

LEED[®] for Homes Program Rating System



US Green Building Council

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Introduction to LEED® for Homes

What are green homes?

The environmental impact of the residential industry is significant. There are more than 120 million homes in the US, and about 2 million additional homes are constructed each year. Residences account for 55% of the total energy consumed in the US and 74% of the water. Indoor air pollutants can often be four to five times higher than outdoor levels. Twenty-one percent of US carbon dioxide emissions are contributed by the residential sector. The considerable impact on the environment created by homes necessitates a shift toward more sustainable residences.

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

The features of a green home are established and proven technologies that do not have a significantly large cost. Many green measures will actually reduce long term costs, particularly those features that involve energy and water efficiency. Ideally, the additional costs of a green home can be substantially offset by their lower operating costs. The home building industry is beginning to recognize the value of environmentally responsible projects, and creating standards for green homes will help facilitate a wider embrace of sustainable design.

The LEED® Green Building Rating System

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

Overview of LEED for Homes

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

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

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

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

1. **Location and Linkages**—the placement of homes in socially and environmentally responsible ways in relation to the larger community.
2. **Sustainable Sites**—the use of the entire property in such a way to minimize the impact on the site.
3. **Water Efficiency**—the water conservation practices (both indoor and outdoor) built into the home.
4. **Indoor Environmental Quality**—the improvement of indoor air quality by reducing possible air pollution.
5. **Materials and Resources**—the minimization of materials used during construction, recycling of construction materials, and the durability measures.
6. **Energy and Atmosphere**—the improvement of energy efficiency particularly in the building envelope and heating and cooling design.
7. **Homeowner Education**—the education of homeowner or tenant about the operations and maintenance of the green features of his / her home.
8. **Innovative Design**—the category for recognition of a home meeting an intent not already defined in the Rating System or exceeding the maximum performance set out in a particular credit.

The LEED for Homes rating system works by awarding credits for different aspects of environmental design in each of the above categories. The "shade of green," or the level of performance achieved in the above categories, is separated into four performance tiers. LEED for Homes will rate qualified homes at the Certified, Silver, Gold and Platinum levels (presented in Exhibit 1) according to how many points the home achieves in the Rating System. .

Exhibit 1
LEED for Homes 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

The rating system is designed to guarantee minimum levels of sustainable practices through the 20 mandatory measures across six categories. At the same time, the rating system also ensures flexibility for the builders with the wide variety of optional credits available to achieve the four LEED for Homes performance levels. Credit Interpretation Requests (CIRs) are also available to projects that need clarification or special consideration on specific credits.

Does LEED for Homes include affordable and multifamily homes?

LEED for Homes includes both affordable single family and low-rise multifamily projects of three floors and below. Exactly how mid-rise multifamily projects will ultimately be addressed by LEED for Homes will be examined during a separate pilot phase for this housing type, scheduled to run through the end of 2007. Mid-rise multifamily housing structures between four and six stories may be eligible to participate in this pilot phase, and project managers should contact USGBC at (202) 828-77422 for further information. Also, multifamily housing structures that are over three stories are currently eligible to participate in LEED for New Construction (LEED-NC).

Does LEED for Homes include the renovation of existing homes?

LEED for Homes was designed to assessment the level of green-ness of newly constructed homes. It cannot be used to assess the green-ness of a portion of a home. So only substantial or “gut” rehab included in LEED for Homes at this time. The partial rehabilitation of homes is not included.

How to Participate in LEED for Homes?

The strength of the LEED for Homes program is its third-party verification through the LEED for Homes Providers. Currently, the pilot LEED for Homes initiative is open to participation by builders in locations served by our 11 pilot LEED for Homes Providers. Home builders outside of these 11 service areas may contact their nearest Provider to discuss participation in LEED for Homes. The reality is that in the short term, not every home builder will have local access to a Provider. But, in the next couple of months, USGBC will establish 10-20 new Providers in new markets.

These Providers are local and regional organizations that have been chosen by USGBC to provide technical, marketing and verification support to builders. They have demonstrated outstanding abilities and have a proven record of supporting builders in the construction of high performance, sustainable homes. A Provider is under contract to the USGBC to perform the following specific services: recruiting and certifying builders for LEED for Homes, coordination of raters, assistance in 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.

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

Five Steps to Participate

There are five basic steps for a builder / project manager to follow in participating in LEED for Homes:

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

Step 1: Contact a Provider and Join the Program

Any project that is to participate in LEED for Homes must start with selecting a Provider. Through a Provider, builders / project managers register to participate in LEED for Homes. The Providers can also provide an orientation and up-front technical assistance to builders. A list of available Providers is included in Exhibit 2 or on the LEED for Homes website at <http://www.usgbc.org/leed/homes>.

Once the builder / project manager and the Provider have agreed to work in partnership on the project, the builder will submit a Builder Registration form to the Provider for a sign-off by the Provider and subsequent submission to

USGBC. At this time, the builder pays USGBC a registration fee of \$150. The one-time builder registration fee enables the builder to build as many LEED homes as they want to. A copy of the Builder Registration form is included in Attachment A.

Exhibit 2
List of USGBC Approved Pilot LEED for Homes Providers

Name Title / Organization	Contact Information
Arizona (Scottsdale and Metro Phoenix) <i>Anthony Floyd Green Building Program Manager City of Scottsdale Green Building Program</i>	(480)312-4202 afloyd@scottsdaleaz.gov
California (Statewide) <i>Mark Berman Principal Davis Energy Group, Inc.</i>	(530)753-1100 mjberm@davisenergy.com
Colorado (Statewide) <i>Kristin Shewfelt Program Development Officer E-Star Colorado</i>	(303)297-7499 kshewfelt@e-star.com
Florida (Statewide) <i>Eric Martin Senior Research Engineer Florida Solar Energy Center/ University of Central Florida</i>	(321)638-1450 martin@fsec.ucf.edu
Georgia (Statewide, and AL, SC and VA) <i>Laura Uhde Southface Energy Institute</i>	404-872-3549 x129 laura@southface.org
Michigan (Central and Western MI) <i>Michael Holcomb President The Alliance for Environmental Sustainability</i>	(616)241-5537 mholcomb@triton.net
New Jersey (Statewide, and Eastern PA) <i>Ben Adams Vice President MaGrann Associates</i>	(856)813-8741 benadams@magrann.com
Northeast Team (CT, MA, ME, NH, RI, and VT) <i>Richard Faesy Senior Project Manager Vermont Energy Investment Corporation</i>	(802) 453-5100 x19 rfaesy@veic.org
Oklahoma (Statewide and Northern TX) <i>Jennifer Boyle Marketing Coordinator Guaranteed Watt Saver Systems, Inc.</i>	405-946-0206 jboyle13@cox.net
Oregon (Statewide and Southern WA) <i>Randy Hansell Green Building Specialist Earth Advantage</i>	(503)968-7160, ext. 16 rhansell@earthadvantage.org
Pennsylvania (Eastern PA and DE) <i>Liz Robinson Executive Director Energy Coordinating Agency of Philadelphia</i>	(215)988-0929 lizr@ecasavesenergy.org
Texas (San Antonio) <i>Chip Henderson President Contactcs Consultants and Architects</i>	(210)824-8758 chip@contactcs.com

Step 2: Identify a Project Team

After registering through a Provider, it is critical to identify a project team to plan, design and build the home. The team should include professionals with both knowledge and experience in each of the eight LEED for homes resource categories identified above. These professionals should work together as a

team to develop the project goals, to identify potential challenges ahead, and to understand how they can each best contribute to the success of the project.

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

The project team must review the home's current design and determine how it currently scores on this LEED for Homes Rating System. As part of this design review, the following steps should be completed:

- Performance testing of a typical example of builder's home design
- Completion of preliminary project documentation file (including suggested additional measures that may be needed to achieve a LEED rating)
- Preliminary LEED for Homes score/rating

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

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

Step 3: Build the Home

The LEED for Homes initiative is intended to provide project teams with guidance on both green design and green construction practices. Often green home building will require that the trades learn new ways of doing things. Those new to green construction practices should be trained to make sure they understand the green measures they will be implementing.

The rater will be on site at different phases of construction to verify compliance with the different credits, and it is important to remain in contact with the Provider or rater if questions or problems arise. During the construction process, the Provider and rater will work with the construction team and trades to schedule and complete multiple inspections of the home and related performance tests of some of the systems and features.

Step 4: Certify the home

The rater will collect in-field data about the home through reviews and inspections during and after construction. The rater will then prepare a project documentation file used by the Provider to determine if the home qualifies for a LEED for Homes rating. This file should include:

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

- Durability Checklist
- LEED for Homes Project Completion Checklist (Attachment C)

The Provider will then perform the final stages of certification, including:

- Review project documentation file that was prepared by the rater (including data listed in Exhibit 4)
- Completion of LEED for Homes rating and presentation of LEED for Homes label and rating certificate to builder / homeowner
- Send notification of rating to USGBC

Exhibit 4

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 mandatory tests, and for up to four 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 "✎" symbol on the checklist)

What is the Accountability Form?

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

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

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

Exhibit 6
List of LEED for Homes Credits that Must Use the Accountability Form

List of Measures		Responsible Party	
Resource Category	Credit # and Name	Mandatory	Optional
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"/>
Sustainable Sites	2.1 Landscaping; Basic Design	Landscaper	<input checked="" type="checkbox"/>
	2.4 Minimize Landscape Water Demand	Landscaper	<input checked="" type="checkbox"/>
	3. Shading of Hardscapes	Landscaper	<input checked="" type="checkbox"/>
Water Efficiency	1.1 Water Re-Use - Rainwater	Irrigation	<input checked="" type="checkbox"/>
	1.2 Water Re-Use - Grey Water	Irrigation	<input checked="" type="checkbox"/>
	2.2 Irrigation System	Irrigation	<input checked="" type="checkbox"/>
Indoor Environmental Quality	3 Humidity Control	HVAC	<input checked="" type="checkbox"/>
	4.1 Outdoor Air Ventilation; Meets ASHRAE std 62.2	HVAC	<input checked="" type="checkbox"/>
	5.1 Local Exhaust; Meets ASHRAE std 62.2	HVAC	<input checked="" type="checkbox"/>
	6.1 Supply Air Distribution	HVAC	<input checked="" type="checkbox"/>
	8.3 3 rd Party Testing for Pollutants before Occupancy	Builder	<input checked="" type="checkbox"/>
	9.1 Radon Protection, EPA Zone 1	Builder	<input checked="" type="checkbox"/>
	9.2 Radon Protection, not EPA Zone 1	Builder	<input checked="" type="checkbox"/>
Materials and Resources	1. Home Size	Builder	<input checked="" type="checkbox"/>
	4.1 Durability Plan	Builder	<input checked="" type="checkbox"/>
	6.1 Waste Management; <= 2.5 Lbs/SF	Builder	<input checked="" type="checkbox"/>
	6.2 Waste Management; <= 2.0 Lbs/SF	Builder	<input checked="" type="checkbox"/>
Energy and Atmosphere	2.3 Insulation above code	Builder	<input checked="" type="checkbox"/>
	6.1 HVAC Meets ENERGY STAR for HVAC	HVAC	<input checked="" type="checkbox"/>
	8.2 ENERGY STAR Advanced Lighting Package	Electrician	<input checked="" type="checkbox"/>
	10. Renewable Electric System	Electrician	<input checked="" type="checkbox"/>
	11. Refrigerant Management	HVAC	<input checked="" type="checkbox"/>
Homeowner Awareness	1.1 Basic Manual and Training	Builder	<input checked="" type="checkbox"/>
	1.2 Comprehensive Manual and Training	Builder	<input checked="" type="checkbox"/>
Innovation	1.1-1.4 Innovation and Design	Builder	<input checked="" type="checkbox"/>

Step 5: Market and Sell the LEED Home

Builders registered with LEED for Homes have access to the LEED for Homes logo to be used in marketing of LEED certified homes. See the attached guidelines for logo usage.

