

Ashworth Cottages – LEED for Homes Checklist Summary

Locations and Linkages:

- LLc2.1: Avoid Environmentally Sensitive Sites and Farmland
- LLc3.1: Site Within 1/2 Mile of Existing Water, Sewer and Roads
- LLc3.2: Select Infill Site
- LLc4.2: Site Within 1/4 Mile of Public Transportation
- LLc4.3: Site Within 1/2 Mile of Green Spaces
- LLc5.3: Average Housing Density > 20 Units per Acre

Sustainable Sites:

- SSr1.1: Minimize Disturbed Area of Site
 - Site was already 100% disturbed
- SSr1.2: Erosion Controls During Construction
 - Stabilize soils that are disturbed.
 - Control path and velocity of runoff with silt fencing.
- SSr2.1: Basic Landscape Design
 - Install drought-tolerant turf in sunny areas only.
 - Use no invasive or exotic plant species.
- SSc2.2: Apply 3 to 4 Inches of Mulch Around Plants
- SSc2.3: Limit Turf to 20% of Landscape Areas
- SSc2.4: Minimize Landscape Water Demand
 - 50% of plants from drought tolerant list.
 -
- SSc4.2: Use Permeable Paving Materials for 40% of Total Paved Surfaces (verify with GGLO)
- SSc4.3: Design and Install Permanent Erosion Controls
 - Install permanent stormwater controls such as vegetated swales and rain gardens.
- SSc5.1: Non-Toxic Pest Control
 - Avoid use of poisons for insect and disease control.

Water Efficiency

- WEc1.1: Rainwater Harvesting System
- Install rainwater harvesting system that is sized for 3/4" rainfall event and is able to collect a minimum of 50% of rain from roof.
- WEr2.1: Install a Main Shutoff Valve and Sub-Meter for Irrigation System
- WEc2.2: Design and Install High-Efficiency Irrigation System
- At least 50% of landscape planting beds have a drip irrigation system.
 - A timer/controller activates the valves for each watering zone and allows irrigation at most efficient time of day (11pm – 7am)
 - Pressure regulating devices to maintain optimal pressure and prevent misting.
- WEc2.3: Rain Sensing System
- Install moisture sensor controller or rain delay controller, directing the system to replace only the moisture the landscape has lost.
- WEc3.2: Very High-Efficiency Fixtures
- All lavatory faucets very high efficiency (≤ 1.5 GPM)
 - All shower heads very high efficiency (≤ 1.5 GPM)
 - All toilets very high efficiency (dual-flush toilets)

Indoor Environmental Quality

- EQr2.1: Design and Install HVAC/DHW Combustion Equipment with Direct Vented Exhaust.
- EQr4.1: Design and Install a Whole Building Ventilation System that Complies with ASHRAE Standard 62.2
- EQc4.2: Dedicated Outdoor Air System with Heat Recovery Ventilator
- EQr5.1: Design and Install Energy Star Labeled Exhaust Fans
- EQc5.2: Install Timer/Automatic Controls for Bath Exhaust Fans
- Operates fan for either a timed interval after occupant leaves the room or until humidity level is reduced.

- EQc5.3: Third-Party Testing of Exhaust Air Flow Rate Out of House
- EQc7.3: Install HEPA Air Filters.
- EQr8.1: Seal Off Ducts During Construction
- EQc8.2: Install Permanent Walk-Off Mats at Unit Entries
- Helps reduce contaminants and dust tracked into the home.
- EQr10.1: No Air Handling Equipment or Return Ducts in Garages
- EQr10.2: Tightly Seal Shared Surfaces Between Garage and House
- CO detectors in any occupied rooms above garage.
- Weatherstripped doors.
- All penetrations sealed.
- Connecting floor/ceiling joist bays sealed.
- Paint wall/ceilings so CO cannot penetrate unfinished drywall.
- Seal all cracks at base of walls.
- EQc10.3: Exhaust Fan in Garage
- Install min. 100 cfm exhaust fan rated for continuous operation with automatic timer control linked to occupant sensor, light switch, or garage door opening/closing mechanism.

Materials and Resources

- MRr1.1: Home is Smaller than National Average
- MRc2.2: Material-Efficient Framing
- Size headers for actual loads.
- Design roof pitch/eave width to 24" module.
- Use ladder blocking/drywall clips.
- MRc3.1: Materials Extracted/Manufactured/Produced within 500 miles
- Promote use of materials from within the region, supporting use of indigenous resources, reducing environmental impacts from transportation.
- Examples: Cement, Doors, Flooring, Framing, Gypsum Board, Masonry, Sheathing, Siding, Cabinets, Counters, Windows

- MRc5.2: Select Environmentally Preferable Products
- Low-Voc carpet and pad (InterFlor) w/ recycled content
 - Low-Voc paint
 - 30% fly ash/slag as replacement to cement content
 - FSC-Certified framing
 - FSC-Certified Siding/Trim
 - Recycled Content in Decking (Trex Deck or similar)
 - FSC-Certified hardwood flooring
- MRc6.2: Waste Management
- Reduce job-site waste so only 1 lb/sf of conditioned floor area is sent to landfill or incinerators. (typ. 2000 sf house normally provides 4 lb/sf)

Energy and Atmosphere

- EAr1.1: Energy Star Home w/ Third-Party Testing
- EAc2.2: Third-Party Testing of HERS Grade I (per National Home Energy Rating Standards) Insulation
- EAc3.2: Envelope Air Leakage Test \leq .25 ACH
- EAc4.2: Design and Install Windows Meeting Energy Star Ratings
- Windows will AT LEAST meet Energy Star U-Factor of .35, but will also exceed in many cases.
- EAc5.3: Third-Party Duct Leakage Test \leq 1.0 CFM25/100 to Outside
- EAc6.2: Exceed Energy Star HVAC Requirements by 10%
- EAc7.2: Improved Water Heating Equipment
- Instantaneous Hot Water Heater with on-demand buttons at fixtures.
- EAc8.2: Energy Star Advanced Lighting Package
- 50% of fixtures in high-use and outdoor areas, 25% of fixtures in low-use areas shall be Energy Star labeled.
- EAc9.1: Energy Star Labeled Appliances
- EAc11.1: No Refrigerants Used (no air conditioning system)

Homeowner Awareness

- HAr1.1: Basic Homeowner's Manual and Walkthrough of House
- Manual with LEED for Homes rating certificate, checklist, product manuals, information on efficient use of energy, water, and natural resources.
 - Min. 60 minute walkthrough of home before closing including identification of all installed equipment, how to properly use equipment, and how to properly maintain the equipment in the home.
- HAc1.2: Provide Three Additional One Hour In-Home Trainings during the Construction Process.

**Rating System
For Pilot Demonstration of
LEED® for Homes Program**



US Green Building Council

**Version 1.72
September 8, 2005**

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Introduction to LEED® for Homes (LEED-H)

What is LEED for Homes?

“LEED” stands for Leadership in Energy and Environmental Design. LEED for Homes is a voluntary initiative, currently under development, to actively promote the transformation of the mainstream home building industry towards more sustainable practices. LEED for Homes is targeting the top 25% of homes with best practice environmental features. LEED for Homes is a collaborative initiative that actively works with all sectors of the home building industry.

The rating system will become part of the comprehensive suite of LEED assessment tools offered by the USGBC to promote sustainable design, construction, and operations practices in buildings nationwide.

Objective of the LEED for Homes Pilot

The objective of pilot testing LEED for Homes is to ensure the LEED for Homes rating system is practical for application and will become an effective tool for introducing green building practices to a significant portion of the new home building marketplace.

Schedule

The pilot is planned for August 2005 thru early 2007. Pilot projects will be selected beginning in August, 2005. Orientation workshops for participants in the pilot have been planned for the first three months of the pilot. After the pilot, the LEED for Homes rating system will be revised based on lessons learned. A public review of the revised LEED for Homes rating system is planned for the second half of the year 2006. Based on this review, the final version of the LEED for Homes specifications and protocols will be completed and balloted with USGBC membership. The balloted version will be used for the public roll-out of the fully chartered LEED-H program in early 2007.

Overview of the LEED for Homes Rating System

USGBC has established Leadership in Energy and Environmental Design (LEED) as a recognized national green building rating system in the US. LEED for Homes is a voluntary initiative designed to actively promote the transformation of the mainstream home building industry towards more sustainable practices. LEED for Homes aims to recognize the top 25 percent of homes which incorporate best-practice environmental features, including:

1. The efficient use of energy resources;
2. The efficient use of water resources;

3. The efficient use of building construction resources (i.e., through improved design, material selection and utilization, and construction practices),
4. The efficient use of land resources, and
5. Enhanced indoor environmental quality to safeguard the health of the home's occupants.

LEED for Homes will rate qualified homes at the certified, silver, gold and platinum levels, in recognition of the level of performance achieved in each of the above five resource categories as presented in Exhibit 1.

Exhibit 1
LEED for Homes Performance Levels

LEED for Homes Performance Levels	Minimum Number of LEED for Homes Points Required
Certified	30 / 108
Silver	50 / 108
Gold	70 / 108
Platinum	90 / 108

How do I participate in the LEED for Homes Pilot?

An application form for participation in the LEED for Homes Pilot is available at www.usgbc.org/leed/homes. The pilot demonstration phase is intended to test the LEED for Homes checklist with stakeholders all across the country. The primary criterion for pilot participation is that the home builders must be willing to hire a third party LEED for Homes Provider to verify the LEED for Homes features of their homes (including performance testing). A list of approved LEED for Homes Providers is presented in Exhibit 2.

Where can I find out more about green home building?

There are many green home building resources available on the internet. A list of the websites for existing local green home building programs that offer training and educational information is posted at www.usgbc.org/leed.homes.

Exhibit 2
List of USGBC Approved LEED for Homes Providers

Name	Title / Organization	Contact Information
Arizona (Scottsdale and Metro Phoenix)		
<i>Anthony Floyd</i>	<i>Green Building Program Manager City of Scottsdale Green Building Program</i>	<i>(480)312-4202 afloyd@scottsdaleaz.gov</i>
California (Statewide)		
<i>Mark Berman</i>	<i>Principal Davis Energy Group, Inc.</i>	<i>(530)753-1100 miberm@davisenergy.com</i>
Colorado (Statewide)		
<i>Kristin Shewfelt</i>	<i>Program Development Officer E-Star Colorado</i>	<i>(303)297-7499 kshewfelt@e-star.com</i>
Florida (Statewide)		
<i>Eric Martin</i>	<i>Senior Research Engineer Florida Solar Energy Center/ University of Central Florida</i>	<i>(321)638-1450 martin@fsec.ucf.edu</i>
Georgia (Statewide, and AL, SC and VA)		
<i>Laura Uhde</i>	<i>Southface Energy Institute</i>	<i>404-872-3549 x129 laura@southface.org</i>
Michigan (Central and Western MI)		
<i>Michael Holcomb</i>	<i>President The Alliance for Environmental Sustainability</i>	<i>(616)241-5537 mholcomb@triton.net</i>
New Jersey (Statewide, and Eastern PA)		
<i>Ben Adams</i>	<i>Vice President MaGrann Associates</i>	<i>(856)813-8741 benadams@magrann.com</i>
Northeast Team (CT, MA, ME, NH, RI, and VT)		
<i>Richard Faesy</i>	<i>Senior Project Manager Vermont Energy Investment Corporation</i>	<i>(802) 453-5100 x19 rfaesy@veic.org</i>
Oklahoma (Statewide and Northern TX)		
<i>Jennifer Boyle</i>	<i>Marketing Coordinator Guaranteed Watt Saver Systems, Inc.</i>	<i>405-946-0206 jboyle13@cox.net</i>
Oregon (Statewide and Southern WA)		
<i>Randy Hansell</i>	<i>Green Building Specialist Earth Advantage</i>	<i>(503)603-1649 randy.hansell@pgn.com</i>
Pennsylvania (Eastern PA and DE)		
<i>Liz Robinson</i>	<i>Executive Director Energy Coordinating Agency of Philadelphia</i>	<i>(215)988-0929 lizr@ecasavesenergy.org</i>
Texas (San Antonio)		
<i>Chip Henderson</i>	<i>President Contects Consultants and Architects</i>	<i>(210)824-8758 chip@contects.com</i>

Will LEED for Homes include affordable and multifamily homes?

The initial phase of LEED for Homes will focus on market rate single family homes. Affordable and multi-family homes will be included in the pilot to explore how to best meet the needs of these unique markets. Over the next year, specifications will be developed to address multifamily housing (three stories and under). Multi-family housing structures that are over three stories are covered under LEED for New Construction (LEED-NC).

Will LEED for Homes include existing homes?

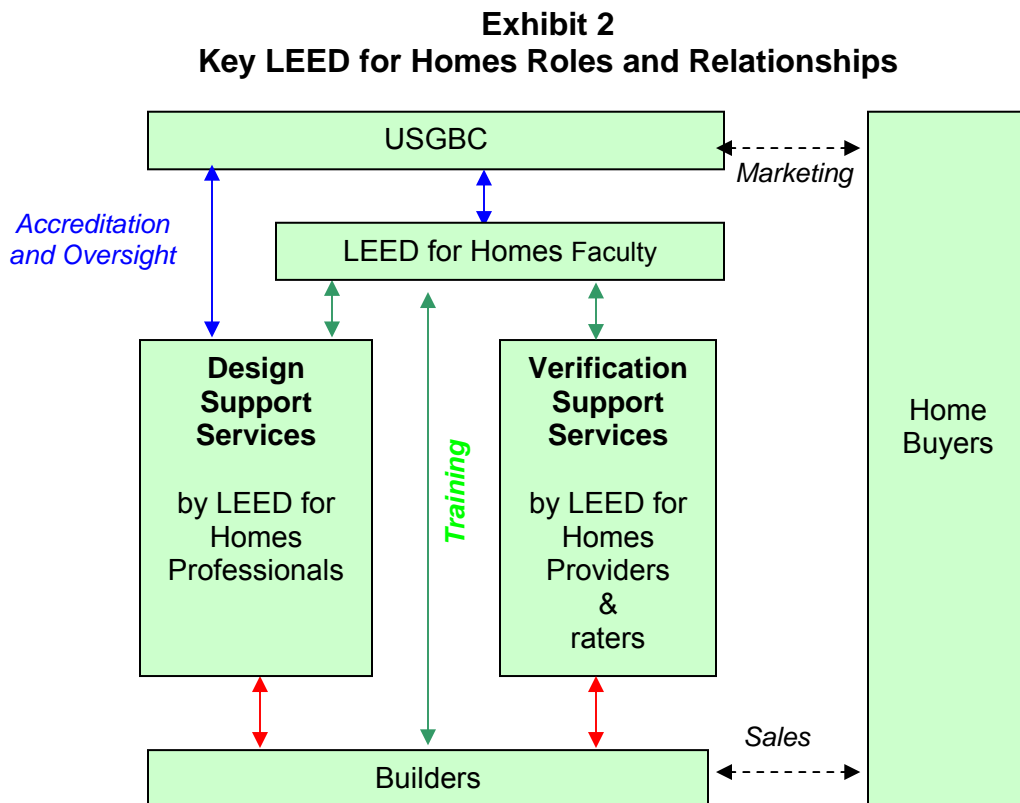
The first phase of LEED for Homes is focused on the construction of new homes. Specifications and protocols for existing homes are under consideration, but no specific development plans are in place.

For Additional Information

If you have any questions about the LEED for Homes Pilot, please contact Jim Hackler, LEED for Homes Program Manager, Email: jhackler@usgbc.org. For more information on LEED, visit the U.S. Green Building Council web site at: www.usgbc.org/leed/homes

Overview of Key Stakeholders in Support of LEED for Homes

A schematic diagram of the key LEED for Homes stakeholders and their relationships is presented in Exhibit 2.



The principal roles of the stakeholders are summarized below, with more detailed definitions following:

- **LEED for Homes Provider** – an organization that is under contract to the USGBC to provide certification services to builders. Providers will employ (or subcontract with) raters who provide in-field verification of the installation of the required LEED for Homes measures and performance testing of homes.
- **LEED for Homes Professional** – an individual who provides design consulting services to builders. The specifications for the LEED for Homes Professional will not be established until later in the pilot.
- **LEED for Homes Faculty** – an individual who is under contract to the USGBC to provide training and program development services to LEED for Homes

Professionals, Providers, and raters. The specifications for the LEED for Homes Faculty will not be established until later in the pilot.

Exhibit 3 indicates suggested LEED for Homes roles for various parties in the homebuilding industry. All individuals, however, are encouraged to seek any qualification(s) desired.

Exhibit 3
Suggested LEED for Homes Roles

Type of Stakeholder			
	LEED for Homes Provider	LEED for Homes Professional	LEED for Homes Faculty
Builder & Trades		○	
Marketing & Sales Staff		○	
Green Rater	○	○	
A/E or Technical Consultant		○	○
Trainer		○	○

Definitions

The USGBC has established as its intellectual property the terms defined below, which it will protect in the marketplace.

LEED for Homes Provider

A LEED for Homes Provider is an organization that is under contract to the USGBC to perform the following services: recruiting builders, coordination of 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 chapter. A LEED for Homes Provider must have at least one employee (or contractor) who is a rater with the qualifications below. Any organization, business, governmental entity, or other party interested in taking responsibility for local promotion and operation of LEED for Homes programs and initiatives may seek to establish a relationship with USGBC as a LEED for Homes Provider. Provider candidates will need to demonstrate certain competencies and the existence of sufficient quality assurance provisions in order to qualify.

