ensure that the longest water heater to fixture piping run is 20 feet in one-story homes and 30 feet in two-story homes. Branch lines run from a central header to each fixture and are a maximum of ½" in diameter.

7.2 ***Pipe Insulation***. (1 Point.) All domestic hot water piping shall have R4 insulation. Insulation shall be properly installed on all piping elbows to adequately insulate the 90° bend.

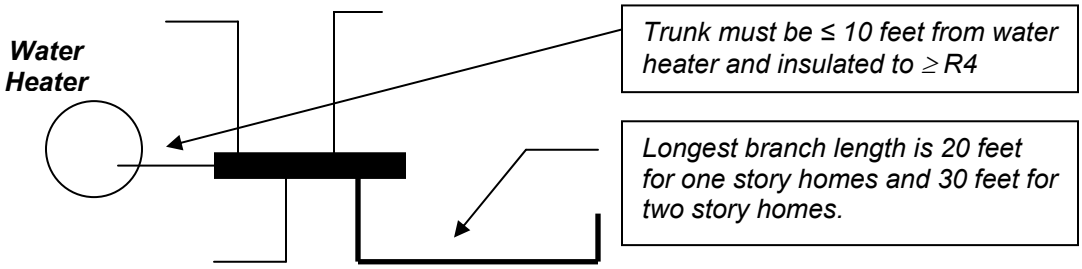
7.3 ***Efficient DHW Equipment***. (Max. 3 Points, see Exhibit Ea 7-B.) Design and install energy-efficient water heating equipment. Select one measure from Exhibit EA7-B.

Exhibit EA7-A
Schematic Diagrams of Sample Hot Water Distribution Systems

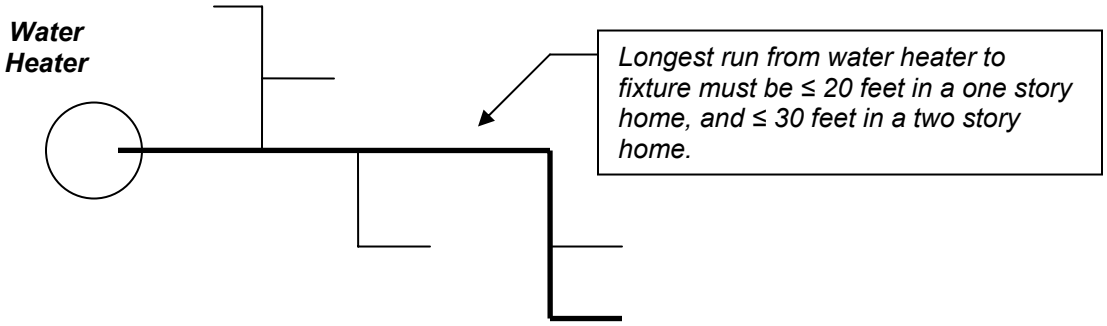
Structured Plumbing System



Central Manifold Distribution System



Compact Design of Conventional System



Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection of installed measure(s), to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using EA 1 is used, then must skip EA Credit 7.2.

Low flow shower heads also may reduce demand for hot water and resulting energy use for water heating by up to 20 percent. The LEED points for installing low flow shower heads are included in WE Credit 3, Low Flow Fixtures.

Exhibit EA7-B
List of High Efficiency Water Heating Equipment

Type / Energy Factor	Description	Points
Gas-fired Water Heaters		
EF ≥ 0.53 (80 Gallon)	Conventional High Efficiency Unit	1
EF ≥ 0.57 (60 Gallon)	Conventional High Efficiency Unit	1
EF ≥ 0.61 (40 Gallon)	Conventional High Efficiency Unit	1
EF ≥ 0.8	Conventional or Instantaneous Water Heater	2
CAE ≥ 0.8 (Note 1)	Combination Water/Space Heaters	2
Electric Water Heaters		
EF ≥ 0.89 (80 Gallon)	Conventional High Efficiency Unit	1
EF ≥ 0.92 (50 Gallon)	Conventional High Efficiency Unit	1
EF ≥ 0.93 (40 Gallon)	Conventional High Efficiency Unit	1
EF ≥ 0.99	Instantaneous Water Heater	2
EF ≥ 2.0	Heat Pump Water Heater	3
Solar Water Heaters, Back-Up		
≥ 40% of Annual DHW Load	With Pre-Heat Tank	2
≥ 60% of Annual DHW Load	With Pre-Heat Tank	3

Product Info:

Energy Factors for various manufacturers available at:
http://www.gamanet.org/gama/inforesources.nsf/vContentEntries/Product+Directories
Note 1. CAE - Combined Annual Efficiency

Additional Information

Rationale

Indoor water savings can be achieved with more efficient water distribution systems. LEED points for indoor water distribution-related savings are included in this credit.

Approx.10 to 15 percent of energy use in hot water systems is from distribution losses. Distribution losses can be greatly reduced by ensuring that all hot water end-uses (i.e., fixtures & appliances) are located with 20 feet of the hot water tank.

Potential Technologies and Strategies

TBD

Resources and References

TBD

EA 8. Lighting

Maximum *Points: 3*

Intent

Reduce energy consumption associated with interior and exterior lighting.

Requirements

Prerequisites (Mandatory Measures)

8.1 Install at least three ENERGY STAR labeled light fixtures or ENERGY STAR labeled Compact Fluorescent Light Bulbs (CFLs) in high-use rooms (kitchen, dining room, living room, family room, hallways).

Credits (Optional Measures)

8.2 Select and install any of the following measures (0.5 Point each, 1.5 Max. Points):

- o motion sensor controls on all outdoor light fixtures.
- o four wireless photovoltaic exterior light fixtures, if exterior fixtures are installed.
- o three additional ENERGY STAR labeled light fixtures, or three ENERGY STAR labeled Compact Fluorescent Light Bulbs (CFLs), *in addition to those installed per EA Prerequisite 8.1*.

OR

8.3 Install ENERGY STAR Advanced Lighting Package (ALP) (3 Points)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection of this installed measure and fixture labels/packaging, to affirm that the requirements above have been completed,
- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the lighting designer engineer or responsible party, declaring that the project site meets the credit requirements, and placed in the project documentation file; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If EA 1 is used, then must skip this credit.

Additional Information

Rationale

Exterior lighting is usually installed with on/off controls. Thus, the lights may be on for extended periods of time when they are not actually needed. Infrared sensors turn fixtures on only when motion is sensed and will turn fixtures off after a period of inactivity, thus operating lighting only when illumination is needed

High efficiency indoor lighting fixtures (with the ENERGY STAR label) use approximately 25 to 50 percent of the energy used by conventional incandescent fixtures.

Potential Technologies and Strategies

TBD

Resources and References

Information on ENERGY STAR labeled light fixtures can be found at EPA's website:
http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.ALP_Builder

The Lighting Pattern Book for Homes, Lighting Research Center, Rensselaer Polytechnic Institute, Troy, NY, 1993.

Alliance to Save Energy information on the installation and energy savings from occupancy Sensors.
www.ase.org

EA 9. Appliances

Maximum *Points: 3*

Intent

Reduce appliance energy consumption.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

9.1 ***ENERGY STAR Labeled Appliances.*** (Max. 2 Points.) Install appliances from list below. Points are not available for more than one of each type of appliance.

- o ENERGY STAR labeled refrigerator (1 Point)
- o ENERGY STAR labeled ceiling fans (at least one in living or family room ***AND*** one per bedroom) (0.5 Point)
- o ENERGY STAR labeled dishwasher (0.5 Point)
- o ENERGY STAR labeled clothes washer (0.5 Point)

9.2 ***Very Efficient Clothes Washer***. (1 Point.) Install clothes washer with modified energy factor (MEF)[9] > 1.8, ***AND*** water factor (WF) < 5.5. A clothes washer that meets these requirements and the requirement in EA 9.1 can be counted for both.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection of this installed measure and product labels, to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If credit EA 1 is used, then must skip EA 9.1 and EA 9.2.

Indoor water savings can also achieved by selecting water-efficient appliances. LEED points for appliance-related water savings are included in this credit.

[9] For more information on MEF and WF, see the CEE or ENERGY STAR websites.

Additional Information

Rationale

Energy-efficient appliances with the ENERGY STAR label use 10 to 20 percent less energy than conventional appliances.

Clothes washers and dishwashers account for about 25 percent of indoor water use water, or as much as 10 to 15 percent of total water use. On average, ENERGY STAR labeled appliances consume 20 percent less energy than conventional appliances, and an ENERGY STAR clothes washers use 50 percent less water than conventional clothes washers.

Potential Technologies and Strategies

TBD

Resources and References

Detailed information on ENERGY STAR labeled appliances is available at EPA's website: http://energystar.gov/index.cfm?c=appliances.pr_appliances

And ENEREGY STAR labeled ceiling fans at: http://www.energystar.gov/index.cfm?c=ceiling_fans.pr_ceiling_fans

EA 10. Renewable Energy

Maximum *Points: 10*

Intent

Reduce consumption of non-renewable energy sources by encouraging the installation and operation of renewable electric generation systems.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

10 **Renewable Energy System. (Max 10 Points.)** Design and install a renewable electricity generation system. Receive 1 Point for every 5 percent of annual electrical load met by the system.

Annual electric load is defined as the amount of electricity that a typical home (e.g. the HERS Reference Home) would consume in a typical year. The annual electric load in the base or reference home must be determined using the procedures specified in the 2006 Mortgage Industry National Home Energy Rating System (HERS) Guidelines.

As an example:

Annual electric load (based on HERS Reference Home)	= 10,000 KWh
Annual electricity consumption in LEED Home	= 7,000 KWh
Annual electricity supplied by PV system	= 2,000 KWh
Percent of annual electric load supplied by PV system	= 2,000 / 10,000
	= 20%
LEED points, under EA 10	*= 20 ÷ 5 = 4 Points*

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the renewable electric generation system meets the EA 10 requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If credit EA 1 is used, then must skip EA Credit 10.

Additional Information

Rationale

Several promising technologies are available for on-site renewable electric energy generation, including wind generators and photovoltaic (PV) solar power systems. These systems are becoming increasingly cost-competitive as fuel prices rise; in some areas, incentives such as utility rebates are available, reducing the payback period.

Potential Technologies and Strategies

TBD

Resources and References

Listing of public and private resources for renewable and alternative energy sources TBD.

Solar Energy Society [www.ases.org]

Solar Energy Industries Association [www.seia.org]

American Wind Energy Association [www.awea.org]

EA 11. Residential Refrigerant Management **Maximum *Points: 1***

Intent

Minimize contributions to ozone depletion and global warming through selection of appropriate refrigerants in the HVAC system.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

11. **Appropriate HVAC Refrigerants.** (1 Point.) Do not use refrigerants.

OR

Install HVAC systems with non-HCFC refrigerant (e.g. R-410a)

OR

Install HVAC systems with refrigerants that comply with the following equation. (See example case of residential refrigerants in Exhibit EA11-A).

LCGWP + LCODP x 10^5 ≤ 160

Where:

LCODP = [ODPr x (Lr x Life +Mr) x Rc]/Life

LCGWP = [GWPr x (Lr x Life +Mr) x Rc]/Life

LCODP: Lifecycle Ozone Depletion Potential (lbCFC11/Ton-Year)

LCGWP: Lifecycle Direct Global Warming Potential (lbCO2/Ton-Year)

GWPr: Global Warming Potential of Refrigerant (0 to 12,000 lbCO2/lbr)

ODPr: Ozone Depletion Potential of Refrigerant (0 to 0.2 lbCFC11/lbr)

Lr: Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)

Mr: End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)

Rc: Refrigerant Charge (0.5 to 5.0 lbs of refrigerant per ton of cooling capacity)

Life: Equipment Life (10 to 35 years; default based on equipment type, unless otherwise demonstrated)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the HVAC refrigerant meets the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Exhibit EA11-A

Example Cases of Residential Refrigerants that are Compliant with EA c11

Refrigerant	Combined LCGWP+ LCODP Score	System Size	Refrigerant Charge	Leakage Rate	Equip Life
R410A	152	2 Ton	3.7 Lb / Ton	1.5%	15 Years
R410A	151	3 Ton	3.0 Lb / Ton	2.0%	15 Years
R410A	151	4 Ton	3.0 Lb / Ton	2.0%	15 Years
R410A	121	5 Ton	3.0 Lb / Ton	2.0%	15 Years

Synergies and Trade-Offs

TBD

Additional Information

Rationale

This credit encourages the early adoption of non-CFC refrigerants in HVAC equipment by builders.

HCFCs (i.e., R-22) have been the refrigerants of choice for residential heat pump and air-conditioning systems for more than four decades. Unfortunately for the environment, releases of HCFCs from system leaks contribute to ozone depletion.

After 2010, chemical manufacturers may only produce HCFCs (i.e., R-22) for servicing existing equipment. Thereafter, HCFCs cannot be manufactured for use in new equipment.

Potential Technologies and Strategies

Design and operate the facility without mechanical cooling and refrigeration equipment. Where mechanical cooling is used, utilize HVAC systems that minimize direct impact on ozone depletion and global warming. Select HVAC&R equipment with reduced refrigerant charge (i.e., locate evaporator and condenser as close together as possible), low annual leakage rates, and increased equipment life. Provide guidance to assist homeowner to maintain equipment to prevent leakage of refrigerant to the atmosphere.

Resources and References

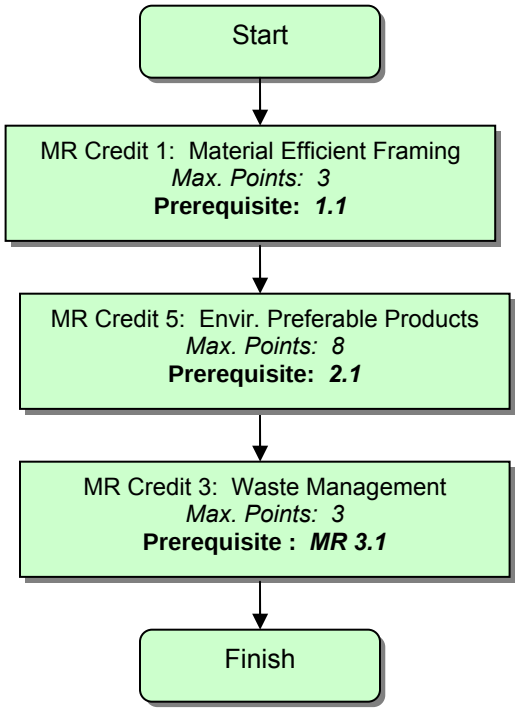
"What You Should Know about Refrigerants When Purchasing or Repairing a Residential A/C System or Heat Pump"
http://www.epa.gov/ozone/title6/phaseout/22phaseout.html

Materials and Resources (MR)

Pathway through MR Credits

Important Note:

*A minimum of **2 points** must be achieved in the MR category*



MR 1. Material-Efficient Framing

Maximum Points: 3

Intent

Optimize the use of framing materials.

Requirements

Prerequisites (Mandatory Measures)

1.1 ***Waste Factor in Framing Order.*** Overall waste factor (WF) may not exceed 10%. If WF on any portion of the framing order exceeds 10 %, calculate overall WF as shown in Exhibit MR1-A.

Exhibit MR1-A
Sample Waste Factor (WF) in Framing Order Calculation for MR Prerequisite 1.1

Framing Component	Total Cost ($)	Waste Factor (%)	Waste Cost ($)
Random lengths	$1,000	15%	$150
Studs	$2,000	5%	$100
Beams/headers	$500	20%	$100
Roof deck	$2,000	0%	$0
Wall sheathing	$0	0%	$0
Rafters	$2,000	0%	$0
Ceiling joists	$1,500	10%	$150
Cornice work	$3,000	10%	$300
TOTAL	**$12,000**		**$1,000**
Overall WF (Waste $/Cost $)			**8.3%**

Credits (Optional Measures)

1.2 **Advanced Framing Techniques**. (Max. 3 Points.) Implement measures from the list shown in Exhibit MR 1-B throughout the home, where applicable and appropriate.

OR

1.3 Structurally Insulated Panels (SIPs). (2 Points.) Use SIPs for all wall and roof components, where applicable and appropriate.