Quality Assurance

Two levels of quality assurance on the certification of LEED Homes are required. These are summarized below.

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

Overview of the Rating System

Intents

The intent of each credit is a statement of the expected benefit to be achieved from a given credit. Each credit has its own clearly stated intent.

Requirements

The requirements of a credit are the specific measures that must be designed or built into the home to achieve the points for that credit. Each credit has its own clearly stated requirements.

Credit Interpretations and Innovative Design Credits

The LEED for Homes Rating System provides a menu of 90 credits (worth a total of 108 possible points). Aside from the requirements stated for each credit, there are two alternative methods of acquiring points using this Rating System:

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

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

Both CIRs and IDRs are handled using the following process:

1. **Provider Submits a Request to USGBC.** A Provider may submit a Credit Interpretation Request (CIR) 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 to earn the desired point(s) with some indicated modifications (e.g., additional documentation or increased performance threshold).
In case “c,” the USGBC ruling is preliminary, subject to the receipt of the indicated modifications from the Provider.

3. ***Final Rating.*** At the time of the final rating, the Provider can include the credit interpretation and/or ID credits in the final scoring for that builder's LEED Home(s).

Both credit interpretation and ID credit proposals must be submitted during the Preliminary Rating, and may be submitted only by the Provider on behalf of the builder.



LEED
for **HOMES**

Project Checklist

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

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

Yes	?	No	Location and Linkages (LL)	OR	10
HOLD			1 LEED-ND Neighborhood	LL2-5	10
		<input checked="" type="checkbox"/>	2 Site Selection Avoid Environmentally Sensitive Sites and Farmland	LL1	2
			31 Infrastructure Site within 1/2 Mile of Existing Water, Sewer, and Roads	LL1	1
			32 Select an Infill Site	LL1	1
			4.1 Community Resources <= 1/4 mile of Basic Community Resources / Public Transportation	LL1	1
			4.2 OR <= 1/4 Mile of Extensive Community Resources / Public Transportation	LL1	2
			4.3 AND/OR <= 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
Y			1.1 Site Stewardship Minimize Disturbed Area of Site (if Site > 1/4 Acre)		Mandatory
Y			1.2 Erosion Controls (During Construction)		Mandatory
Y		<input checked="" type="checkbox"/>	2.1 Landscaping Basic Landscaping Design		Mandatory
Y		<input checked="" type="checkbox"/>	2.2 No Invasive Plants		Mandatory
		<input checked="" type="checkbox"/>	2.3 Add mulch or soil amendments as appropriate		1
		<input checked="" type="checkbox"/>	2.4 Limit Turf	5	3 1
		<input checked="" type="checkbox"/>	2.5 Minimize Landscape Water Demand	3	2 1
		<input checked="" type="checkbox"/>	3 Shading of Hardscapes Locate and Plant Trees to Shade Hardscapes		1
Y			4.1 Surface Water Management Maintain Permeable Material >= 65% of Lot (if Lot >= 1/4 acre)		Mandatory
			4.2 Use Permeable Paving Materials	1	3 5
			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	13
		<input checked="" type="checkbox"/>	1.1 Water Reuse Rainwater Harvesting System		1
		<input checked="" type="checkbox"/>	1.2 Grey Water Re-Use System		1
			2.1 Irrigation System Main Shutoff Valve, Sub-Meter, and Third-Party Inspection		1
		<input checked="" type="checkbox"/>	2.2 Select High Efficiency Measures from List	5	3 1
			2.3 Rain Sensing Controls		1
			2.4 OR Install Landscape Designed by Licensed or Certified Professional	6	4 2
			2.5 OR Avg Housing Density >= 10 Units Per Acre	1	1 1
			3.1 Indoor Water Use High Efficiency Fixtures (Toilets, Showers, and Faucets)		3
			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	6
Y			2.1 Combustion Venting Space Heating & DHW Equip w/ Closed/Power-Exhaust	IE1	Mandatory
Y			2.2 Fireplaces w/ Outside Air Supply and Closed Combustion	IE1	Mandatory
		<input checked="" type="checkbox"/>	3 Humidity Control Analyze Moisture Loads AND Install Central System (if Needed)	IE1	1
Y		<input checked="" type="checkbox"/>	4.1 Outdoor Air Ventilation Meets ASHRAE Std 62.2	IE1	Mandatory
			4.2 Dedicated Outdoor Air System (w/ Heat Recovery)	IE1	2
			4.3 Third-Party Testing of Outdoor Air Flow Rate into Home		1
Y		<input checked="" type="checkbox"/>	5.1 Local Exhaust Meets ASHRAE Std 62.2	IE1	Mandatory
			5.2 Timer / Automatic Controls for Bathroom Exhaust Fans	IE1	1
			5.3 Third-Party Testing of Exhaust Air Flow Rate Out of Home		1
Y		<input checked="" type="checkbox"/>	6.1 Supply Air Distribution Meets ACCA Manual D	IE1	Mandatory
			6.2 Third-Party Testing of Supply Air Flow into Each Room in Home		2
Y			7.1 Supply Air Filtering >= 8 MERV Filters, w/ Adequate System Air Flow	IE1	Mandatory
			7.2 >= 10 MERV Filters, w/ Adequate System Air Flow		1
			7.3 OR >= 12 MERV Filters, w/ Adequate System Air Flow		2
Y			8.1 Contaminant Control Seal-Off Ducts During Construction	IE1	Mandatory
			8.2 Permanent Walk-Off Mats OR Central Vacuum		1
		<input checked="" type="checkbox"/>	8.3 Third-Party Testing of Particulates and VOCs OR Flush		1
Y		<input checked="" type="checkbox"/>	9.1 Radon Protection Install Radon Resistant Construction if Home is in EPA Zone 1	IE1	Mandatory
		<input checked="" type="checkbox"/>	9.2 Install Radon Resistant Construction if Home is not in EPA Zone 1	IE1	1
Y			10.1 Vehicle Emissions Protection No Air Handling Equipment OR Return Ducts in Garage	IE1	Mandatory
Y			10.2 Tightly Seal Shared Surfaces between Garage and Home	IE1	Mandatory
			10.3 Exhaust Fan in Garage OR No Garage in Contact with Home	IE1	1
			Sub-Total		

Yes	?	Nb	Materials and Resources (MR)		24	
		<input checked="" type="checkbox"/>	1	Home Size	Home that is Smaller than National Average	10
Y			21	Material Efficient Framing	Overall waste factor for framing order shall be no more than 10%.	Mandatory
			22		Advanced Framing Techniques	2
			3	Local Sources	Materials Extracted /Manufactured /Produced within 500 Miles	3
Y		<input checked="" type="checkbox"/>	41	Durability Plan	Detailed Durability Plan; (Pre-Construction)	Mandatory
			42		Third-Party Verification of Implementation of Durability Plan	1 3 5
Y		<input checked="" type="checkbox"/>	51	Environmentally Preferable Products	Tropical Hardwoods, if used, must be FSC	Mandatory
			52		Select Environmentally Preferable Products from List	4
Y		<input checked="" type="checkbox"/>	61	Waste Management	Max of 2.5 Lbs /Sq. Ft. of Construction Waste Sent to Landfill	Mandatory
			62		0.5 Pts for Each Additional 0.5 Lbs Per Square Foot Reduction	2
			Sub-Total			
Yes	?	Nb	Energy and Atmosphere (EA)		OR	27
Y			11	ENERGY STAR Home	Meets ENERGY STAR for Homes with Third-Party Testing	Mandatory
			12		Exceeds ENERGY STAR for Homes, 2 Pts/HERS Pt > HERS 86	EA2-7 16
Y			21	Insulation	Third-Party Inspection of Insulation, At Least HERS Grade II	EA1 Mandatory
			22		Third-Party Inspection of Insulation, Grade I OR 5% above code	EA1 1
Y			31	Air Infiltration	Third-Party Envelope Air Leakage Tested <= 0.35 ACH	EA1 Mandatory
			32		Third-Party Envelope Air Leakage Tested <= 0.25 ACH	EA1 1
			33		OR Third-Party Envelope Air Leakage Tested <= 0.15 ACH	EA1 2
Y			41	Windows	Windows Meet ENERGY STAR for Windows (See Table)	EA1 Mandatory
			42		Windows Exceed ENERGY STAR for Windows by >= 10% (See Table)	EA1 1
			43		OR Windows Exceed ENERGY STAR for Windows by >= 20% (See Table)	EA1 2
Y			51	Duct Tightness	Third-Party Duct Leakage Tested <= 5.0 CFM25 / 100 SF to Outside	EA1 Mandatory
			5		Third-Party Duct Leakage Tested <= 3.0 CFM25 / 100 SF to Outside	EA1 1
			53		OR Third-Party Duct Leakage Tested <= 1.0 CFM25 / 100 SF to Outside	EA1 2
Y		<input checked="" type="checkbox"/>	61	Space Heating and Cooling	Meets ENERGY STAR for HVAC w/ Manual J & refrigerant charge test	EA1 Mandatory
			62		Exceeds ENERGY STAR for HVAC by >= 10%, w/ Manual J	EA1 1
			63		OR Exceeds ENERGY STAR for HVAC by >= 20%, w/ Manual J	EA1 3
			71	Water Heating	Improved Hot Water Distribution System	3
			72		Improved Water Heating Equipment	EA1 3
Y			81	Lighting	Install at Least Three ENERGY STAR labeled Light Fixtures	EA1 Mandatory
			82		Energy Efficient Fixtures and Controls	1
			83		OR ENERGY STAR Advanced Lighting Package	3
Y			91	Appliances	Install any one ENERGY STAR Appliance	EA1 Mandatory
			92		Select Appliances from List	1.5
			93		Very Efficient Clothes Washer (MEF > 1.8, AND WF < 5.5)	1
			10	Renewable Energy	Renewable Electric Generation System (1 Point/ 10% Annual Load Reduction)	6
			11	Refrigerant Management	Minimize Ozone Depletion and Global Warming Contributions	1
			Sub-Total			
Yes	?	Nb	Homeowner Awareness (HA)			1
Y		<input checked="" type="checkbox"/>	11	Homeowner Education	Basic Owner's Manual and Walkthrough of LEED Home	Mandatory
			12		Comprehensive Owner's Manual and Multiple Walkthroughs / Trainings	1
			Sub-Total			
Yes	?	Nb	Innovation and Design Process (ID)			4
			11	Innovative Design	Provide Description and Justification for Specific Measure	1
			12		Provide Description and Justification for Specific Measure	1
			13		Provide Description and Justification for Specific Measure	1
			14		Provide Description and Justification for Specific Measure	1
			Sub-Total			
10	0	0	Project Totals ¹ (pre-certification estimates)			107