Rater

A rater is an individual who performs field inspections, HERS-related software analyses, and performance testing for a LEED for Homes Provider. Raters should have the qualifications listed below¹.

Minimum Qualifications:

- ✓ A 2-year college education or equivalent.
- ✓ Two classroom days of green home building training or equivalent.
- ✓ Certification as a Home Energy Rater or equivalent experience.
- ✓ Two years of experience with a local home energy rating program or equivalent.
- ✓ Hands-on energy performance testing of 50 homes or equivalent.

A general understanding of:

- ✓ Technologies and practices used in green home building;
- ✓ The documentation requirements of the LEED for Homes program; and
- ✓ Green marketing and sales messaging.

A high level of competency with:

- ✓ Testing equipment (e.g. blower door, duct pressurization, etc.);

¹ *The selection and training of raters is the LEED for Homes Provider's responsibility. These minimum qualifications are provided as general guidelines. The Provider must ensure that raters have the skills needed to assure consistent quality in the delivery of verification services for LEED for Homes.*

- ✓ Data tracking and transfer;
- ✓ Customer service; and
- ✓ Quality assurance.

LEED For Homes Professional

A LEED for Homes Professional is an individual who provides design support services to builders. A Professional will be accredited by USGBC and must demonstrate a depth of knowledge of residential green building strategies, approaches, resources, construction, and marketing; and of all aspects of LEED for Homes, including the details of verification (i.e., field inspections, HERS-related software analyses, and performance testing).

Minimum Qualifications:

- ✓ To be developed.

LEED for Homes Faculty

LEED for Homes Faculty are the USGBC accredited and contracted trainers for LEED for Homes related trainings (i.e., LEED for Homes Provider and Professionals classes). A LEED for Homes Faculty is intended to be a Professional with extensive experience in all aspects of LEED for Homes and green home building who wishes to provide consultation services to LEED for Homes Providers or deliver training on behalf of USGBC. This is the highest designation and demonstrates the level of greatest proficiency and experience within LEED for Homes.

Minimum Qualifications:

- ✓ To be developed.

LEED Home, Certified LEED Home, LEED-Rated Home

USGBC will maintain a registry of *new homes* that are certified as LEED for Homes compliant by LEED for Homes Providers. The compliance of these homes with LEED for Homes criteria must be verified by a third party (other than the builder). Verification activities include: documentation review, field inspection, and performance testing. When the verification has been successfully completed, the home will be certified as a LEED Home and a rating (certified, silver, gold, or platinum) will be conferred.

A sampling protocol has been developed to verify homes constructed by production home builders. USGBC's certification procedures and requirements for newly constructed homes will be posted on the LEED for Homes website.

Builder Participation Roadmap

How does a builder construct a LEED Home?

There are 5 simple steps for a builder to follow in participating in the LEED Homes program, including:

1. Join LEED Homes
2. Select Green Features
3. Build Home
4. Certify as a LEED Home
5. Sell LEED Home

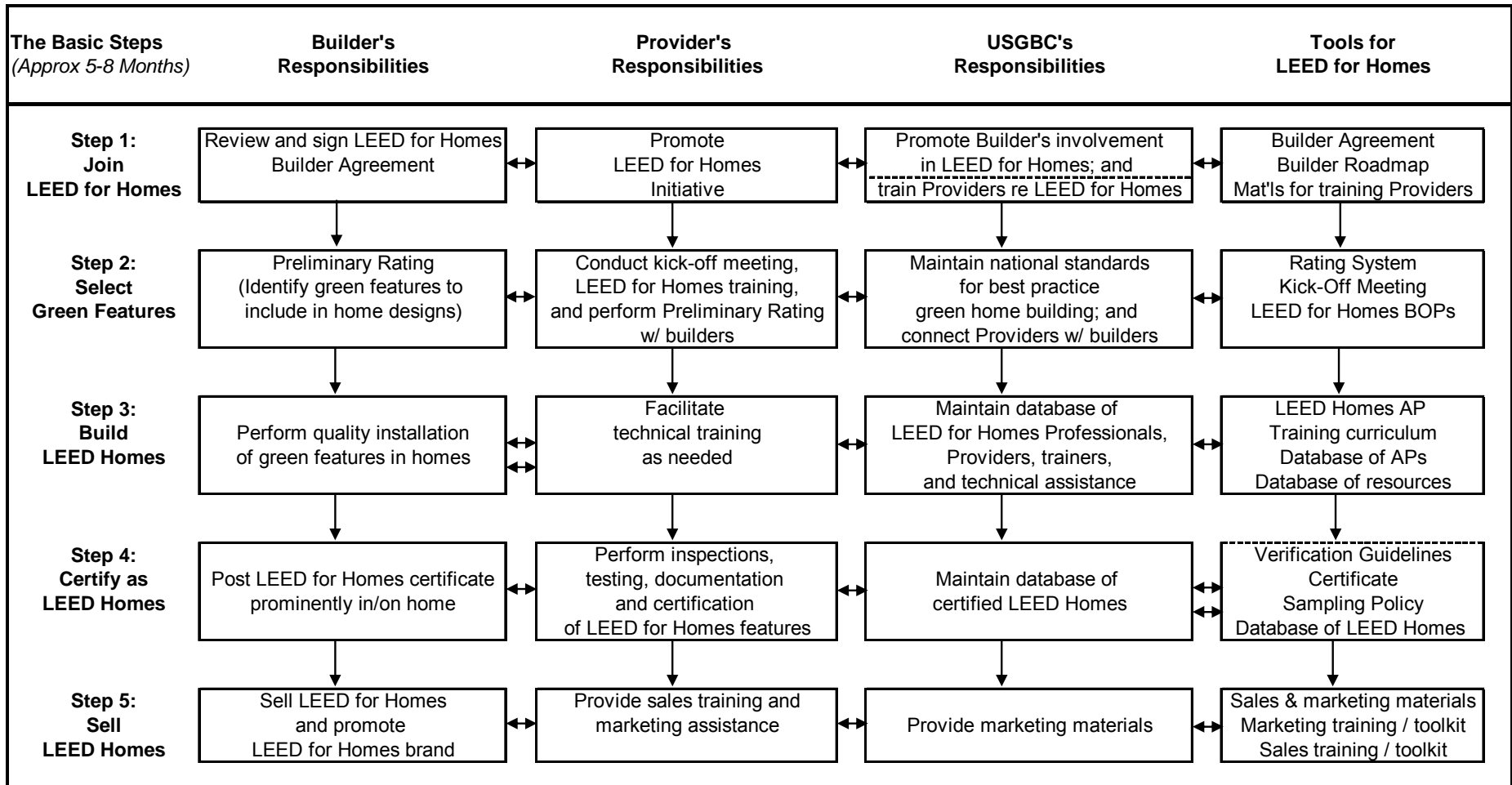
The builder's responsibilities in each of these steps are summarized in Exhibit 4. Similarly, the ways that USGBC will support the builder (including available tools) through this process are presented in this same graphic.

A LEED Homes Provider will be available on a consultative basis to assist builders to select the appropriate green / sustainable measures to qualify their homes as LEED Homes.

What are the Specialized Areas of Knowledge Required to Design and Build a LEED Home?

There are a number of specialized areas of green home design and planning that are required to build a LEED Home. A builder should ensure that their design team is familiar with the design and planning of green homes. Additional green home building training may be required to successfully meet the LEED for Homes requirements.

Exhibit 4 Builder Roadmap



Verification Process

Basic Definitions

Inspection: is the process of performing the necessary in-field inspections to confirm that each of the builder's targeted measures in the LEED for Homes Rating System has been installed. Only raters trained by and operating in concert with an approved LEED Program Provider can perform inspection services for a LEED Home.

Performance Testing: is the process of conducting the necessary in-field performance testing to confirm that each of the builder's targeted measures in the LEED for Homes Rating System are in compliance with the specified performance requirements. Only raters trained by and operating in concert with an approved LEED Program Provider can provide these performance testing services for a LEED Home.

Rating: is the process or scoring each of the credits, including: adding up the total number of points achieved for each of the LEED measures successfully installed, and determining the LEED for Homes performance level achieved (i.e., Certified \geq 30 points; Silver \geq 47 points; Gold \geq 63 points, and Platinum \geq 82 points)

Certification: is the formal process of assessing and approving the performance level of a LEED Home and conferring the certificate, after the Provider has conducted a detailed review of the information compiled in the field by the rater. Certification can only be conferred by an approved LEED for Homes Program Provider.

Who is Responsible for Certifying a LEED Home?

A local organization, called a LEED for Homes Provider, (hereafter, the Provider) has formal responsibility for certifying a LEED Home. The Provider has five primary roles in a given market:

1. Hosting and participating in a LEED for Homes kickoff/orientation for builders;
2. Providing green home building design reviews for builders;
3. Training, coordination, and oversight of its raters, including assuring quick response to builders for LEED-required verification services;
4. Reporting completed LEED certifications to USGBC and maintaining project files for each LEED Home; and,
5. Marketing LEED for Homes to builders.

An employee (or contractor) of the Provider, called a rater, will perform the actual documentation and in-field verification services for LEED Homes, while the LEED for Homes Provider is the official rating body.

The primary role of the Provider is rating. All Providers will be under contract with the USGBC as third party certifiers of LEED Homes, using a model similar to that developed by the Residential Energy Services Network (RESNET) for home energy ratings.

Summary of Verification/Inspection Process

As indicated above, the rater will collect in-field data about the LEED Home and prepare a project documentation file. This file should include:

- ✓ Completed LEED for Homes checklist (including the scoring / rating);
- ✓ Performance test reports; and
- ✓ Completed Accountability Form, as applicable (see description below, and a copy of the form in Attachment A).

This information is used by the Provider to determine if the home qualifies for a LEED for Homes rating. **Only the Provider can confer a LEED Home rating.**

The three-step LEED for Homes certification process is outlined below. Note that the preliminary rating is only needed once per model of home built, whereas, the final rating must be performed for every home built (of every model). (An exception is provided for production builders - see Sampling Protocol below.)

Step 1: Preliminary Rating (by rater)

- 1.1 Detailed plan review of a builder's home design;
- 1.2 Performance testing of a typical example of builder's home design;
- 1.3 Completion of preliminary project documentation file (including suggested additional measures that may be needed to achieve a LEED rating); and
- 1.4 Preliminary LEED for Homes score / rating.

Step 2: Final Rating (by rater)

- 2.1 Pre-drywall inspection;
- 2.2 Final inspection and performance testing;
- 2.3 Completion of project documentation file (including completed LEED for Homes checklist, performance test reports, and completed Accountability Form); and
- 2.4 Final LEED for Homes scoring / rating.

Step 3: Certification (by Provider)

- 3.1 Review of project documentation file that was prepared by the rater (including data listed in Exhibit 5).
- 3.2 Completion of LEED for Homes rating and presentation of LEED for Homes label and rating certificate to builder / homeowner.
- 3.3 Send notification of rating to USGBC (including data listed in Exhibit 6).

Note: *These same three steps are required to verify an ENERGY STAR labeled Home (or will be soon), so the rater will be collecting additional information for LEED for Homes at each of these steps.*

Exhibit 5
Data to Be Maintained in Project File at Provider's Offices

1. Set of Construction Drawings and Specifications
2. Completed Checklist (w/ rater's and Provider's signatures)
3. Copy of ENERGY STAR for Homes certificate
4. Reports for Completed Performance Tests
For each of five (5) mandatory tests, and
For up to four (4) additional optional tests, as applicable
5. Completed Accountability Form (one copy for each type of organization providing design services to the builder, and to include sign-offs for each credit marked with a "X" symbol on the checklist).

Exhibit 6
Data to Be Submitted to USGBC by Provider
(As soon as ratings are completed)

Administrative Data

1. Builder Name
2. Subdivision
3. House Address
4. Provider Name
5. Rater Name
6. Date of Final Inspection
7. Rating Approach Used (BOP or HERS Score)
8. Sampling Protocol Used? (Y/N)

Overall Performance Data

9. LEED Score & Rating Achieved
10. HERS Score Achieved

Documentation

All of this information can be submitted to USGBC using the following two forms

1. *LEED for Homes Checklist*
2. *LEED for Homes Accountability Form (one for each type of organization providing design services to the builder)*

Anticipated Verification Support Services for Builders during the Pilot Demonstration

USGBC wants to ensure reasonably comparable treatment of pilot builders that are working with different Providers across the country. To that end, USGBC is suggesting an approximate level of effort associated with the delivery of basic LEED for Homes verification/rating services by Providers (shown in Exhibit 7). Each Provider is expected to develop their own builder fee schedule.

Exhibit 7 Anticipated Verification Services for a LEED Home

Service	Approx. Effort Required
Preliminary Rating: to assess current performance of builder's homes relative to LEED for Homes performance levels.	4 to 8 hours per model of home. Each model needs only a single preliminary verification.
Final Rating & Certification: for all needed in-field and office services including: inspections, performance testing, and preparation of LEED documentation for certification.	4 to 8 hours per individual home, and will vary with house size and builder's familiarity with LEED measures. <i>The effort required for production homes will be considerably less (see sampling protocol above below).</i>
Technical Consultation Service: for preparation of credit interpretation requests (CIRs) and innovation and design process (ID) credit submission to USGBC.	Approx. 2 to 4 hours per consultation/submission.

What Performance Tests are Required?

Five mandatory performance tests must be completed on each LEED Home. These are identified in Exhibit 8. Four other optional performance tests are also identified in this Exhibit.

Exhibit 8 List of Performance Tests for Verification of a LEED Home

List of Measures		Resp.	Performance Level	
Category	Credit		Mandatory	Optional
Performance Testing				
Energy	1. ENERGY STAR Home	Rater	X	
	3. Envelope Air Leakage	Rater	X	
	5. Duct Leakage	Rater	X	
	6. Refrigerant Charge	HVAC	X	
IEQ	4.3. Outdoor Air Flow Test	Rater		X
	5.3 Exhaust Air Flow Test	Rater		X
	6.2 Supply Air Flow Test	Rater		X
	8.3 Contaminant Testing	3rd-Party		X

Note: The certification of an ENERGY STAR Home includes the envelope air leakage and duct leakage testing.

What is the Accountability Form?

An Accountability Form is to be signed by responsible parties (e.g., engineers, architects, landscape architects, et al.), that are used to attest to the completion of LEED measures/credits that are difficult to inspect or verify by other means. For example, the review of a design requires full knowledge of the proper design procedure and sufficient experience to detect errors and/or omissions.

To simplify the verification process and to ensure consistency across raters (with varying degrees of skills and experience), a “letter template” is required to verify some of the design-related LEED for Homes credits. A list of the credits that require a letter template is provided in Exhibit 9. All of these credits are contained in a single electronic letter template file that will be provided to each Provider by the USGBC (See Attachment A).

Note that there are a total of 10 credits that are included in the accountability Form. Five of these are mandatory credits.

Sampling Protocol for Certification of Production Home Building

A LEED for Homes sampling protocol for certification of production homes is based on testing one home in seven (with the exception that Platinum homes must be individually verified).

This sampling protocol is designed to assure consistent high quality of production–built homes. However, because it is expected that pilot builders will typically be building only a few LEED Homes in the pilot year, and the sampling protocol requires building at least ten homes, many builders will not be eligible to use the sampling protocol during the pilot.

The details of the sampling protocol will be available by the start of the pilot.

How Much Will it Cost to Earn a LEED for Homes Rating?

USGBC will not establish fees for Provider-delivered LEED for Homes services. Providers will develop fee schedules for LEED for Homes services to builders, based on the nature and extent of services provided and their market circumstances.

Exceptions: Credit Interpretations and Innovation Credits

The LEED for Homes Rating System provides a menu of 90 credits (worth a total of 110 possible points). There are two common forms of exception to this Rating System:

Credit Interpretation. A credit interpretation is an alternative way of achieving the same intent as an existing LEED credit; and

Innovation in Design (ID) credit. An ID 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.