Exhibit MR 1-B
List of Advanced Framing Measures
for MR Credit 1.2

Efficient Framing Measures	Points Earned
Use exterior wall shear technique other than wood sheathing for the whole building	1
Use wood wall sheathing for shear only at corners	0.5
Space joists greater than 16" o.c.	0.5
Space studs greater than 16" o.c	0.5
Design roof pitch/eave width to 24" module	0.5
• Size headers for actual loads • Use ladder blocking or drywall clips • Use 2-stud corners	2 of 3 measures: 0.5

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Inspect installed measure(s) and review relevant documents to affirm that the requirements above have been met; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

Efficient framing practices can reduce the need for lumber, while still providing sufficient structural support. A reduction in lumber demand reduces material, but can also reduce labor and shipping costs. Minimizing header sizes may allow placement of windows higher on the wall, which provide design advantages.

Additional Information

Rationale

Conventional framing techniques use about 15 to 20 percent more framing material than is structurally needed. This credit focuses on wood framing because ~90% of U.S. housing stock is wood-framed. Efficient use of other materials is also good, but comparable data on efficient approaches to other structural systems isn't readily available.

Potential Technologies and Strategies

Provide detailed framing drawings (e.g., framing elevations and plans). Have an engineer or architect calculate needed header sizes and/or substitute composite or box or SIP headers in place of solid lumber. Avoid use of excess lumber for purely aesthetic purposes, such as false "thick" walls. Thoroughly brief and supervise framing crew.

In addition to the Credits (Optional Measures) listed above, there are other strategies that have been shown to reduce framing material consumption, when utilized effectively. These include single top plates (with stack framing), designing to modular (i.e., two-foot) dimensions, and other approaches. The resources and references listed below provide additional guidance that may be helpful in maximizing your material-efficiency.

Resources and References

National Association of Home Builders Research Center (www.NAHBRC.com)

Builder's Guide. Energy and Environmental Building Association (www.eeba.org)

Efficient Wood Use In Residential Construction, NRDC, 1998.

California Integrated Waste Management Board, *Designing With Vision: A Technical Manual For Material Choices In Sustainable Construction*.

www.toolbase.org/tertiaryT.asp?TrackID=&CategoryID=70&DocumentID=2021

http://www.energy.state.or.us/code/respub/res10.pdf

http://www.toolbase.org/tertiaryT.asp?TrackID=&DocumentID=2021&Category

MR 2. Environmentally Preferable Products

Maximum Points: 8

Intent

Increase demand for environmentally preferable products (EPPs) [1] and products or building components that are extracted, processed, and manufactured within the region.

Requirements

Prerequisites (Mandatory Measures)

2.1 ***FSC Certified Tropical Woods***. Products containing tropical woods, if intentionally used (i.e., specified in purchasing documents), must be certified in accordance with the guidelines of the Forest Stewardship Council (FSC). See Technologies and Strategies and Resources and References for a definition of "tropical" and other relevant information. [2]

AND

The builder shall provide all wood product suppliers with a notice, such as the example shown in Exhibit MR2-A, containing all of the following elements:

- Statement that the builder's preference is to purchase products containing tropical woods *only* if they are FSC-certified;
- Request for the country of manufacture of each product supplied; *and*
- Request for a list of FSC-certified products the vendor can supply.

Credits (*Optional Measures*)

2.2 ***Environmentally Preferable Materials***. (0.5 Point each, Max. 8 Points.)

Use products that are environmentally preferable.

AND/OR

Extracted, processed, *and* manufactured within 500 miles of the home ("local").

For each **Component** shown in Exhibit MR2-B, earn 0.5 point for each **Product Specification Type** met (EPP Specifications, Emission Specifications, and/or "Local"). Except as noted otherwise below, 90% of the component, by weight or volume, must meet the specification shown.

[1] The term "environmentally preferable products" means products or services that have a lesser or reduced effect on human health and the environment when compared with competing products or services that serve the same purpose.
[2] Wood products that are reused or reclaimed are exempt.

Exhibit MR2-A
Sample FSC Preference Language for Purchasing Documents

Notice to Vendors: This company prefers to purchase products that contain tropical wood only if they are certified according to the guidelines of the Forest Stewardship Council (FSC). Please provide the country of manufacture of each product you expect to supply to us. Also please provide a list of FSC-certified products you can supply.

Exhibit MR2-B
Environmentally Preferable Products (EPPs)

Assembly	Component	Product Specification Types (see Note 1)		
		EPP Specifications (see Note 2)	Emission Specifications	Local
Exterior wall	framing	FSC-certified		X
Exterior wall	siding or masonry	recycled content or FSC-certified		X
Floor	flooring	linoleum, cork, bamboo, FSC-certified or reclaimed wood, sealed concrete, recycled-content flooring, *or combination* in 45% of home's floor area.	carpet & pad: comply with Carpet and Rug Institute's Green Label Plus program	X
Floor	flooring	BONUS .5 pt for 90% of home	BONUS .5 pt for NO carpet in home	
Floor	framing	FSC-certified		X
Foundation	aggregate			X
Foundation	cement	fly ash or slag as replacement for, not addition to, cement content (min. 30%)		X
Interior wall	framing	FSC-certified		X
Interior walls AND ceilings	gypsum board	recycled content		X
Interior walls AND ceilings AND millwork	Paint		comply with Green Seal Standard GS-11, Paints, First Edition, May 20, 1993	
Landscape	decking or patio material	recycled content or FSC-certified		X
Other	cabinets	recovered, recycled content, or FSC-certified	wood and/or agrifiber products with no added urea-formaldehyde resins	X
Other	counters	recycled content	wood and/or agrifiber products with no added urea-formaldehyde resins	
Other	doors (not incl. garage)	recycled content or FSC-certified		X
Other	trim	recovered, recycled content, or FSC-certified	wood and/or agrifiber products with no added urea-formaldehyde resins	X
Other	adhesives & sealants		TBD	
Other	windows	recycled content or FSC-certified		X
Roof	framing	FSC-certified		X
Roof	roofing	recycled content or vegetated (min. 200 sf)		X
Roof AND floor AND wall	insulation	recycled content (min. 20%)	comply with State of California, DHS, "Practice for Testing of VOCs from Building Materials Using Small Chambers": www.dhs.ca.gov/ehlb/IAQ/VOCS/Practice.htm	X
Roof, floor, wall (2 of 3)	sheathing	recycled content or FSC-certified		X

Note 1: A maximum of 2 points can be earned for any single component listed in Exhibit MR2-B (e.g., roofing, siding, etc.) regardless of the amount by which a minimum performance threshold is exceeded. Exemplary performance (i.e., additional qualifying components) may be rewarded under ID Credit 3.

Note 2: "Recycled content" products must contain a minimum of 25% post-consumer recycled content except as noted otherwise above. (Post-industrial (pre-consumer) recycled content is counted at half the rate of post-consumer content.)

Verification / Submittals

The Provider's third-party rater shall:

MR 2.1: FSC Certified Tropical Wood

- ✓ Confirm that the Accountability Form (in Attachment C) is signed by the builder or responsible party, declaring that all tropical wood, if used, is FSC certified; and
- ✓ Place the signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

MR 2.2: Environmentally Preferable Materials

- ✓ Confirm that the Accountability Form (in Attachment C) is signed by the builder or responsible party, declaring that the materials meet the criteria in Exhibit MR 2-B; and
- ✓ Place the signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

Products with low-VOC emissions may improve indoor air quality. Such products are included in this credit rather than in the IEQ section in order to consolidate information that pertains to materials selection, specifying, and purchasing.

A substantial amount of energy is used to transport materials from product manufacturing plants to home construction sites. The local sourcing aspect of this credit includes the energy-related benefits of shorter transportation routes.

Additional Information

Rationale

MR2.1.The biological wealth of the tropical rainforests, and their devastation due to poor forestry practices in those regions, are of such great importance that they merit singular treatment in this credit. Tropical wood content can end up in a wide variety of products unbeknownst to the purchaser.

MR2.2. Many new products are available which are less harmful to the environment and/or to humans than their conventional counterparts, including those that have lower emissions, are sustainably produced, include recycled content, are rapidly renewable, etc. The use of these materials in place of conventional products, while difficult to evaluate objectively, can nevertheless significantly improve the overall environmental performance of the home. Qualifying materials have one or more of the following attributes:

- o FSC-certified (wood products)
- o Recycled content
- o Reclaimed
- o Bio-based
- o Agricultural residue
- o Low or no VOC emissions

Local sourcing is another aspect of environmental preferability. Demand for products that are extracted, processed, and manufactured within the region encourages the use of indigenous resources, reduces environmental impacts from transportation, and increases awareness of the environmental impacts associated with material extraction and consumption, such as deforestation, mining, etc., thereby encouraging a conservation ethic.

Potential Technologies and Strategies

MR2.1. A species of wood is considered "tropical" for purposes of this credit if it is grown in a moist tropical country that lies, either in part or in its entirety, between the Tropics of Cancer and Capricorn (23.5 degrees latitude north and south, respectively). See Exhibit MR2-C for a reference list by continent. Also see ***Resources and References*** below for information on locating FSC products and on identifying tropical species.

Include FSC purchasing preference language in all purchasing contracts, purchase orders, etc., as shown in Exhibit MR2-A.

MR2.2. Specifications for many "alternative" and/or salvaged building materials have not been listed in this credit because they are not used in most homes. However, use of significant quantities of such materials may merit consideration for an innovation credit or credit interpretation.

Exhibit MR2-C
Tropical Countries by Continent

Continent	Tropical Countries
Africa	all except Morocco, Tunisia, Algeria, Egypt, and Libya
Asia & Southeast Asia	all except Japan, N. & S. Korea, and Russia
Australia/Oceana	all except New Zealand
Central America & Caribbean	all countries
Europe	None
Middle East	None
North America	Mexico
South America	all except Uruguay

Resources and References

Environmentally Preferable Products: Many helpful sources of green product information are available, both in print and on the Internet. A few are listed below.

- *Green Building Products: The GreenSpec® Guide to Residential Building Materials*, copublished by BuildingGreen, Inc., and New Society Publishers. Available in print or online at https://www.buildinggreen.com/ecommerce/gbp.cfm

- Oikos Green Building Source, http://oikos.com/green_products/index.php
- Green Building Pages, http://www.greenbuildingpages.com/main_a.html
- Green HomeGuide, http://www.greenhomeguide.com/

Tropical Woods: If you are unable to identify a product's country of origin, you may wish to consult one or more of the following databases. Please note that wood species can only be identified accurately by scientific (botanic) and not by either common or proprietary name.

- USDA Forest Service – http://www2.fpl.fs.fed.us/TechSheets/tropicalwood.html (free). This database is incomplete with respect to species, common, and trade names.
- Forest World's "Woods of the World" – http://www.forestworld.com/wow.cfm. This CD covers 910 species, equaling 95 percent of wood in trade. It includes scientific and common names, origins, and properties.
- "The Wood Explorer" – http://www.toolcenter.com/wood/index.html. This CD covers 1,650 wood species. It includes scientific and common names, origins, and properties.

Information on eco-regions of concern is available from the World Wildlife Foundation at http://www.panda.org/about_wwf/where_we_work/ecoregions/ecoregion_list/index.cfm.

FSC-certified Products: The following two resources can assist project teams in locating FSC certified products.

- FSC-US – www.findfsc.org. For help in locating FSC-certified products, fill out the form on this website and submit it to FSC-US; FSC will then circulate it to certified companies, who then will contact you if they have your desired product(s) available.
- Rainforest Alliance *SmartGuide to Green Building Wood Sources* – www.rainforestalliance.org/smartguides. This document lists US suppliers, manufacturers, and distributors of FSC certified building products.

Life Cycle Analysis Tools: There are a variety of life cycle analysis tools that may be helpful in the selection of environmentally preferable materials and assemblies. These include the following:

- BEES (Building for Environmental and Economic Sustainability) software – http://www.bfrl.nist.gov/oae/software/bees.html
- Athena Institute Environmental Impact Estimator – http://www.athenasmi.ca/tools/software/

MR 3. Waste Management

Maximum Points: 3

Intent

Reduce waste generation level to below the industry norm.

Requirements

Prerequisites (Mandatory Measures)

3.1 ***Waste Management Planning***. Complete the following waste management tasks.

- Investigate and document local options for diversion (recycling, reuse, etc.) of all anticipated major constituents of the project waste stream, including cardboard packaging and "household" recyclables (e.g., beverage containers).
- Document rate of diversion; record diversion rate for land clearing and/or demolition, if applicable (e.g., on gut rehab project), separately from rate for new construction phase of project.

Credits (Optional Measures)

3.2 ***Waste Reduction***. (Max. 3 Points, see Exhibit MR3-A.) Divert waste generated from new construction activities from landfills and incinerators, limiting to level below the industry norm. Use either option described below.

- **Fixed diversion weight or volume.** Generate 2.5 pounds (or .16 cubic yards) or less of waste per square foot of conditioned floor area. Use column 1 or 2 and column 5 to determine score. [12]
- **Project-specific diversion rate.** Divert 25% of more of the total materials taken off the construction site from landfills and incinerators. Use column 3 or 4 and column 5 to determine score; calculate percentage using either weight or volume.

NOTE: Land clearing and demolition waste (e.g., from removal of pre-existing structures on the site) may not be counted toward diversion rate**.**

[12] The industry averages is 4.2 pounds (or 0.265 cubic yards) of waste per square foot of conditioned floor area, based on data provided by the National Association of Home Builder's Research Center. See Exhibit MR3-C for more information.

Exhibit MR3-A
Points for Waste Diversion

Amount to Landfills and Incinerators				Points Earned
Lbs / SF	Cubic Yards / 1000 SF	Percent Waste	Percent Diverted	
4.0	25.5	100%	0%	0.0
3.5	22.3	88%	13%	0.0
3.0	19.1	75%	25%	0.5
2.5	15.9	63%	38%	1.0
2.0	12.8	50%	50%	1.5
1.5	9.6	38%	63%	2.0
1.0	6.4	25%	75%	2.5
0.5	3.2	13%	88%	3.0

Verification / Submittals

The Provider's third-party rater shall:

MR 3.1: Waste Management Planning

- ✓ Confirm that the Accountability Form (in Attachment C) is signed by the builder or responsible party, declaring that the three requirements of this credit have been achieved; and
- ✓ Place the signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

MR 3.2: Waste Reduction

- ✓ Review relevant documents (i.e., waste hauler tags) to affirm that the requirements above have been met;
- ✓ Complete waste diversion tabulation (see Exhibit MR3-B); and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Exhibit MR3-B
Sample Waste Reduction Tabulation

Load Tag Date	Volume Hauled (cubic yards)	Weight Hauled (pounds)*
TOTAL		
Home Size (SF)		
Weight Hauled/ SF of Home		

* One cubic yard of waste is equivalent to approximately 160 pounds.

Synergies and Trade-Offs

Waste generation should be measured by weight, rather than volume, whenever possible. Volume can vary substantially depending on how a dumpster is loaded (compaction can alter volume dramatically). However, if loads are recorded by volume rather than weight, use the conversion indicated above, below Exhibit MR3-B.

Additional Information

Rationale

Because landfill space is rapidly diminishing, incineration produces pollutants, and waste of materials in itself carries negative environmental impacts, waste should be avoided to the extent possible.

The National Association of Home Builders (NAHB) has collected data nationally and estimates that the construction of a "typical" 2,000-square-foot home generates about 8,000 pounds of waste, occupying roughly 51 cubic yards of landfill space, as shown in Exhibit MR3-C. This equates to an average of about four pounds of waste per square foot of conditioned space. These estimates are based on the assumption that three sides of the home's exterior are covered with vinyl siding and the front facade is brick veneer. Exhibit MR3-C contains NAHB's waste estimate for this typical home. These numbers are the basis for the "industry norm" values used in this credit. *Source*: NAHB Research Center, 2001, www.nahbrc.org

Exhibit MR3-C
NAHB Construction Waste Estimate of a Typical 2000-Sq.-Ft. House

Material	Weight		Volume	Density
	(lb)	(lb/SF)	(cu. yd.)	(lbs / cu. yd.)
Solid Dimensional Wood	1600	0.8	6	267
Engineered Wood	1400	0.7	5	280
Drywall	2000	1.0	6	333
Cardboard	600	0.3	20	30
Metal	150	0.08	1	150
PVC	150	0.08	1	150
Masonry	1000	0.5	1	1000
Hazardous Materials	50	0.03	-	-
Other	1050	0.53	11	95
Total	**8000**	**4.0**	**51**	**160**

Potential Technologies and Strategies

Develop a complete construction and demolition waste management plan by assessing waste types, quantities and disposal costs; identifying licensed haulers and processors of recyclables; identifying markets for salvaged materials; employing deconstruction, salvage, reuse, and recycling strategies and processes, including waste auditing; and documenting the cost for recycling, salvaging, and reusing materials. Source reduction on the job site should be an integral part of the plan.