Notes: 1. Certified 30-49 points Silver 50-69 points Gold 70-89 points Platinum 90-107 points
2. "Points" are shown for 3 precipitation zones: Dry (<20 inches /year); Normal (20-40 inches /year); and Wet (>40 inches /year)

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.).

Rater's Name Company
Signature Date

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.).

Provider's Name Company
Signature Date

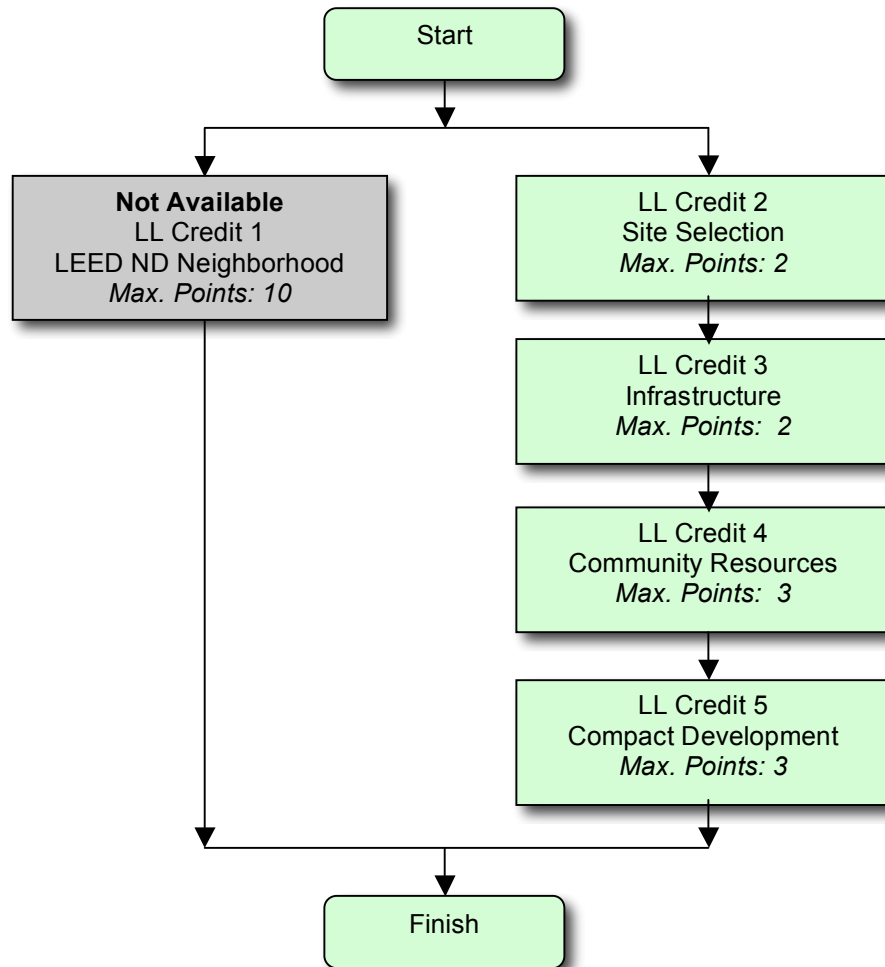
LEED for Homes Rating System Detailed Explanation of Credits

Location and Linkages (LL)	19
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Innovation and Design.....	130

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

Encourage the building of LEED Homes in LEED-ND certified developments, thereby minimizing the environmental impact of 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 development on environmentally sensitive sites.

Requirements**Mandatory Measures**

None

Optional Measures

Do not develop buildings, built structures, 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).

- Notes: 1. New wetlands constructed as part of stormwater mitigation, or other site restoration efforts, are excluded from the above definitions.
2. "Prime Farmland" is defined as land that meets both of the following criteria:
- Land Use:** Has been used for irrigated agricultural production at some time during the four years prior to the Important Farmland Map date. Irrigated land use is determined by FMMP staff during examination of current aerial photos, local comment letters and field verification; and
- Soil:** The soil must meet the physical and chemical criteria for Prime Farmland or Farmland of Statewide Importance as determined by the USDA Natural Resources Conservation Service (NRCS). NRCS compiles lists of which soils in each survey area meet the quality criteria.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment A) is signed by the civil engineer or responsible party, declaring that the project site meets the credit requirements, and place in Project Documentation File; and

LOCATION AND LINKAGES

Site Selection

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

- ✓ 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 building of LEED Homes in developments that are served by or are near existing infrastructure (i.e., roads, sewers, and water).

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 (the area where new homes are being built) 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

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

Requirements

Mandatory Measures

None

Optional Measures

Note: For developers of larger communities, the distances below can be measured from the center of the community. Using this approach, whole communities can be qualified for this credit.

- 4.1 Walkable access to four (within $\frac{1}{4}$ mile) or seven (within $\frac{1}{2}$ mile) basic community resources (see list in Exhibit LL-4A) **OR** proximity to transit service (within $\frac{1}{4}$ mile for bus; $\frac{1}{2}$ mile for train or ferry) (1 Point)

OR

- 4.2. Walkable access to eleven (within $\frac{1}{4}$ mile) or fourteen (within $\frac{1}{2}$ 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)

"Transit rides per day" are to be calculated as follows: (1) within a $\frac{1}{2}$ mile radius, count all the transit stops, and then (2) multiply the number of transit stops by the number of buses that pass through the area per day.. Example: 16 buses with 16 stops equals 256 transit rides.

AND/OR

- 4.3. Walkable access to (within $\frac{1}{2}$ mile) to a community-based open space that is at least 0.75 acre in size. (1 Point)

"Community-based open spaces": are defined as publicly accessible land that consists predominantly of unsealed, permeable surfaces such as soil, grass, shrubs, and trees. These include natural open spaces, city, county, and state parks, play areas, and other community open spaces specifically intended for recreational use. Ponds can be counted as open space if they are part of a walking or bicycle path.

"Community-based open space" also includes private lands open to the public for passive recreation provided that there is 1) deeded public access, or 2) a history of allowable public use and anticipated continued future public use for at least 10 years.

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

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

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

Verification / Submittals

The Provider’s third-party rater shall:

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

Synergies and Trade-Offs

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

Additional Information

Rationale

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

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

Benefits include reduced energy consumption (and other associated environmental impacts) from personal vehicle transportation and associated infrastructure.

Neighborhoods with nearby services also encourage a more active lifestyle, correlating to reduced health risks due to heart disease, obesity, etc.

Potential Technologies and Strategies

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

LOCATION AND LINKAGES

Community Resources

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

Resources and References

"TBD

Project Phase: Design: Site Planning

Construction: N/A

Trades: Architect /Engineer

Credit #5: Compact Development

Maximum Points: 3

Intent

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

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)

“Buildable land” area is to be calculated as follows:

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

Verification / Submittals

The Provider’s third-party rater shall:

- ✓ Confirm that the Accountability Form (in Attachment A) is 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

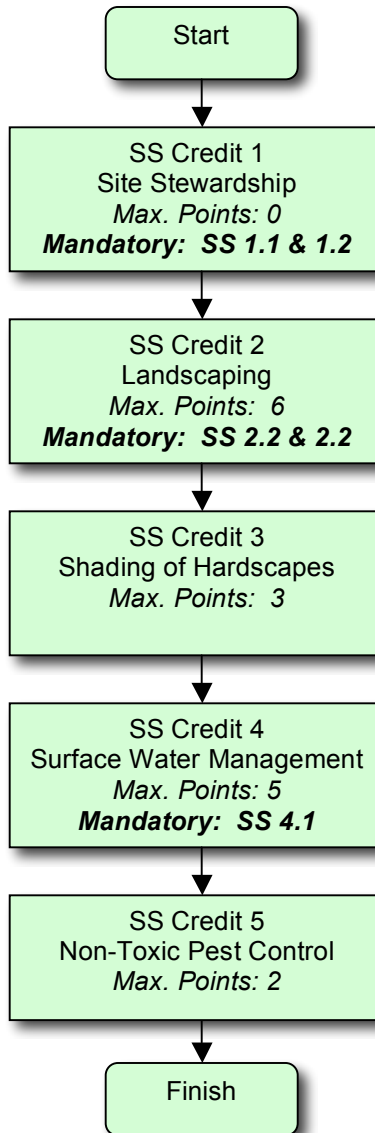
Project Phase: Design: Site Planning

Construction: N/A

Trades: Architect /Engineer

Sustainable Sites (SS)

Pathway Through SS Credits



Credit #1: Site Stewardship

Maximum *Points*: 0

Intent

Minimize environmental impact on the building lot during the construction process.

Requirements

Mandatory Measures

- 1.1 Minimize disturbed area of site, 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 the lot area. If the lot has been previously developed (e.g., a grayfield or brownfield), then the lot must be restored (i.e., must achieve at least 2 points each under SS 2 and SS 4)."

Project is exempt from this mandatory measure if the site is less than 1/4 acre, or if the housing density for the project is equal to or greater than 4 units per acre. For multifamily homes, the average lot size shall be calculated as the total lot size divided by the number of units. The lot size exemption is to be calculated based on the average lot size per unit.