Exhibit 9
List of LEED for Homes Credits
that Must Use the Accountability Form

List of Measures		Resp.	Performance Level		
			Mandatory	Optional	
Resource Category	Credit # and Name				
Location & Linkages	2. Site Selection	Builder		<input checked="" type="checkbox"/>	
	5.1 Avg Housing Density >= 7 Units/Acre	Builder		<input checked="" type="checkbox"/>	
	5.2 Avg Housing Density >= 10 Units/Acre	Builder		<input checked="" type="checkbox"/>	
	5.3 Avg Housing Density >= 20 Units/Acre	Builder		<input checked="" type="checkbox"/>	
Sites	2.1 Landscaping; Basic Design	Landscaper	<input checked="" type="checkbox"/>		
	2.4 Minimize Landscape Water Demand	Landscaper		<input checked="" type="checkbox"/>	
Water	1.1 Water Re-Use - Rainwater System	Irrigation		<input checked="" type="checkbox"/>	
	1.2 Water Re-Use - Grey Water System	Irrigation		<input checked="" type="checkbox"/>	
	2.2 Irrigation System	Irrigation		<input checked="" type="checkbox"/>	
IEQ	3 Humidity Control	HVAC		<input checked="" type="checkbox"/>	
	4.1 Outdoor Air Ventilation	HVAC	<input checked="" type="checkbox"/>		
	5.1 Local Exhaust	HVAC	<input checked="" type="checkbox"/>		
	6.1 Supply Air Distribution	HVAC	<input checked="" type="checkbox"/>		
	9.1 Radon Protection, in EPA Zone 1	Builder	<input checked="" type="checkbox"/>		
	9.2 Radon Protection, not in EPA Zone 1	Builder		<input checked="" type="checkbox"/>	
Materials	1. Home Size	Builder	<input checked="" type="checkbox"/>		
	4.1 Durability Plan	Builder	<input checked="" type="checkbox"/>		
Energy	6.1 HVAC Sizing - Manual J	HVAC	<input checked="" type="checkbox"/>		
	10. Renewable Electric System	Electrician		<input checked="" type="checkbox"/>	
	11. Refrigerant Management	HVAC		<input checked="" type="checkbox"/>	
Homeowner	1.1 Basic Manual and Training	Builder	<input checked="" type="checkbox"/>		
	1.2 Comprehensive Manual and Training	Builder		<input checked="" type="checkbox"/>	
Innovation	1.1 Innovation and Design Process	Builder		<input checked="" type="checkbox"/>	
	1.2 Innovation and Design Process	Builder		<input checked="" type="checkbox"/>	
	1.3 Innovation and Design Process	Builder		<input checked="" type="checkbox"/>	
	1.4 Innovation and Design Process	Builder		<input checked="" type="checkbox"/>	

Both credit interpretations and ID credits are handled using the following process:

1. **Provider Submits a Request to USGBC.** A Provider may submit a credit interpretation request or an ID proposal (on behalf of a builder) 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 credit interpretation request (or ID credit proposal), 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 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 Homes.

Both credit interpretations and ID credit proposals must be submitted during the Preliminary Rating, and may be submitted only by the Provider on behalf of the builder. Submittal forms will be available on the LEED for Homes website.

How Will the Providers be Audited for Quality Assurance?

QA 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

QA 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://natesnet.org/standards/enhancements.htm>

LEED for Homes Rating System

Checklist *(Version 1.72)*



LEED
for **HOMES**

Project Checklist

(Version 1.72 - August 18, 2005)

Builder Name:	Maximum Points ²
Address (Street/City/State):	Dry Normal Wet

Yes	?	No	Location and Linkages (LL)	OR	10
			1 LEED-ND Neighborhood	LL2-5	10
			<input checked="" type="checkbox"/> 2 Site Selection Avoid Environmentally Sensitive Sites and Farmland	LL1	2
			<input checked="" type="checkbox"/> 3.1 Infrastructure Site within 1/2 Mile of Existing Water, Sewer, and Roads	LL1	1
			<input checked="" type="checkbox"/> 3.2 Select an Infill Site	LL1	1
			<input checked="" type="checkbox"/> 4.1 Community Resources Within 1/4 mile of Basic Community Resources / Public Transportation	LL1	1
			<input checked="" type="checkbox"/> 4.2 OR Within 1/4 Mile of Extensive Community Resources / Public Transportation	LL1	2
			<input checked="" type="checkbox"/> 4.3 AND/OR Within 1/2 Mile of Green Spaces	LL1	1
			<input checked="" type="checkbox"/> 5.1 Compact Development Average Housing Density >= 7 Units / Acre	LL1	1
			<input checked="" type="checkbox"/> 5.2 OR Average Housing Density >= 10 Units / Acre	LL1	2
			<input checked="" type="checkbox"/> 5.3 OR Average Housing Density >= 20 Units / Acre	LL1	3
			Sub-Total		
Yes	?	No	Sustainable Sites (SS)	OR	14
<input checked="" type="checkbox"/>			1.1 Site Stewardship Minimize Disturbed Area of Site (If Site > 1/3 Acre)		Required
<input checked="" type="checkbox"/>			1.2 Erosion Controls (During Construction)		Required
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 2.1 Landscaping Basic Landscaping Design		Required
			<input checked="" type="checkbox"/> 2.2 Apply 3 to 4 Inches of Mulch Around Plants		1
			<input checked="" type="checkbox"/> 2.3 Limit Turf	5	3 1
			<input checked="" type="checkbox"/> 2.4 Minimize Landscape Water Demand	3	2 1
			3 Shading of Hardscapes Locate and Plant Trees to Shade Hardscapes		1
<input checked="" type="checkbox"/>			4.1 Surface Water Management Install Permeable Material for at Least 65% of Lot (If Lot >= 1/4 acre)		Required
			<input checked="" type="checkbox"/> 4.2 Use Permeable Paving Materials	1	3 5
			<input checked="" type="checkbox"/> 4.3 Design and Install Permanent Erosion Controls	1	2 3
			5 Non-Toxic Pest Control Select Insect and Pest Control Alternatives from List		2
			Sub-Total		
Yes	?	No	Water Efficiency (WE)	OR	12
			<input checked="" type="checkbox"/> 1.1 Water Reuse Rainwater Harvesting System		1
			<input checked="" type="checkbox"/> 1.2 Grey Water Re-Use System		1
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 2.1 Irrigation System Main Shutoff Valve, Sub-Meter, and Third-Party Inspection		Required
			<input checked="" type="checkbox"/> 2.2 Select High Efficiency Measures from List	5	3 1
			<input checked="" type="checkbox"/> 2.3 Rain Sensing Controls		1
			<input checked="" type="checkbox"/> 3.1 Indoor Water Use High Efficiency Fixtures (Toilets, Showers, and Faucets)		3
			<input checked="" type="checkbox"/> 3.2 OR Very High Efficiency Fixtures (Toilets, Showers, and Faucets)		6
			Sub-Total		
Yes	?	No	Indoor Environmental Quality (IEQ)	OR	14
			1 ENERGY STAR with IAP Meets ENERGY STAR w/ Indoor Air Package (IAP)	IE2-10	10
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 2.1 Combustion Venting Space Heating and DHW Equip w/ Closed/Power-Exhaust; & CO Monitor	IE1	Required
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 2.2 Fireplaces w/ Outside Air Supply and Closed Combustion	IE1	Required
			<input checked="" type="checkbox"/> 3 Humidity Control Analyze Moisture Loads AND Install Central System (where Needed)	IE1	1
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 4.1 Outdoor Air Ventilation Meets ASHRAE Std 62.2	IE1	Required
			<input checked="" type="checkbox"/> 4.2 Dedicated Outdoor Air System (w/ Heat Recovery)	IE1	2
			<input checked="" type="checkbox"/> 4.3 Third-Party Testing of Outdoor Air Flow Rate into Home		1
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 5.1 Local Exhaust Meets ASHRAE Std 62.2	IE1	Required
			<input checked="" type="checkbox"/> 5.2 Timer / Automatic Controls for Bathroom Exhaust Fans	IE1	1
			<input checked="" type="checkbox"/> 5.3 Third-Party Testing of Exhaust Air Flow Rate Out of Home		1
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 6.1 Supply Air Distribution Meets ACCA Manual D	IE1	Required
			<input checked="" type="checkbox"/> 6.2 Third-Party Testing of Supply Air Flow into Each Room in Home		2
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 7.1 Supply Air Filtering >= 8 MERV Filters, w/ Adequate System Air Flow	IE1	Required
			<input checked="" type="checkbox"/> 7.2 >= 10 MERV Filters, w/ Adequate System Air Flow		1
			<input checked="" type="checkbox"/> 7.3 OR >= 12 MERV Filters, w/ Adequate System Air Flow		2
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 8.1 Contaminant Control Seal-Off Ducts During Construction	IE1	Required
			<input checked="" type="checkbox"/> 8.2 Permanent Walk-Off Mats OR Central Vacuum		1
			<input checked="" type="checkbox"/> 8.3 Third-Party Testing of Particulates and VOCs before Occupancy		1
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 9.1 Radon Protection Install Radon Mitigation System if Home is Located in EPA Region 1	IE1	Required
			<input checked="" type="checkbox"/> 9.2 Install Ground Contaminant Mitigation System (Outside of EPA Region 1)	IE1	1
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 10.1 Vehicle Emissions Protection No Air Handling Equipment OR Return Ducts in Garage	IE1	Required
<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/> 10.2 Tightly Seal Shared Surfaces between Garage and Home	IE1	Required
			<input checked="" type="checkbox"/> 10.3 Exhaust Fan in Garage OR No Garage in Contact with Home	IE1	1
			Sub-Total		

Yes	?	No	Materials and Resources (MR)		24	
			<input checked="" type="checkbox"/>	1 Home Size	Home that is Smaller than National Average	10
			<input checked="" type="checkbox"/>	2.1 Material Efficient Framing	No Extra Uses of Lumber for Aesthetic Purposes	Required
			<input checked="" type="checkbox"/>	2.2	Advanced Framing Techniques	2
			<input checked="" type="checkbox"/>	3 Local Sources	Materials Extracted / Manufactured / Produced within 500 Miles	3
Y			<input checked="" type="checkbox"/>	4.1 Durability Plan	Detailed Durability Plan; (Pre-Construction)	Required
			<input checked="" type="checkbox"/>	4.2	Third-Party Verification of Implementation of Durability Plan	1 3 5
Y			<input checked="" type="checkbox"/>	5.1 Environmentally Preferable	Tropical Hardwoods, if used, must be FSC	Required
			<input checked="" type="checkbox"/>	5.2 Products	Select Environmentally Preferable Products from List	4
Y			<input checked="" type="checkbox"/>	6.1 Waste Management	Max of 2.5 Lbs Per Square Foot of Construction Waste Sent to Landfill	Required
			<input checked="" type="checkbox"/>	6.2	0.5 Pts for Each Additional 0.5 Lbs Per Square Foot Reduction	2
				Sub-Total		
Yes	?	No	Energy and Atmosphere (EA)		OR	29
Y			<input checked="" type="checkbox"/>	1.1 ENERGY STAR Home	Meets ENERGY STAR for Homes with Third-Party Testing	Required
			<input checked="" type="checkbox"/>	1.2	Exceeds ENERGY STAR for Homes, 2 Pts Per HERS Point > HERS 86	EA2-7 16
Y			<input checked="" type="checkbox"/>	2.1 Insulation	Third-Party Inspection of Insulation Installation, At Least HERS Grade II	EA1 Required
			<input checked="" type="checkbox"/>	2.2	Third-Party Inspection of Insulation Installation, At Least HERS Grade I	EA1 1
			<input checked="" type="checkbox"/>	2.3	OR Above Code Insulation; At Least 5% > Local Code Per REScheck	EA1 1
Y			<input checked="" type="checkbox"/>	3.1 Air Infiltration	Third-Party Envelope Air Leakage Tested <= 0.35 ACH	EA1 Required
			<input checked="" type="checkbox"/>	3.2	Third-Party Envelope Air Leakage Tested <= 0.25 ACH	EA1 1
			<input checked="" type="checkbox"/>	3.3	OR Third-Party Envelope Air Leakage Tested <= 0.15 ACH	EA1 2
Y			<input checked="" type="checkbox"/>	4.1 Windows	Windows Meet ENERGY STAR for Windows (See Table)	EA1 Required
			<input checked="" type="checkbox"/>	4.2	Windows Exceed ENERGY STAR for Windows by >= 10% (See Table)	EA1 1
			<input checked="" type="checkbox"/>	4.3	OR Windows Exceed ENERGY STAR for Windows by >= 20% (See Table)	EA1 2
Y			<input checked="" type="checkbox"/>	5.1 Duct Tightness	Third-Party Duct Leakage Tested <= 5.0 CFM25 / 100 SF to Outside	EA1 Required
			<input checked="" type="checkbox"/>	5	Third-Party Duct Leakage Tested <= 3.0 CFM25 / 100 SF to Outside	EA1 1
			<input checked="" type="checkbox"/>	5.3	OR Third-Party Duct Leakage Tested <= 1.0 CFM25 / 100 SF to Outside	EA1 2
Y			<input checked="" type="checkbox"/>	6.1 Space Heating and Cooling	Meets ENERGY STAR for HVAC w/ Manual J & refrigerant charge test	EA1 Required
			<input checked="" type="checkbox"/>	6.2	Exceeds ENERGY STAR for HVAC by >= 10%, w/ Manual J	EA1 1
			<input checked="" type="checkbox"/>	6.3	OR Exceeds ENERGY STAR for HVAC by >= 20%, w/ Manual J	EA1 3
			<input checked="" type="checkbox"/>	7.1 Water Heating	Improved Hot Water Distribution System	3
			<input checked="" type="checkbox"/>	7.2	Improved Water Heating Equipment	EA1 3
			<input checked="" type="checkbox"/>	8.1 Lighting	Energy Efficient Fixtures and Controls	1
			<input checked="" type="checkbox"/>	8.2	OR ENERGY STAR Advanced Lighting Package	3
			<input checked="" type="checkbox"/>	9.1 Appliances	Select Appliances from List	2
			<input checked="" type="checkbox"/>	9.2	Very Efficient Clothes Washer (MEF > 1.8, AND WF < 5.5)	1
			<input checked="" type="checkbox"/>	10 Renewable Energy	Renewable Electric Generation System (1 Point / 10% Annual Load Reduction)	6
			<input checked="" type="checkbox"/>	11 Refrigerant Management	Minimize Ozone Depletion and Global Warming Contributions	1
				Sub-Total		
Yes	?	No	Homeowner Awareness (HA)			1
Y			<input checked="" type="checkbox"/>	1.1 Homeowner Education	Basic Owner's Manual and Walkthrough of LEED Home	Required
			<input checked="" type="checkbox"/>	1.2	Comprehensive Owner's Manual and Multiple Walkthroughs / Trainings	1
				Sub-Total		
Yes	?	No	Innovation and Design Process (ID)			4
			<input checked="" type="checkbox"/>	1.1 Innovative Design	Provide Description and Justification for Specific Measure	1
			<input checked="" type="checkbox"/>	1.2	Provide Description and Justification for Specific Measure	1
			<input checked="" type="checkbox"/>	1.3	Provide Description and Justification for Specific Measure	1
			<input checked="" type="checkbox"/>	1.4	Provide Description and Justification for Specific Measure	1
				Sub-Total		
Project Totals ¹ (pre-certification estimates)						108

Notes: 1. **Certified** 30-49 points **Silver** 50-69 points **Gold** 70-89 points **Platinum** 90-108 points
2. "Points" are shown for 3 precipitation zones: Dry (< 20 inches / year); Normal (20-40 inches / year); and Wet (> 40 inches / year)

I hereby attest that I have verified all of the indicated credits above as installed in the home identified above.

Rater's Name Company
Signature Date

I hereby attest that I have reviewed the verification information, and certify that this home meets the requirements of LEED for Homes

Provider's Name Company
Signature Date

LEED for Homes Rating System

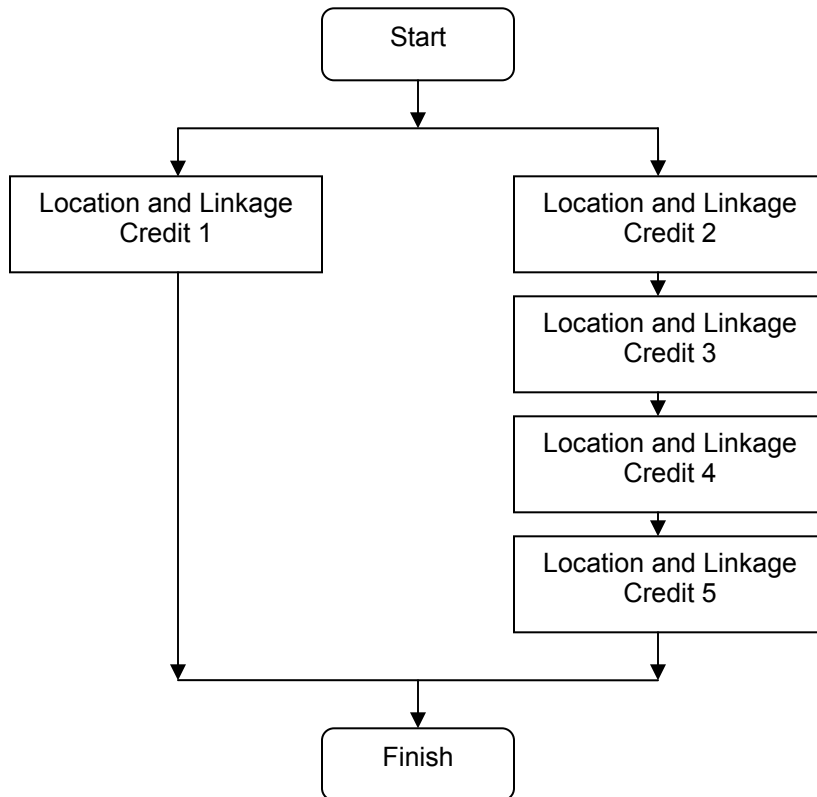
Detailed Explanation of Credits

Location and Linkages (LL).....	24
Sustainable Sites (SS)	35
Water Efficiency (WE)	46
Indoor Environmental Quality (IEQ)	53
Materials and Resources (MR).....	71
Energy and Atmosphere (EA)	91
Homeowner Awareness (HA).....	117
Innovation and Design Process (ID).....	120

Location and Linkages (LL)

Optional Pathways Through LL Credits

Note: LL1 is not applicable during the pilot demonstration of LEED for Homes, as the LEED-ND Rating System is not yet available.



Credit #1: LEED–ND Neighborhood

Maximum *Points*: 10

Note: LL1 is not applicable during the pilot demonstration of LEED for Homes, as the LEED-ND Rating System is not yet available.