Address reuse or recycling of materials found at the job-site, including demolition materials, if any, from pre-existing structures, corrugated cardboard, metals, concrete, brick, asphalt, land clearing debris (if applicable), beverage containers, clean dimensional wood, plastic, glass, gypsum board, and carpet/ Evaluate the cost-effectiveness of recycling/reusing rigid insulation, engineered wood products, and other materials. Also address the minimization and proper disposal of any hazardous materials generated during construction and/or demolition.

Resources and References

General

NAHB Research Center, Residential Construction Waste Management: A Builder's Field Guide and Residential Construction Waste Management: A Coordinator's Guide To Conducting Workshops At the Local Level, www.nahbrc.org, (Click on Builder Programs, and then on Green Building Activities, then on Construction Waste Management Publications). The first publication should be used to produce a step-by-step construction waste management and recovery plan, while the second should be used to train key players on the jobsite in the use of construction waste recovery methods.

U.S. Environmental Protection Agency, Characterization of Building-Related Construction and Demolition Debris in the United States, June 1998 – www.epa.gov/epaoswer/hazwaste/sqg/demol.htm. This provides national data that may be helpful in estimating and characterizing builder waste generation.

Cardboard recycling:

Corrugated Packaging Council can help locate local outlets for cardboard – www.corrugated.org, 800-879-9777.

American Forest & Paper Association publishes a directory of waste paper dealers and recycling centers – www.afandpa.org, 202-463-2700.

Packaging reduction:

US EPA WasteWise program, www.epa.gov/wastewise, 1-800-EPA-WISE.

National Recycling Coalition Source Reduction Forum, Transport Packaging Savings: Strategies to Source Reduce and Reuse Transport Packaging, www.nrc-recycle.org, 703-683-9025.

Wood recycling:

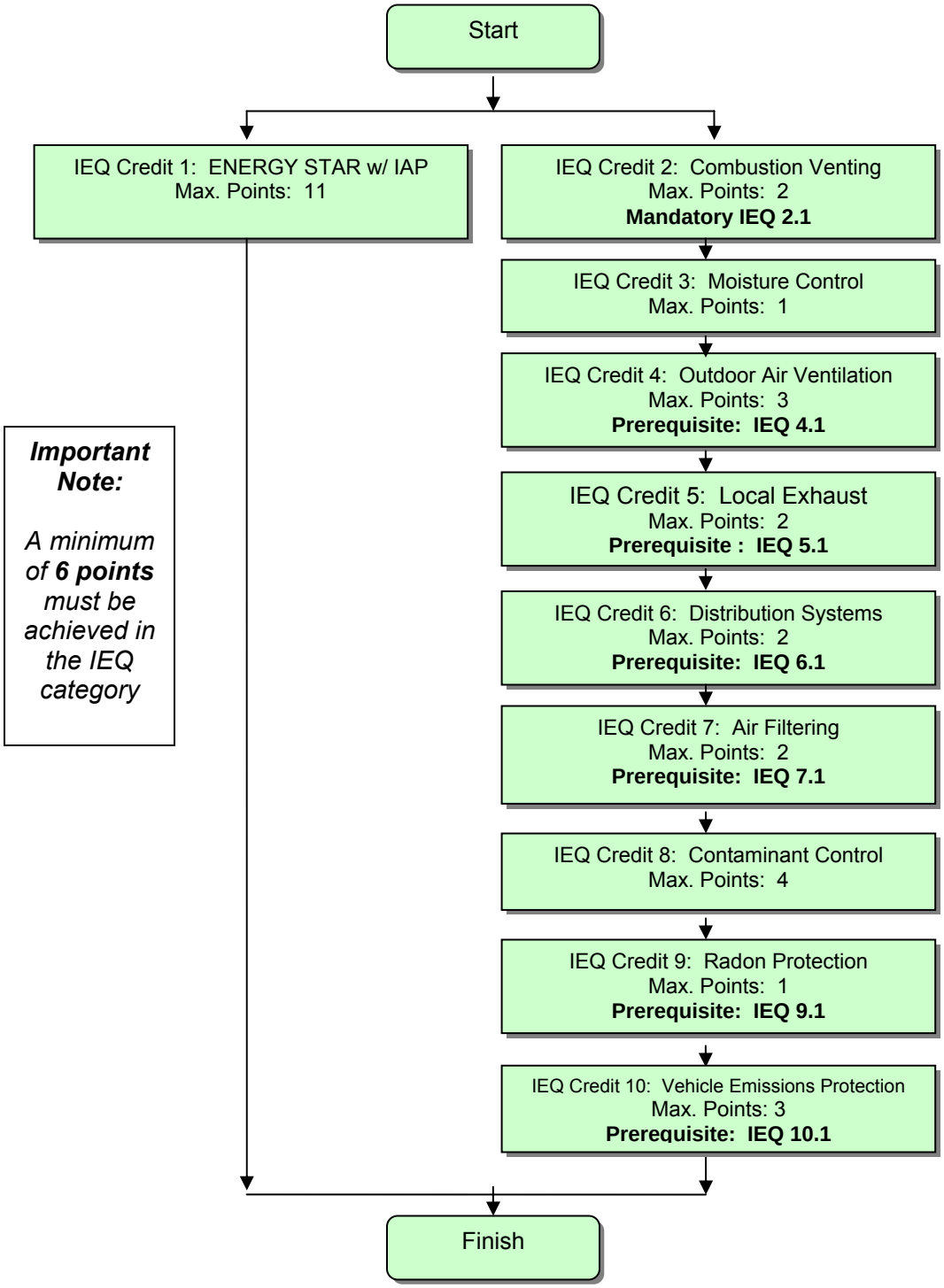
American Forest & Paper Association, National Wood Recycling Directory (searchable directory of outlets for wood) – www.afandpa.org/recycling/recycling.html.

Wood and gypsum, land application:

NAHB Research Center, On-site Grinding of Residential Construction Debris: The Indiana Grinder Pilot, February 1999, www.nahbrc.org. (Click on Builder Programs, then on Green Building Activities, then on Construction Waste Management Publications.)

Indoor Environmental Quality (IEQ)

Optional Pathways through IEQ Credits



IEQ 1. ENERGY STAR with Indoor Air Package

Maximum *Points: 11*

Intent

Improve overall quality of indoor environment by installing an approved bundle of air quality measures.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

1. ***Indoor Air Package***. (11 Points.) Complete all of the requirements of EPA's ENERGY STAR with Indoor Air Package. Note that the ENERGY STAR with Indoor Air Package initiative is being pilot tested and is not yet available in all U.S. markets.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection of installed measure(s) and relevant documents/test results, to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using IEQ credit 1, then must skip IEQ credits: 2, 3, 4.1, 4.2, 5.1, 5.2 , 6.1, 7.1, 8.1, 9, and 10.1, and 10.2.

Additional Information

Rationale

The ENERGY STAR with Indoor Air Package is a comprehensive set of indoor air quality measures that includes ventilation, source control, and source removal measures.

Potential Technologies and Strategies

TBD

Resources and References

Website for ENERGY STAR with Indoor Air Package
http://energystar.gov/index.cfm?c=bldrs_lenders_raters.pt_builder_news#indoorair

IEQ 2. Combustion Venting

Maximum *Points: 2*

Intent

Minimize the leakage of combustion gases (e.g., backdrafting) into the occupied space of home.

Requirements

Prerequisites (Mandatory Measures)

2.1 ***Basic Combustion Venting Measures.*** Space and water heating ***c***ombustion equipment must be designed and installed with closed combustion (i.e., sealed supply air and exhaust ducting) or power-vented exhaust, or it must be located in detached utility building or open-air facility. Homes in hot climates (e.g. EPA climate zone 1 or 2) are exempt from this requirement. Unvented combustion appliances are not allowed.

AND

A carbon monoxide (CO) monitor must be installed on each floor.

AND

All fireplaces and woodstoves must have tight-fitting doors, and no unvented units are allowed.

Credits (Optional Measures)

2.2 ***Enhanced Combustion Venting Measures***. (Max. 2 Points.) Design and install fireplace as per requirements in Exhibit IEQ2-A.

Exhibit IEQ 2-A
List of Combustion Venting Measures Required for IEQ Credit 2.2

Type of Fireplace / Stove	Optional Measures	
	Better Practice (1 Point)	Best Practice (2 Points)
None	N/A	Granted automatically
Wood-burning stove or fireplace	Meet requirements in Exhibit IEQ 2-B	Meet requirements in Exhibit IEQ 2-B. Conduct back-draft potential test and ensure Δ P < 5 Pascals (see note 1)
Natural gas, propane, or alcohol fireplace	N/A	Meet requirements in Exhibit IEQ 2-B
Pellet stove	Meet requirements in Exhibit IEQ 2-B	Meet requirements in Exhibit IEQ 2-B. Include power-venting or direct-venting

Conducting a back-draft potential test. Using the results from a blower-door test, a home can minimize the back-draft potential by limiting the pressure difference created by the presence of a chimney vented appliance. In order to ensure a limited risk of back-drafting, the pressure difference (∆ P) must less then 5 Pascals, where:

$$\Delta P = (Q/C)^{1/n} \quad \text{(must be} \leq 5 \text{ Pascals)}$$

and Q is equal to air flow, C is the constant (?), and n is the air flow exponent.

Exhibit IEQ2-B
Requirements for Fireplaces and Woodstoves
For IEQ Credit 2.2

Masonry fireplaces must be masonry heaters, as defined by the American Society for Testing and Materials Standard E-1602, and the International Building Code, 2112.1.

Factory-built, wood-burning fireplaces shall meet the certification requirements of Underwriters Laboratory UL-127, "Standard for Factory-Built Fireplaces," and either have the EPA-certified label or notice or meet the following requirement: equipment with a catalytic combustor must emit less than 4.1 g/hr of particulate matter, and equipment without a catalytic combustor must emit less than 7.5 g/hr of particulate matter.

Natural gas and propane fireplaces shall be power vented or direct-vented, as defined by 3.3.108 of the National Fuel Gas Code, have a permanently fixed glass front or gasketed door, and comply with the American National Standards Institute, ANSI/Z21.88/CSA 2.33 Harmonized Standard, "Vented Gas Fireplace Heaters" of the International Code Council's International Fuel Gas Code.

Wood stove and fireplace inserts as defined in Section 3.8 of Underwriters Laboratory UL 1482, "Standard for Safety, Solid-Fuel Type Room Heaters," shall meet the certification requirements of that standard, and meet .S. EPA Standard 40 CFR Part 60, subpart AAA, , 60.530-539b, "Standards of Performance for New Residential Wood Heaters," and Washington State's particulate air containment emission standard, WAC 173-433-100 (3).

Pellet stoves shall meet the requirements of the American Society for Testing and Materials (ASTM) E 1509-04, "Standard Specification for Room Heaters, Pellet Fuel-Burning Type."

Decorative gas logs as defined in K.1.11 of the National Fuel Gas Code are not permitted.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection of this installed measure, to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using IEQ Credit 1, then must skip this credit.

Additional Information

Rationale

Indoor air quality is adversely affected by leakage of combustion exhaust gases into the home. Direct- or power- venting reduces the risk of combustion gases being drawn into the home when negative pressure occurs in the home.

Having no fireplace or stove is the most effective way to reduce risk associated with combustion gases. Meeting the prerequisite (Mandatory measure) for fireplaces or stoves provides minimal back-draft protection. Meeting “better practice” provides for improved appliance efficiency, leading to a more complete burn that results in fewer pollutants and lower risk. Meeting “best practice” includes appliance efficiency and extra back-draft protection.

Potential Technologies and Strategies

TBD

Resources and References

TBD

IEQ 3. Moisture Control

Maximum *Points: 1*

Intent

Control moisture levels in order to provide comfort, reduce the risk of mold, and increase the durability of the home.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

3 ***Moisture Load Analysis***. (1 Point.) Conduct a detailed analysis of moisture loads to determine if there is a need for a central humidity control system (i.e., to provide additional humidity, or dehumidification control beyond that provided by the air conditioner). Install humidity control system where needed to maintain humidity ratios below 0.012 (lb. water vapor / lb. dry air) per Section 52.2 of ASHRAE Standard 55-2004.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the humidity control system meets the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using credit IEQ 1, then must skip this credit.

Water leakage through the building envelope can be another major cause of indoor environmental problems (e.g., mold). The LEED points for improved foundation, exterior wall, and roof water management water are included in ID credit 2, Quality Management for Durability.

Additional Information

Rationale

Occupant comfort may be adversely affected by very high or very low humidity levels in the home. High humidity levels may also foster mold growth.

Potential Technologies and Strategies

Humidity control equipment should be selected to maintain maximum humidity levels as shown in Exhibit IEQ3-A, based on the summer design indoor air temperature. Maintaining minimum humidity levels in winter is controversial. ASHRAE Standard 55 has no lower limit and ASHRAE Standard 62 suggest 25 percent RH as a lower guideline. Note that adding humidity may waste

energy and in some cases has been shown to be unhealthy and may have adverse affects on durability.

Exhibit IEQ3-B
Thermal Environment Conditions for Required Humidity Comfort Control

Summer Indoor Design Temperature (F)	Relative Humidity (%)	Humidity Ratio (lb water / lb dry air)
70	76%	0.012
74	66%	0.012
78	58%	0.012
82	50%	0.012

Resources and References

ANSI / ASHRAE Standard 55-2004, “Thermal Environmental Conditions for Human Occupancy”

IEQ 4. Outdoor Air Ventilation

Maximum *Points: 3*

Intent

Reduce occupant exposure to indoor pollutants by ventilating with outdoor air.

Requirements

a. Forced Air Systems:

Prerequisites (Mandatory Measures)

4.1 ***Basic Outdoor Air Ventilation***. Design and install a whole building ventilation system that complies with ASHRAE Standard 62.2 - 2004.[13] Note that Standard 62.2 provides for the design of alternative (e.g., passive) ventilation designs in Section 4.1.2. ASHRAE 62.2 requirements for minimum whole house ventilation air flow rates are shown in Exhibit EA4-A.

Exhibit IEQ 4-A
Minimum Required Ventilation Air Flow (CFM) Requirements

Conditioned Floor Area (ft^2)	Number of Bedrooms				
	0 – 1	2 – 3	4 - 5	6 - 7	> 7
< 1,500	30	45	60	75	90
1,501 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 6,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

Credits (Optional Measures)

4.2 ***Enhanced Outdoor Air Ventilation***. (2 Points.) Install dedicated outdoor air supply system that complies with ASHRAE Standard 62.2

AND

Provides for heat transfer between the incoming outdoor air stream and exhaust air streams (except in very mild and dry climates)

AND

Has fully ducted supply (or trickle ventilators) and exhaust.

4.3 ***Third-Party Performance Testing***. (1 Point.) Third-party tests the flow rate of outdoor air brought into the home through the outdoor ventilation system.

[13] Refer to section 4.1.3 of ASHRAE Standard 62.2-2004, to ensure that natural and mechanical ventilation are properly integrated (i.e., avoid under- and/or over-ventilating).

b. Non-Ducted HVAC Systems (e.g., Hydronic Systems):

Prerequisites (Mandatory Measures)

4.1 ***Basic Outdoor Air Ventilation***. Homes with non-ducted HVAC systems must have mechanical ventilation systems that meet the requirements of ASHRAE Standard 62.2 above, except for the two special cases below:

a. If the home is located in a climate with less than 4,500 infiltration degree days[14];

b. If the home is designed with a passive ventilation system that is stamped by a licensed HVAC engineer.

Credits (Optional Measures)

4.2 ***Enhanced Outdoor Air Ventilation***. (2 Points.) Same requirements as for forced air systems, defined in Part *a* above.

4.3 ***Third-Party Performance Testing***. (1 Point.) Same requirements as for forced air systems, defined in Part *a* above.

Verification / Submittals

The Provider's third-party rater shall:

IEQ 4.1*: Basic Outdoor Air Ventilation*

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the outdoor air ventilation system meets the credit requirements;
- ✓ Place the signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

IEQ 4.2: Enhanced Outdoor Air Ventilation

- ✓ Perform a visual inspection of this installed measure, to affirm that the requirements above have been completed,
- ✓ Check the appropriate box on signed LEED for Homes checklist.