- 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 sewer 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:
8 (Dry) / 6 (Normal) / 3 (Wet)

Intent

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

Requirements

Mandatory Measures

- 2.1 Basic landscape design:
 - o Areas planted with turf shall use only drought-tolerant turf, and turf should be avoided in densely shaded areas.
 - o Areas planted with turf should not exceed a slope of 25 percent (i.e., a 4 to 1 slope).

Project is exempt from this mandatory measure if the building lot is less than 1/4 acre, or if the housing density for the lot is equal to or greater than 4 units per acre.
- 2.2 Use no invasive plant species, as identified by local Agriculture Cooperative Extension Service.

Optional Measures

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

- 2.3 Add mulch or soil amendments as appropriate. (1 Point)
Mulch is defined as a covering placed around plants to reduce erosion and water loss, and to help to regulate the soil temperature. In addition, upon decomposition (for organic mulches), mulches serve as soil amendments. The type of mulch you select can affect soil pH.
- 2.4 Limit turf. See as specified in Exhibit SS2-A. (0-5 Points)

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

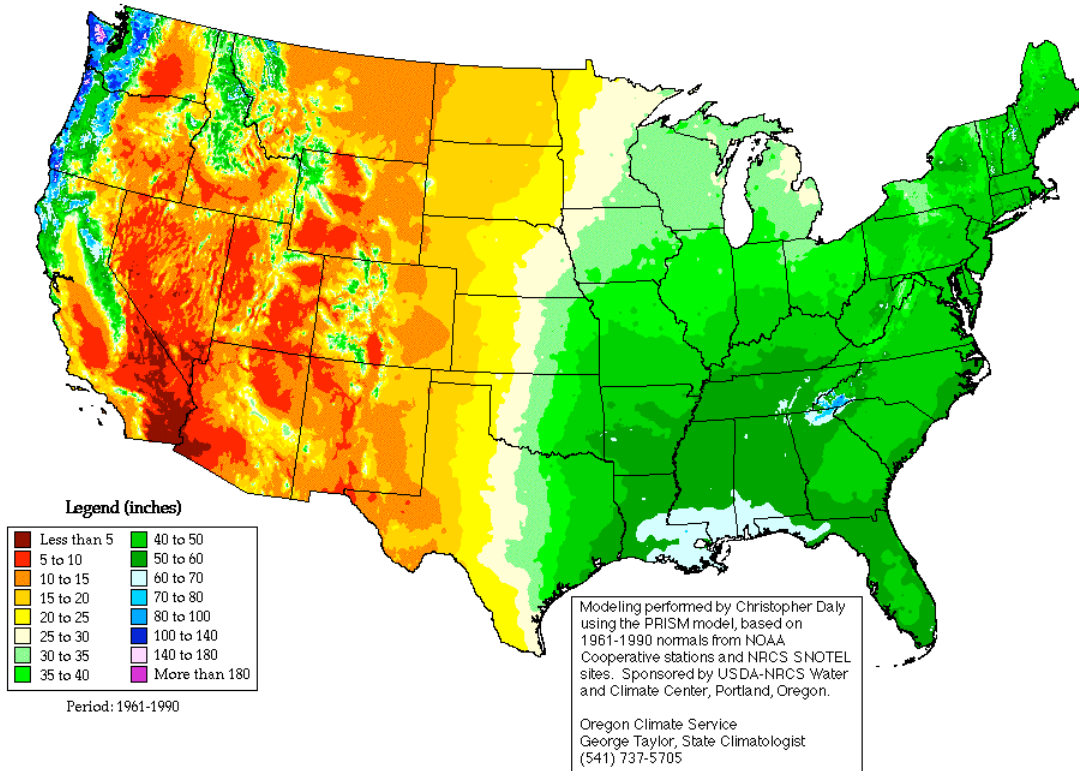
Limit Turf to __ % of Total Landscaped Area	Dry Region (< 20 in/yr)	Normal Region (20-40 in/yr)	Wet Region (> 40 in/yr)
50%	2	1	0
20%	5	3	1

Notes: 1. Minimum of at least 2000 SF of total landscaped area required.
2. Precipitation regions are shown in Exhibit SS2-B.

Exhibit SS2-B

Annual Average Precipitation

United States of America



LEED for Homes Precipitation Regions

- Dry < 20 inches of rainfall per year
- Normal 20-40 inches of rainfall per year
- Wet > 40 inches of rainfall per year

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

Exhibit SS2-C

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

Note: 1. Minimum of at least 2 trees required (or equivalent number of shrubs, 10 shrubs at 5 gallons each).

2. Water budget is to be calculated based on the landscaped area of lot.

Verification / Submittals

The Provider's third-party rater shall:

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

Synergies and Trade-Offs

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

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

Additional Information

Rationale

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

Potential Technologies and Strategies

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

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

Resources and References

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

Project Phase: Design: Site planning Construction: Site preparation

Trades: Excavating Contractor / Landscaping

Credit #3: Shading of Hardscapes

Maximum Points: 1

Intent

Design landscape features to reduce local heat island effects.

Requirements

Mandatory Measures

None

Optional Measures

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

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:

- ✓ Confirm that the Accountability Form (Attachment A) is 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:
 1 (Dry) / 3 (Normal) / 5 (Wet)

Intent

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

Requirements

Mandatory Measures

- 4.1 Maintain permeable surface for at least 65% of the undeveloped portion of the site. Project is exempt if lot is less than ¼ acre (or if the housing density on the lot is equal to or greater than 4 units per 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

Percentage of Permeable Paved Surfaces:	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

Note: Minimum permeable paving area of at least 150 square feet required.

- 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, dry well or rainwater cistern, 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.

Note: The builder must demonstrate that they did something to minimize run-off, to qualify for points under this credit.

Exhibit SS4-B

Points for Erosion Controls for Various Precipitation Zones

Permanent Erosion Control	Dry Region (< 20 in/yr)	Normal 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 assist in 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 Stormwater Management Manual. Utilize biologically based and innovative storm water management features for pollutant load reduction, such as constructed wetlands, storm water filtering systems, bioswales, bio-retention basins, and vegetated filterstrips.

Resources and References

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>)

SUSTAINABLE SITES
Surface Water Management

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

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

Trades: Excavating Contractor & Landscaping

Credit #5: Non-Toxic Pest Control

Maximum Points: 2

Intent

Design home features to minimize the need for 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 those areas marked as “moderate to heavy” through “very heavy” on the termite infestation probability map (see Exhibit SS5-A):
 - Treat all cellulosic material (e.g., wood framing) with a borate product to a minimum of 3 feet above the foundation OR place sand or diatomaceous earth or a steel mesh barrier termite control system OR use non-cellulosic (i.e., not wood or straw) wall structure;
 - Use solid concrete foundation walls OR masonry wall with top course of solid block bond beam or concrete filled block;
- Keep all wood used (i.e., siding, trim, structure) at least 12" above soil (code requires 8");
- Seal all cracks, joints, penetrations, edges, and entry points with caulking;
- 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.
- Install termite bait system.

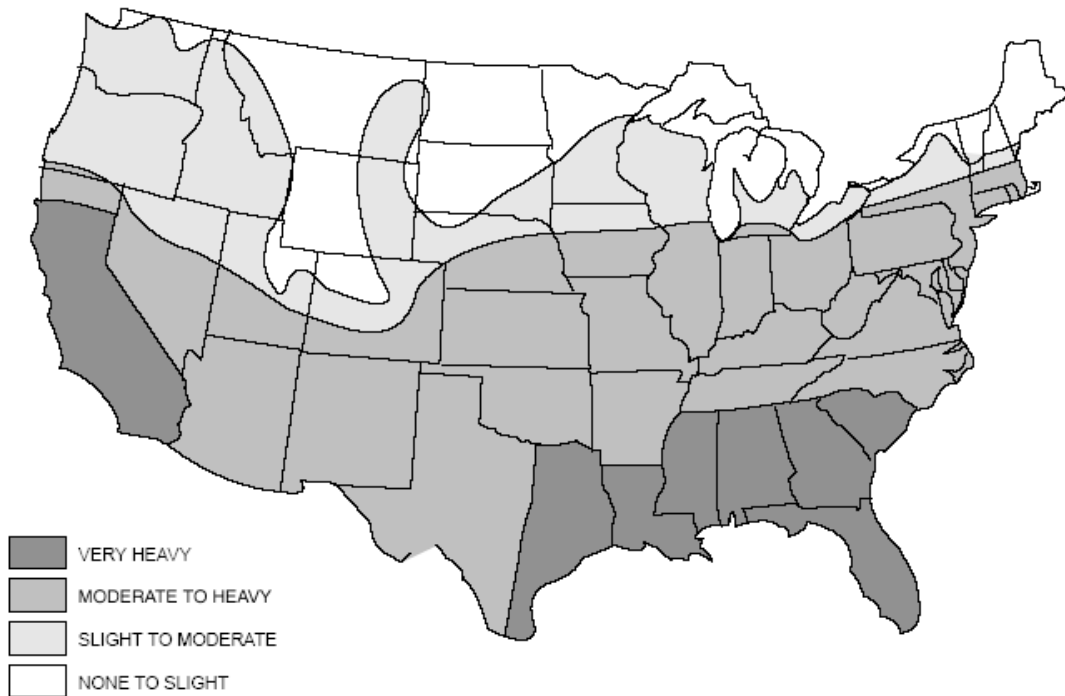
Verification / Submittals

The Provider’s third-party rater shall:

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

Exhibit SS5-A

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



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

FIGURE R301.2(6)
TERMITE INFESTATION PROBABILITY MAP

2000 INTERNATIONAL RESIDENTIAL CODE™

Synergies and Trade-Offs

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

Additional Information

Rationale

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

Potential Technologies and Strategies

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

Resources and References

Integrated Pest Management (IPM) Practitioners Association:

<http://www.efn.org/~ipmpa/keydocs.html>

An emphasis on urban, non-agricultural applications.

Appropriate Technology Transfer for Rural Areas: Focuses on agricultural applications, but provides an exhaustive list of references, and definitions of key terms and practices.