Intent

Promote environmentally and socially sustainable responsible land development practices.

Requirements

Mandatory Measures

None

Optional Measures

Complete the requirements of the LEED for Neighborhood Developments (LEED-ND) program (10 Points)

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 credit LL1, then must skip credits LL2-5.

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: reduced sprawl, 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

TBD

Project Phase: Design: Site Planning

Construction: N/A

Trades: Architect /Engineer

Credit #2: Site Selection

Maximum *Points*: 2

Intent

Avoid environmentally sensitive sites.

Requirements

Mandatory Measures

None

Optional Measures

Do not develop buildings, roads or parking areas on portions of sites that meet any one of the following criteria: (2 Points)

- 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).

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

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Complete Accountability Form for LLc2 (in Attachment A), 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

Project Phase: Design: Site Planning

Construction: N/A

Trades: Architect /Engineer

Credit #3: Infrastructure

Maximum Points: 2

Intent

Encourage the selection of infill sites and other sites that are already served by or near existing infrastructure.

Requirements

Mandatory Measures

None

Optional Measures

- 3.1 Select a site that is within ½ mile of existing water service lines, sewer service lines, and paved roads (within ½ mile). (1 Point)
- 3.2 Select an infill site such that at least 75% of the perimeter of the development site (where the home is located) borders existing development. (1 Point)

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

LOCATION AND LINKAGES
Infrastructure

LL	SS	WE	IEQ	MR	EA	HA	ID
----	----	----	-----	----	----	----	----

Project Phase: Design: Site Planning

Construction: N/A

Trades: Architect /Engineer

Credit #4: Community Resources

Maximum Points: 3

Intent

Minimize dependency on personal automobiles and associated environmental impacts by encouraging development patterns that allow for walking, biking, or transit as alternative means of transportation to necessary services.

Requirements

Mandatory Measures

None

Optional Measures

4.1 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) (1 Point)

OR

4.2. Walkable access to eleven (within ¼ mile) or fourteen (within ½ mile) basic community resources (see list in Exhibit LL4-A) **OR** proximity to transit service constituting 250 or more transit rides per weekday (combined bus, rail, and ferry) (2 Points)

AND/OR

4.3. Walkable access to (within ½ mile) to a community-based open space that is at least 0.75 acre in size. (1 Point)

Community 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, parks, play areas, and other community open spaces specifically intended for recreational use.

**Exhibit LL4-A
List of Basic Community Resources**

<input type="checkbox"/> Bank	<input type="checkbox"/> Police Station
<input type="checkbox"/> Community or Civic Center	<input type="checkbox"/> Post Office
<input type="checkbox"/> Convenience Store	<input type="checkbox"/> Place of Worship
<input type="checkbox"/> Fire Station	<input type="checkbox"/> Restaurant
<input type="checkbox"/> Laundry or Dry Cleaner	<input type="checkbox"/> School
<input type="checkbox"/> Library	<input type="checkbox"/> Supermarket
<input type="checkbox"/> Medical or Dental Office;	<input type="checkbox"/> Other neighborhood-serving retail
<input type="checkbox"/> Park	<input type="checkbox"/> Other office building or major
<input type="checkbox"/> Pharmacy	employment center

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

Project Phase: Design: Site Planning

Construction: N/A

Trades: Architect /Engineer

Credit #5: Compact Development

Maximum *Points*: 3

Intent

Encourage compact development patterns in order to use land efficiently and support a range of transportation options.

Requirements

Mandatory Measures

None.

Optional Measures

5.1 Build homes with an average housing density of 7 or more dwelling units per acre of buildable land. (1 Point)

OR

5.2 Build homes with an average housing density of 10 or more dwelling units per acre of buildable land. (2 Points)

OR

5.3 Build homes with an average housing density of 20 or more dwelling units per acre of buildable land. (3 Points)

When calculating buildable land area, 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.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Complete Accountability Form (in Attachment A), signed by the civil engineer or responsible party, declaring that the average housing density 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

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

Potential Technologies and Strategies

TDB

Resources and References

TBD

Project Phase: Design: Site Planning

Construction: N/A

Trades: Architect /Engineer

Sustainable Sites (SS)

Credit #1: Site Stewardship

Maximum *Points*: 0

Intent

Design and construct building with minimal impact on building lot.

Requirements

Mandatory Measures

- 1.1 Minimize disturbed area of site, if site is greater than 1/3 acre, including:
 - Develop a tree / plant preservation plan with no-disturbance zone clearly delineated on drawings AND on the building lot; and
 - Leave undisturbed at least 40% of previously undeveloped lot area
- 1.2 Design and install erosion controls during construction
 - Stockpile and protect existing topsoil from erosion (for reuse)
 - Stabilize soils that have been 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 sewers inlets with straw bales, silt fencing, silt sacks, or rock filters

Optional Measures

None

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

TBD

Additional Information

Rationale

The selection of the location of the home's footprint on the building lot has a large 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

Project Phase: Design: Site Selection

Trades: Architect / Engineer

Credit #2: Landscaping

Maximum Points: 5

Intent

Design and install landscape features that minimize demand for water and synthetic chemicals.

Requirements

Mandatory Measures

- 2.1 Basic landscape design:
- Install drought-tolerant turf in sunny areas only, no turf in densely shaded areas.
 - Areas planted with turf should not exceed a slope of 25 percent (i.e., a 4 to 1 slope).
 - Use no invasive or exotic plant species, as identified by local Agriculture Cooperative Extension Service.
- Lots less than (1/10 acre?) are exempt.

Optional Measures

- 2.2 Apply mulch. Mulch applied 3-4 inches deep around plants. (1 Point)
- 2.3 Limit turf. See as specified in Exhibit SS2-A. (0-5 Points)

**Exhibit SS2-A
Points For Limited Turf (By Precipitation Region)**

Limit Turf to __ % of Landscape	Dry Region (< 20 in/yr)	Normal Region (20-40 in/yr)	Wet Region (> 40 in/yr)
50%	2	1	0
20%	5	3	1

- 2.4 Design plantings to minimize landscape water demand as specified in Exhibit SS2-B. (0-3 Points)

**Exhibit SS2-B
Points for Minimizing Water Demand (By Precipitation Region)**

__ % of Plants from Drought Tolerant List (OR Water Budget of __ Gal/SF/Yr)	Dry Region (< 20 in/yr)	Normal Region (20-40 in/yr)	Wet Region (> 40 in/yr)
50% (15)	2	1	0
90% (5)	3	2	1

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Credit 2.2 and 2.3: Inspect these installed measures, to affirm that all of the requirements above have been completed, AND verify that plant list was obtained from appropriate source (e.g., local cooperative extension office, native plant society, etc.), and
- ✓ Credit 2.1 and 2.4: Obtain Accountability Form (Attachment A), 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 credit 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 (WE c1) 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 offices, as well as through numerous Internet resources.

Project Phase: Design: Site planning Construction: Site preparation

Trades: Excavating Contractor / Landscaping

Credit #3: Shading of Hardscapes

Maximum Points: 1

Intent

Reduce local heat island effects.

Requirements

Mandatory Measures

None

Optional Measures

Design and install trees and shrubs to that will shade at least 50% of sidewalks, patios, and driveways within 50 feet of house (at 5 years' growth) **OR** install light colored, high-albedo materials (reflectance of at least 0.3) for at least 50% of site's non-roof impervious surfaces. (1 Point)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Obtain Accountability Form (Attachment A), signed by the landscape designer or responsible party, declaring that the plantings (if applicable) meet the credit requirements, and place in Project Documentation File;
- ✓ Inspect these installed measures, to affirm that all of the requirements above have been completed;
- ✓ Inspect/verify manufacturer's cut sheet/specification for site surfacing materials, as applicable, to ensure requirements have been met; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

The shading of hardscapes around the home will reduce irrigation needs as well as temper the home's outdoor environment.

The Shading of the home/roof is addressed in two other credits:

- EA credit 1 Energy Star roofs, using the HERS energy modeling credit
- MR credit 5.2 Environmentally Preferable Products - vegetated roofs

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

Also, locate trees, fences, shrubbery or other plantings to capture or deflect seasonal breezes as appropriate.

Additional Information

Rationale

The local heat island effect can be minimized by providing shade over paved surfaces. These actions will enable the homeowner to better utilize the outdoors, even on hotter days.

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

Project Phase: Design: Site planning

Construction: Site preparation

Trades: Landscaping

Credit #4: Surface Water Management

Maximum Points: 5

Intent

Minimize erosion and run-off from site.

Requirements

Mandatory Measures

- 4.1 Install permeable material for at least 65% of the undeveloped portion of the site. (Project is exempt if lot is $\leq 1/4$ acre).

Optional Measures

- 4.2 Install permeable paving material (e.g., pervious pavement or grid pavers) for exposed walkways, patios, playgrounds, recreation courts, aprons, and driveways, as specified in Exhibit SS4-A. (0-5 Points)

Exhibit SS4-A
Points for Permeable Paving for Various Precipitation Regions

Fraction of Permeable Paved Surfaces is:	Dry Region (< 20 in/yr)	Normal Region (20-40 in/yr)	Wet Region (> 40 in/yr)
> 40% of Total Paved Surfaces	0	1	2
> 60% of Total Paved Surfaces	0	2	4
> 80% of Total Paved Surfaces	1	3	5

- 4.3 Design and install permanent erosion control measures as specified in Exhibit SS4-B. Each installed measure is worth 1 point. (1-3 points possible, based on precipitation region).
 - o Install permanent storm water control (i.e., vegetated swales, on-site rain garden, etc.)
 - o Reduce long term run-off effects through use of terracing and retaining walls.
 - o Plant one tree or four 5-gallon shrubs per 500 square feet of disturbed construction area (including home site), or four large, 5 gallon, shrubs are equivalent to one tree.

Exhibit SS4-B
Points for Erosion Controls for Various Precipitation Zones

Permanent Erosion Control	Dry Region (< 20 in/yr)	Wet Region (20-40 in/yr)	Wet Region (> 40 in/yr)
Max. Number of Points	1	2	3

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

N/A

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 encourage recharging local aquifers and may reduce irrigation needs.

Potential Technologies and Strategies

Significantly reduce impervious surfaces, use 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 Storm water 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

See 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>)

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

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

Project Phase: Design: Site planning Construction: Site preparation & Landscaping

Trades: Excavating Contractor & Landscaping

Credit #5: Non-Toxic Pest Control

Maximum Points: 2

Intent

Avoid use of poisons for insect and disease control.

Requirements

Mandatory Measures

None

Optional Measures

Note all physical action (for pest management practices) on construction plans.
Implement measures below for 0.5 points each. (Max.0.5- 2 Points)

- In areas with termite infestation, 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;
- In areas with termite infestation, use solid concrete foundation walls OR masonry wall with top course of solid block bond beam or concrete filled block;
- Keep all wood used (i.e., siding, trim, structure) at least 12" above soil (code requires 8");
- Seal all edges, transitions, and entry points;
- Protect exposed foundation insulation with moisture- resistant, pest- proof cover (e.g., fiber cement board, galvanized insect screen);
- Install rodent- and corrosion- proof screens (e.g., copper or stainless steel mesh) on all openings that cannot be caulked or sealed;
- 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;
- Install landscaping so that all parts of mature plants will be at least 24" from house.

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

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 known 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

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

Project Phase: Design: Programming Construction: Pre-occupancy preparation

Trades: Pest Control

Water Efficiency (WE)

Credit #1 Water Reuse

Maximum Points: 2

Intent

Minimize demand for potable water.

Requirements

Mandatory Measures

None

Optional Measures

- 1.1 Design and install rainwater harvesting system (including surface run-off and/or roof run-off) for irrigation use. Size system based on $\frac{3}{4}$ inch rainfall event and able to collect minimum of 50% of rain from the roof (based on total roof surface area). (1 Point)
- 1.2 Design and install grey water re-use system, with minimum of dedicated clothes washer with 2 inch drain directed to subterranean drain field for landscape irrigation (i.e., not a septic system). Grey water system must include a storage tank that can be used as part of the irrigation system. Also, *grey water systems are subject to local codes and may require special permits.* (1 Point)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Complete Accountability Form (in Attachment A), signed by the design engineer or responsible party, declaring that the systems 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

As much as 50% of potable water use in a home may be for maintenance of lawns and gardens. Obviously, the other half is for indoor uses. This credit promotes the re-use of indoor waste water and rainwater to help meet landscape water demand.

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)

Project Phase: Design: Programming

Construction: Plumbing & Gutters

Trades: Specialty Contractor

Credit #2: Irrigation System

Maximum Points: 5

Intent

Minimize water demand for landscape irrigation.

Requirements

Mandatory Measures

- 2.1 Install a central shut-off valve and sub-meter for the irrigation system, and third-party visual inspection of installed irrigation system. Inspection to include observation that all spray heads are operating and delivering water to intended zones.

Optional Measures

- 2.2 Design and install high efficiency irrigation system (based on overall landscaping plans, including measures adopted in SS credit 2) with the following features (1 point each, max number of points shown in Exhibit WE2-A):
 - o At least 50% of landscape planting beds have a drip irrigation system to minimize evaporation
 - o Turf and each type of bedding area (based on watering needs) should be separately zoned
 - o A timer/controller that activates the valves for each watering zone and allows irrigation at the most efficient time of the day – 11 PM to 7 AM - when evaporation losses are minimal.
 - o Pressure regulating devices to maintain optimal pressure and prevent misting.
 - o High efficiency nozzles.
 - o Check valves in heads.

Exhibit WE2-A
Points for Irrigation System for Various Climate Regions

Irrigation Credit 2.1	Dry Region (< 20 in/yr)	Normal Region (20-40 in/yr)	Wet Region (> 40 in/yr)
1 Pt Each, Max. No. of Points	5	3	1

- 2.3 Design and install high efficiency irrigation system (per SS c2.1), 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. (1 point)

OR

Install landscape designed by a licensed or certified landscape design professional that needs no irrigation (1 point)

OR

Average housing density \geq 10 units per acre. (1 point)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ WE c2.1: Perform a visual inspection of installed measure(s), to affirm that the requirements above have been completed;
- ✓ WE c2.2: Complete Accountability Form (in Attachment A), signed by the engineer or responsible party, declaring that the irrigation system meets the credit requirements, and place in Project Documentation File;
- ✓ WE c2.3: 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

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

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

Additional Information

Rationale

As much as 50% of potable water use in a home may be for maintenance of lawns and gardens. By selecting water efficient landscaping (under SS c2), and designing a properly zoned irrigation system with automated controls, outdoor water usage can be carefully and efficiently controlled.

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 are work closely together to ensure that the system performs as intended.

Resources and References

TBD

Project Phase: Design: Programming

Construction: Landscaping / Irrigation

Trades: Landscaping Contractor

Credit #3: Indoor Water Use

Maximum Points: 6

Intent

Minimize indoor demand for potable water.

Requirements

Mandatory Measures

None

Optional Measures

3.1 Install high efficiency (low flow) fixtures:

- All lavatory faucets must be high efficiency ≤ 2.0 GPM (1 point)
- All shower heads must be high efficiency² ≤ 2.0 GPM (1 point)
- All toilets must be high efficiency ≤ 1.3 GPF (1 point)

OR

3.2 Install very high efficiency fixtures:

- All lavatory faucets must be very high efficiency ≤ 1.5 GPM (2 points)
- All shower heads must be very high efficiency³ ≤ 1.5 GPM (2 points)
- All toilets must be very high efficiency toilets ≤ 1.1 GPF on average, includes dual flush toilets (2 points)

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.

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.

² Builders are strongly cautioned to investigate shower head manufacturer's info 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.

³ Builders are strongly cautioned to investigate the shower head manufacturer's info on the performance of very high efficiency shower heads, similar to the caution for credit 3.1 for high efficiency shower heads.

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 account for two thirds of indoor water use in a home, and as much as 1/3 of total water use. Low flow 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

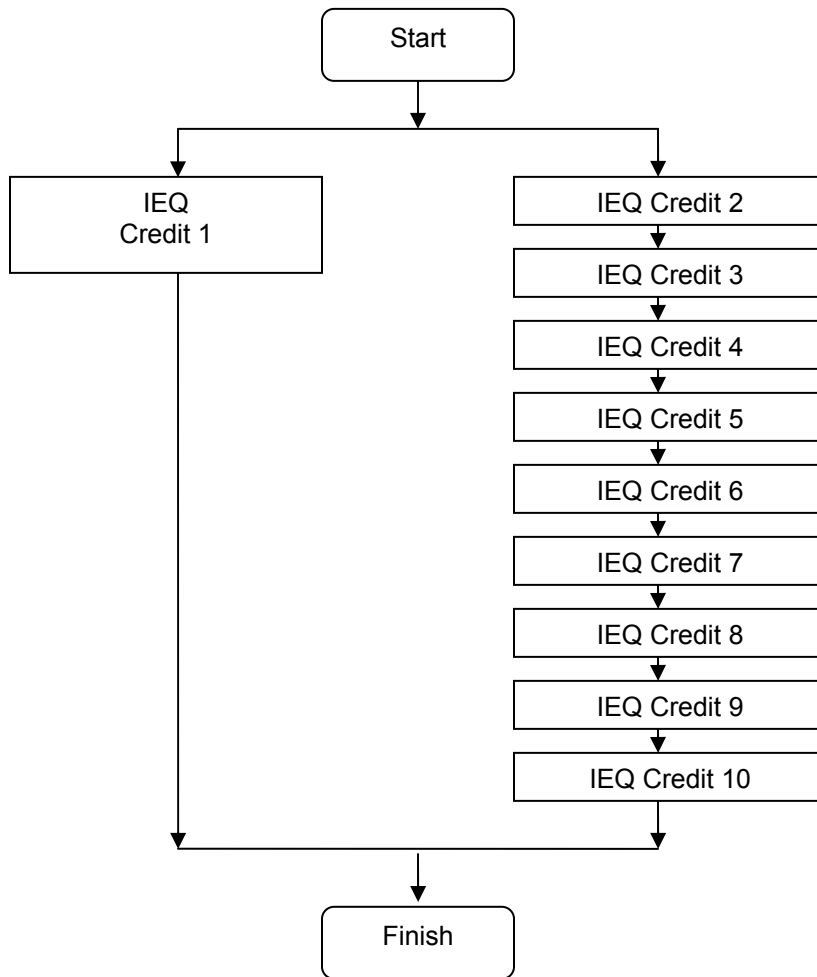
TBD

Project Phase: Design: Equipment Selection Construction: Plumbing / Finish

Trades: Plumbing Contractor

Indoor Environmental Quality (IEQ)

Optional Pathways Through IEQ Credits



Credit #1: ENERGY STAR with Indoor Air Package *Maximum Points: 10*

Intent

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

Requirements

Mandatory Measures

None

Optional Measures

Complete all of the requirements of EPA's ENERGY STAR Indoor Air Package (10 Points)

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.