IEQ c4.3: Third-Party Performance Testing

- ✓ Measure outdoor air flow rate into the home to confirm that it at least meets the Std 62.2 requirements, and recommend adjustments as needed; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using IEQ credit 1, then must skip credits 4.1 and 4.2.

[14] Infiltration degree days are defined by ASHRAE in ANSI/ASHRAE Standard 119-1988. Homes located in climates with less than 4,500 infiltration degree days are effectively in very mild climates and can meet their minimum outdoor air ventilation needs by the opening of windows for most of the year. These homes are also exempt from meeting the air filtering requirements of ASHRAE Standard 62.2 under IEQ 7.1. An infiltration degree day is defined as the sum of the heating season infiltration degree days and the cooling season infiltration degree days.

Also, note that the natural air leakage through the envelope contributes to the overall ventilation rate of the home (see EA credits 3.1-3.3). From a health perspective, it is important to not "under-ventilate" a home. In IEQ credit 4, required mechanical ventilation may bring in up to 0.2 ACH of additional ventilation air into the home.

However, from an energy perspective, it is also important not to over-ventilate a home.

In section 4.1.3 of ASHRAE Standard 62.2, specific guidance is provided on balancing mechanical and natural ventilation.

A substantial energy savings can be achieved by using heat recovery equipment for the outdoor air brought into a home. The LEED points for the energy savings from heat recover have been included in this credit.

Additional Information

Rationale

Without adequate outdoor air ventilation, humidity, odors, and pollutants may accumulate within the home, leading to discomfort and increased health risks.

Potential Technologies and Strategies

TBD

Resources and References

ASHRAE Standard 62.2-2003, "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings"

IEQ 5. Local Exhaust

Maximum *Points: 2*

Intent

Reduce occupant exposure to indoor pollutants in kitchens and bathrooms.

Requirements

Prerequisites (Mandatory Measures)

5.1 ***Basic Local Exhaust***. Design and install local exhaust systems in bathrooms and kitchen per ASHRAE Standard 62.2. ASHRAE 62.2 requirements for minimum local exhaust flow rates are shown in Exhibit EA5-A.

AND

Local exhaust systems must be designed and installed to remove exhaust air from the structure to the outdoors (i.e. exhaust outlets into unconditioned spaces are not permitted).

AND

Use ENERGY STAR labeled bathroom exhaust fans (except for exhaust fans serving multiple bathrooms).

Exhibit IEQ 5-A
Minimum Intermittent Local Exhaust Flow Requirements

Location	Minimum Airflow	Notes
Kitchen	100 cfm	Vented range hood required if exhaust fan flow rate is less than 5 kitchen air changes per hour.
Bathroom	50 cfm	N/A

Credits (Optional Measures)

5.2 ***Enhanced Local Exhaust***. (1 Point.) Install occupancy sensor ***OR*** automatic humidistat controller **OR** timer for bath exhaust fans to operate fan either for a timed interval after occupant leaves room or until humidity level is reduced.

5.3 ***Third-Party Performance Testing***. (1 Point.) Perform third-party test of each exhaust air flow rate from the home – for compliance with Std 62.2 requirements.

Verification / Submittals

The Provider's third-party rater shall:

IEQ c5.1: Basic Local Exhaust

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the local exhaust system meets the credit requirements,
- ✓ Place signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

IEQ c5.2: Enhanced Local Exhaust

- ✓ Perform a visual inspection of this installed measure, to affirm that the requirements above have been completed; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

IEQ c5.3: Third-Party Performance Test

- ✓ Measure exhaust air flow rate for each bath and kitchen fan to confirm that it meets the Std 62.2 requirements, and recommend adjustments as needed; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using IEQ Credit 1, then must skip IEQ Credit 5.2.

Additional Information

Rationale

Odors, pollutants, and moisture may accumulate in kitchens and baths that have poor local exhaust.

Potential Technologies and Strategies

TBD

Resources and References

ASHRAE Standard 62.2-2003, "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings"

Additional information on ENERGY STAR labeled exhaust fans can be found at EPA's website: http://www.energystar.gov/index.cfm?c=vent_fans.pr_vent_fans

IEQ 6. Distribution of Space Heating and Cooling

Maximum *Points: 2*

Intent

Provide appropriate distribution of space heating and cooling in the home in order to improve thermal comfort and energy performance.

Requirements

a. Forced Air Systems:

Prerequisites (Mandatory Measures)

6.1 ***Room by Room Load Calculations***. Perform design calculations (using ACCA Manual J and D, ASHRAE 2001 Handbook of Fundamentals, or an equivalent computation procedure) and install ducts accordingly

AND

Ensure that every room has adequate return air flow through the use of either multiple returns or transfer grills.

Credits (Optional Measures)

6.2 ***Third Party Performance Test.*** (2 Points.) Test total supply air flow rates in each room of home using a flow hood or one of the acceptable methods cited by the ACCA Quality Installation Specifications

AND

Adjust using balancing dampers to ensure that supply air flow rates are within +/- 15% (or +/- 10 cfm) of calculated values from ACCA Manual J (as required by EA Prerequisite 6.1).

b. Non-Ducted HVAC Systems (e.g., Hydronic Systems):

Prerequisites (Mandatory Measures)

6.1 ***Room by Room Load Calculations***. Non-ducted systems must be designed to meet heating and cooling loads in each room of home as calculated with ACCA Manual J (or equivalent), on a room by room basis.

Credits (Optional Measures)

6.2 ***Third Party Performance Test.*** (2 Points.) Install non-ducted HVAC system with at least two distinct zones with independent controls.

Verification / Submittals

The Provider's third-party rater shall:

IEQ 6.1: Room by Room Load Calculations

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the supply air system meets the credit requirements, and
- ✓ Place signed Accountability Form in the Project Documentation File;
- ✓ Check the appropriate box on signed LEED for Homes checklist.

IEQ 6.2: Third-Party Performance Test.

- ✓ Measure total supply air flow rate in each room in home to confirm that all flow rates meet the Manual D calculations within +/-15% (or within 10 cfm), and recommend adjustments as needed (or for non-ducted HVAC systems, confirm that there are at least two thermal zones with controls); and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using credit IEQ 1, then must skip credit 6.1.

Space heating and cooling loads are room air flow rates must be calculated using ACCA Manual J in EA 6.1. The ACCA Manual D calculations for this credit are based on these Manual J calculations.

Ducts installation should be visually inspected in credit EA 2 during the pre-drywall insulation inspection.

Additional Information

Rationale

TBD

Potential Technologies and Strategies

TBD

Resources and References

Air Conditioning Contractors' Association (ACCA) Manual D - Residential Duct Systems (http://www.acca.org/tech/manualj/)

IEQ 7. Air Filtering

Maximum *Points: 2*

Intent

Reduce particulate matter from air supply system.

Requirements

a. Forced Air Systems:

Prerequisites (Mandatory Measures)

7.1 ***Good Filters***. Install air filters ≥ MERV 8 and ensure that air handlers can maintain adequate pressure (and air flow). Air filter housings must be air-tight to prevent bypass or leakage.

Credits (Optional Measures)

7.2 ***Better filters***. (1 Point.) Install air filters ≥ MERV 10 and ensure that air handlers can maintain adequate pressure (and air flow). Air filter housings must be air-tight to prevent bypass or leakage.

OR

7.3 ***Best Filters***. (2 Points.) Install air filters ≥ MERV 13 and ensure that air handlers can maintain adequate pressure (and air flow). Air filter housings must be air-tight to prevent bypass or leakage.

b. Non-Ducted HVAC Systems (e.g., Hydronic Systems):

Prerequisites (Mandatory Measures)

7.1 ***Good Filters***. Install air filters ≥ MERV 8 and maintain adequate pressure (and air flow) in any mechanical ventilation systems. If the home is located in a climate with less than 4,500 infiltration degree days or utilizes only passive or exhaust-only ventilation, then it is exempt from this mandatory requirement.

Credits (Optional Measures)

7.2 ***Better Filters***. (2 Points.) Install air filters ≥ MERV 10 and maintain adequate pressure (and air flow) for any mechanical ventilation systems.

7.3 ***Best Filters***. (3 Points.) Install air filters ≥ MERV 13 and maintain adequate pressure (and air flow) for any mechanical ventilation systems.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection of this installed measure, to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using IEQ Credit 1, then must skip IEQ Prerequisite 7.1.

Additional Information

Rationale

Inadequate air filtration may have adverse health effects. Improved air filters will remove more particles from the supply air stream.

Potential Technologies and Strategies

TBD

Resources and References

TBD

IEQ 8. Contaminant Control

Maximum *Points: 4*

Intent

Reduce occupant's exposure to indoor airborne contaminants through source testing and removal.

Requirements

Prerequisites (Mandatory Measures)

None.

Credits (Optional Measures)

8.1 ***Indoor Contaminant Control During Construction***. (1 Point.) Seal off ducts during construction.

8.2 ***Indoor Contaminant Control***. (1 Point each, Max. 2 Points) Select from the measures below:

- Design and install permanent walk-off mats at each entry that are at least 4 feet in length and allow accessibility for cleaning (e.g. grating with catch basin).
- Design a space near primary entryway for removing and storing shoes that is separated from living areas. This space may not have wall-to-wall carpeting and it must be large enough to accommodate a bench and at least 2 pairs of shoes per bedroom.
- Install central vacuum system with exhaust to the outdoors. Ensure exhaust is not near ventilation air intake.

8.3 ***Pre-Occupancy Flush***. (1 Point.) Flush the home with fresh air continuously for one week with all windows kept open and the HVAC system fan running continuously. Replace air filter afterwards if necessary.

Verification / Submittals

The Provider's third-party rater shall:

IEQ 8.1: Indoor Contaminant Control During Construction

- ✓ Perform a visual inspection of ducts for cleanliness prior to occupancy, to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

IEQ 8.2: Indoor Contaminant Control

- ✓ Perform a visual inspection of installed measure(s), to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

IEQ 8.3: Pre-Occupancy Flush

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the builder, or responsible party, declaring that the flush was completed;
- ✓ Place signed Accountability Form in the Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

Products with low VOC emissions greatly benefit indoor air quality. Thus, the LEED points for such products are included in MR Credit 2, Environmentally Preferable Products.

If using IEQ Credit 1, then must skip this credit.

Additional Information

Rationale

Indoor air quality may be adversely affected by contaminants brought into home by occupants (e.g., on shoes). Walk-off mats trap some of the dirt at the entryway that would otherwise be tracked into the home. Central vacuums exhaust collected dust and particulates to the outdoors.

Potential Technologies and Strategies

TBD

Resources and References

TBD

IEQ 9. Radon Protection

Maximum *Points: 1*

Intent

Reduce occupant's exposure to radon gas and other soil gas contaminants.

Requirements

Prerequisites (Mandatory Measures)

9.1 ***High Radon Risk Areas***. If home is located in EPA Zone 1, design and build home with radon resistant construction techniques.

Credits (Optional Measures)

9.2 ***Moderate Radon Risk Areas***. (1 Point.) If home is NOT located in EPA Zone 1, design and build home with radon resistant construction techniques.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the engineer or responsible party, declaring that the ground contaminant mitigation system meets the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using IEQ Credit 1, then must skip this credit.

Additional Information

Rationale

Occupant health may be adversely affected by the presence of radon gas.

Potential Technologies and Strategies

A ground contaminant protection system provides the following basic benefits:

- o Improved drainage below slab;
- o Sealed cracks and holes to prevent penetration of gases; and
- o Reduced negative pressure in basement.

Resources and References

The EPA radon zones are shown on the website: http://www.epa.gov/iaq/radon/zonemap.html

EPA info on Radon-Resistant New Construction (RRNC), see RRNC language in revised IAP - 9/30/05 - section 2 and item 7.6.
http://www.epa.gov/iaq/radon/construc.html#What%20are%20Radon-resistant%20construction%20techniques

IEQ 10. Garage Pollutant Protection

Maximum *Points: 3*

Intent

Reduce occupant's exposure to indoor pollutants originating from adjacent garage.

Requirements

Prerequisites (Mandatory Measures)

10.1 ***No HVAC in Garage***. Do not place air handling equipment or any ductwork in garage.

Credits (Optional Measures)

10.2 ***Minimize Pollutants from Garage.*** (2 Points) Tightly seal shared surfaces between garage and conditioned spaces, including:

Conditioned spaces above garage

- All penetrations sealed
- All connecting floor/ceiling joist bays sealed
- Paint walls/ceilings (CO can penetrate unfinished drywall through diffusion)

Conditioned spaces next to garage

- Weather stripped doors, with CO detector in interior room adjacent to inside of door;
- All penetrations sealed; and
- Seal all cracks at the base of walls.

10.3 ***Exhaust Fan***. (1 Point.) Install minimum 100 cfm exhaust fan rated for continuous operation with automatic timer control linked to occupant sensor, light switch, or garage door opening/closing mechanism.

OR (in lieu of 10.2 and 10.3)

10.4 ***Detached Garage or No Garage***. (3 Points)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection of this installed measure, to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

If using IEQ Credit 1, then must skip this credit.

Additional Information

Rationale

Occupant health may be adversely affected by car emissions leaking from garage into home.

Potential Technologies and Strategies

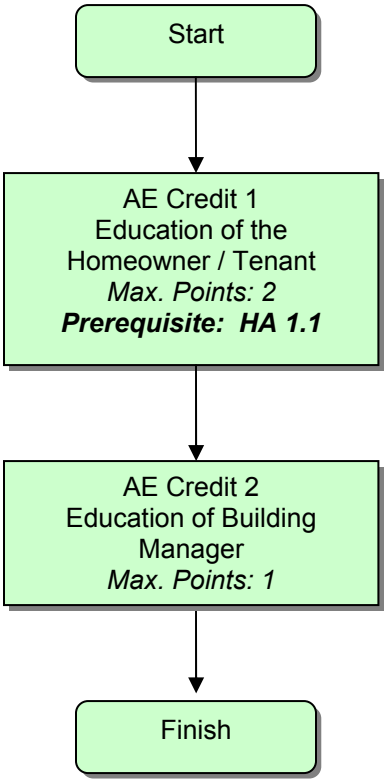
TBD

Resources and References

TBD

Awareness and Education (AE)

Pathway through the Awareness Credits



AE 1. Education of the Homeowner/Tenant

Maximum *Points: 2*

Intent

Maintain the post-occupancy performance of the home through education of occupants (i.e., homeowner or tenant) about the operations and maintenance of the home's key LEED features and equipment.

Requirements

Prerequisites (Mandatory Measures)

1.1 ***Basic Operations Training***. The builder shall provide the home's occupant(s) with:

a. An operations and maintenance manual / binder that includes all of the following items:

- The LEED FOR HOMES Rating Certificate;
- The completed checklist of LEED FOR HOMES features;
- A copy of each signed Accountability Forms;
- A copy of the Durability Plan;
- The product manufacturer's manuals for all installed equipment, fixtures, and appliances;
- General information on efficient use of energy, water, and natural resources;
- Operations and maintenance guidance for LEED for Homes related equipment installed in the home, including:
  - Space heating and coolling equipment;
  - Mechanical ventilation equipment;
  - Humidty control equipment (if installed);
  - Radon protection system (if installed);
  - Renewable energy system (if installed); and
  - Irrigation, rain water harvesting, and or grey water system (if installed)
- Guidance on occupant activities and choices, including:
  - Cleaning materials, methods, and supplies
  - Water-efficient landscaping (SS 2)
  - Impacts of chemical fertilizers, insecticide and pesticides
  - Irrigation (WE 2 & 3)
  - Lighting selection (EA 8); and
  - Appliance selection (EA 9).
- Educational information on "green power"

b. A minimum one-hour walkthrough of the home/building, to include:

- Identification of all installed equipment,
- How to appropriately use measures and operate equipment in the home; and
- How to properly maintain the measures and equipment in the home.

Credits (Optional Measures)

1.2 ***Enhanced Training***. (1 Point.) The builder must provide 2 hours of training, In addition to the training provided for HA Prerequisite 1.1.

Some examples of eligible trainings are:

- An additional walkthrough or training held in another home that has similar green measures and equipment;
- A builder- or developer-sponsored meeting of potential homebuyers that informs participants of the unique features of a LEED Home relative to a conventional home;
- A group homebuyer training that includes discussion of items required in the homeowner's manual maintenance, including: information on efficient use of resources, appropriate use of measures and systems and proper maintenance of measures and systems; and
- A home buyer DVD with operations and maintenance information related to the LEED for Homes measures in the home.