<http://www.attra.org/attra-pub/ipm.html>

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

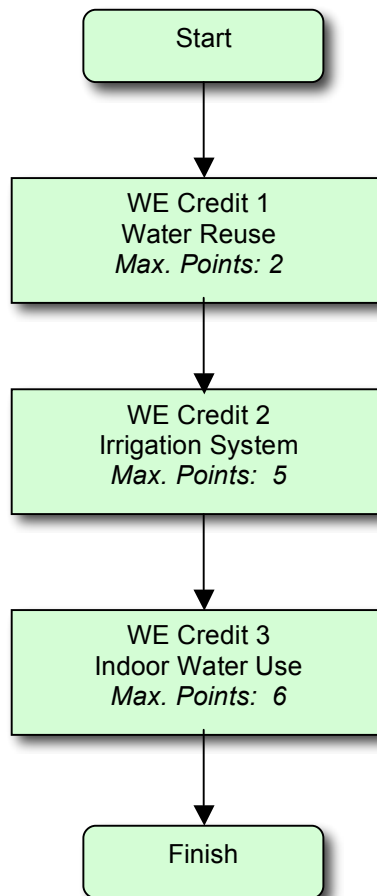
Bio-Integral Resource Center, www.birc.org

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

Trades: Pest Control

Water Efficiency (WE)

Pathway Through WE Credits



Credit #1 Water Reuse

Maximum Points: 2

Intent

Minimize demand for potable water through capture and controlled reuse of rainwater and/or grey water.

Requirements

Mandatory Measures

None

Optional Measures

- 1.1 Design and install a rainwater harvesting system (including surface run-off and/or roof run-off) for landscape irrigation use or indoor water use. Storage system must be sized to collect a minimum of 50% of rain from the roof (based on total roof surface area) based on a 3/4 inch rainfall event. (1 Point)
- 1.2 Design and install a grey water re-use system for landscape irrigation use (i.e., not a septic system) or indoor water use. System must be designed to collect the grey water from at least the clothes washer. Grey water system must include a storage tank that can be used as part of the irrigation system. *Note that grey water systems are subject to local codes and may require special permits.* (1 Point)

Verification / Submittals

The Provider's third-party rater shall:

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

Synergies and Trade-Offs

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

Additional Information

Rationale

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:
7 (Dry) / 5 (Normal) / 3 (Wet)

Intent

Minimize outdoor demand for potable water through water-efficient irrigation.

Requirements

Mandatory Measures

None

Optional Measures

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

- 2.1 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. (1 Point)
- 2.2 Design and install high efficiency irrigation system (based on overall landscaping plans, including measures adopted in SS 2) with the following features (1 point each, max number of points shown in Exhibit WE2-A):
 - At least 50% of landscape planting beds have a drip irrigation system to minimize evaporation
 - Turf and each type of bedding area (based on watering needs) should be separately zoned
 - A timer/controller that activates the valves for each watering zone and allows irrigation at the most efficient time of the day – 11 PM to 7 AM - when evaporation losses are minimal.
 - Pressure regulating devices to maintain optimal pressure and prevent misting.
 - High efficiency nozzles.
 - Check valves in heads.
- 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

- 2.4 Install landscape designed by a licensed or certified landscape design professional that needs no irrigation. (See Exhibit WE2-A for points.)

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

OR

- 2.5 If average housing density ≥ 10 units per acre, 1 point is awarded for inherent water efficiency of sites with compact housing design.

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)
WE 2.2: Max. No. of Points	5	3	1
WE 2.4: No. of Points	6	4	2
WE 2.5: No of Points	1	1	1

Verification / Submittals

The Provider's third-party rater shall:

- ✓ WE 2.1: Perform a visual inspection of installed measure(s), to affirm that the requirements above have been completed;
- ✓ WE 2.2 – 2.4: Confirm that the Accountability Form (in Attachment A) is signed by the engineer or responsible party, declaring that the irrigation system meets the credit requirements, and place in Project Documentation File;
- ✓ WE 2.5: Perform a visual inspection of site, 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 2.

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

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

Additional Information

Rationale

As much of 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 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 through water efficient fixtures.

Requirements**Mandatory Measures**

None

Optional Measures

- 3.1 Install high efficiency (low flow) fixtures:
- The average flow rate for all lavatory faucets must be high efficiency ≤ 2.0 GPM (1 point)
 - The average flow rate for all shower heads must be high efficiency¹ ≤ 2.0 GPM (1 point)
 - The average flow rate for all toilets must be high efficiency ≤ 1.3 GPF (1 point)

OR

- 3.2 Install very high efficiency fixtures:
- The average flow rate for all lavatory faucets must be very high efficiency ≤ 1.5 GPM (2 points)
 - The average flow rate for all shower heads must be very high efficiency² ≤ 1.5 GPM (2 points)
 - The average flow rate for 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.

¹ Builders are strongly cautioned to investigate shower head manufacturer's information on the performance of the high efficiency shower heads (including testing for scalding and thermal shock at the respective low flow rate) before making selections and installing them.

² Builders are strongly cautioned to investigate the shower head manufacturer's information on the performance of very high efficiency shower heads, similar to the caution for credit 3.1 for high efficiency shower heads.

Synergies and Trade-Offs

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

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

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

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

Additional Information

Rationale

Faucets, showers, baths, and toilets 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

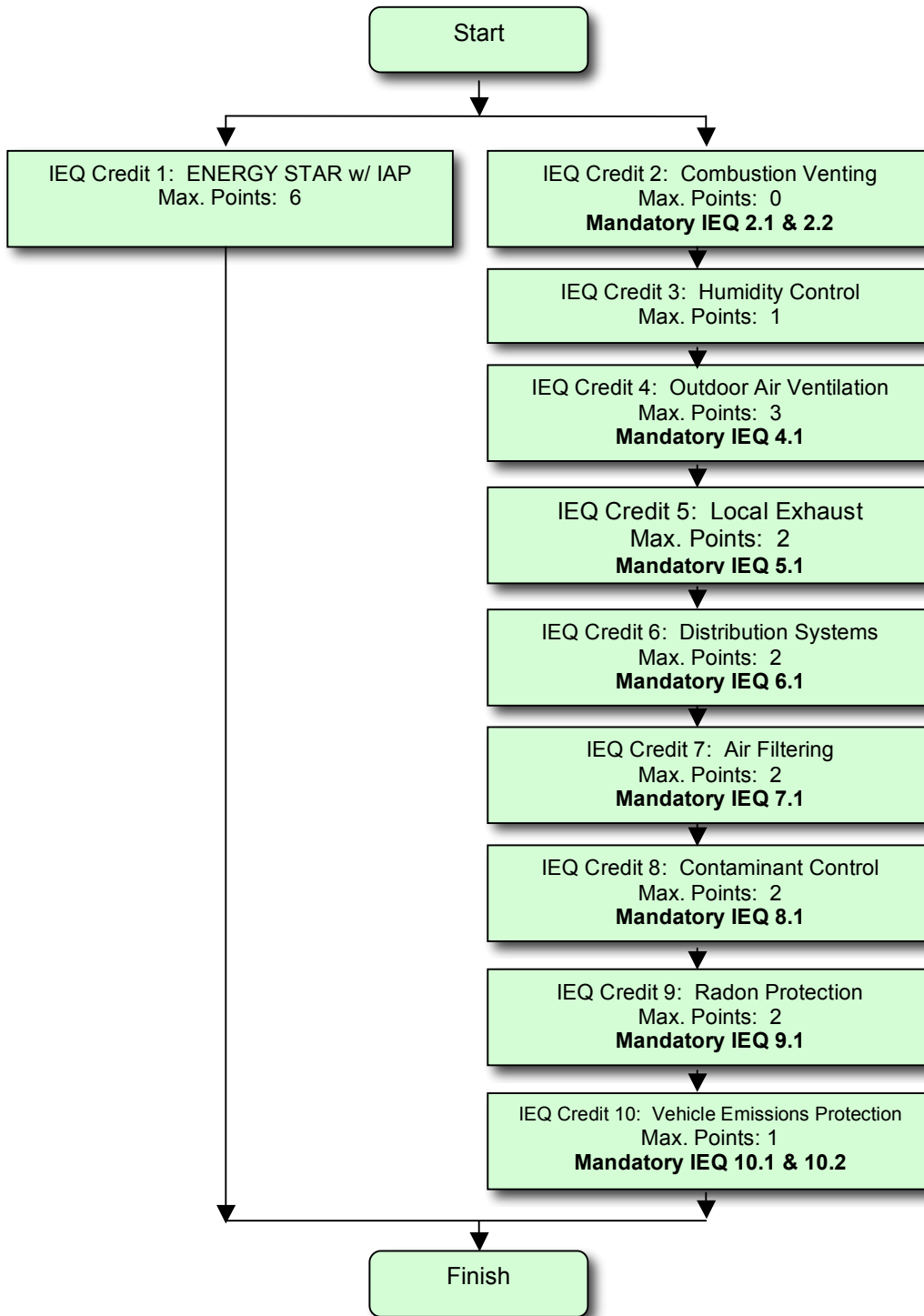
TBD

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: 6**

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 with Indoor Air Package. Note that the ENERGY STAR with Indoor Air Package initiative is being pilot tested and is not yet available in all U.S. markets. (6 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 the leakage of combustion gases (e.g., backdrafting) into the occupied space of home.

Requirements

Mandatory Measures

- 2.1 Design and install space heating and water heating combustion equipment with closed combustion (i.e., sealed supply air and exhaust ducting);

OR

Power-vented exhaust;

OR

Combustion system is located in a detached utility building or an open-air facility;

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 either have the EPA-certified label or notice or meet the following requirement: equipment with a catalytic combustor must emit less than 4.1 g/hr of particulate matter, and equipment without a catalytic combustor must emit less than 7.5 g/hr of particulate matter.

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

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

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

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

No unvented combustion appliances are allowed.

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

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

Requirements

Mandatory Measures

None

Optional Measures

Conduct a detailed analysis of moisture loads to determine if there is a need for a central humidity control system (i.e., to provide additional humidity, or dehumidification control beyond that provided by the air conditioner). Install humidity control system where needed to maintain humidity ratios below 0.012 (lb. water vapor / lb. dry air) per Section 5.2.2 of ASHRAE Standard 55-2004.

Verification / Submittals

The Provider's third-party rater shall:

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

Synergies and Trade-Offs

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

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

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

Requirements

a. Forced Air Systems:

Mandatory Measures

- 4.1 Design and install a whole building ventilation system that complies with ASHRAE Standard 62.2.³ Note that Standard 62.2 provides for the design of alternative (e.g., passive) ventilation designs in Section 4.1.2. ASHRAE 62.2 requirements for minimum whole house ventilation air flow rates are shown in Exhibit EA4-A.

**Exhibit EA 4-A
Minimum Required Ventilation Air Flow Requirements**

Floor Area (Ft ²)	No. of Bedrooms				
	0 - 1	2 - 3	4 - 5	6 - 7	> 7
< 1,500	30	45	60	75	90
1,501 – 3,000	45	60	75	90	105
3,001 – 4,500	60	75	90	105	120
4,501 – 6,000	75	90	105	120	135
6,001 – 7,500	90	105	120	135	150
> 7,500	105	120	135	150	165

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

³ 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).