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

Project Phase: Design: Programming Construction: All

Trades: All

Credit #2: Combustion Venting

Maximum Points: 0

Intent

Minimize leakage of combustion gases into occupied space of home.

Requirements

Mandatory Measures

- 2.1 Design and install HVAC and DHW combustion equipment with closed combustion (i.e., direct vented or power-vented exhaust) if equipment is located inside the building envelope,
AND
Install a CO monitor on each floor of home
- 2.2 Design and install fireplace per requirements in Table IEQ2-A, **OR** install no fireplace.

Exhibit IEQ2-A Requirements for Fireplaces and Woodstoves

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 pt 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 .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.

Optional Measures

None

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 credit IEQ 1, then must skip this credit.

Additional Information

Rationale

Indoor air quality may be 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.

Potential Technologies and Strategies

TBD

Resources and References

TBD

Project Phase: Design: Preliminary Design Construction: Post-Framing / Fireplace

Trades: Specialty Contractor

Credit #3: Humidity Control

Maximum Points: 1

Intent

Provide a comfortable thermal environment in the home.

Requirements

Mandatory Measures

None

Optional Measures

Analyze moisture loads and need for a central humidity control system. Install humidity control system where needed to maintain humidity ratios below 0.012 (lb. water vapor / lb. dry air) per Section 5.2.2 of ASHRAE Standard 55-2004.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Complete Accountability Form (in Attachment A), 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 building envelopes 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 MR credit 4, durability plan.

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-A
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"

Project Phase: Design: Preliminary Design Construction: HVAC

Trades: HVAC Contractor

Credit #4: Outdoor Air Ventilation

Maximum Points: 3

Intent

Protect occupants from indoor pollutants by ventilating with outdoor air.

Requirements

Mandatory Measures

- 4.1 Design and install a whole building ventilation system that complies with ASHRAE Standard 62.2.⁴ Note that Standard 62.2 provides for the design of alternative (e.g., passive) ventilation designs in Section 4.1.2.

Optional Measures

- 4.2 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 and exhaust. (2 Point)
- 4.3 Third-party testing of outdoor air flow rate into the home (1 Point)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ IEQ c4.1: Complete Accountability Form (in Attachment A), signed by the engineer or responsible party, declaring that the outdoor air ventilation system meets the credit requirements, and place in Project Documentation File;
- ✓ IEQ c4.2: Perform a visual inspection of this installed measure, to affirm that the requirements above have been completed,
- ✓ IEQ c4.3: 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 credit IEQ 1, then must skip credits 4.1 and 4.2.

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 c4, 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.

⁴ 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).

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

Occupant health and comfort may be adversely affected by poor ventilation in a home. Without adequate outdoor air ventilation, humidity, odors, and pollutants may accumulate within the home.

Potential Technologies and Strategies

TBD

Resources and References

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

Project Phase: Design: Programming

Construction: HVAC

Trades: HVAC Contractor / Rater

Credit #5: Local Exhaust

Maximum Points: 2

Intent

Remove indoor pollutants in kitchens and bathrooms.

Requirements

Mandatory Measures

- 5.1 Design and install local exhaust systems in bathrooms and kitchen per ASHRAE Standard 62.2, **AND** use ENERGY STAR labeled exhaust fans, except for exhaust fans serving multiple bathrooms.

Optional Measures

- 5.2 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. (1 Point)
- 5.3 Perform third-party test of each exhaust air flow rate from the home – for compliance with Std 62.2 requirements. (1 Point)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ IEQ c5.1: Complete Accountability Form (in Attachment A), signed by the engineer or responsible party, declaring that the outdoor air ventilation system meets the credit requirements, and place in Project Documentation File;
- ✓ IEQ c5.2: Perform a visual inspection of this installed measure, to affirm that the requirements above have been completed;
- ✓ IEQ c5.3: 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 credit IEQ 1, then must skip this credit.

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

Project Phase: Design: Preliminary Design Construction: HVAC

Trades: HVAC Contractor / Rater

Credit #6: Supply Air Distribution

Maximum Points: 2

Intent

Ensure supply air is distributed adequately to conditioned spaces.

Requirements

Mandatory Measures

- 6.1 Perform ACCA Manual D duct design calculations and install ducts accordingly **AND** ensure that every room has adequate return air flow (through use of either multiple returns or transfer grills) OR install ductless space conditioning system (e.g., hydronic heat with passive ventilation system per Section 4.1.2 of ASHRAE Standard 62.2.)

Optional Measures

- 6.2 Test total supply air flow rates in each room of home using a flow hood, **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 (performed in EA 6.1). (2 Points)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ IEQ c6.1: Complete Accountability Form (in Attachment A), signed by the engineer or responsible party, declaring that the supply air system meets the credit requirements, and place in Project Documentation File;
- ✓ IEQ c6.2: 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; 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.

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

Occupant Comfort may be adversely affected by inadequate air distribution to each room in a home.

Potential Technologies and Strategies

TBD

Resources and References

INDOOR ENVIRONMENTAL QUALITY

Supply Air Distribution

LL	SS	WE	IEQ	MR	EA	HA	ID
----	----	----	------------	----	----	----	----

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

Project Phase: Design: Preliminary Design

Construction: HVAC

Trades: HVAC Contractor / Rater

Credit #7: Supply Air Filtering

Maximum Points: 2

Intent

Remove particulate matter from supply air system.

Requirements

Mandatory Measures

- 7.1 Install air filters \geq MERV 8 and ensure that air handlers can maintain adequate pressure (and air flow), **OR** install a ductless space conditioning system (e.g., a hydronic heating systems).

Optional Measures

- 7.2 Install air filters \geq MERV 10 and ensure that air handlers can maintain adequate pressure (and air flow). (1 Point)

OR

- 7.3 Install HEPA air filters, and ensure that air handlers can maintain adequate pressure (and air flow). (2 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 credit IEQ 1, then must skip this credit.

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

Project Phase: Design: Preliminary Design Construction: HVAC

Trades: HVAC Contractor

Credit #8: Contaminant Control

Maximum Points: 2

Intent

Protect occupants from exposure to contaminants.

Requirements

Mandatory Measures

8.1 Seal off ducts during construction **OR** clean HVAC ducts and coils before occupancy.

Optional Measures

8.2 Design and install permanent walk-off mats at each entry **OR** install central vacuum system with exhaust to the outdoors. (1 Point)

8.3 Hire third party to test for contaminant concentration prior to occupancy. Measure and report concentration levels for contaminants shown in Exhibit IEQ8-A. (1 Point)

Exhibit IEQ8-A
Max. Concentrations for Indoor Contaminants

Chemical Contaminant	Maximum Concentration	Reference Standard
Formaldehyde	50 parts per billion	State of Washington IAQ Standard
Particulates (PM 10)	150 micrograms per cubic meter EPA	National Ambient Air Standard
TVOC	500 micrograms per cubic meter	State of Washington IAQ Standard

Verification / Submittals

The Provider's third-party rater shall:

- ✓ IEQ c8.1: Perform a visual inspection of installed measure(s), to affirm that the requirements above have been completed,
- ✓ IEQ c8.2: Perform a visual inspection of installed measure(s), to affirm that the requirements above have been completed
- ✓ IEQ c8.3: Measure VOC and particulate concentrations in the home after construction is completed (but prior to occupancy); 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 5, Environmentally Preferable Products.

If using credit IEQ 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

Project Phase: Design: Programming

Construction: All

Trades: Builder

Credit #9: Radon Protection

Maximum Points: 1

Intent

Protect occupants from exposure to radon gas, and other ground contaminants.

Requirements

Mandatory Measures

9.1 If home is located in EPA Region 1, design and install radon mitigation system.

Optional Measures

9.2 If home is NOT located in EPA Region 1, design and build home with radon resistant construction techniques. (1 Point)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Complete Accountability Form (in Attachment A), 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 credit IEQ 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:

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

Resources and References

EPA info on Radon-Resistant New Construction (RRNC),
<http://www.epa.gov/iaq/radon/construc.html#What%20are%20Radon-resistant%20construction%20techniques>

Project Phase: Design: Programming Construction: HVAC

Trades: HVAC Contractor / Rater

Credit #10: Vehicle Emissions Protection

Maximum Points: 1

Intent

Protect occupants from exposure to car emissions.

Requirements

Mandatory Measures

- 10.1 No air handling equipment, return ducts or un-sealed supply ducts in garage.
- 10.2 CO detector in any occupied rooms above the garage AND tightly seal shared surfaces between garage and conditioned spaces, including:
 - Weatherstripped doors
 - All penetrations sealed
 - All connecting floor/ceiling joist bays sealed
 - Paint walls/ceilings (CO can penetrate unfinished drywall through diffusion)
 - Seal all cracks at the base of walls

Optional Measures

- 10.3 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. (1 Point)

OR

No garage in contact with conditioned spaces. (1 Point)

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 credit IEQ 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

Project Phase: Design: Programming

Construction: Framing

Trades: Builder / Rater

Materials and Resources (MR)

Credit #1: Home Size

Maximum Points: 10

Intent

Promote construction of homes that are smaller than the national average.

Requirements

Mandatory Measures

Assign score for home size, based on number of bedrooms, as shown in Exhibit MR1-A. (Up to 10 Points)

To determine the score for a home between two sizes shown, interpolate and then round to the closest point. Example: a 3-bedroom home of 1800 square feet – the midpoint between 0 points and 2 points for a 3-bedroom home is 1795 square feet; 1800 is closer to 1795 (1 point) than to 1890 (0 points) or to 1700 (2 points), therefore the score is 1 point.

**Exhibit MR1-A
Points for Home Size**

House Size In Square Feet By Number Of Bedrooms (See Note 1)					Score
0 Bedrooms	1 Bedroom	2 Bedrooms	3 Bedrooms	4 Or More Bedrooms	
275	350	750	900	1150	10
350	400	875	1100	1450	8
425	500	1000	1300	1750	6
500	600	1125	1500	2050	4
575	700	1250	1700	2350	2
650 SF	800 SF	1375 SF	1900 SF	2650 SF	0
725	900	1500	2100	2950	-2
800	1000	1625	2300	3250	-4
875	1100	1750	2500	3550	-6
950	1200	1875	2700	3850	-8
1025	1300	2000	2900	4150	-10
>1025	>1300	>2000	>2900	>4150	See Note 2

Note 1: A bedroom is defined as an enclosed room that is used principally for sleeping or contains a closet and has ready access to a bathroom, i.e., a room other than a kitchen, bathroom, living room, dining room, family / media room, laundry room, garage, hallway, or unfinished basement area.

Note 2: Determine size score for homes larger than those shown in the applicable column by subtracting one additional point for each added size increment, as shown in Exhibit MR1-B below.

Exhibit MR1-B
Size Increments for Larger Homes (Square Feet)

0 Bedrooms	1 Bedroom	2 Bedrooms	3 Bedrooms	4 Or More Bedrooms	Deduction Per Increment
37.5	50	62.5	100	150	-1

Optional Measures

None.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Obtain Accountability Form (in Attachment A), signed by the architect or responsible party, and place in Project Documentation File; and
- ✓ Indicate the size score in the appropriate box on the LEED for Homes checklist.

Synergies and Trade-Offs

In developing this credit, initially 5 points were made available for smaller homes. However, the same rationale that gave rise to this credit – that as size increases, so does the home's consumption of materials – applies equally to the home's energy consumption. Thus the pool of points for this credit was doubled to reflect the intimate linkage between home size and its dual consumption profiles: materials and energy. A more detailed explanation follows under Rationale.

Additional Information

Rationale

Most homes will house a number of different households and populations over their lifespans, rendering it impossible to directly correlate the size of a given home with the number of occupants it will house. However, there is a relationship – loosely understood – between the number of bedrooms in a given place (city, state, region, country) and the population of that place. It is therefore reasonable to assume that, by and large, a given number of bedrooms represents the ability to house a given population, regardless of how those bedrooms are distributed amongst homes, and independent of bedroom size. This assumption is reinforced by the statistics, readily available, which show that average household size (2 and change) is less than the number of bedrooms in the average house (3 or so). Since many master bedrooms do house two individuals, it is clear that most bedrooms do not house more than one individual, thus larger bedrooms (in larger homes) will not house more occupants across the landscape.

Research indicates that as home size increases, so do both material consumption and energy consumption. And although it is possible (within limits) to increase the efficiency of usage of both materials and energy such that a larger home may consume no more than a smaller, less efficient home, the efficient larger home nevertheless consumes more than a similarly efficient smaller home. Thus for a given size family, a larger home uses more materials and energy to meet the same need. And those increases can be shown to be roughly proportional to the increases in the size of the home itself.

Credit #2: Material-Efficient Framing

Maximum Points: 2

Intent

Promote optimized use of framing materials.

Requirements

Mandatory Measures

- 2.1 No extra lumber may be used for purely aesthetic purposes, such as double-thick walls to create deep window reveals, etc.

Optional Measures

- 2.2 Select from measures below. (0.5 points each, 2 points maximum)
- Space joists & studs greater than 16"OC
 - Size headers for actual loads
 - Design roof pitch/eave width to 24" module
 - Use ladder blocking / drywall clips
 - Use two-stud corners

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

More efficient framing practices result in savings on lumber. Increased joint/stud spacing may affect choice or installation of sheathing or surfacing materials. It may also reduce labor costs due to the handling of fewer pieces. Minimizing header sizes may allow placement of windows higher on the wall, which may provide design advantages.

Additional Information

Rationale

Conventional framing techniques use about 15 to 20 percent more framing material than is structurally needed.

Potential Technologies and Strategies

Thoroughly brief and supervise framing crew. Provide detailed framing drawings (e.g., framing elevations and plans). Have engineer or architect calculate needed header sizes and/or substitute composite or box or SIP headers in place of solid lumber.

In addition to the 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>

Project Phase: Design: Preliminary Design Construction: Framing

Trades: Framing Contractor

Credit #3: Local Sources

Maximum Points: 3

Intent

Promote use of materials that are extracted, processed, and manufactured within the region, thereby supporting the use of indigenous resources, reducing the environmental impacts resulting from transportation, and increasing awareness of the environmental impacts of resource use and extraction.

Requirements

Mandatory Measures

None

Optional Measures

Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the home. Eligible components are listed in Exhibit MR3-A. Ninety percent of component must meet the source requirements in order to earn 0.5 point. (0.5 points each, 3 points maximum)

Exhibit MR3-A

	Assembly/System	Component	Points
<input type="checkbox"/>	FOUNDATION	aggregate	0.50
<input type="checkbox"/>	FOUNDATION	Cement	0.50
<input type="checkbox"/>	OTHER	Doors	0.50
<input type="checkbox"/>	FLOOR	Flooring	0.50
<input type="checkbox"/>	EXT. WALL	Framing	0.50
<input type="checkbox"/>	FLOOR	Framing	0.50
<input type="checkbox"/>	INT. WALL	Framing	0.50
<input type="checkbox"/>	ROOF	Framing	0.50
<input type="checkbox"/>	INTERIOR WALLS & CEILINGS	gypsum board	0.50
<input type="checkbox"/>	LANDSCAPE	masonry / wood	0.50
<input type="checkbox"/>	ROOF	Roofing	0.50
<input type="checkbox"/>	EXTERIOR WALLS	Sheathing	0.50
<input type="checkbox"/>	FLOOR	Sheathing	0.50
<input type="checkbox"/>	ROOF	Sheathing	0.50
<input type="checkbox"/>	EXTERIOR WALL	siding, masonry	0.50
<input type="checkbox"/>	OTHER	Cabinets	0.50
<input type="checkbox"/>	OTHER	Counters	0.5
<input type="checkbox"/>	OTHER	Insulation	0.5
<input type="checkbox"/>	OTHER	Windows	0.5

Total Points (Max. of 3)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Review purchasing documents and/or supplier information to affirm that the requirements above have been completed; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

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

Additional Information***Rationale***

Substantial amounts of energy are needed to deliver materials that are produced far away. Purchasing from local sources also fosters a heightened awareness of the impacts associated with material extraction and consumption such as deforestation, mining, etc., hence encouraging a conservation ethic.