1.3 ***Public Awareness***. (1 Point.) Promote general public awareness about LEED for Homes, including at least three of the following activities:

- Hold an advertised, attended public open house that lasts at least 4 hours per day on at least four weekends, or participate in a green building exhibition or tour; the home/building must display at least four informational stations about the LEED for Homes features (and/or offer a guided tour that highlights at least four LEED for Homes features);
- Publish a website with at least two pages that provides detailed info about the features and benefits of LEED homes;
- Generate a newspaper article on the LEED for Homes project.
- Display LEED for Homes signage on the exterior of the home/building that exceeds 6 square feet.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that builder's Occupant's Manual meets the requirements above; and
- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the builder or responsible party, declaring that the manual and trainings have been (or will be) delivered to the occupant, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

N/A

Additional Information

Rationale

The performance and durability of a LEED home can be significantly influenced through proper use of its features and maintenance of its systems throughout its service life. Thus, the HA category is a critical one to achieving long-term sustainability goals in the residential sector. Home occupants need general information about their new LEED Home, including:

1. What is unique about a sustainable or LEED Home;
2. The value that a sustainable or LEED Home provides;
3. How to use measures and operate the equipment in the LEED Home appropriately; and
4. How to maintain the measure and equipment in the LEED Home properly.

Potential Technologies and Strategies

TBD

Resources and References

A free Homebuyer Manual (with basic content) is available at:
www.dep.state.ct.us/wst/p2/individual/healthyhome.pdf

"Home Energy Guide." Calif. Energy Commission. Publication # 400-99-003 (compliant with Title 24 requirements)

CMHC "Homeowner's Manual" (see: http://www.cmhcschl.gc.ca/en/burema/gesein/homa/homa_001.cfm)

Donald Wulfinghoff. 2000. The Energy Efficiency Manual. 1536 pages. Energy Institute Press. ISBN: 0965792676

AE 2. Education of Building Manager

Maximum *Points: 1*

Intent

Maintain the post-occupancy performance of the home through education of the Building Manager about the operations and maintenance of the home's key LEED features and equipment.

Requirements

Prerequisites (Mandatory Measures)

None

Credits (Optional Measures)

2 **Education of Building Manager.** (1 Point.) In multifamily buildings (more than 5 units), the builder shall provide the Building Manager with:

a. A building owner's manual / binder that includes all of the following items:
- The LEED FOR HOMES Rating Certificate;
- The completed checklist of LEED FOR HOMES features;
- A copy of each signed Accountability Forms;
- A copy of the Durability Plan;
- The product manufacturer's manuals for all installed equipment, fixtures, and appliances;
- General information on efficient use of energy, water, and natural resources;
- Operations and maintenance guidance for LEED for Homes related equipment installed in the home, including:
  - Space heating and cooling equipment;
  - Mechanical ventilation equipment;
  - Humidity control equipment (if installed);
  - Radon protection system (if installed);
  - Renewable energy system (if installed); and
  - Irrigation, rain water harvesting, and or grey water system (if installed)
- Guidance on occupant activities and choices, including:
  - Cleaning materials, methods, and supplies
  - Water-efficient landscaping (SS 2)
  - Impacts of chemical fertilizers, insecticide and pesticides
  - Irrigation (WE 2 & 3)
  - Lighting selection (EA 8); and
  - Appliance selection (EA 9).
- Educational information on "green power"

b. A minimum 60-minute walkthrough of the home before occupancy, to include:
- Identification of all installed equipment;
- how to appropriately use measures and operate equipment in each unit;
- how to properly maintain the measures and equipment in each unit.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that Building Manager's Manual meets the requirements above; and
- ✓ Confirm that the Accountability Form (in Attachment C) has been signed by the builder or responsible party, declaring that the manual and trainings meet the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

N/A

Additional Information

Rationale

The performance and durability of a LEED home can be significantly influenced through proper use of its features and maintenance of its systems throughout its service life. The Building Manager has a critical role in the long-term sustainability goals in a multifamily building (more than 5 dwelling units). Building owner's need to know the following information about their new LEED Home:

1. What is unique about a sustainable or LEED Home;
2. The value that a sustainable or LEED Home provides;
3. How to use measures and operate the equipment in the LEED Home appropriately; and
4. How to maintain the measure and equipment in the LEED Home properly.

Potential Technologies and Strategies

TBD

Resources and References

TBD

Glossary

Adjacent site: A site having at least 25% of its perimeter bordering land that has been **previously developed.**

Agriculture residue based materials: Construction materials composed of by-products created in agriculture (such as wheat chaff). Often agricultural by-products are used in fiberboards and plywood alternatives. MRC5

Balancing dampers: Regulates fresh air flow by restricting air flow to specific rates. IEQC6

Black water: Waste water generated from toilets and kitchen sinks that contains high levels of bacterial pollutant.

Borate: Borate is used as a wood preservative and is non-toxic to humans. Borate treated wood must be kept dry to remain effective. SSC5

Buildable land: The portion of the site where construction can occur. When used in **density** calculations, the calculation for buildable land excludes: public streets and other public rights of way, and land excluded from residential development by law or other prerequisites of LEED-ND.

Circulation loop: A system that loops cold water back to the water heater (instead of down the drain) until hot water reaches the faucet. EA C7

Central vacuum system: Network of tubing with inlets throughout the house designed to remove debris to an out of the way receptacle. A central vacuum system is more efficient at the removal of dust and debris than traditional vacuums. IEQC8

CFM: Cubic Feet per Minute. EAC5

CIR (Credit Interpretation Requests): A request for clarification on certain credits the design team may have questions about. The CIRs should be submitted to the Provider who will then bring them to the attention of a TASC (Technical Advisory Sub-Committee).

Climate zones: The climate of a project's location can have a significant effect on environmental design and construction (particularly in terms of heating and cooling), thus the LEED for Homes rating system awards credit to projects that include sustainable goals appropriate for the local climate. See the Energy Star assessment of climate zones: http://www.energystar.gov/index.cfm?c=windows_doors.pr_crit_windows#map

Combustion exhaust gases: The most common gases resulting from fossil fuel combustion include carbon dioxide, carbon monoxide, sulfur dioxide, and a number of sulfur dioxides. These gases can be dangerous if allowed to build up indoors. IEQC2

Conditioned Floor Area (CFA): An interior space that utilizes any method of air conditioning or heating for the comfort of the occupants. CFA is generally used to determine a building's habitable floor area. MRC6

Demand controlled circulation pump: Circulation pumps use looped systems to ensure hot water is immediately available while keeping unused cold water in the system. The demand controlled circulation pumps uses a switch or motion sensor to automatically activate the circulation of water, thus it saves water and energy.

Density: Density is the amount of building structures constructed on the project site, measured for residential buildings as dwelling units per **net acre** of **buildable land** available for residential uses, and for non-residential buildings as floor area ratio per net acre of buildable land available for non-residential uses.

DHW: Domestic Hot Water. IEQC2

Direct vented exhaust: Part of a system for heaters in which outside air is drawn into a sealed combustion chamber and then vented back outside often using no electricity.

Drip irrigation system: An irrigation system that slowly applies water to the root system of plants to maximize transpiration while minimizing wasted water and topsoil runoff. Drip irrigation usually involves a network of pipes and valves that rest on the soil or underground at the root zone. WEC1

Drywall clips: Provide support for drywall at corners while eliminating the need for excessive wood backing.

Dry well: An underground structure that distributes unwanted water over a large area increasing absorption of the water by the soil.

Durability plan: This is done to insure a long life span for the structure of the home, with emphasis placed on the building envelope.

Envelope: See "Thermal Envelope"

ENERGY STAR Qualified Homes: Homes built to a high standard of energy efficiency (at least 15% more efficient than the International Energy Conservation Code). For more information see: http://www.energystar.gov/index.cfm?c=new_homes.nh_features

ENERGY STAR with Indoor Air Package (IAP): A rating that recognizes homes with systems to insure high standards of indoor air quality and rated as an Energy Star Qualified Home. For more details of the specifications see Attachment G or go to http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/IAQ_Specification_093005.pdf

Fly ash: The fine ash residue resulting from coal combustion. It can be substituted for Portland Cement (a bonding material in concrete).

Formaldehyde: Can pollute indoor air from certain carpets, plywood, plastics, and insulators that outgas (slowly emit fumes into the air) . Airborne, formaldehyde can cause strong irritation to the eyes and throat, and long term exposure has been linked to increased instances of cancer. IEQC8

Grey water: Waste water that is not clean but is also not heavily polluted. Generally it comes from bathing, laundry, etc. SSC2

GPM: Gallons per minute.

Gypsum board (also known as drywall): A flat sheet of gypsum used as a building material for interior walls and ceilings. MRC5

Heat island effects: Higher temperatures due to materials such as asphalt or concrete that retain heat as well as a lack of vegetation that provides shade and cooling by evapotranspiration. SSC3

HEPA (High Efficiency Particulate Absorbing): An extremely effective air filter that removes nearly all air particulates. IEQC7

HERS (Home Energy Ratings Systems): An evaluation system for the energy efficiency of homes with scores from 0-100.

High albedo materials: Materials with a high amount of surface reflectivity. SSC3

High Efficiency Toilets (HET): Toilets that expend a maximum of 1.3 gallons per flush.

HVAC: Heating, Ventilation, and Air Conditioning.

Infill site: A site having at least 75% of its perimeter bordering land that has been **previously developed**.

Infill development: The use of land that has already been developed for further development, as opposed to using undeveloped land currently left to nature or used in agriculture.

Ladder blocking: A method of framing that is used where interior partition walls meet and are reinforced by exterior walls. This eliminates unnecessary framing at these intersections. MRC2

LEED for Homes Provider: An organization that works locally to recruit builders, coordinate raters, certify LEED Homes, and facilitate training in green building.

Montreal Protocol on substances that deplete the ozone layer: An international treaty designed to phase out chemicals known to break down the ozone layer. The phase out of HCFCs (chemicals that deplete the ozone but are less active than CFCs) began in 1996, and HCFCs will be completely banned by 2010. The full document can be found at: http://ozone.unep.org/pdfs/Montreal-Protocol2000.pdf

MERV: The Minimum Efficiency Reporting Value is used to describe worst case performance of air filters. IEQC7

No-disturbance zone: An area that has no alterations or construction byproducts located within it. SSC1

Pedestrian oriented design: Elements in the urban landscape that promote walking. This can include properly wide sidewalks with shading and buffers from the street (such as on street parking), short pedestrian crossings, and street level pedestrian access to buildings (as opposed to access from parking lots). LLC1

Permeable material: Anything porous that allows water to enter the ground beneath it. When paving with permeable materials, there are fewer problems with water run-off (erosion, siltation of streams, and SSC4

Post-consumer recycled content: Material used and then recycled by consumers as opposed to by-products of the manufacturing process that are recycled (pre-consumer recycling). MRC5

Power vented exhaust: Part of a system for combustion heaters in which indoor air is used to feed the flame and exhaust is vented outside.

Precipitation zone: The precipitation in a project's location can have a significant effect on environmental design and construction (particularly in terms of durability and water management), thus the LEED for Homes rating system awards credit to projects that include sustainable goals appropriate for the precipitation zone. http://gis.ncdc.noaa.gov/website/ims-climatls/index.html

Previously developed: Having pre-existing paving, construction, or altered landscapes. This does not apply to altered landscapes resulting from current agricultural use, forestry use, or use as preserved natural area.

Previously developed site: A site consisting of at least 75% **previously developed** land**.**

Prime farmland (as defined by US CFR, Title 7, Part 657.5): "Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses." For the detailed and extensive definition see: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=322756ad2805e4d0e179fcbc6d18b7b2&rgn=div5&view=text&node=7:6.1.3.6.27&idno=7#7:6.1.3.6.27.1.1.5

Project: The land and construction that constitutes the basis for LEED-ND application.

Project boundary: The outermost property line of the **project**. Projects located on publicly-owned campuses that do not have internal property lines shall delineate a sphere of influence line to be used in place of "property line."

Radon: A radioactive gas that naturally vents from the ground. It can be dangerous if certain areas of the house like basements are not properly sealed and ventilated. Areas with potentially elevated indoor radon levels can be found at: http://www.epa.gov/radon/zonemap.html
IEQC9

Rain garden: Swales (low tracts of land that water flows to) with vegetation designed to absorb rain water in ways that reduce stress on storm drains and replenish ground water. SSC4

Rater: An individual that performs field inspections and performance testing for a LEED for Homes Provider.

Rating: The process or scoring each of the credits for the successful implementation of LEED measures.

Return air flow: The differing air pressure throughout a house can potentially cause problems with the building envelope, thus it is important to ensure that pressure is equalized throughout the house by allowing for vents (usually return or transfer grills) to "return" air. IEQC6

R values: A measure of thermal resistance (the number of watts that will be lost per square meter at a given temperature difference). The inverse of U value (i.e., R=1/U). EAC7

SHGC (Solar Heat Gain Coefficient): A measure of how well a window blocks heat from the sun as a fraction of the heat from the sun that enters the window. A lower SHGC is preferable. EAC4

Siltation: The deposition and accumulation of sediments in bodies of water, often harming the ecosystem of streams, rivers, and lakes. SSC4

Smart growth: A blanket term for a number of urban planning policies and land use strategies that seek to provide the greatest benefit to the community and preserve the natural environment. This often includes higher density development, mixed-use buildings, and a strong consideration of transportation issues. LLC1

Solar window screens: A mesh screen that is used to block insects as well as light and heat from the sun. EAC4

Subterranean drain field: An underground system of pipes and gravel that allow waste water to be spread over a large area often used with septic tanks. LEED for Homes recommends the use of a grey water subterranean drain field that bypasses any septic systems. WEC1

TAG (Technical Advisory Group): Formalized groups in each of the credit categories that work to assist in understanding of credits and assist in rulings on CIRs across all the LEED programs.

TASC (Technical Advisory Sub-Committee): Approves Credit Interpretation Requests (CIRs) and innovative design credits in LEED for Homes. Advisory committee to LEED for Homes Core Committee.

Termites: Please see the information on risk of termite infestation according to location: http://www.agoodinspector.com/termite_map.htm

Thermal bridges: Areas in a building envelope that have a high heat conductance lowering the average R value. EAC2

Thermal envelope: The thermal enclosure created by the building exterior and insulation. Improving the thermal envelope is one of the most important aspects to creating an energy efficient home. EAC2

Topsoil: The uppermost layer of soil with high levels of nutrients and organic matter. Healthy topsoil is essential for the survival of trees and plants.

Tree/plant preservation plan: A formal assessment of the lot and a development of a landscaping plan that seeks to preserve the most trees and native plants. This is important to do as one of the first steps in the design process to ensure the developed area takes into account the preservation plan.

TVOC: Total Volatile Organic Compounds. (IEQC8)

Ultra Low Flow Toilets (ULFT): Federal standards require all renovations and new buildings to install ULFTs, which must not exceed 1.6 gallons per flush.

Undeveloped lot area: Sections of the lot that are not paved or built on.

U value (U-factor): A measure (often used for windows) of thermal conductivity that is the inverse of R value. A lower U value means a more energy efficient window. EAC4

Vegetated swales: see "Rain garden."SSC4

Vegetated roof (green roof): A roof partially or fully covered by vegetation. By creating roofs with a vegetated layer, the roof can counter-act the heat island effect as well as provide additional insulation and cooling during the summer. MRC5 (and elsewhere)

VOC: Volatile Organic Compounds. VOCs are often released by certain paints and plastics.

Walk-off mats: Interior mats designed to reduce dust and debris. Walk-off mats should be placed at the entrances and allow for a few strides on the mat to be most effective. IEQC8

Wetlands (as defined by US CFR, Title 40, Part 232): "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." More information can be found at: http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=322756ad2805e4d0e179fcbc6d18b7b2&rgn=div5&view=text&node=40:24.0.1.3.26&idno=40#40:24.0.1.3.26.0.17.2

List of Attachments

Attachment A
Initiative for Affordable Housing

Overview of Initiative for Affordable Housing

What are the objectives of the Initiative for Affordable Housing?

The Initiative for Affordable Housing is a component of LEED for Homes that addresses the inherent differences between affordable housing – particularly multi-family homes – and market-rate, single-family homes. It is being funded by a generous grant provided by The Home Depot Foundation. The ultimate goal of this initiative is to recognize and reward the intrinsic resource efficiencies of affordable housing for the LEED for Homes rating system. In this way, USGBC will promote sustainable building practices specifically for affordable homes.