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

Mandatory Measures

- 4.1 Homes with non-ducted HVAC systems must have mechanical ventilation systems that meet the requirements of ASHRAE Standard 62.2 above, except for the two special cases below:
- a. If the home is located in a climate with less than 4,500 infiltration degree days⁴;
 - b. If the home is designed with a passive ventilation system that is stamped by a licensed HVAC engineer.

Optional Measures

- 4.2 Same requirements as for forced air systems, defined in Part a above.
- 4.3 Same requirements as for forced air systems, defined in Part a above.

Verification / Submittals

The Provider's third-party rater shall:

- ✓ IEQ 4.1: Confirm that the Accountability Form (in Attachment A) has been 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 4.2: 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.

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

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

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

Reduce occupant exposure to 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. ASHRAE 62.2 requirements for minimum local exhaust flow rates are shown in Exhibit EA5-A.

AND

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

AND

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

**Exhibit EA5-A
Minimum Intermittent Local Exhaust Flow Requirements**

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

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: Confirm that the Accountability Form (in Attachment A) has been 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 credits 5.1 and 5.2.

Additional Information

Rationale

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

Potential Technologies and Strategies

TBD

Resources and References

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

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

Project Phase: Design: Preliminary Design Construction: HVAC

Trades: HVAC Contractor / Rater

Credit #6: Distribution of Space Heating and Cooling

Maximum Points: 2

Intent

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

Requirements

a. Forced Air Systems:

Mandatory Measures

- 6.1 Perform ACCA Manual J and D 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 (as required by EA credit 6.1 on page X). (2 Points)

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

Mandatory Measures

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

Optional Measures

- 6.2 Non-ducted HVAC system must have at least two distinct zones with independent controls. (2 Points)

Verification / Submittals

The Provider's third-party rater shall:

- ✓ IEQ 6.1: Confirm that the Accountability Form (in Attachment A) has been signed by the engineer or responsible party, declaring that the supply air system meets the credit requirements, and place in Project Documentation File;
- ✓ IEQ 6.2: 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 credit 6.1.

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

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

Additional Information

Rationale

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

Potential Technologies and Strategies

TBD

Resources and References

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: Air Filtering

Maximum Points: 2

Intent

Reduce particulate matter from air supply system.

Requirements

a. Forced Air Systems:

Mandatory Measures

- 7.1 Install air filters \geq MERV 8 and ensure that air handlers can maintain adequate pressure (and air flow).

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 air filters \geq MERV 12 and ensure that air handlers can maintain adequate pressure (and air flow). (2 Points)

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

Mandatory Measures

- 7.1 Homes with non-ducted HVAC systems must have mechanical ventilation systems with air filters \geq MERV 8 and maintain adequate pressure (and air flow). If the home is located in a climate with less than 4,500 infiltration degree days⁵, then it is exempt from this mandatory requirement.

Optional Measures

- 7.2 Homes with non-ducted HVAC systems must have mechanical ventilation systems with air filters \geq MERV 10 and maintain adequate pressure (and air flow). If the home is located in a climate with less than 4,500 infiltration degree days, then it is exempt from this mandatory requirement. (1 Point)
- 7.3 Homes with non-ducted HVAC systems must have mechanical ventilation systems with air filters \geq MERV 12 and maintain adequate pressure (and air flow). All homes must meet this requirement, even if located in a climate with less than 4,500 infiltration degree days. (2 Points)

Verification / Submittals

⁵ Infiltration degree days are defined by ASHRAE in ANSI/ASHRAE Standard 119-1988. Homes located in climates with less than 4,500 infiltration degree days are effectively in very mild climates and can meet their minimum outdoor air ventilation needs by the opening of windows for most of the year. These homes are also exempt from meeting the mechanical ventilation requirements of ASHRAE Standard 62.2 under IEQ 4.1. (An infiltration degree day is defined as the sum of the heating season infiltration degree days and the cooling season infiltration degree days.)

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 credit 7.1.

Additional Information

Rationale

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

Potential Technologies and Strategies

TBD

Resources and References

TBD

Project Phase: Design: Preliminary Design Construction: HVAC

Trades: HVAC Contractor

Credit #8: Contaminant Control

Maximum Points: 2

Intent

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

Requirements

Mandatory Measures

- 8.1 Seal off ducts during construction. Homes with non-ducted HVAC systems (e.g., hydronic systems) are exempt.

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. Values shown in Exhibit IEQ 8-A are targets, not mandatory requirements. If these recommended values are exceeded, then additional remediation steps should be performed (e.g., flush below). (1 Point)

OR

Flush the home with fresh air continuously for one week with all windows kept open and the HVAC system fan running continuously. (1 Point)

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

Exhibit IEQ8-A
Target Concentrations for Indoor Contaminants

Chemical Contaminate	Recommended 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

Resources and References

TBD

Project Phase: Design: Programming

Construction: All

Trades: Builder

Credit #9: Radon Protection

Maximum Points: 1

Intent

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

Requirements

Mandatory Measures

9.1 If home is located in EPA Zone 1, design and install radon resistant construction techniques.

Optional Measures

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

Verification / Submittals

The Provider's third-party rater shall:

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

Synergies and Trade-Offs

If using 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

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

EPA info on Radon-Resistant New Construction (RRNC), see RRNC language in revised IAP - 9/30/05 - section 2 and item 7.6.

<http://www.epa.gov/iaq/radon/construc.html#What%20are%20Radon-resistant%20construction%20techniques>

Project Phase: Design: Programming

Construction: HVAC

Trades: HVAC Contractor / Rater

Credit #10: Vehicle Emissions Protection

Maximum Points: 1

Intent

Reduce occupant's exposure to indoor pollutants originating from vehicle emissions in an adjacent garage.

Requirements

Mandatory Measures

- 10.1 No air handling equipment, return ducts or un-sealed supply ducts in garage adjacent to the house.
- 10.2 Tightly seal shared surfaces between garage and conditioned spaces, including:
- Conditioned spaces above garage
 - All penetrations sealed
 - All connecting floor/ceiling joist bays sealed
 - Paint walls/ceilings (CO can penetrate unfinished drywall through diffusion)
 - Conditioned spaces next to garage;
 - Weather stripped doors, with CO detector in interior room adjacent to inside of door;
 - All penetrations sealed; and
 - Seal all cracks at the base of walls.

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. Carports qualify if they have no more than two walls (e.g. 2 sides directly open to outside air). (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

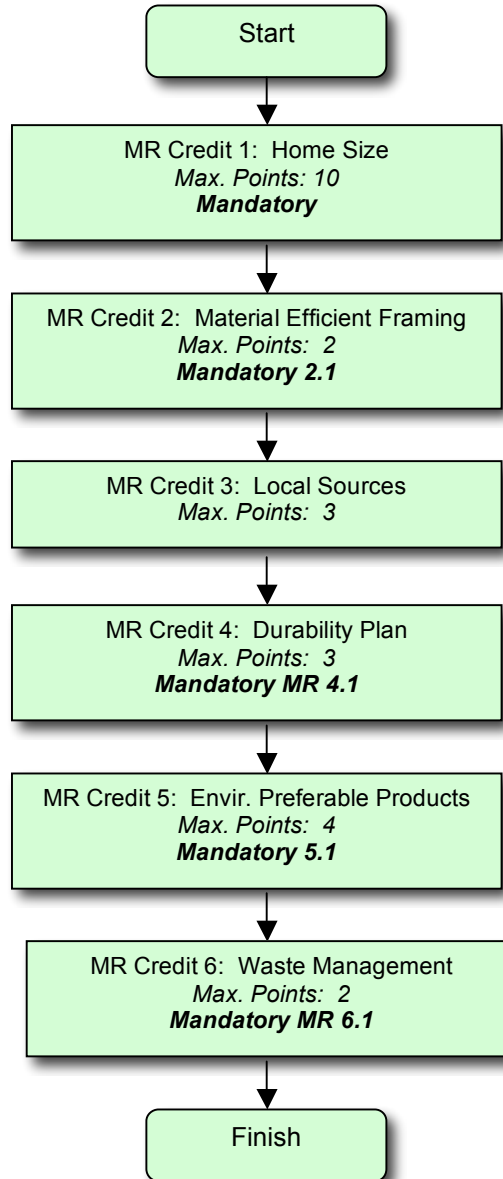
TBD

Project Phase: Design: Programming

Construction: Framing

Trades: Builder / Rater

Materials and Resources (MR)



Credit #1: Award Level Threshold Adjuster

Maximum Points: 10

Intent

Acknowledge the overarching effect of home size on resource consumption by adjusting the award level point thresholds (for certified, silver, gold, and platinum) based on home size.

Requirements

Mandatory Measures

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

Multifamily Buildings: Assign score for home size, based on number of bedrooms, as shown in the “Special Procedures for Multifamily Buildings” at the end of this credit. (Up to 10 Points).

**Exhibit MR1-A
MR 1 Points for Single Family Homes**

House Size in Square Feet (by Number of Bedrooms)										LEED for Homes Score
0 Bedrooms		1 Bedroom		2 Bedrooms		3 Bedrooms		4 or More Bedrooms		
Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
281	320	536	565	771	830	956	1045	1076	1225	10
321	360	566	595	831	890	1046	1135	1226	1375	9
361	400	596	625	891	950	1136	1225	1376	1525	8
401	440	626	655	951	1010	1226	1315	1526	1675	7
441	480	656	685	1011	1070	1316	1405	1676	1825	6
481	520	686	715	1071	1130	1406	1495	1826	1975	5
521	560	716	745	1131	1190	1496	1585	1976	2125	4
561	600	746	775	1191	1250	1586	1675	2126	2275	3
601	640	776	805	1251	1310	1676	1765	2276	2425	2
641	680	806	835	1311	1370	1766	1855	2426	2575	1
681	720	836	865	1371	1430	1856	1945	2576	2725	0
721	760	866	895	1431	1490	1946	2035	2726	2875	-1
761	800	896	925	1491	1550	2036	2125	2876	3025	-2
801	840	926	955	1551	1610	2126	2215	3026	3175	-3
841	880	956	985	1611	1670	2216	2305	3176	3325	-4
881	920	986	1015	1671	1730	2306	2395	3326	3475	-5
921	960	1016	1045	1731	1790	2396	2485	3476	3625	-6
961	1000	1046	1075	1791	1850	2486	2575	3626	3775	-7
1001	1040	1076	1105	1851	1910	2576	2665	3776	3925	-8
1041	1080	1106	1135	1911	1970	2666	2755	3926	4075	-9
1081	1120	1136	1165	1971	2030	2756	2845	4076	4225	-10
1121		1166		2031		2846		4226		See Note 2

Note 1: Home size is to be calculated using ANSI Z765, where only the conditioned floor area of

MATERIALS AND RESOURCES

Home Size

LL	SS	WE	IEQ	MR	EA	HA	ID
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the home is to be included. Conditioned basements are to be included in the floor area calculation.