Potential Technologies and Strategies

TBD

Resources and References

TBD

Project Phase: Design: Materials Selection
Finishes

Construction: Interior and Exterior

Trades: All

Credit #4: Durability Plan

Points: 1 (Dry) / 3 (Normal) / 5 (Wet)

Intent

Promote increased service life of the building enclosure (envelope) and its components and systems through appropriate design, materials, and installation

Requirements

Mandatory Measures

4.1 Prepare a detailed durability plan per the design process in Exhibit MR4-A.

Optional Measures

4.2 Verify implementation of durability plan via third-party inspection as described in Exhibit MR4-C. (Max .points shown in Exhibit MR4-A.)

Exhibit MR4-A
Points for Durability Plan By Precipitation Region

Durability Credit	Dry Region (< 20 in/yr)	Normal Region (20-40 in/yr)	Wet Region (> 40 in/yr)
Implementation with third party inspection (per Exhibit MR4-B)	1 Point	3 Points	5 Points

Verification / Submittals

The Provider's third-party rater shall:

- ✓ MR 4.1: Complete Accountability Form (in Attachment A), signed by the engineer or responsible party, declaring that the durability plan complies with these requirements, and place in Project Documentation File; and/or
- ✓ MR 4.2: Inspect builder-specified installed measures, per the checklist developed in Credit 4.1, to affirm that the requirements have been completed; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

In high performance homes, durability, energy efficiency, and indoor air quality are inextricably linked. Moisture management becomes more critical as energy management reduces the building's overall drying potential. Thus, homes with increasing levels of energy efficiency increase the importance of a durability evaluation and plan accordingly.

Moisture can be a major cause of indoor environmental problems (e.g., mold). The point value of this credit therefore reflects the related indoor environmental benefits of improved water management at the foundation, exterior walls, and roof.

Water management of the property (i.e., both lot and structure) is a combination of

surface and ground water management, with the dual goals of protecting the structure from water as well as keeping as much water as possible on the site in order to limit the burden on municipal infrastructure, recharge the aquifer, etc. To the greatest extent possible, the site and landscape should be designed with these goals in mind. The durability plan is intended to prevent damage to the home by water – both surface and ground – that can not be effectively managed at the site level, as well as to protect the structure from other damage functions.

Exhibit MR4-B
Durability Plan Requirements (MR c4.1)

Pre-Design

Step 1: Develop statement of intended service life.

1. Structure - Major assemblies and their components:
 - a. Foundation
 - b. Exterior walls
 - c. Roof
 - d. Components:
 - i. Insulation
 - ii. Wiring
 - iii. Plumbing
 - iv. Windows/doors
2. Claddings
 - a. roof cladding
 - b. wall cladding
 - c. finished flooring
3. Finishes
 - a. exterior (paint/stain)
 - b. interior (paint/wallcoverings)
4. Mechanical systems
 - a. HVAC
 - b. Water heating
 - c. Plumbing – distribution
 - d. Plumbing – delivery (faucets/showerheads/appliances/hookups)
 - e. Electrical – distribution
 - f. Electrical – delivery (lighting/appliances/hookups)
5. Fittings
 - a. Casework – Kitchen/baths/laundry

Step 2: Collect site-specific environmental conditions information (see CSA and ASTM resources).

1. Site (e.g., slope, wind, soil, ground water, pest intensity, etc.).
2. Meteorological (temperature regimes/extremes, solar radiation, precipitation, humidity, wind, etc.).
3. Likely exposure to natural disasters (earthquake, flood, wildfire, tornado, etc.)

Step 3: Set range of internal environmental conditions and intensity of use.

1. Temperature
2. Relative humidity
3. Range of full-time occupants
4. Prohibited activities

Step 4: Identify/prioritize damage functions the structure is likely to face, based on Steps 2 and 3 above. Formulate a design strategy, addressing, as appropriate, each of the following systems, assemblies, and components:

1. Drainage plane details and continuity
2. Air barrier details and continuity
3. Thermal barrier details and continuity
4. Vapor profile – relative vapor permeability of each assembly and component and dedicated direction of drying potential
5. Relationship of mechanical systems and enclosure assembly performance
6. Pest management strategies and continuity of pest barriers
7. Management of moisture originating in “wet” rooms – baths, kitchens, laundry rooms

Design

Step 5: Identify an overall management/protection strategy for each of the damage functions identified in Step 4.

1. Foundations (i.e., slabs, basements, crawl spaces)
2. Framing (i.e., structural members, flooring, walls, roof)
3. Exterior wall systems (i.e., insulation, air sealing, sheathing, drainage planes, exterior materials and finishes)
4. Windows systems
5. HVAC systems (i.e., air conditioners, outdoor ventilation systems, local exhaust systems, heat/energy recovery systems, dehumidification systems)
6. “Wet” rooms – baths, kitchens, laundry rooms

Step 6: Analyze and select specific technologies and practices for each strategy:

1. Develop specific details for the Construction Drawings.
2. Confirm that each high durability risk and each critical goal identified in previous steps have been addressed.
3. Specifically address connections, intersections, and interactions of key components and systems.

Specification

Step 7: For each durability design strategy, provide the following, as needed:

1. Detailed specifications for materials needed.
2. Detailed notations on construction drawings for all related components and systems.

Installation

Step 8: Develop scopes of work for each trade contractor based on the Construction Drawings details and the material specifications, including:

1. Pre-work checklists, signed by both the trade contractor and the site supervisor.
2. Post-work checklists, signed by both the trade contractor and the site supervisor.

Exhibit MR4-C **Durability Plan Verification Requirements (MR 4.2)**

- | |
|---|
| <p>A. The Provider's third-party rater must review:</p> <ol style="list-style-type: none">1. Durability-related specifications and drawings (as identified by builder)2. Recommendations from third-party design review, if applicable3. QA checklist <p>B. The Provider's third-party rater must inspect the home at completion of each of the following systems:</p> <ol style="list-style-type: none">1. Foundation2. Exterior walls (before exterior cladding is installed)3. Roof (before exterior cladding is installed)4. Air sealing (before interior sheathing/wallboard is installed)5. Mechanical systems (prior to final inspection) <p>C. Builder must correct any reported deficiencies as soon as possible after they are reported.</p> <p>D. The Provider's third-party rater must verify that builder has corrected any reported deficiencies.</p> |
|---|

Additional Information

Rationale

Durability problems can substantially shorten the life of the assemblies, systems, and/or materials in a home and indeed the home itself. While the development and implementation of a durability plan can not guarantee improved durability, there are a number of precedents in the insurance industry, in particular, supporting the premise that a prescribed *process* aimed at improving durability can indeed correlate to improved performance, as measured by decreases in warranty claims for durability-related building defects and failures.

Development and implementation of a **detailed durability plan** as prescribed herein will ensure that the critical durability-related features of a home are given the appropriate level of attention in design, specification, and installation.

This credit places the emphasis on the building enclosure (envelope) because the enclosure is most frequently affected by durability problems. In addition, interior surfaces and finishes are often removed or remodeled due to matters of taste rather than to issues of durability. More durable interior finishes may also be more resource-intensive.

Technologies & Strategies

The development and implementation of a well-designed durability plan are tasks that will be new, and may be daunting, to many builders. Particularly the first time around, It may be helpful to engage an experienced third-party durability expert (i.e., a professional with at least five years of specialization in durable design and construction of homes) to conduct a detailed durability review of specifications and drawings.

The reviewer should provide detailed comments on any weaknesses identified, including missed goals and inappropriately or inadequately addressed:

- strategies
- designs
- specifications or drawings
- installation instructions
- QA checklist

Based on this input, the builder should incorporate reviewer comments into final drawings and specifications unless the comments are not supported by the builder's prior experience.

Resources and References

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>

Additional Resources:

EEBA *Water Management Guide*, www.eeba.org

<http://www.huduser.org/publications/destech/durdesign.html>

CSA Guide S478-95

ASTM standard E 2136-01

"The Scopes of Work Program," Linda Haas Davenport, NAHB Builder Press.

Project Phase: Design: Programming

Construction: All

Trades: All

Credit #5: Environmentally Preferable Products Maximum Points: 4

Intent

Encourage the use of environmentally preferable products⁵ (EPPs).

Requirements

Mandatory Measures

- 5.1 Tropical hardwoods, if used, must be certified in accordance with the guidelines of the Forest Stewardship Council (FSC).

Optional Measures

- 5.2 Select environmentally preferable products. Choose from among those listed in Exhibit MR5-A and/or products that are listed in *GreenSpec* (see References and Resources below). (0.5 points each, 4 points maximum)

Exhibit MR5-A
Environmentally Preferable Products (EPPs)

(Unless noted otherwise below, 90% of the selected component must meet the specifications shown in order to earn 0.5 point.)

Products With Benefits Related to Indoor Air Quality

Assembly	Component	Qualifying EPPs	Specifications*
Other	Cabinets & trim	low-VOC	Specify wood and agrifiber products that contain no added urea-formaldehyde resins
Other	Counters	low-VOC	Specify wood and agrifiber products that contain no added urea-formaldehyde resins
Floor	Flooring	low-VOC carpet & pad	Must comply with Carpet and Rug Institute's Green Label Plus program
Floor	Flooring	no carpet in house	
Roof + floor + wall	Insulation	low-VOC	Must comply with State of California, DHS, "Practice for Testing of VOCs from Building Materials Using Small Chambers", (http://www.dhs.ca.gov/ehlb/IAQ/VOCS/Practice.htm),
Walls, ceilings, trim	Paint	low-VOC	Must comply with Green Seal Standard GS-11, Paints, First Edition, May 20, 1993.

⁵ 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.

Other Environmentally Preferable Products

Assembly	Component	Qualifying EPPs	Soecifications *
Foundation	cement	cement replacements	minimum 30% fly ash/slag as <i>replacement</i> , not addition to, cement content
Roof	framing	FSC-certified	
Floor	framing	FSC-certified	
Floor	flooring	<ul style="list-style-type: none"> ▪ recycled content carpet & pad ▪ linoleum ▪ bamboo ▪ FSC-certified wood ▪ recycled content tile ▪ sealed concrete 	for 50% of house (sf); carpet & pad minimum recycled content 25%
Floor	flooring	<ul style="list-style-type: none"> ▪ recycled content carpet & pad ▪ linoleum ▪ bamboo ▪ FSC-certified wood ▪ recycled content tile ▪ sealed concrete 	additional .5 point for 100% of house (sf); carpet & pad minimum recycled content 25%
Exterior wall	framing	FSC-certified	
Interior wall	framing	FSC-certified	
Walls + ceilings	gypsum board	recycled content	for 100% of gypsum board in house; minimum recycled content 25%
Roof + floor + wall	insulation	recycled content	for 100% of insulation in house; minimum recycled content 35%
Roof + floor + wall	insulation	recycled content	for 100% of insulation in house; additional .5 point for recycled content of 70%+
Roof	roofing	<ul style="list-style-type: none"> ▪ recycled content ▪ vegetated 	minimum recycled content 25%; minimum of 200 sf if vegetated
Roof + floor + wall	sheathing	<ul style="list-style-type: none"> ▪ recycled content ▪ FSC-certified 	minimum recycled content 25%
Exterior wall	siding	<ul style="list-style-type: none"> ▪ recycled content ▪ FSC-certified 	minimum recycled content 25%
Landscape	decking	recycled content	minimum recycled content 25%
Other	doors & windows	<ul style="list-style-type: none"> ▪ recycled content ▪ FSC-certified 	25% min. recycled content
Other	cabinets & trim	<ul style="list-style-type: none"> ▪ recycled content ▪ FSC-certified 	100% recycled/recovered, 25% min. post-consumer
Other	counters	recycled content	25% min. recycled content

Total Points (4 maximum)

* Recycled content is post-consumer unless noted otherwise.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Review purchasing documents and supporting documentation (e.g., manufacturers' cut sheets), to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

Products with low VOC emissions may benefit indoor air quality. Thus, some of the points for this credit are to account for the indoor air quality benefits of selecting products which have reduced VOC emissions into the home.

Additional Information

Rationale

MR5.1. The biological wealth of the tropical rainforests, and their devastation due to poor forestry practices (particularly clearcutting) in those regions, are of such great importance that they merit singular treatment in this credit.

MR5.2. Many new products are available which are less harmful to the environment than their conventional counterparts, including those that have lower emissions, are sustainably produced, are made from recycled content, 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:

- FSC-certified (wood products)
- Recycled content (post-consumer unless noted otherwise in Exhibit MR5-A)
- Bio-based
- Agricultural residue
- Low- or no-VOC

Potential Technologies and Strategies

Specifications for salvaged, reused, and alternative building materials, because they are typically not incorporated in most homes, have not been included in this credit. However, use of significant quantities of such materials may merit consideration for an innovation credit or credit interpretation.

Resources and References

Green Building Products: *The GreenSpec® Guide to Residential Building Materials*, copublished by BuildingGreen, Inc. and New Society Publishers. Available online at <http://www.buildinggreen.com/ecommerce/gbp.cfm> (\$34.95)

GreenSpec® is also available online as part of the BuildingGreen Suite, at <http://www.BuildingGreen.com>. BuildingGreen Suite access costs \$199/year or \$12.95 for a week

Project Phase: Design: Programming

Construction: All

Trades: All

Credit #6: Waste Management

Maximum Points: 2

Intent

Reward waste generation rates below the national average.

Requirements

Mandatory Measures

- 6.1 Generate no more than half the national average of job-site waste. No more than 2.5 lbs per square foot of conditioned floor area may be sent to landfill and/or incinerators.

Optional Measures

- 6.2 Further reduce job-site waste. Less than 2 lbs per square foot of conditioned floor area may be sent to landfill and/or incinerators in order to earn this point. See Exhibit MR6-A (0.5 point per additional 0.5 lb/SF reduction, 2 points maximum)

**Exhibit MR6-A
 Points for Waste Reduction**

Max. Waste		Additional Waste Diverted		Points Earned (Pts)
(Lb / SF)	(Cu Yd /1000 SF)	(lb / SF)	(Cu Yd /1000 SF)	
2.0	12	0.5	3	0.5
1.5	9	1.0	6	1.0
1.0	6	1.5	9	1.5
0.5	3	2.0	12	2.0

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a visual inspection to verify that appropriate waste reduction practices are being followed on the job site;
- ✓ Review hauler load tags and builder's waste tabulation (see sample in Exhibit MR6-B) to affirm that the requirements above have been completed, and
- ✓ Check the appropriate box on signed LEED FOR HOMES checklist.

Exhibit MR6-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. Volume can vary substantially depending on how one packs a dumpster (compaction can alter volume dramatically). However, in areas where loads are recorded by volume rather than weight, the conversion indicated above, following Exhibit MR6-B, may be used.

Additional Information

Rationale

The amount of job-site waste resulting from construction of the average U.S. home is 4.0 pounds per square foot of conditioned space, totaling about 8,000 pounds and taking up 50 cubic yards of landfill space. As landfill space is rapidly diminishing, incineration produces pollutants, and waste of materials is in itself a negative environmental impact, waste should be avoided to the extent possible. *Source:* National Association of Home Builders Research Center, 2001, www.nahbrc.org

Potential Technologies and Strategies

Develop a complete construction 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.

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

The National Association of Home Builders (NAHB) has been able to collect data nationally and compiled estimates on the amounts of wastes generated during construction on a “typical” 2,000 square foot home. 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 MR6-C contains NAHB’s data for this typical home.

**Exhibit MR6-C
NAHB Construction Waste Estimate of a Typical 2000 Sq.-Ft House**

Material	Weight		Volume (cu. yd)	Density (lbs / cu. Yd)
	(lb)	(lb/SF)		
Solid Dimensional Wood	1600	0.8	6.0	267
Engineered Wood	1400	0.7	5.0	280
Drywall	2000	1.0	6.0	333
Cardboard	600	0.3	20.0	30
Metal	150	0.08	1.0	150
PVC	150	0.08	1.0	150
Masonry	1000	0.5	1.0	1000
Hazardous Materials	50	0.03	-	-
Other	1050	0.53	11.0	95
Total	8000	4.0	51.0	160

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.