How does the Initiative for Affordable Housing fit within the scope of the LEED for Homes program?

LEED for Homes is a collaborative initiative that actively works with *all sectors of the home building industry*, including the affordable housing sector. LEED for Homes is a voluntary initiative designed to actively promote the transformation of the mainstream home building industry towards more sustainable practices

The Initiative for Affordable Housing is being developed by the LEED for Homes Committee as an integral part of the LEED for Homes Rating System. With the inclusion of the Initiative, LEED for Homes will represent a program that encourages the development of housing based on the three facets of sustainability: economics, equity and environmental responsibility.

LEED for Homes includes several measures specifically intended to reward efficiencies typical of affordable projects:

- ☐ Compact developments;
- ☐ Site selection and proximity to existing infrastructure;
- ☐ Limit outdoor water use;
- ☐ Homes with ready access to community resources and open spaces; and

- ☐ Homes that are smaller than the national average.

Collectively these measures represent more than 50 percent of the points needed to achieve a certified LEED Home.

Why should I build LEED for Homes qualified affordable housing?

A home is not affordable if its residents cannot afford to operate and maintain it. Affordable homes that are LEED certified are energy and resource efficient, healthy, durable, and will perform better than conventional homes. LEED certified homes benefit residents directly because the LEED Rating System incorporates prerequisities (or mandatory measures) related to occupant health, comfort and well-being. In addition, the mandatory energy-related measures ensure at least 20-30% energy savings relative to the national energy code. Additional energy measures can result in 30 to 70% reductions in energy costs. The selection of environmentally preferred materials, recommended in LEED for Homes, provides improved durability and is more environmentally responsible.

How will the quality of LEED Homes be assured?

The strength of LEED for Homes is third-party verification. This verification process includes both on-site inspections to ensure that the LEED features have been installed correctly, and performance testing to ensure proper performance. LEED for Home Providers are local and regional organizations that have been selected to provide technical, marketing and verification support services to builders. A Provider will arrange for certain performance tests to be conducted on the home. When all of the LEED for Homes features have been verified, the Provider issues a rating certificate to the builder for that qualified LEED Home.

How do I participate in the LEED for Homes Pilot?

Affordable housing developers interested in participating in the pilot should contact the Provider located in their geographic region to determine their eligibility for participation. The list of Providers is available at www.usgbc.org/leed/homes.

LEED for Homes contact information

For questions about LEED for Homes, please call the USGBC at (202) 828-7422 or send your e-mail to leed-homes@usgbc.org.

Attachment B
Builder Agreement Form

Agreement

for Home Builders Supporting the LEED® for Homes Rating System Pilot Demonstration

This Builder Agreement is made between the US Green Building Council (USGBC) and a home builder, or the person with primary responsibility for the design ***and*** construction of homes that are expected to meet the LEED for Homes program requirements (hereafter the Builder). The purpose of this Agreement is two-fold:

1. To define the terms of use of the LEED brand by the Builder; and
2. To define the roles and responsibilities of USGBC and the Builder.

This agreement is valid for the duration of the LEED for Homes Rating System Pilot Demonstration (Pilot), and expires when the fully chartered LEED for Homes program is made available to the public (anticipated to be in mid 2007). A new Builder Agreement will be required at that time.

LEED for Homes: Background Information

The USGBC has established Leadership in Energy and Environmental Design (LEED) as a recognized national environmental rating system for buildings in the US. LEED for Homes is a voluntary initiative to actively promote the transformation of the mainstream home building industry towards more sustainable practices. Like other LEED rating systems, LEED for Homes will rate at the certified, silver, gold and platinum levels, in recognition of the level of environmental performance achieved in five basic categories:

1. Use of energy;
2. Use of water;
3. Use of materials;
4. Use of land; and
5. Enhanced indoor environmental quality.

General Commitments by USGBC

1. Increase awareness of the LEED for Homes brand by distributing key messages on the benefits of LEED Homes and related products.
2. Provide (via the USGBC web site, e-mail, conference calls or other means) current LEED for Homes news, information, and reference documents.
3. Provide Builders with public recognition for participation in the Pilot (and their role in promoting sustainable best practices in homes) through the USGBC website, certificates, and other media.
4. Organize a local orientation for each pilot market to introduce LEED for Homes to Builders and Providers.
5. Respond expediently to any Builder requests for information or clarification on the LEED for Homes Rating System and related policies.

General Commitments by Builders

1. Use the Pilot program and LEED for Homes brand to promote sustainable home design and construction.
2. Adhere to the LEED for Homes Rating System and ensure that authorized representatives, such as advertising agencies, distributors, and subcontractors, also comply.
3. Participate in a local LEED for Homes orientation as appropriate.
4. Work with a LEED for Homes Provider to build and certify at least one LEED Home before the end of the pilot (USGBC will not limit the number of homes participating in the Pilot as long as they are certified before the Pilot end date). Builders not completing and certifying a LEED Home before the end of the pilot will be deemed 'inactive,' thereby forfeiting all rights to the LEED for Homes name and mark, their listing on the USGBC website, and any inclusion in LEED for Homes promotional materials.
5. Provide a LEED for Homes label and/or certificate to all homes that are independently verified to meet the LEED for Homes performance guidelines.
6. Inform homebuyers when their new homes have qualified as LEED Homes under the pilot and be able to describe the features and benefits of these LEED Homes. Also, provide homebuyer's with the Rater's Code of Ethics Disclosure form.
7. Provide USGBC with a completed LEED for Homes accountability form and checklist for each certified LEED Home, within two weeks of completion of the certification process (via the Provider).

Pay a $150 registration fee to join the pilot, then a certification fee of $50 per home. Additional fees and services for

1. participation in the LEED for Homes pilot are set by the Provider and not the USGBC.

Terms and Conditions

1. Builder shall not construe, claim, or imply that its participation in LEED for Homes constitutes USGBC's approval, acceptance, or endorsement of anything other than the builder's commitment to use the LEED for Homes Rating System. This relationship does not constitute endorsement by USGBC of the Builder, its homes, or its services.
2. It is expressly understood that this Builder Agreement does not create a partnership or common enterprise with respect to separate operations now being conducted by the USGBC and Builder. This Builder Agreement does not create any joint ownership of operating assets of USGBC and Builder, or any other entities now owned by either party. Further, this Builder Agreement does not grant either party any powers of management over any aspect of the other party's operations, facilities, financial and contractual arrangements, or compensation of officers and directors. No debts or liabilities of either party to the Builder Agreement are assumed by the other party
3. USGBC and the Builder will assume good faith as a general principle for resolving conflict and will seek to resolve all matters informally, so as to preserve maximum public confidence in LEED for Homes.
4. Builder's use of the LEED brand is limited to the Pilot program, and Builder cannot grant others the right to use the LEED brand.
5. This agreement is voluntary and can be terminated by either party at any time for any reason, with no penalty. Builder's right to use the LEED brand ceases upon the termination of this Agreement.
6. Failure to comply with any of the terms of this Builder Agreement can result in its termination and cessation of access to the benefits of LEED for Homes, including use of the LEED brand. Builder must immediately cease use of the LEED brand upon request of USGBC.
7. USGBC will actively pursue resolution of noncompliance related to the use of the LEED brand.

Authorized Company Representative

Name	Title
Signature	Date

☐ **USGBC may post basic information about my company or project on its website www.usgbc.org**

Organization Name	
Address	City/State/Zip
Phone	Email
Fax	Website

Please Specify Business Type: (check all that apply):

☐ Custom Builder
☐ Production Builder
☐ Multi-Family Builder
☐ 501 (c)(3) Affordable Home Builder
☐ For-Profit Affordable Home Builder
☐ Other _____

Average # of Homes Built per year:

# of LEED Homes Anticipated Certified Under Pilot:

To be completed by your Local LEED for Homes Provider:

Printed Name:_____ Organization:_____

Signature: _____ *Date:*_____

To be completed by US Green Building Council:

Tom Hicks, Vice President, LEED®

*Signature:*_____ *Date:*_____.

Mail or Fax this form to: *Your Local LEED for Homes Provider*

For more information, please call LEED for Homes at 1-202-828-7422 or visit www.usgbc.org/leed

Attachment C
Accountability Form

Accountability Form
LEED for Homes

All declarations and affirmations made in this accountability form are made to USGBC solely for the purpose of assisting USGBC in determining whether LEED Certification is merited. No such declaration or affirmation can be construed as a warranty or guarantee of the performance of the building.

INSTRUCTIONS: This form is to be completed by the person / organization responsible for the design and/or implementation of one or more of the LEED for Homes credits below. A separate form shall be completed by each design professional responsible for one or more credits.

Step 1. Review the requirements for the credits in the LEED for Home Rating system for which you are responsible.
Step 2. In the Areas of Accountability section, initial boxes to indicate the LEED for Homes credits for which you have the primary design / implementation responsibility.
Step 3. Complete the Official Certification section at the bottom of the form.
Step 4. Maintain a project documentation file to assist in the event of an audit of your credit(s) or of this project by the USGBC.

General Information

Builder Name:	
Subdivision Name:	
House Address:	
Provider's Name:	
Rater's Name:	

Areas of Accountability

initial		Innovation and Design Process
	1.2	Integrated Project Team
	1.3	Design Charrette
	2.1	Durability Plan
	3.1	Innovative Measure: _____
	3.2	Innovative Measure: _____
	3.3	Innovative Measure: _____
	3.4	Innovative Measure: _____

initial		Location and Linkages
	2	Site Selection

initial		Sustainable Sites
	2.1	No Invasive Plants
	2.2	Basic Landscaping Design
	2.3	Limit Turf
	2.4	Drought Tolerant Plantings
	3	Shading of Hardscapes
	4.1	Maintain permeable material (permeable paving)
	6.1	Average Housing Density ≥ 7 Units / Acre
	6.2	Average Housing Density ≥ 10 Units / Acre
	6.3	Average Housing Density ≥ 20 Units / Acre

initial		Water Efficiency
	1.1	Water Reuse; Rainwater Harvesting
	1.2	Water Reuse; Grey Water Reuse
	2.1	Irrigation System; High Efficiency Measures
	2.3	Professional Landscape Design

initial		Other Measures

initial		Energy and Atmosphere
	2.3	Insulation; Above Code
	6.1	HVAC - Refrigerant Charge Test
	7.1	Improved Hot Water Distribution System
	8.2	ENERGY STAR Advanced Lighting Package
	10	Renewable Electric Generation System
	11	Residential Refrigerant Management

initial		Materials and Resources
	1.1	Waste Factor in Framing Order ≤ 10%
	2.1	Tropical Woods must be FSC Certified
	2.2	Select Environmentally Preferable Products
	3.1	Recycle cardboard & document diversion rate

initial		Indoor Environmental Quality
	3	Moisture Control System
	4.1	Outside Air Ventilation Meets ASHRAE/Std 62.2
	5.1	Local Exhaust; Meets ASHRAE Std 62.2
	6.1	Supply Air Distribution; ACCA Manual D
	8.3	Flush Home Continuously for 1 Week
	9.1	Radon Protection System, in EPA Zone 1
	9.2	Radon Protection System, not in EPA Zone 1

initial		Awareness and Education
	1.1	Basic Owner's Manual & Walkthrough
	1.2	Comprehensive Manual & Multiple Walkthroughs
	1.3	Public Awareness for LEED Home
	2.1	Education for Building Manager

Official Certification (to be Completed as Part of the LEED for Homes Post -Construction Rating)

By affixing my signature below, the undersigned does hereby declare and affirm to the USGBC that the LEED for Homes requirements, as specified in the LEED for Homes Rating System, have been met for the indicated credits and will, if audited, provide the necessary supporting documents (drawings, calculations, etc.).

Responsible Party	
Date	
Printed Name	
Project Role / Title	
Organization / Company	
Signature	

Attachment D
Durability Inspection Checklist

How to Use the Durability Inspection Checklist

Introduction:

These guidelines are provided as a tool to assist you in evaluating and implementing Durabuility Plan for LEED Homes. This worksheet (1st tab) provides instructions for the use of the remaining worksheets in this file.

The program and measures you develop should document your unique set of responses to the specifics of your project and location. The strategies listed herein are not intended for this purpose; rather, these are individual strategies, without a specific context, each of which may or may not be appropriate for a given home. This is not an exhaustive list of possibilities, nor is it intended to represent a set of strategies appropriate for any specific project. Additional and/or different strategies are likely to be needed depending on the home's location, details of construction, and anticipated occupant requirements.

An effective quality management program will consider -- among other things -- the important interrelationships among energy, moisture, and air quality, and how those dynamics are addressed in other LEED for Homes credits that you may or may not be pursuing. Among the credits/issues that should be considered are SS4 and 5; IEQ 3-6; EA 1-6; and MR5.

Tthe ***Resources*** worksheet (5th tab) in this file contains a list of resources you may find helpful in your quality enclosure management program. The ***Durability Strategies*** worksheet (4th tab) lists measures that are required or rewarded in other programs. **Please verify detailed requirements by contacting the programs directly.**

Durability Evaluation Steps:

1. Collect site- and project-specific data on environmental conditions (outdoor and indoor) and occupancy and enter into the appropriate sections of the ***Durability Evaluation Information*** worksheet (2nd tab).
2. Review the builder's quality management program documents and records of callbacks, warranty claims, and litigation in order to identify recurring quality problems.
3. Identify issues of particular interest or concern. Record in Issues section of ***Durability Evaluation Information*** , which lists major issues for which quality management strategies typically are needed and provides space for
4. Characterize each of the issues identified as to degree of risk (low, moderate, or high). For each moderate and high risk issue, complete steps 5 through 8 below.
5. Ensure that the quality management program includes a specific design and/or construction strategy.
6. Ensure that the strategy addresses each of the applicable building systems, assemblies, components, and areas, and that it addresses all connections, intersections, and interactions between and among them.
7. Ensure that each strategy is adequately drawn and/or described in the relevant project documents.

Durability Inspection Checklist Steps:

1. Prior to construction, create a ***Durability Inspection Checklist*** (3rd tab), listing the enclosure management measures to be incorporated in the home and noting where those measures appear in the project documents (drawings, specifications, scopes of work). Note that the ***Verification Checklist*** lists a few sample strategies under each heading; these strategies are not intended to be universal, although some may apply to a variety of projects and sites. They are included for illustrative purposes only.
2. Use the ***Durability Inspection Checklist*** to confirm that the quality measures shown in the project documents are incorporated in the home as drawn and/or specified.

Durability Evaluation Information

Builder Name:
Address of LEED Home (Street, City, State):

Home & Occupancy

Conditioned floor area:		square feet
Number of bedrooms:		
Number of stories:		
Number of bathrooms:		
Garage (attached/detached/none):		
Building type (SF, MF):		
Attached or detached:		
Structure (wood, etc.):		

Site

Site & surrounding terrain:		
Type of soil:		
Depth of soil (to bedrock):		feet
Depth of ground water below structure:		feet
Other significant features:		
Level/type(s) of pest threat:		
EPA Radon Zone:		(1, 2, or 3) http://www.epa.gov/iaq/radon/zonemap.html

Climate

ENERGY STAR Climate Zone		(N, NC, SC, S)	http://www.energystar.gov/index.cfm?c=windows_doors.pr_crit_windows#map
Annual rainfall		inches per year	http://gis.ncdc.noaa.gov/website/ims-climatls/index.html
Heating degree days (HDD):			
Cooling degree days (CDD):			
Annual maximum wind speed:		mph	http://gis.ncdc.noaa.gov/website/ims-climatls/index.html
Average annual solar insolation		KWh/M^2/day	http://rredc.nrel.gov/solar/old_data/nsrdb/redbook/atlas/colorpdfs/13.PDF

Issues

Issue Type	Degree of Risk (l/m/h)	Protection Systems	Related Credits
Exterior water		Bulk water: Weatherlap drainage plane; design vapor profile with designated drying potential. Capillary action: include capillary breaks.	
Interior water / "wet" rooms		Room-specific strategies	IEQ
Air infiltration		Air barrier	IEQ
Interstitial condensation		Vapor profile that prevents interstitial condensation	IEQ, EA
Heat loss		Thermal barrier	EA
Ultraviolet radiation		Site storage of UV-sensitive materials and strategy for priming and finishing in one week or less	
Pests		Insect and rodent protection systems	SS5
Natural disaster (Hurricane, tornado, earthquake, flood, wildfire, etc.) Types:		See Resources sheet for specific guidance.	
Other:			

Builder Declaration

I hereby declare and affirm to USGBC that I have evaluated our company's quality management program and enhanced it, as needed, to adequately address the issues identified above as moderate or high risks.