- Note 2:** Determine size score for homes larger than shown in the applicable column by subtracting one additional point for each size increment, as shown in Exhibit MR1-B below.
- Note 3:** If a space is defined explicitly on the home plans as a bedroom and it meets local code definition of a bedroom, then the space may be counted as a bedroom
- Note 4:** If a basement is determined to be a "conditioned, legal living space", it counts the same as above-ground living space.

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

0 Bedrooms	1 Bedroom	2 Bedrooms	3 Bedrooms	4 or More Bedrooms	Deduction Per Increment
40	30	60	90	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 life spans, 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.

This credit reflects that greater consumption and in so doing requires a higher level of performance in other areas (other credits) by way of compensation, in order for the larger home to achieve the same score as its smaller counterpart. Conversely, the credit recognizes and rewards the inherent efficiency of smaller homes.

The scoring for this credit was established as follows:

1. The smallest size unit for each number of bedrooms was found through informal surveying; those values were used for the highest scores (10 points).
2. Home size statistics were researched to determine the average size of new homes, by number of bedrooms; those values were used for the “neutral” scores (0 points).
3. The intervening score steps were determined by proration, or establishing a uniform per-point increment between the high scores and zero.
4. The negative scores were determined by using the same, or rounded, per-point increments.
5. Recognizing that houses can be virtually infinitely larger than “neutral”, and that as they increase in size they continue to increase in environmental impact, no negative point cap has been established; it was seen as unfair and indefensible to make the path to certification no more difficult for a home that is merely large than for one that is positively enormous. Instead, it has been left to the project teams to determine whether it is possible, and how, to compensate sufficiently for the larger homes’ material and resource consumptiveness through other areas of high performance such that they can achieve a LEED for Homes rating.

Potential Technologies and Strategies

Design and build a home that is smaller than the national average. Eliminate little-used spaces such as formal dining rooms. Design spaces that accommodate multiple concurrent uses. Design spaces that can accommodate different uses for different household configurations and for different needs over time, e.g., a room adjoining the master bedroom that can serve as a nursery, a home office, or a hobby space. Provide outdoor “rooms” to expand living space in mild weather.

Resources and References

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

Sarah Susanka 1999. *The Not So Big House*. Taunton Press, USA

Project Phase: Design: Programming

Construction: N/A

Trades: Builder/Architect

Special Procedures for Multifamily Buildings

The home size credit shall be determined for type of unit within the building, as follows. For each size of unit (i.e., # of bedrooms, 0, 1, 2, 3 BR units), respectively:

Weighted Average MR 1 Score for Building

$$= [\sum_{\text{by type of unit}} (\text{unit score} * \text{number of that type of unit in building})] / \text{total number of units in building}$$

Where:

Unit Score

= lookup from Table MR 1-A (above), based on the “average floor area” for all units of a given size in the building

Average floor area

= Total floor area in building for units of a given size / number of units of that size

Example:

1 Bedroom Units

Number of Units:	10
Total Floor Area for 1BR Units:	8,250 SF
Avg Area/Unit:	825 SF
Unit Score (1 Bedroom):	1 Point

2 Bedroom Units

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

3 Bedroom Units

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

Overall MR1 Score

$$\begin{aligned} \text{Weighted Average MR1 Score} &= [(1\text{BR score} * 1\text{BR units}) \\ &\quad + (2\text{BR score} * 2\text{BR units}) \\ &\quad + (3\text{BR score} * 3\text{BR units})] / \text{Total Units} \\ &= [(1 * 10) + (0 * 10) + (2 * 30)] / 50 \\ &= 1.4 \text{ (round to 1.5)} \end{aligned}$$

Credit #2: Material-Efficient Framing

Maximum Points: 2

Intent

Optimize the use of framing materials.

Requirements

Mandatory Measures

- 2.1 Builder must supply a framing material takeoff/cut list and waste factor (WF).
- 2.2 Overall waste factor may not exceed 10%. If WF on any portion of the framing order exceeds 10 %, calculate overall WF as shown in Exhibit MR2-A.

Exhibit MR2-A (New)
Sample Framing Waste Factor (WF) Calculation

Framing Component	Total Cost (\$)	Waste Factor (%)	Waste Cost (\$)
Random lengths	\$930	10%	\$93
Studs	\$1,860	5%	\$93
Beams/headers	\$372	0%	\$0
Roof deck	\$1,960	10%	\$196
Wall sheathing	\$0	0%	\$0
Rafters	\$2,460	0%	\$0
Cceiling joists	\$1,552	0%	\$0
Cornice work	\$2,960	10%	\$296
TOTAL	\$12,094		\$678
Overall WF (Waste \$/Cost \$)			5.6%

Optional Measures

- 2.3 Select from measures below (2 points maximum).

The following measures are worth 0.5 point each:

- Space joists greater than 16" o.c.;
- Space studs greater than 16" o.c.;
- Design roof pitch/eave width to 24" module;
- Reduce framing waste factor (as described in MR2.2 above) to 7% or less.

Combine any two of the following measures to earn 0.5 point:

- Size headers /loads;
- Use ladder blocking/drywall clips;
- Use 2-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. This credit is about wood because ~90% of U.S. housing stock is wood-framed. Efficient use of other materials is also good, but comparable data on efficient approaches to other structural systems isn't readily available.

Potential Technologies and Strategies

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.

Other systems can be considered, but must be submitted as CIRs, accompanied by supporting research and analysis. The approach used must be efficient as compared to how that system is typically done and/or efficient as compared to the status quo (i.e., wood frame w/o efficient framing).

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

Increase demand for 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), and 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. The use of indigenous resources reduces the environmental impacts resulting from transportation. 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: Quality Management for the Building Enclosure

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

Intent

Promote long-term, high-quality performance of the building enclosure and its components and system through appropriate design, materials selection, and construction practices.

Requirements

Mandatory Measures

- 4.1 The builder shall develop and document durability strategies as described in Exhibit MR4-A. The principal steps are to:
- 1) Analyze durability issues;
 - 2) Develop durability strategies;
 - 3) Include durability strategies in the construction documents; and
 - 4) Create a **Durability Checklist** using template as shown in Exhibit MR4-B (or similar format).

Optional Measures

- 4.2 The Provider's third party rater shall verify implementation of durability strategies to earn points as follows:
- Dry region (< 20 in/yr) – 1 point
 - Normal region (20-40 in/yr) – 3 points
 - Wet region (> 40 in/yr) – 5 points

Verification / Submittals

Mandatory Measures

- 4.1 The Provider's third-party rater shall perform all of the following:
- ✓ Confirm that the Accountability Form (in Attachment A) has been signed by the engineer or responsible party, declaring that the Durability Checklist has been completed, and place in Project Documentation File;
 - ✓ Check the appropriate box on signed LEED for Homes checklist.

Optional Measures

- 4.2 The Provider's third-party rater shall perform all of the following:
- ✓ Inspect durability measures listed in the Durability Checklist and verify that they have been constructed as shown in construction documents.⁶
 - ✓ Conduct any testing needed (as identified in Exhibit MR4-A, Step 3C) and verify performance.

⁶ Depending on the durability measures used, required inspections may include foundation, exterior walls (before cladding is installed), roof (before roofing is installed), air sealing (before interior sheathing/wallboard is installed), and mechanical systems (before final inspection).

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

Synergies and Trade-Offs

This credit is intended to promote an integrated, systems-oriented, approach to durability analysis and management. A number of other credits in LEED for Homes address specific durability issues individually; these include IEQ5 (mechanical ventilation); EA3 (air leakage); EA2 and EA4 (heat flow); EA1, EA4, and MR5 (protection from ultraviolet radiation); IEQ3, 4, and 6 (mechanical ventilation systems); and SS5 (pest management).

**Exhibit MR4-A
Durability Plan Detailed Requirements**

Step 1: Analyze durability issues and record using Durability Checklist template (see Exhibit MR4-B) or similar format.⁷

- A. Collect site-specific information on environmental conditions.
- B. Collect information on indoor environmental conditions and occupants.
- C. Identify and prioritize durability issues the home is likely to face, based on information collected above, making particular note of any significant conditions. Principal durability issues for which control strategies may be needed typically include those listed below.
 - Water – exterior sources
 - Water – interior sources
 - Water vapor flow
 - Air flow
 - Heat flow
 - Ultraviolet (solar) radiation
 - Wildfire
 - Pests

Step 2: Develop durability strategies.

- Develop a durability strategy for each of the high priority issues identified in Step 1C for each of the building systems, assemblies, components, and areas identified below, as applicable.
- Foundations (i.e., slabs, basements, crawl spaces)
 - Framing (i.e., structural members, flooring, walls, roof)
 - Exterior wall systems (i.e., insulation, air sealing, sheathing, drainage planes, exterior materials and finishes)
 - Openings (windows and doors)
 - HVAC systems (i.e., air conditioning, outdoor ventilation, local exhaust, heat/energy recovery, dehumidification)
 - Moisture-generating rooms – baths, kitchens, laundry rooms

⁷ See CSA and ASTM resources listed in **Resources and References** section.

Step 3: Include durability strategies in construction documents.

- A. Construction Details. For each of the strategies developed in Step 2, develop and record construction methods in drawings, specifications, and/or scopes of work. Address as needed the following key components and systems and their connections, intersections, and interactions.
- Drainage plane details and continuity
 - Air barrier details and continuity
 - Thermal barrier details and continuity
 - Water vapor movement (specify intended drying direction and select vapor permeability of assembly layers/components accordingly)
 - Mechanical system performance objectives
 - Pest management strategies and continuity of pest barriers
 - Management of moisture originating in baths, kitchen, laundry
- B. Material Specifications. Select materials that support the durability strategies developed in Step 2. Record selections as needed in drawings, specifications, and/or scopes of work.
- Structure
 - foundation
 - exterior walls
 - roof and floors
 - Windows and doors
 - Roofing
 - Wall cladding
 - Finishes
 - exterior (paint/stain)
 - interior (paint/wall-coverings)
 - Mechanical, plumbing, and electrical systems
 - HVAC
 - water heating
 - plumbing – distribution
 - plumbing – delivery (faucets/showerheads/appliances/hookups)
 - electrical – distribution
 - electrical – delivery (lighting/appliances/hookups)
- C. Scopes of Work. Develop construction/installation scopes of work for each trade contractor based on the durability strategies developed above. Each scope of work should include, by reference, the Durability Checklist (see Step 4), and require completion of the relevant portions of the Durability Checklist by the applicable trade contractor.
- D. Testing Requirements (for MR4.2 only). Work with Provider, third-party rater, or other qualified party to identify any testing that will be needed to verify the performance of installed durability measures (e.g., hosing down window walls to test resistance to moisture penetration). (Provider's third-party rater will perform testing.)