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 a builder may find helpful to estimate and characterize his/her own 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, and then on Green
Building Activities, then on Construction Waste Management
Publications)

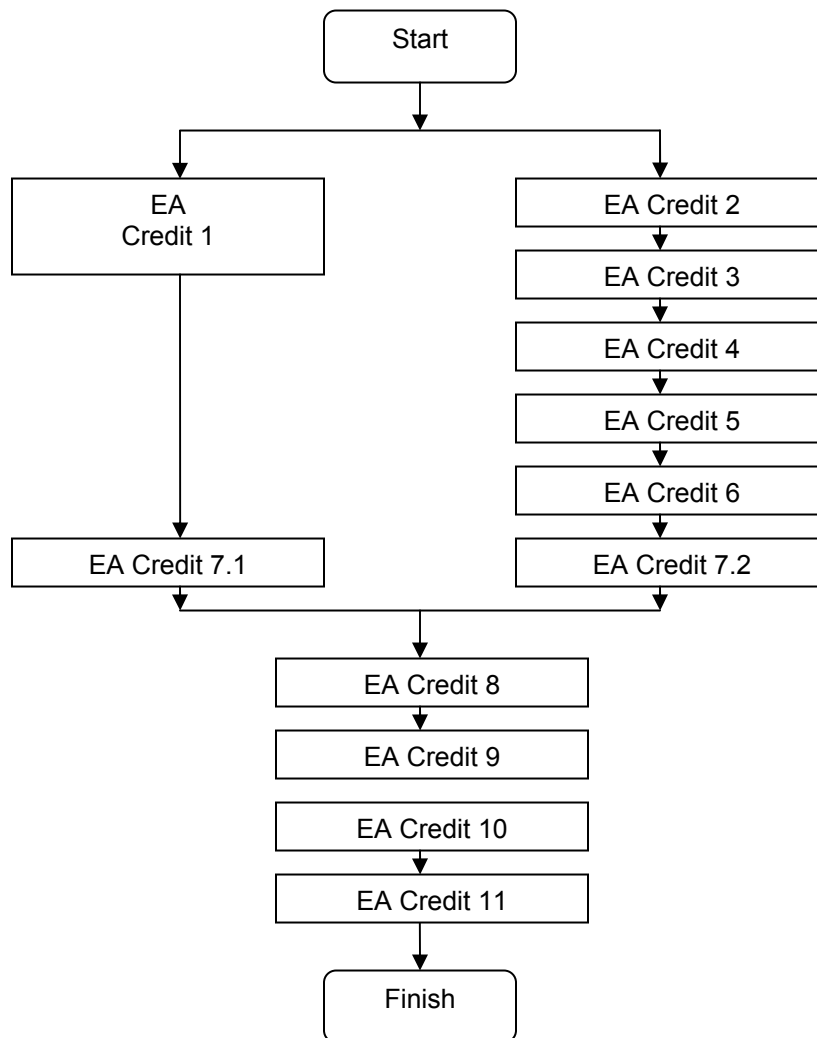
Project Phase: Design: Programming

Construction: Framing

Trades: Framing and Carpenters

Energy and Atmosphere (EA)

Optional Pathways Through EA Credit



Credit 1: ENERGY STAR Labeled Home

Maximum Points: 16

Intent

Improve overall energy performance of home by designing and building a high performing ENERGY STAR labeled home.

Requirements

Mandatory Measures

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

Optional Measures

- 1.2 Exceed requirements of ENERGY STAR for Homes; home must be third-party inspected. Use formula below (max. 16 Points):

$$\# \text{ of LEED for Homes Points} = 2 \times (\text{HERS Score} - 86)$$

Example Values

<i>HERS Score</i>	<i>LEED for Homes Points</i>
87	2
88	4
89	6
...	...
<i>>/= 94</i>	16

Verification / Submittals

The Provider's third-party rater shall:

- Perform a HERS rating on this house, including envelope air leakage testing with a blower door, and duct leakage testing with a duct blower/ pressurizer.
- 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.

Synergies and Trade-Offs

If this credit is used, then must skip EA credits 2 through 7.

Additional Information

Rationale

Over half of the energy use in a home is for space heating, space cooling, and domestic water heating. An ENERGY STAR qualified home is both designed and field tested to use 30 percent less of these end uses than a comparable home built to the Model Energy Code.

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.

Project Phase: Design: Programming Construction: All

Trades: Rater

Credit 2: Insulation

Maximum *Points*: 1

Intent

Design and install insulation to minimize thermal bridging.

Requirements

Mandatory Measures

- 2.1 Install insulation to meet at least Grade II specifications (per National Home Energy Rating Standards)⁶; Provider's third party rater to verify by performing pre-drywall / thermal bypass inspection of installation as summarized in Exhibit EA2-A.

Optional Measures

- 2.2 Install insulation to meet at least Grade I specifications (per National Home Energy Rating Standards). Provider's third party rater to verify by performing pre-drywall / thermal bypass inspection of installation as summarized in Exhibit EA2-A. (1 Point)

OR

- 2.3 Install above code insulation that exceeds local code requirements by at least 5% - as demonstrated using REScheck code compliance software. (1 Point).

OR

Demonstrate comparable performance for alternative wall/insulation system. (1 Point).

Verification / Submittals

The Provider's third-party rater shall:

- ✓ EA c 2.1 & 2.2: Inspect of installation of insulation, per the checklist above, to affirm that the requirements above have been completed;
- ✓ EA c 2.2 & 2.3: Complete Accountability Form (in Attachment A), signed by the engineer or responsible party, declaring that the insulation meets the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

⁶ 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>

Exhibit EA2-A
Pre-Drywall Thermal Bypass Inspection Procedure

Complete all of the appropriate visual inspections below.

Thermal Bypass	Inspection Guidelines	Rater Verified
1. Shower/Tub at Exterior Wall	Walls have been sheathed with an air barrier material	<input type="checkbox"/>
	Walls have been fully insulated	<input type="checkbox"/>
2. Insulated Floor above Garage	Air barrier is installed at any exposed edges of insulation	<input type="checkbox"/>
	Insulation is installed to maintain permanent contact with the underside of the sub-floor decking	<input type="checkbox"/>
3. Attic Knee Walls	Air barrier is installed on attic side of insulated wall and is continuous across floor joists at knee wall base or continuous along rafters at exterior wall plate	<input type="checkbox"/>
	Insulation is in complete alignment with interior wall finish and the attic side air barrier	<input type="checkbox"/>
4. Attic Hatch/Drop-down Stair	Attic hatch or cover is fully gasketed for an air-tight fit	<input type="checkbox"/>
	Hatch is covered with insulation that is attached and fits snugly in framed opening	<input type="checkbox"/>
5. Cantilevered Floor	Air barrier spans cantilever and any exposed edges of insulation	<input type="checkbox"/>
	Floor framing is completely filled with insulation or insulation is installed to maintain permanent contact with the sub-floor decking	<input type="checkbox"/>
6. Duct Shafts	Openings to unconditioned space are sealed with solid blocking and any remaining gaps are sealed with caulk or foam	<input type="checkbox"/>
7. Flue Shaft	Opening around flue is fully sealed with flashing and any remaining gaps are sealed with fire-rated caulk or sealant	<input type="checkbox"/>
	Combustion clearance between flue and combustible materials (e.g., OSB) are properly closed with UL approved metal collars	<input type="checkbox"/>
8. Piping Shaft/ Penetrations	Opening is fully sealed as required with flashing and any remaining gaps are sealed with caulk or foam	<input type="checkbox"/>
9. Dropped Ceiling/ Soffit	Air barrier is fully aligned with insulated framing and any gaps are fully sealed with caulk or foam or fire-rated sealant	<input type="checkbox"/>
10. Fireplace Wall	Air barrier is fully aligned with insulated framing in framed shaft behind fireplace and any gaps are fully sealed with caulk or foam	<input type="checkbox"/>
11. Staircase Framing at Exterior Wall/Attic	Air barrier is fully aligned with insulated framing and any gaps are fully sealed with caulk or foam	<input type="checkbox"/>
12. Recessed Lighting	Seal airtight IC-rated recessed light fixtures (that meet ASTM E283 requirements) to drywall with gasket, caulk or foam	<input type="checkbox"/>
13. Whole-house Fan Attic Penetration	An insulated cover is provided that is gasketed or sealed to the opening from either the attic side or ceiling side of the fan	<input type="checkbox"/>

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

Project Phase: Design: Preliminary Design` Construction: Post Framing / Insulation

Trades: Insulation Contractor

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

Credit 3: Air Infiltration

Maximum Points: 2

Intent

Minimize unnecessary energy consumption due to air leakage into and out of conditioned spaces.

Requirements

Mandatory Measures

- 3.1 Air leakage rate from envelope ≤ 0.35 ACH, verified by Provider's third party rater.⁷

Optional Measures

- 3.2 Air leakage rate from envelope ≤ 0.25 ACH, verified by Provider's third party rater. (1 Point)

OR

- 3.3 Air leakage rate from envelope ≤ 0.15 ACH, verified by Provider's third party rater. (2 Points)

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 test report 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.

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 c4, 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.

⁷ 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).

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

Project Phase: Design: Programming
Sealing

Construction: Post Framing / Air

Trades: Rater

Credit 4: Windows

Maximum Points: 2

Intent

Optimize energy performance of windows.

Requirements

Mandatory Measures

- 4.1 Design and install windows that at least meet requirements for ENERGY STAR labeled windows, per Exhibit EA1-A below.

Optional Measures

- 4.2 Design and install windows that exceed requirements for ENERGY STAR labeled windows by 10%, per Exhibit EA4-A below. (1 Point)

OR

- 4.3 Design and install windows that exceed requirements for ENERGY STAR labeled windows by 20%, per Exhibit EA4-A below. (2 Points)

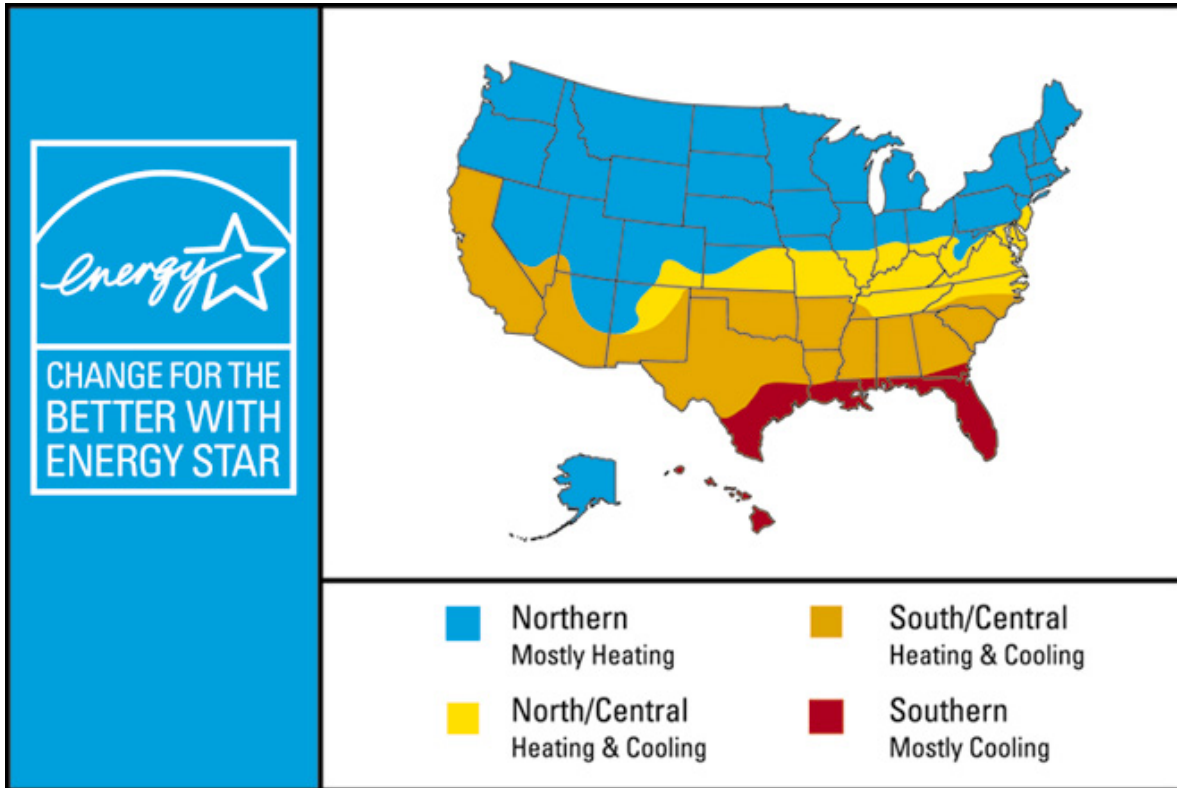
Exhibit EA4-A

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	Climate Region			
			Northern	North Central	South Central	Southern
<input checked="" type="checkbox"/>	<i>Credit 4.1</i> ENERGY STAR (Required)	U-Factor SHGC	<= 0.35 Any	<= 0.4 <= 0.55	<= 0.4 <= 0.4	<= 0.65 <= 0.4
<input type="checkbox"/>	<i>Credit 4.2</i> 10% > ENERGY STAR (1 Point)	U-Factor SHGC	<= 0.32 Any	<= 0.35 <= 0.55	<= 0.35 <= 0.35	<= 0.65 <= 0.35
<input type="checkbox"/>	<i>Credit 4.3</i> 20% > ENERGY STAR (2 Points)	U-Factor SHGC	<= 0.30 Any	<= 0.32 <= 0.55	<= 0.32 <= 0.30	<= 0.65 <= 0.30
<input type="checkbox"/>	Total Points					

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:

$$\begin{aligned} &[(\text{window SHGC}) \times (\text{solar screen SHGC}) \times (\text{percent of area covered})] \\ &+ [\text{window SHGC} \times \text{percent of area not covered}]. \end{aligned}$$

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 $[0.5 \times 0.3 \times 0.6] + [0.5 \times 0.4] = 0.09 + 0.20 = 0.29$.

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

Project Phase: Design: Programming

Construction: Post-Framing / Windows

Trades: Framing (window) Contractor

Credit 5: Duct Tightness

Maximum *Points*: 2

Intent

Minimize energy consumption due to leaks in heating and cooling distribution systems.

Requirements

Mandatory Measures

- 5.1 Air leakage rate from ducts to exterior \leq 5.0 CFM at 25 PA per 100 square feet of conditioned floor area (for each installed system), verified by Provider's third-party rater.

Optional Measures

- 5.2 Air leakage rate from air ducts \leq 3.0 CFM at 25 PA per 100 square feet of conditioned floor area (for each installed system), verified by Provider's third-party rater. (1 Point)

OR

- 5.3 Air leakage rate from air ducts to exterior \leq 1.0 CFM at 25 PA per 100 square feet of conditioned floor area, (including systems with all ducts in conditioned space), verified by Provider's third-party rater, **OR** install only ductless space conditioning equipment. (2 Points)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform duct leakage testing (with a blaster blower) that the ducts meet the requirements above.
- ✓ 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.

Synergies and Trade-Offs

If using credit 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 / 100 SF at 25 PA 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

Project Phase: Design: Programming

Construction: HVAC / Ducts

Trades: Rater

Credit 6: Space Heating and Cooling

Maximum Points: 3

Intent

Optimize energy performance of HVAC equipment.

Requirements

Mandatory Measures

- 6.1 Design (w/ Manual J) ,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, **AND** provide proof of proper refrigerant charge (unless home has no mechanical cooling system)

Optional Measures

- 6.2 Design and install HVAC equipment that exceeds requirements for ENERGY STAR labeled HVAC by 10 percent, per Exhibit EA6-A below. (Up to 2 Points)

OR

- 6.3 Design and install HVAC equipment that exceeds requirements for ENERGY STAR labeled HVAC by 20 percent, per Exhibit EA6-A below, (Up to 3 Points)

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.
- ✓ Complete Accountability Form (in Attachment A), 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 credit EA 1, then must skip this credit.

Each cubic foot per minute of outdoor air brought into a home represents about 2 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 credit 4, outdoor air ventilation system.

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	Type of HVAC Equipment					
			Central AC & Air Source Heat Pumps	Furnaces	Boilers	Open Loop	Geothermal Heat Pumps Closed Loop	Direct Expansion
<input checked="" type="checkbox"/>	Credit 7.1 ENERGY STAR (Required)	Cooling Heating	>= 13 SEER >= 8.0 HSPF	Any >= 90 AFUE	Any >= 83 AFUE	>= 16.2 SEER >= 3.6 COP	>= 14.1 SEER >= 3.3 COP	>= 15 SEER >= 3.5 COP
<input type="checkbox"/>	Credit 7.2 10% > ENERGY STAR (1 Point)	Cooling Heating	>= 14 SEER >= 8.7 HSPF	>= 92 AFUE	>= 87 AFUE	>= 17.8 SEER >= 4.0 COP	>= 15.5 SEER >= 3.6 COP	>= 16.5 SEER >= 3.9 COP
<input type="checkbox"/>	Credit 7.3 20% > ENERGY STAR (HP 3 Pts, Other 2 Pts)	Cooling Heating	>= 16 SEER >= 9.5 HSPF	>= 94 AFUE*	>= 90 AFUE	>= 19.4 SEER >= 4.3 COP	>= 17 SEER >= 4.0 COP	>= 18 SEER >= 4.2 COP

<input type="checkbox"/>	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	Type of HVAC Equipment					
			Central AC & Air Source Heat Pumps	Furnaces	Boilers	Open Loop	Geothermal Heat Pumps Closed Loop	Direct Expansion
<input checked="" type="checkbox"/>	Credit 7.1 ENERGY STAR (Required)	Cooling Heating	>= 13 SEER >= 8.0 HSPF	Any >= 80 AFUE	Any >= 80 AFUE	>= 16.2 SEER >= 3.6 COP	>= 14.1 SEER >= 3.3 COP	>= 15 SEER >= 3.5 COP
<input type="checkbox"/>	Credit 7.2 10% > ENERGY STAR (1 Point)	Cooling Heating	>= 14 SEER >= 8.07 HSPF	>= 90 AFUE	>= 87 AFUE	>= 17.8 SEER >= 4.0 COP	>= 15.5 SEER >= 3.6 COP	>= 16.5 SEER >= 3.9 COP
<input type="checkbox"/>	Credit 7.3 20% > ENERGY STAR (HP 3 Pts, Other 2 Pts.)	Cooling Heating	>= 16 SEER >= 9.5 HSPF	>= 92 AFUE*	>= 90 AFUE	>= 19.4 SEER >= 4.3 COP	>= 17 SEER >= 4.0 COP	>= 18 SEER >= 4.2 COP

<input type="checkbox"/>	Total # of LEED HOMES Points
--------------------------	-------------------------------------

Note: * designates furnace with low electric energy use

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

The minimum performance level for air conditioners will be increased from 10 SEER to 13 SEER in January 2006. The requirements for this credit will be increased accordingly at that time.