Date: _____
Name: _____
Title: _____
Signature: _____

Durability Inspection Checklist

Builder Name: 0
Address of LEED Home (Street, City, State): 0

Durability Strategies by Issue Type

For each of the high and moderate risk areas indicated in the Enclosure Evaluation, list the durability strategies used in the enclosure or, if none are used, provide a brief statement explaining why not. Remove "example strategies"; add lines as needed.

	Location in Drawings, Specs, and/or Scopes	Pre-work Acknowledgement (Builder/trade)	Completion Acknowledgement (Builder/trade)	Construction Verified (Rater)
Exterior Water				
Example Strategy: Site graded to drain rainwater away from building **Strategies/Explanation:**		☐	☐	☐
Interior Water (Wet Rooms)				
Example Strategy: Clothes washer - use stainless steel hoses & position washer on drainage basin **Strategies/Explanation:**		☐	☐	☐
Air Infiltration				
Exampl Stratgy: Install all recessed light fixtures inside of the thermal envelope **Strategies/Explanation:**		☐	☐	☐
Interstitial Condensation				
Example Strategy: Wall sections are designed so that if vapor condenses within wall section the moisture can dry to outside of bldg **Strategies/Explanation:**		☐ ☐	☐ ☐	☐ ☐
Heat Loss				
Example Strategy: Above-code insulation installed in walls, ceiling, under floor **Strategies/Explanation:**		☐ ☐	☐ ☐	☐ ☐
Ultraviolet Radiation				
Example Strategy: Overhangs above south windows **Strategies/Explanation:**		☐	☐	☐
Pests				
Example Strategy: Termite shields installed **Strategies/Explanation:**		☐	☐	☐
Natural Disaster: *(Hurricane, tornado, earthquake, flood, wildfire, etc.) Types:*				
Example Strategy: Non-flammable roofing specified **Strategies/Explanation:**		☐	☐	☐
Other				
Strategies/Explanation:				

Resources

Specific Issue:	*Resources:*
Exterior water	Water Management Guide, http://www.eeba.org
Interior water	Builder's Guides: http://www.buildingsciencepress.com/books.asp?CatID=1
Air infiltration	Energy Star for Homes Thermal Bypass checklist (see LEED for Homes EA2)
Condensation / water vapor	Houses That Work building profiles: http://www.buildingscience.com/housesthatwork/default.htm Builder's Guides: http://www.buildingsciencepress.com/books.asp?CatID=1
Heat loss	Builder's Guides: http://www.buildingsciencepress.com/books.asp?CatID=1
Ultraviolet radiation	http://rredc.nrel.gov/solar/old_data/nsrdb/redbook/atlas/colorpdfs/13.PDF http://www.fpl.fs.fed.us/ http://farpoint.forestry.ubc.ca/fp/search/Faculty_View.aspx?FAC_ID=3095 http://www.agriculture.purdue.edu/fnr/faculty/hunt/facade.htm
Pests	Mike Potter at U of KY - http://www.uky.edu/Ag/Entomology/enthp.htm
Wildfire	http://www.firewise.org/fw_index.htm http://www.fpl.fs.fed.us/documnts/pdf2004/fpl_2004_quarles001.pdf
Wind	http://gis.ncdc.noaa.gov/website/ims-climatls/index.html http://www.wcc.nrcs.usda.gov/climate/windrose.html (wind speed, direction and frequency)
Climate	http://www.energystar.gov/index.cfm?c=windows_doors.pr_crit_windows#map
Rainfall	http://gis.ncdc.noaa.gov/website/ims-climatls/index.html
Radon	http://www.epa.gov/iaq/radon/zonemap.html

General Information:	*Resources:*
Contributors	3-D Building Solutions, LLC, http://www.3-d-buildingsolutions.com The Building Science Consortium of the U.S. Department of Energy's Building America program, Masco Contractor Services (Environments for Living program), http://www.eflbuilder.com
Misc.	CSA Guide S478-95 ASTM standard E 2136-01 "The Scopes of Work Program," Linda Haas Davenport, NAHB Builder Press "Durability, A Key Component of Green Building", *Environmental Building News*, Nov. 2005 "Managing Residential Construction Risks", Insurance Risk Management Institute (IRMI), Nov. 2005 http://www.irmi.com/conferences/crc/Handouts/Crc23/Workshops/ManagingResidentialConstructionRisks.pdf#search='insurance%20liability%20risk%20durability%20in%20homes' Additional info about IRMI: http://www.irmi.com/conferences/crc/Handouts/Crc23/ "BASF's Better Home, Better Planet Showhouse Initiative", June 2005: http://www.basf.com/businesses/plasticportal/PH_Sponsor_Main_Paterson.htm April 2005, "Reducing Builder Risk", Steve Andrews, Homebuilder.com: http://www.e-star.com/docs/Andrews/seven_ways_to_reduce_builder_risk_04.2005.pdf#search='insurance%20liability%20risk%20durability%20in%20homes' "Warranties and the Bottom Line", *Builder News*, March 2004: http://www.buildernewsmag.com/viewnews.pl?id=28 EEBA Houses That Work educational series, http://www.eeba.org Insurance industry risk maps: http://www.cdsys.com/risk_maps.htm
NIST	"National Economic Service-life Tools (NEST)", 2005: http://www2.bfrl.nist.gov/projects/projcontain.asp?cc=8601392000 Building for Environmental and Economic Sustainability (BEES): http://www2.bfrl.nist.gov/projects/projcontain.asp?cc=8601030000
DOE	"Houses that Work", 2004 http://pix.nrel.gov:8020/BASIS/nich/www/bapublic/DDW?W%3DTITLE_V+PH+WORDS+%27houses+that+work%27+ORDER+BY+PUBYEAR/Descend%26M%3D1%26K%3D34585%26R%3DY%26U%3D1 "Wood Durability", 1999: http://www.buildingscience.com/resources/misc/wood_durability.htm

HUD / PATH

"Concept Home", June 2005:
http://www.pathnet.org/sp.asp?id=11175
http://www.huduser.org/publications/destech/durdesign.html
Oct., 2004, "Building Moisture and Durability - Past, Present, and Future Work".
http://www.newportpartnersllc.com/PDFs/NewportPublications/Building%20Moisture%20and%20Durability-
"Durability by Design", May 2002
"Baseline Measures for Improving Durability", 2002:
http://fire.nist.gov/bfrlpubs/build02/PDF/b02159.pdf
"Making the Quality Connection: Improving the Building Industry Insurance Situation Through Quality Assurance Programs", Jan. 2003:
http://www.toolbase.org/docs/ToolBaseTop/Research/3919_iiqaroundtable.pdf#search='zurich%20%20durability%20in%20homes'
"Report of the General Liability Insurance Task Force," National Association of Home Builders, Sept. 2002
"Residential Construction Defects: Exposures, Coverage and Risk Mitigation," prepared by Karen A. Reutter, CPCU, ARM, Senior Vice President, Willis, Inc", Summer 2002
"The Liability Insurance Crisis for Builders: Reasons and Responses," prepared for the National Association of Home Builders by Jeffrey D. Masters, Sandra C. Stewart, and R. Jane Lynch of Cox, Castle & Nicholson LLP, Los Angeles, CA, Dec. 2001
Durability-Related Web Resources:
http://www.pathnet.org/sp.asp?id=1263&f=2

NAHB Research Center

"Liability Insurance Issues and Quality Assurance", Ric Glover, Marsh, Inc. & Jim McErlean, HBW Services, Inc.,
http://www.nahbrc.org/Docs/NewHomeNav/NationalHousingQuality/4545_benchmark2004_liability.pdf#search='insurance%20builder%20liability%20risk%20in%20homes'
"Back to Quality Assurance Basics with ISO 9000":
http://www.toolbase.org/tertiaryT.asp?TrackID=&CategoryID=679&DocumentID=1028
"National Housing Quality Certified Builder Program":
http://www.nahbrc.org/qualitybuilder.asp?TrackID=&CategoryID=1927

CA Green Builder Program

California Green Builder program scopes of work (insulation, air sealing, HVAC installation, window installation):
www.cagreenbulider.com

Attachment E

LEED for Homes Project Completion Checklist

[Under Development]

Attachment F
Overview of
ENERGY STAR Advance Lighting Program (ALP)

WHAT IS AN ENERGY STAR ADVANCED LIGHTING PACKAGE?

1. An upgrade option that replaces fixtures in high traffic areas with quality, high efficiency, ENERGY STAR qualified models. The table below describes the ENERGY STAR Advanced Lighting Package specifications.

2. Features advanced lighting technology. Consumers are increasingly attuned to the benefits of new technology. With the ENERGY STAR mark, they can be assured that their new home uses the latest in energy–efficient lighting technologies to improve performance, while lowering monthly costs.

3. ***A marketing tool you can use to differentiate yourself from your competition.***

Room Category	Specific Rooms within Category	Minimum Percentage of Required ENERGY STAR Qualified Fixtures Per Room Category
High-Use Rooms	Kitchen, Dining Room, Living Room, Family Room Bathroom(s), Hall(s)/Stairway(s)	50% of Total Number of Fixtures
Med/Low-Use Rooms	Bedroom, Den, Office, Basement, Laundry Room, Garage, Closet(s), and All Other Rooms	25% of Total Number of Fixtures
Outdoor	Outdoor Lighting Affixed to the Home or Free-Standing Pole(s) except for landscape and solar lighting	50% of Total Number of Fixtures (including all flood lighting)

Note: To qualify as ENERGY STAR, all ceiling fans that are included in the home must be ENERGY STAR qualified. ENERGY STAR qualified ventilating fans and qualified ceiling fan light kits can be counted as a qualified fixture.

Attachment G
Overview of
ENERGY STAR with Indoor Air Package Form (IAP)

ENERGY STAR with INDOOR AIR PACKAGE PILOT SPECIFICATIONS

April 4, 2005

The following specifications have been developed by the U.S. Environmental Protection Agency (EPA) to recognize homes equipped with a comprehensive set of indoor air quality measures. Homes that comply with these specifications can use "***Indoor Air Package***" as a complementary label to ENERGY STAR for homes. ***As a prerequisite for this label, a home must first be ENERGY STAR qualified***. These specifications are being released for this pilot to only a limited number of markets identified by EPA. This is because EPA wants to avoid widespread dissemination of these specifications before anticipated refinements can be made following an evaluation of this initial pilot. EPA feels the need for refinements is virtually assured based on the substantial scope and complexity of these specifications. To identify these refinements, EPA will actively monitor and evaluate the pilot markets regarding a number of key factors including reasonable cost, strength and fairness of technical underpinnings, compatibility with production builder practices, and enforceability. It is anticipated that EPA will be able to fine tune these specifications after one year and expand the label to more markets in 2006.

1. Moisture Control Required Measures		Reference(s)
Water Managed Roofs		
1.1	Provide minimum No. 30 roof felt underlayment or equivalent.	• Copper Development Assn. Design Handbook, Sect. 4
1.2	In IECC 2004 Climate Zones 5 and higher, provide self-sealing water protection membrane ice flashing over the sheathing at the eave extending 2 feet inside the exterior wall plane.	• Moisture Control Handbook • IRC
1.3	Provide metal drip edge at all exposed roof decking.	• NAHB Green Home Building Guidelines
1.4	Provide self-sealing bituminous membrane at all eaves, valleys and penetrations except in climates with less than 20 inches annual rainfall.	•
1.5	Provide insulation wind baffle or other air barrier to block wind washing at all attic eave bays in roof assemblies with soffit vents.	• EBBA Builder Guides • Moisture Control Handbook
1.6	Provide step flashing at all intersections of roof and walls with the exception of continuous flashing at metal and rubber membrane roofs. Metal "kick-out" flashing shall be provided at the end of roof/wall intersections to direct water away from wall. Drainage plane above shall be direct water flow onto and not behind flashing. Intersecting wall siding shall terminate a minimum of 2 inches above roof.	• EEBA Builder Guides • EEBA Water Management Guide
1.7	Direct roof water from house with either: • Guttering and downspouts shall empty to lateral piping that deposit(s) water on finish grade a minimum of 5 ft. from foundation, or in limited spaces, deposit to underground catchment system that carries water 10 ft. from foundation. • In dry climates with less than 20 inches annual rainfall as shown in EEBA Builder Guides, provide minimum 18" roof overhangs that deposit water to grade sloped away from home.	• HUD/NAHB spec for gutters and downspouts • IRC Code 801.c • EEBA Builder Guides
Water Managed Walls		
1.8	Install continuous drainage plane fully sealed at all penetrations that directs water away from all wall assemblies with either: • monolithic weather resistant barrier (e.g., house wrap) sealed or taped at all overlap joints, top, and bottom • weather resistant sheathings (e.g., faced rigid insulation) fully taped at all "butt" joints, or • lapped shingle-style building paper or felts.	• EEBA Builder Guides • EEBA Water Management Guide
1.9	Fully flash all window and door openings, including pan flashing at sills, side flashing that extends over pan flashing and top flashing that extends over side flashing.	• ASTM 2112 • EEBA Builder Guides • EEBA Water Man. Guide
1.10	All deck ledger boards shall be attached to homes with either: • minimum 3/8 inch spacers and full flashing shingle fashion from drainage plane to over framing; or • adhesive membrane strip taped to drainage plane running over ledger board and folded around joists over hanger with adhesive membrane cap patch over each joist.	• EEBA Water Management Guide
1.11	Provide flashing at the bottom of all wall cladding including weeps holes per manufacturer specification with insect barrier at the bottom of all masonry veneer and weep screed at stucco cladding systems.	• EEBA Water Management Guide • EEBA Builder Guides
Attic/Ceiling Interface		
1.12	Recessed lights in insulated ceilings must be insulated-can, airtight (ICAT) rated with trim foam sealed to ceiling if no gasket provided.	• Get Washington State standard
1.13	Provide complete air barrier and sealing between attic and conditioned space including at chases, penetrations, open wall cavities, dropped ceilings, and soffits.	• EEBA Builder Guides • EEBA Water Management Guide

1. Moisture Control Required Measures continued		References
Water Managed Foundations		
1.14	Slope garage floor toward main vehicle entry doorway min. 1/8 inch per foot.	• International Residential

		Code (IRC), R309.3
1.15	Seal all plumbing, electrical, and other penetrations of walls and floors, and joints between building materials with polyurethane caulk.	• EEBA Builder Guide
1.16	Sump pump covers shall be mechanically attached with full gasket seal.	• EEBA Builder Guide
1.17	Surface water management shall be provided as follows: • Final grade shall be back-fill tamped to accommodate settling and be sloped away from the foundation ½ inch per foot within the first 10 feet. Where setbacks limit space to less than 10 feet, provide swales or drains designed to carry water from foundation. • Patio slabs, walks and driveway shall be sloped ¼ inch per foot away from house.	• IRC R461.3 • IRC R401.3
1.18	Capillary break shall be provided at all concrete slabs: • 4 inch bed of ½ inch diameter or greater clean or washed gravel, covered with minimum 6 mil polyethylene sheeting in direct contact with the concrete slab, lapped minimum of 12 inches at joints; or alternately • A minimum 4 inch uniform layer of sand, overlain with a layer or strips of geotextile drainage matting, covered with polyethylene sheeting lapped minimum of 12 inches at joints. **Exceptions**: • In areas with free-draining soils, identified as Group 1 in the International Residential code by a certified hydrologist, soil scientist, or engineer through a site visit, a gravel bed or geotextile matting is not required. • 6 mil polyethylene sheeting is not required in climates with less than 20 inches annual rainfall.	• EEBA Builder Guides • EEBA Water Management Guide • IRC, Appendix F, AF103.3 Soil Gas Retarder • IRC, Table R405.1, Unified Soil Classification System • IRC R506.2.3, Vapor Retarder
1.19	All crawl spaces shall be unvented and conditioned. Crawl space floor shall be either: • Soil covered with 6 mil. polyethylene (10 mil. recommended) lapped 12 inches and attached to walls and piers with adhesive and furring strips; or • Concrete slab over lapped polyethylene and gravel. Crawl space shall be fully sealed to prevent outside air infiltration and be provided with supply air at a rate not less than 0.02 cfm per square foot of horizontal area and an equal size exhaust opening to the conditioned space. **Exceptions:** • Marine climates as defined by IECC 2004 Climate Zone map • Raised pier foundation with no walls	• IRC • International Mechanical Code, Section 406.1, Ventilation of Uninhabited Spaces
1.20	Exterior surface of below grade walls shall be finished as follows: • poured concrete, concrete masonry and insulated concrete forms with damp proofing coating; • wood framed walls with trowel-on mastic and polyethylene, or equivalent water proofing	• NAHB Green Building Guide
1.21	Provide drain tile at footings, level or sloped to discharge to outside grade (daylight) or to accessible sump pump. Top of drain tile pipe must always be below level of where bottom of concrete slab or crawl space floor will occur. Pipe shall be surrounded with min. 6 inches of ¾ inch washed or clean gravel that is fully wrapped with fabric cloth.	• EEBA Builder Guides
1.22	Insulate exterior walls with International Energy Conservation Code (IECC) specified R-value; do ***not*** install a vapor barrier on interior or living space side of wall (note that semi-vapor permeable rigid insulation is not considered a vapor barrier). **Exception**: Follow restrictions of IRC R320.4 of the International Residential Code, "Termite protection and prohibition of foam plastics" regarding use of foam insulation on the exterior of foundations.	• IECC • EEBA Builder/Water Man. Guides • IRC Section R320.4 • IRC Figure R301.2(6), Termite Infestation Map