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

Project Phase: Design: Programming

Construction: HVAC / Heating and Cooling Equipment

Trades: HVAC Contractor

Credit 7: Water Heating

Maximum *Points*: 6

Intent

Optimize energy performance of water heating system.

Requirements

Mandatory Measures

N/A

Optional Measures

- 7.1 Design and install energy-efficient water distribution system; select one measure:
- Structured plumbing system, including a circulation loop that is within 10 feet of every fixture, and has a demand controlled circulation pump. Branch lines run from the loop to each fixture and are no longer than 10 feet, and a maximum of ½" in diameter. All hot water piping shall have R4 insulation. (3 Points - includes 2 points from water efficiency benefit of 10 percent indoor water savings)
 - Central manifold distribution system, including a trunk line from the heater to the central manifold. Branch lines run from the manifold to each fixture and are no longer than 10 feet, and a maximum of ½" in diameter. All hot water piping shall have R4 insulation (2 Points - includes 1 point from water efficiency benefit of 5 percent indoor water savings)
 - Water heater is located within 20 feet of plumbing to all fixtures. Branch lines run from a central header to each fixture and are a maximum of ½" in diameter. All hot water piping shall have R4 insulation. (2 Points - includes 1 points from water efficiency benefit of 5 percent indoor water savings)
- 7.2 Design and install energy-efficient water heating equipment; select one measure from Exhibit EA7-A.

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 credit EA 1 is used, then must skip 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-A
List of High Efficiency Water Heating Equipment

Type / Energy Factor	Description	Points
Gas Water Heaters		
EF \geq 0.62	Conventional High Efficiency Unit	1
EF \geq 0.8	Instantaneous Water Heater	2
CAE \geq 0.8 (Note 1)	Combination Water/Space Heaters	2
Electric Water Heaters		
EF \geq 0.92	Conventional High Efficiency Unit	1
EF \geq 0.99	Instantaneous Water Heater	2
EF \geq 2.0	Heat Pump Water Heater	3
Solar Water Heaters, Back-Up		
\geq 40% of Annual 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>

Notes:

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

Project Phase: Design: Programming

Construction: Plumbing / DHW

Trades: Plumbing Contractor

Credit 8: Lighting

Maximum Points: 3

Intent

Reduce electric load due to lighting.

Requirements

Mandatory Measures

None

Optional Measures

- 8.1 Select and install any one of the following measures:
- Install motion sensor controls on all outdoor light fixtures **AND** at least four wireless photovoltaic exterior light fixtures, if exterior fixtures are installed. (1 Point)
 - Install at least four ENERGY STAR labeled light fixtures. (1 Point)
 - Install compact fluorescent lamps (CFLs) in least 80% of light fixtures. (1 Point)

OR

- 8.2 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/package, to affirm that the requirements above have been completed,
- ✓ As appropriate, complete Letter Template for EAc8.2 (on Certification Form in Attachment A), signed by the lighting designer engineer or responsible party, declaring that the project site meets the credit requirements; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

N/A

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

Project Phase: Design: Programming

Construction: Electrical / Lighting

Trades: Electrical Contractor

Credit 9: Appliances

Maximum *Points*: 3

Intent

Minimize appliance energy demand.

Requirements

Mandatory Measures

None

Optional Measures

- 9.1 Select from the following measures (0.5 Pt. each)
- ENERGY STAR labeled refrigerator
 - ENERGY STAR labeled ceiling fans (at least one in living or family room **AND** one per bedroom)
 - ENERGY STAR labeled dishwasher
 - ENERGY STAR labeled clothes washer
- 9.2 Very efficient clothes washer with modified energy factor (MEF)⁸ > 1.8, **AND** water factor (WF) < 5.5 (1 Point, *in addition to ½ point for ENERGY STAR labeled clothes washer in EA c9.1*)

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

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

Additional Information

Rationale

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

Also, 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. ENERGY STAR labeled appliances reduce energy use by 20 percent and an ENERGY STAR clothes washer reduces water use by up to 50 percent.

⁸ For more information on MEF and WF, see the CEE or ENERGY STAR websites.

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

Project Phase: Design: Materials/Equipment Selection Construction: Pre-Occupancy
Preparation

Trades: Builder

Credit 10: Renewable Energy

Maximum *Points*: 6

Intent

Reduce demand for non-renewable energy sources by installing a renewable electric generation system.

Requirements

Mandatory Measures

None

Optional Measures

Design and install a renewable electricity generation system. (1 Point for each 10 percent of annual electrical load met by system; Max. 6 Pts)

Annual load is defined as the KWh delivered by the renewable electric generation system, relative to the total annual KWh used in the home.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Complete Accountability Form (in Attachment A), signed by the engineer or responsible party, declaring that the renewable electric generation 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

N/A

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]

Project Phase: Design: Programming

Construction: Electrical

Trades: Specialty Electrical Contractor

Credit 11: Residential Refrigerant Management *Maximum Points: 1*

Intent

Select refrigerants that reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to global warming.

Requirements

Mandatory Measures

None

Optional Measures

Do not use refrigerants. (1 Point)

OR

Install HVAC systems that comply with the following equation:

$$LCGWP + LCODP \times 105 \leq 160$$

See example case of residential refrigerants in Exhibit EA11-A. (1 Point)

Where:

$$LCODP = [\text{ODPr} \times (\text{Lr} \times \text{Life} + \text{Mr}) \times \text{Rc}] / \text{Life}$$

$$LCGWP = [\text{GWPr} \times (\text{Lr} \times \text{Life} + \text{Mr}) \times \text{Rc}] / \text{Life}$$

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:

- ✓ Complete Accountability Form (in Attachment A), 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

N/A

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>

Project Phase: Design: Equipment Selection Construction: HVAC

Trades: HVAC Contractor

Homeowner Awareness (HA)

Credit #1: Homeowner Education

Maximum Points: 1

Intent

Educate homeowner about operations and maintenance of key features and equipment related to home performance to optimize ongoing performance of those features and equipment over time.

Requirements

Mandatory Measures

- 1.1 The builder shall provide the home buyer(s) with:
 - a. A homeowner's manual / binder that includes all of the following items:
 - The LEED FOR HOMES Rating Certificate;
 - The completed checklist of LEED FOR HOMES features;
 - The product manufacturer's manuals for all installed equipment, fixtures, and appliances;
 - General information on efficient use of energy, water, and natural resources;
 - Guidance on occupant activities and choices, including:
 - Water-Efficient Landscaping (SS c2)
 - Impacts of chemical fertilizers, insecticide and pesticides
 - Irrigation (WE c2 & c3)
 - Lighting Selection (EA c8); and
 - Appliance Selection (EA c9).
 - Educational info on Green Power
 - b. A minimum 60-minute walkthrough of the home before closing, 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.

Optional Measures

- 1.2 In addition to HA credit 1.1, the builder shall provide home buyer(s) with at least three additional one hour in-home trainings during the construction process. (1 Point)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that builder's Homeowner Manual meets the requirements above; and
- ✓ Complete Accountability Form (in Attachment A), 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

Home buyers need general information about their new LEED Homes, 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

Project Phase: Design: N/A

Construction: Pre-Occupancy Preparations

Trades: Builder

Innovation and Design Process (ID)

Credit #1: Innovative Design

Maximum Points: 4

Intent

Incorporate green design and construction measures beyond those contained in the LEED for Homes Rating System that produce tangible, demonstrable environmental improvements.

Requirement

Mandatory Measures

None

Optional Measures

- 1.1 Innovation #1. The builder shall prepare a written submittal to USGBC / LEED FOR HOMES that explains (1 point):
 - 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.
- 1.2 Innovation #2 (1 Point)
- 1.3 Innovation #3 (1 Point)
- 1.4 Innovation #4 (1 Point)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Request approval from USGBC for this credit during the preliminary rating.
- ✓ Complete Accountability Form (in Attachment A), 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

Project Phase: Design: Programming

Construction: Any

Trades: Any

**Attachment A
Accountability Form
LEED for Homes**



LEED
for **HOMES**

Accountability Form

(Version 1.7, August 12, 2005)

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.** Complete the General Information section of this form.
- Step 3.** Skip the Overall Performance Data section of the form (to be completed by Provider/Rater).
- Step 4.** In the Areas of Accountability section, check boxes to indicate the LEED for Homes credits for which you have the primary design/implementation responsibility.
- Step 5.** Complete the Official Certification section at the bottom of the form.
- Step 6.** 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:

Sampling Protocol Used: (Y / N)

Overall Performance Data

LEED Score: / 100 Points

LEED Rating Achieved: (Certified, Silver, Gold, Platinum)

HERS Score Achieved: / 100 Points

Areas of Accountability

<p>Location & Linkages</p> <p><input type="checkbox"/> 2 Site Selection</p> <p><input type="checkbox"/> 5.1 Average Housing Density >= 7 Units / Acre</p> <p><input type="checkbox"/> 5.2 Average Housing Density >= 10 Units / Acre</p> <p><input type="checkbox"/> 5.3 Average Housing Density >= 20 Units / Acre</p> <p>Sustainable Sites</p> <p><input type="checkbox"/> 2.1 Basic Landscaping Design</p> <p><input type="checkbox"/> 2.4 Minimize Landscape Water Demand</p> <p>Indoor Environmental Quality</p> <p><input type="checkbox"/> 3 Humidity Control System</p> <p><input type="checkbox"/> 4.1 Outside Air Ventilation; Meets ASHRAE/Std 62.2</p> <p><input type="checkbox"/> 5.1 Local Exhaust; Meets ASHRAE Std 62.2</p> <p><input type="checkbox"/> 6.1 Supply Air Distribution; ACCA Manual D</p> <p><input type="checkbox"/> 9.1 Radon Protection; Install System, EPA Zone 1</p> <p><input type="checkbox"/> 9.2 Radon Protection; Install System, Not EPA Zone 1</p> <p>Homeowner Awareness</p> <p><input type="checkbox"/> 1.1 Basic Owner's Manual & Walkthrough</p> <p><input type="checkbox"/> 1.2 Comprehensive Manual & Multiple Walkthroughs</p>	<p>Water Efficiency</p> <p><input type="checkbox"/> 1.1 Water Reuse; Rainwater Harvesting</p> <p><input type="checkbox"/> 1.2 Water Reuse; Grey Water Reuse</p> <p><input type="checkbox"/> 2.2 Irrigation System; High Efficiency Measures</p> <p>Materials and Resources</p> <p><input type="checkbox"/> 1 Smaller Home</p> <p><input type="checkbox"/> 4.1 Durability Plan; (Pre-Construction)</p> <p>Energy and Atmosphere</p> <p><input type="checkbox"/> 2.3 Insulation; Above Code</p> <p><input type="checkbox"/> 6.1 HVAC Meets ENERGY STAR for HVAC</p> <p><input type="checkbox"/> 10 Renewable Electric Generation System</p> <p><input type="checkbox"/> 11 Residential Refrigerant Management</p> <p>Innovation and Design Process</p> <p><input type="checkbox"/> 1.1 Provide Description and Justification</p> <p><input type="checkbox"/> 1.2 Provide Description and Justification</p> <p><input type="checkbox"/> 1.3 Provide Description and Justification</p> <p><input type="checkbox"/> 1.4 Provide Description and Justification</p>
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Official Certification (to be Completed After Final LEED for Homes 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 B

Requirements for the ENERGY STAR Advanced Lighting Package (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 C

Requirements for the ENERGY STAR with Indoor Air Package

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.

Based on the substantial evaluation of this initiative

1. Moisture Control Required Measures		Reference(s)
Water Managed Roofs		
1.1	Provide minimum No. 30 roof felt underlayment or equivalent.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • Moisture Control Handbook • IRC
1.3	Provide metal drip edge at all exposed roof decking.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> •
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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • EEBA Builder Guides • EEBA Water Management Guide
1.7	Direct roof water from house with either: <ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • ASTM 2112 • EEBA Builder Guides • EEBA Water Man. Guide
1.10	All deck ledger boards shall be attached to homes with either: <ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • EEBA Builder Guides • EEBA Water Management Guide

1. Moisture Control Required Measures continued		Reference(s)
Water Managed Foundations		
1.14	Slope garage floor toward main vehicle entry doorway min. 1/8 inch per foot.	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • EEBA Builder Guide
1.16	Sump pump covers shall be mechanically attached with full gasket seal.	<ul style="list-style-type: none"> • EEBA Builder Guide
1.17	<p>Surface water management shall be provided as follows:</p> <ul style="list-style-type: none"> • Final grade shall be back-fill tamped to accommodate settling and be sloped away from the foundation $\frac{1}{2}$ 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 $\frac{1}{4}$ inch per foot away from house. 	<ul style="list-style-type: none"> • IRC R461.3 • IRC R401.3
1.18	<p>Capillary break shall be provided at all concrete slabs:</p> <ul style="list-style-type: none"> • 4 inch bed of $\frac{1}{2}$ 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. <p>Exceptions:</p> <ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • 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	<p>All crawl spaces shall be unvented and conditioned.</p> <p>Crawl space floor shall be either:</p> <ul style="list-style-type: none"> • 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. <p>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.</p> <p>Exceptions:</p> <ul style="list-style-type: none"> • Marine climates as defined by IECC 2004 Climate Zone map • Raised pier foundation with no walls 	<ul style="list-style-type: none"> • IRC • International Mechanical Code, Section 406.1, Ventilation of Uninhabited Spaces
1.20	<p>Exterior surface of below grade walls shall be finished as follows:</p> <ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • NAHB Green Building Guide
1.20 1	<p>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 $\frac{3}{4}$ inch washed or clean gravel that is fully wrapped with fabric cloth.</p>	<ul style="list-style-type: none"> • EEBA Builder Guides
1.22	<p>Insulate exterior walls with International Energy Conservation Code (IECC) specified R-value; do <i>not</i> 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).</p> <p>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.</p>	<ul style="list-style-type: none"> • IECC • EEBA Builder/Water Man. Guides • IRC Section R320.4 • IRC Figure R301.2(6), Termite Infestation Map

Based on the substantial evaluation of this initial

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.	<ul style="list-style-type: none"> • 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".	<ul style="list-style-type: none"> • 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".	<ul style="list-style-type: none"> • 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

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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).	<ul style="list-style-type: none"> • EEBA Builder Guides
3.2	<p>Foundation and wall construction shall be as follows in areas subject to termite infestation, identified by the International Residential Code Termite Infestation Map:</p> <ul style="list-style-type: none"> • 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 $\frac{1}{2}$ 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. 	<ul style="list-style-type: none"> • IRC R320.4, Figure R301.2(6) • National Pest Management Association
3.3	<p>In areas subject to "very heavy" termite infestation as indicated by International Residential Code:</p> <ul style="list-style-type: none"> • 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. 	<ul style="list-style-type: none"> • IRC R320.4, Figure R301.2(6) • National Pest Management Association

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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: <ul style="list-style-type: none"> • 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; <i>not</i> 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 • ASHRAE 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.	

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4. HVAC Systems Required Measures (continued)		Reference(s)
Ventilation		
4.15	<p>Provide mechanical whole-house ventilation meeting ASHRAE 62.2-2004 accounting for natural air infiltration.</p> <p><i>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)</i></p> <p><i>In addition, whole-house ventilation for "warm-humid" climates as defined by the International Code Council shall also include either:</i></p> <ul style="list-style-type: none"> • 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) 	<ul style="list-style-type: none"> • 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	<p>Provide mechanical spot ventilation (e.g., bathrooms and kitchens) meeting ASHRAE 62.2-2004.</p> <p>In addition, all bathroom ventilation fans shall be ENERGY STAR qualified unless multiple bathrooms exhausted with a central fan.</p>	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.	

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5. Combustion Venting Systems Required Measures		Reference(s)
Combustion Appliances		
5.1	Combustion fueled equipment <i>located in conditioned spaces</i> : <ul style="list-style-type: none"> In IECC 2004 Climate Zones 4 or higher, gas-fired furnaces/boilers shall be direct vented and oil-fired furnaces/boilers shall be power vented or direct vented. Water heaters shall be power vented or direct vented. 	<ul style="list-style-type: none"> IECC 2004 Consumer Product Safety Commission EEBA Builder Guides
5.2	Fireplaces: <ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> ASHRAE 62.2 (6.5)
5.5	Garages shall have a 100 cfm exhaust ventilation fan venting to outdoors, designed for continuous operation.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> NFPA 720 CSA 6.19-01, Standard for Residential CO Alarms UL 2034, Standard for Single and Multiple Station CO Alarms

Based on the substantial evaluation of this initi

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.	<ul style="list-style-type: none"> 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 $\frac{1}{2}$ inch above concrete slabs.	
6.4	Prime painted siding and trim made of wood or processed wood on all six sides.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> American Plywood Association
6.7	Particleboard and medium density fiberboard (MDF) shall be certified compliant with ANSI A208.1 and A208.2, respectively.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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'.	

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7. Home Commissioning Required Measures		References
Final Preparation		
7.1	Inspect air-handling equipment and verify: <ul style="list-style-type: none"> • 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!"	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • 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.	

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