2. Radon Control Required Measures		Reference(s)
Radon Resistant Construction		
2.1	The U.S. EPA radon area shall be identified for each home by consulting U.S. EPA Radon Zone Maps or contacting the State Radon Coordinator through the state health office.	• *http://www.epa.gov/iaq/radon/ zonemap*
2.2	All homes in U.S. EPA Zone 1 radon areas shall be constructed with Radon-resistant features complying with International Residential Code, Appendix F; "One and Two Family Dwelling Code", Council of American Building Officials, 1998 Edition, Appendix F; or EPA/402-K-01-002, "Building Radon Out".	• IRC, Appendix F, "Radon Control Methods", 2000 Edition • One and Two Family Dwelling Code, Appendix F, 1998 Edition, Council of American Building Officials • U.S. Environmental Protection Agency guidance document entitled "Building Radon Out", document #EPA/402-K-01-002, available through EPA's web site: www.epa.gov/iaq/radon/pubs
2.3	All homes in U.S. EPA Zone 2 radon areas are highly recommended to be constructed with Radon-resistant features complying with International Residential Code, Appendix F; "One and Two Family Dwelling Code", Council of American Building Officials, 1998 Edition, Appendix F; or EPA/402-K-01-002, "Building Radon Out".	• IRC, Appendix F, "Radon Control Methods", 2000 Edition • One and Two Family Dwelling Code, Appendix F, 1998 Edition, Council of American Building Officials • U.S. Environmental Protection Agency guidance document entitled "Building Radon Out", document #EPA/402-K-01-002, available through EPA's web site: www.epa.gov/iaq/radon/pubs

3. Pest Control Required Measures		References(s)
3.1	Provide rodent and corrosion proof screens (e.g., copper or stainless steel mesh) for all openings that cannot be fully sealed and caulked (e.g., clothes dryer vents).	• EEBA Builder Guides
3.2	Foundation and wall construction shall be as follows in areas subject to termite infestation, identified by the International Residential Code Termite Infestation Map: • Foundation walls shall be solid concrete or masonry with top course of solid block, bond beam, or concrete-filled block. • Foundation walls not covered with masonry veneer cladding shall be capped with un-interrupted sheet metal, plastic or equivalent termite shield that extends a minimum of ½ inch beyond the interior and exterior sides of the wall, before installation of the sill plate. • Construct all interior concrete slabs with 6" x 6" welded wire fabric or equivalent, and concrete walls with reinforcing rods to control cracking. • Sill plate shall be of preservative-treated wood.	• IRC R320.4, Figure R301.2(6) • National Pest Management Association
3.3	In areas subject to "very heavy" termite infestation as indicated by International Residential Code: • Foam plastic insulation shall not be installed on the exterior face of below-grade foundation walls, or under slabs. • Foam plastics installed on the exterior of above-grade foundation walls shall be kept a minimum of 6 inches above the final grade and any landscaping bedding materials, and be covered with moisture resistant, pest-proof material (e.g., fiber cement board, galvanized insect screen at bottom-edge of openings). • Foam plastics applied to the interior side of conditioned crawl space walls shall be kept a minimum of 3 inches below the sill plate and a minimum of 2 inches above the floor of the crawl space.	• IRC R320.4, Figure R301.2(6) • National Pest Management Association

Based on the substantial scope and complexity of these specifications, EPA anticipates refinements will be needed following evaluation of this initial pilot. As a result, they are being released only in a limited number of markets identified by EPA.

4. HVAC Systems Required Measures		Reference(s)
Ductwork		
4.1	Duct system shall be sized, designed, and installed using latest ANSI/ACCA Manual D.	• Air Conditioning Contractors Association Manual D
4.2	Ductwork shall be sealed with either or combination of: • mastic systems that meet the applicable requirements of UL181a, or UL181b, or • aerosol sealant closures meeting UL 723, • or gasketing systems.	
4.3	Ductwork shall not be installed in garage.	
4.4	Maximum total leakage shall be 3 CFM to outside per 100 square feet floor area as measured by the duct pressurization method at 25 Pascals.	• IECC 2004
4.5	Building cavities shall not be used as part of the forced air supply or return system.	• EEBA Builder Guides
4.6	Transfer grills or jump ducts shall be provided for any closed room without a return grill except for baths, kitchens, closets, pantries, and laundry rooms. Opening size shall be 1 square inch capacity (grille area) per CFM of supply (including free area undercut below door as part of the area).	• EEBA Builder Guides • U.S. DOE Building America www.eren.doe.gov/buildings/building-america
4.7	Supply and return duct boots shall be covered during heavy dust-creating construction activities with "duct mask" or similar sheeting to keep ductwork clean.	
Heating and Cooling Equipment		
4.8	Heating and cooling design loads shall be determined per latest ACCA Manual J with heating and cooling equipment sized based on these design loads using latest ACCA Manual S.	• Air Conditioning Contractors Association Manuals J and S
4.9	Drain pans shall be sloped, corrosion resistant (e.g. stainless or plastic) with drains at the low point. Condensate lines shall be drained to drainage system; ***not*** just deposited under slab.	• IRC
4.10	HVAC cabinet seams, and all seams of plenums and duct work adjacent to the cabinet shall be sealed with mastic, and cabinet doors shall be gasketed.	
4.11	Cooling equipment shall have a maximum sensible heat ratio (SHR) of .70 in "hot humid" climates defined by International Code Council unless the home is equipped with additional whole-house dehumidification.	• IECC 2004 Climate Zone Map • ASHREAE Journal 1/03, "Latent Performance of Unitary Equipment"
4.12	Air handling equipment shall not be located in garages.	
4.13	Heating and cooling equipment shall only be used during construction after specified filter is installed.	
4.14	No equipment is permitted that intentionally produces ozone as a product rather than as an incidental by-product.	

4. HVAC Systems Required Measures (continued)		Reference(s)
Ventilation		
4.15	Provide mechanical whole-house ventilation meeting ASHRAE 62.2-2004 accounting for natural air infiltration. *Note, as per ASHRAE 62.2, that outdoor air ducts connected to the return side of an air handler shall be permitted as supply ventilation only if manufacturers' requirements for return air temperature are met (e.g., air shall be tempered to maintain minimum 60 degree F continuous air flow across furnace heat exchanger)* *In addition, whole-house ventilation for "***warm-humid***" climates as defined by the International Code Council shall also include either:* • *controls that ensure humid outdoor air is not supplied above the minimum rate specified by ASHRAE 62.2 while indoor relative humidity exceeds 60 percent; or* • *whole-house dehumidification system that is capable of removing moisture even in the absence of a demand for sensible cooling; or* • *enthalpy exchange equipment (e.g., energy recovery ventilator)*	• ASHRAE 62.2, ASHRAE Standard, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings • International Code Council Climate Zone Map: Proposal for 2003/2004 Code
4.16	Provide mechanical spot ventilation (e.g., bathrooms and kitchens) meeting ASHRAE 62.2-2004. In addition, all bathroom ventilation fans shall be ENERGY STAR qualified unless multiple bathrooms exhausted with a central fan.	• ASHRAE 62.2, ASHRAE Standard, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
4.17	All clothes dryers shall be vented to outdoors.	
4.18	Locate all outdoor air intakes for ventilation at least 10 feet away from exhaust outlets and areas where vehicles may be idling.	
Air Filtration		
4.19	HVAC filters shall be rated MERV 8 at 295 feet per minute (or higher MERV rating) according to ASHRAE 52.2-1999. HVAC equipment shall be able to accommodate pressure drop from filter selected for the system.	• ASHRAE 52.2-1999
4.20	There shall be no visible bypass between the filter and the filter rack. The filter shall not be loose in the filter rack, and the rack shall be fitted on one side with neoprene gasket material so that fan flow of air brings the filter into complete contact with the rack.	
4.21	Central vacuums, where provided, shall be vented outdoors.	

5. Combustion Venting Systems Required Measures Combustion Appliances		Reference(s)
5.1	Combustion fueled equipment ***located in conditioned spaces***: • In IECC 2004 Climate Zones 4 or higher, gas-fired furnaces/boilers shall	• IECC 2004 • Consumer Product Safety

	be direct vented and oil-fired furnaces/boilers shall be power vented or direct vented. • Water heaters shall be power vented or direct vented.	Commission • EEBA Builder Guides
5.2	Fireplaces: • **Masonry fireplaces** are not permitted, with the exception of masonry heaters, as defined by the American Society for Testing and Materials Standard E-1602, and the International Building Code, 2112.1. • **Factory-built, wood-burning fireplaces** shall meet the certification requirements of Underwriters Laboratory UL-127, "Standard for Factory-Built Fireplaces," and meet the emission limits in U.S. EPA Standard 40 CFR Part 60, subpart AAA, 60.530-539b, "Standards of Performance for New Residential Wood Heaters." • **Natural gas and propane fireplaces** shall be power vented or direct-vented, as defined by 3.3.108 of the National Fuel Gas Code, have a permanently fixed glass front or gasketed door, and comply with the American National Standards Institute, ANSI/Z21.88/CSA 2.33 Harmonized Standard, "Vented Gas Fireplace Heaters" of the International Code Council's International Fuel Gas Code. • **Wood stove and fireplace inserts** as defined in Section 3.8 of Underwriters Laboratory UL 1482, "Standard for Safety, Solid-Fuel Type Room Heaters," shall meet the certification requirements of that standard, and meet U.S. EPA Standard 40 CFR Part 60, subpart AAA, , 60.530-539b, "Standards of Performance for New Residential Wood Heaters," and Washington State's particulate air containment emission standard, WAC 173-433-100 (3). • **Pellet stoves** shall meet the requirements of the American Society for Testing and Materials (ASTM) E 1509-04, "Standard Specification for Room Heaters, Pellet Fuel-Burning Type." • **Decorative gas logs** as defined in K.1.11 of the National Fuel Gas Code are not permitted. • **Un-vented combustion appliances** are not permitted, with the exception of kitchen-type cooking devices with exhaust ventilation.	• ASTM E-1602 • IBC, Section 2112.1 • EPA standard 40 CFR Part 60, subpart AAA, 60.530-539b, Stds. of Performance for New Residential Wood Heaters • UL-127, "Standard for Factory-Built Fireplaces" • National Fuel Gas Code Section 3.3108 • ANSI/Z21.88/CSA 2.33 Harmonized Standard • UL 1482, "Standard of Safety, Solid-Fuel Type Room Heaters" • Washington State particulate air containment standard, WAC 173-433-100 (3) • ASTM E 1509-04, "Standard Specification for Room Heaters, Pellet Fuel-Burning Type" • National Fuel Gas Code, Section K.1.11
Garage Isolation		
5.3	Common walls and ceiling between an attached garage and living space shall be completely sealed before insulation is installed.	• EEBA Builder Guides
5.4	All connecting doors between living space and garage shall be gasketed or made substantially air-tight with weather stripping and an automatic closer.	• ASHRAE 62.2 (6.5)
5.5	Garages shall have a 100 cfm exhaust ventilation fan venting to outdoors, designed for continuous operation.	• International Mechanical Code (2003), 403.3
Carbon Monoxide Alarms		
5.6	All homes with combustion appliances shall have one carbon monoxide (CO) alarm installed outside of each separate sleeping area. They shall be placed according to National Fire Protection Association (NFPA) 720, Recommended Practice, "Installation of Household Carbon Monoxide (CO) Warning Equipment," and be hard-wired with a battery back-up function. The alarm devices shall be certified by either the Canadian Standards Association, CSA 6.19-01, or Underwriters Laboratory UL 2034.	• NFPA 720 • CSA 6.19-01, Standard for Residential CO Alarms • UL 2034, Standard for Single and Multiple Station CO Alarms

6. Building Materials Required Measures		References(s)
Preparation		
6.1	Building materials stored on site shall be protected from exposure to rain. Materials wetted during the construction process shall be allowed to dry before closing in building assembly.	• American Plywood Association
6.2	No construction debris shall be discarded and closed inside any wall assembly.	
Installation		
6.3	Raise paper covered gypsum board ½ inch above concrete slabs.	
6.4	Prime painted siding and trim made of wood or processed wood on all six sides.	• EEBA Builder Guide
6.5	Ventilate home during and shortly after installing products that are known sources of contaminants.	
Materials		
6.6	Structural plywood conforming to PS1 And PS2 and oriented strand board shall be made with exterior-type adhesives. Exterior-type adhesive is evidence by the appearance of "Exposure 1" or "Exterior" in the panel trademark.	• American Plywood Association
6.7	Particleboard and medium density fiberboard (MDF) shall be certified compliant with ANSI A208.1 and A208.2, respectively.	• American Plywood Association • ANSI A208.1 and A208.2
6.8	Hardwood plywood shall be compliant with ANSI/HPV AHP-1-2004 and U.S. HUD Standard 24, Part 3280.	• American Plywood Association • ANSI/HPV AHP-1-2004 • U.S. HUD Std. 24, Part 3280
6.9	Carpets and carpet adhesives shall carry the Carpet & Rug Institute (CRI) Green Label Plus low-emitting product label.	• Carpet and Rug Institute
6.10	No wall-to-wall carpet shall be installed in bathrooms, kitchens, entryways, and utility rooms.	
6.11	Permeability rating of finishes used on the interior side of a home's exterior walls in hot humid or humid mixed climates shall be greater than '1'.	

7. Home Commissioning Required Measures		References
Final Preparation		
7.1	Inspect air-handling equipment and verify: • equipment is generally free of debris and clean; • heat exchanger and coils in air-handler are free of dust created by construction activities (e.g., drywall, floor sanding); and • filter is new and clean, and matches specified MERV rating	
7.2	Inspect ductwork is clean, dry, and free of debris before installing registers, grilles, and diffusers.	
7.3	Inspect each supply and return point in the system to ensure that air is flowing and that there are no disconnects or large air gaps between boot and framed opening.	
7.4	During the period between finishing and occupancy, ventilate the building with outside air at the highest rate the ventilation system can produce.	
7.5	Verify HVAC contractor has installed proper refrigerant charge with Evaporator Superheat Test, Subcooling Test, Weigh-in Refrigerant Test, or "CheckMe!"	• Specification for Energy-Efficient Installation and Maintenance Practices for Residential HVAC Systems (Consortium for Energy Efficiency), p. 31-36 • "CheckMe!" test by Proctor Engineering
7.6	Provide owners of homes in U.S. EPA Zone 1 and Zone 2 radon areas two radon test kits designed for 48-hour exposures, including instructions for use and guidance for follow-up actions to testing results.	• U.S. Environmental Protection Agency guidance document entitled "Building Radon Out", document #EPA/402-K-01-002, available through EPA's web site: www.epa.gov/iaq/radon/pubs
Owner's Checklist/Manual		
7.7	Provide a checklist listing all required measures from this specification along with the signature of official representative of builder indicating full compliance with the checklist.	
7.8	Provide home owner's manual including at a minimum documentation on all special equipment with instructions for proper operation and maintenance, and HVAC load calculations.	

Based on the substantial scope and complexity of these specifications, EPA anticipates refinements will be needed following evaluation of this initial pilot. As a result, they are being released only in a limited number of markets identified by EPA.