Step 4: Create Durability Checklist.

Create a project-specific Durability Checklist using the template shown in Exhibit MR4-B or similar format, listing the durability measures to be incorporated in the

home and noting where those measures appear in the construction documents (drawings, specifications, scopes of work).

Note that the Durability Checklist template (in Appendix X) lists a few sample durability strategies under each heading; these strategies are not intended to be universal, although some may apply to a variety of projects and sites. They are included for illustrative purposes only.

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 durability planning 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 defects and failures. Development and implementation of **durability strategies** as prescribed herein will help to ensure that appropriate attention is paid to the critical durability-related features of a home.

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.

This credit – through the scoring – also places emphasis on water management; although homes are subject to a variety of potential durability challenges, a great majority of durability problems result from inadequate moisture management.

Technologies & Strategies

The development and implementation of **durability strategies** is a task that will be new, and likely challenging, to many builders. Particularly the first time around, it may be helpful to engage an experienced third-party durability expert to conduct a detailed durability review of drawings, specifications, and scopes of work. The reviewer may provide suggestions on how to improve the durability strategies and their implementation.

Life cycle considerations: Note that the selection of inherently durable materials does not in itself ensure a durable structure; however, durable materials do play a role in the building's overall durability. The selection of highly durable materials is particularly appropriate in circumstances where the home owner or developer retains a long-term interest in the home and will thus experience life cycle cost benefits associated with reduced maintenance and/or repair costs.

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

Project Phase: Design: Programming

Construction: All

Trades: All

Credit #5: Environmentally Preferable Products

Maximum Points: 4

Intent

Increase demand for environmentally preferable products⁸ (EPPs).

Requirements

Mandatory Measures

- 5.1 Tropical hardwoods, if used, must be certified in accordance with the guidelines of the Forest Stewardship Council (FSC). A hardwood species is considered tropical if it is grown in a moist tropical country that lies, either in part or in its entirety, between the Tropics of Cancer and Capricorn (23.5 degrees latitude north and south, respectively). See Exhibit MR5-B for a reference list by continent. Also see **Resources and References** below for information on locating FSC products and on identifying tropical hardwood species.

Optional Measures

- 5.2 Incorporate environmentally preferable products into the home. 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.

⁸ 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	Specifications *
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

Note 1: * Recycled content is post-consumer unless noted otherwise.

Note 2: A maximum of 2 points can be earned for any single component listed in Exhibit MR5-A, e.g., roofing, siding, etc., regardless of the amount by which a minimum performance threshold is exceeded. Additional components can earn points as Innovation and Design Process credits as “exemplary performance” measures.

Exhibit MR5-B
Tropical Countries

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

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 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 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.

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

- FSC-US – www.findfsc.org. This website provides a simple form on which an interested party may list products s/he is seeking; the form is then circulated to FSC certified companies, who will contact the party if they have the desired product(s) available.
- Rainforest Alliance *SmartGuide to Green Building Wood Sources* – www.rainforestalliance.org/smartguides. This document lists US suppliers, manufacturers, and distributors of FSC certified building products.

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

- USDA Forest Service – <http://www2.fpl.fs.fed.us/TechSheets/tropicalwood.html> (free). This database is incomplete with respect to species, common, and trade names.
- Forest World's "Woods of the World" – <http://www.forestworld.com/wow.cfm> (\$49). This CD covers 910 species, equaling 95 percent of wood in trade. It includes scientific and common names, origins, and properties.
- "The Wood Explorer" – <http://www.toolcenter.com/wood/index.html> (\$99). This CD covers 1,650 wood species. It includes scientific and common names, origins, and properties.

Project Phase: Design: Programming

Construction: All

Trades: All

Credit #6: Waste Management

Maximum Points: 2

Intent

Reduce waste generation levels to below the industry norm.

Requirements

Mandatory Measures

6.1 Send a maximum of 60 percent of unused material from job-site

OR

Generate no more than half the national average of job-site waste. No more than 2.5 lbs per square foot (16.3 cubic yards per 1000 square foot) of conditioned floor area may be sent to landfill and/or incinerators. MR 6 only includes the waste generated from new construction and does not include demolition waste (e.g., from any existing structures on the site).

Optional Measures

6.2 Further reduce job-site waste. Send a maximum of 50 percent of unused material from the job-site

OR

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 Sent to Landfill (%)	Max Waste Sent to Landfill		Additional Waste Diverted		LEED for Homes Points Earned (Pts)
	(Lb / SF)	(Cu Yd /1000 SF)	(lb / SF)	(Cu Yd /1000 SF)	
60%	2.5	16.3	N/A	N/A	0.0
50%	2.0	13	0.5	3	0.5
38%	1.5	9.3	1.0	6	1.0
25%	1.0	6.6	1.5	9	1.5
12%	0.5	3.3	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:

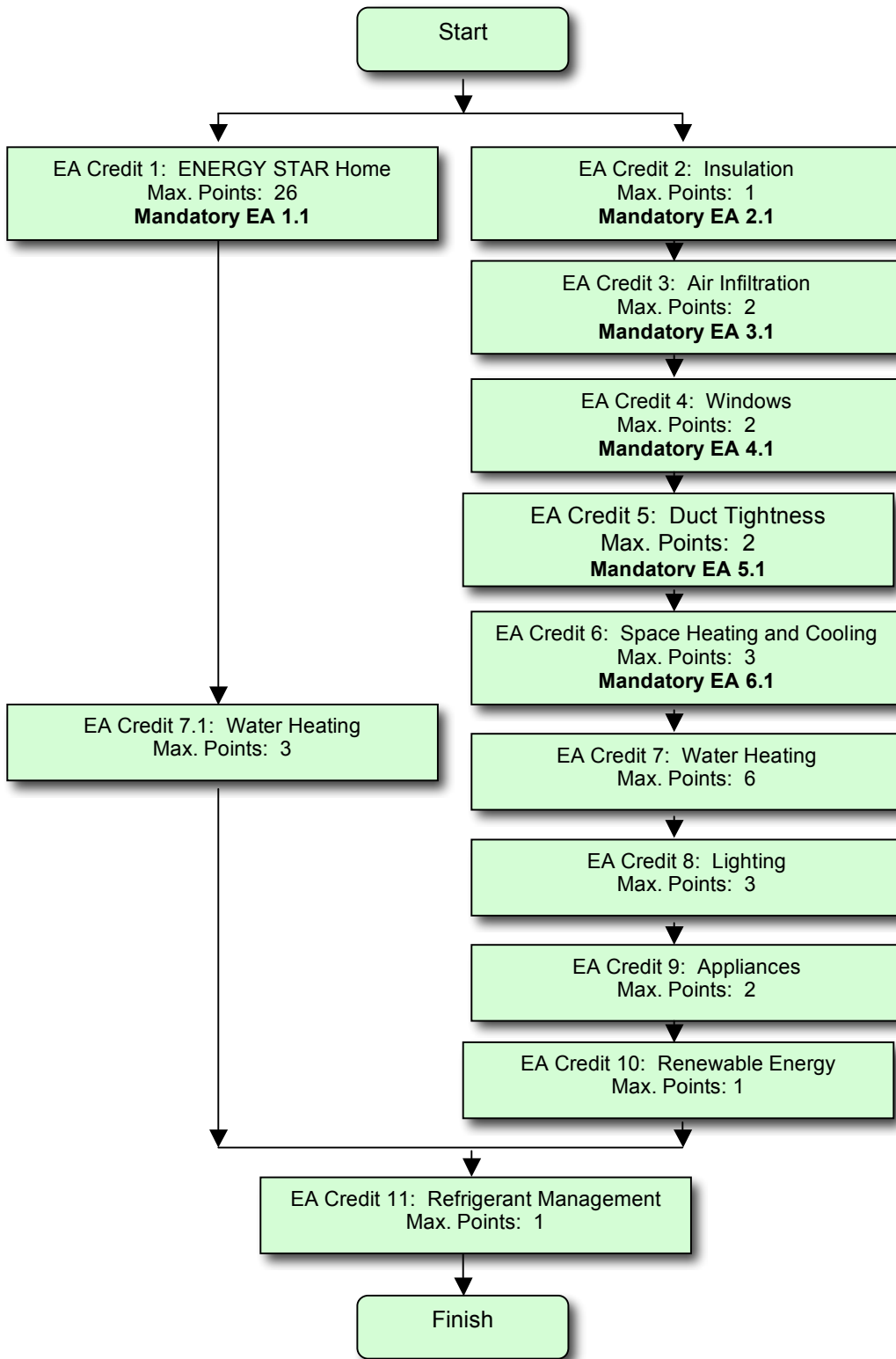
NAHB Research Center, On- Site Grinding of Residential
Construction Debris: The Indiana Grinder Pilot, February 1999,
www.nahbrc.org, (Click on Builder Programs, and then on Green
Building Activities, then on Construction Waste Management
Publications)

Project Phase: Design: Programming Construction: Framing

Trades: Framing and Carpenters

Energy and Atmosphere (EA)

Optional Pathways Through EA Credits



Credit 1: ENERGY STAR Labeled Home

Maximum Points: 26

Intent

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

Requirements

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 or Exhibit EA1-A (max. 26 Points):

Northern States (IECC Climate Zones 6-8):

$$\# \text{ of LEED for Homes Points} = (80 - \text{HERS Index}) / 3$$

Southern States (IECC Climate Zones 1-5):

$$\# \text{ of LEED for Homes Points} = (85 - \text{HERS Index}) / 3$$

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

HERS Index Values		LEED for Homes Points
Southern States (IECC Zones 1-5)	Northern States (IECC Zones 6-8)	
85	80	0
82	77	1
79	74	2
76	71	3
73	68	4
70	65	5
67	62	6
64	59	7
61	56	8
...
13	8	24
10	5	25
7	2	26

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 pressurization fan.
- Place a copy of the HERS rating report in the project documentation file for this house, and
- Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

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

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 15 to 20 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 heat transfer and thermal bridging.

Requirements

Mandatory Measures

- 2.1 Install insulation to meet at least Grade II specifications (per National Home Energy Rating Standards, see Exhibit EA3-A)⁹; 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 a. Install insulation to meet at least Grade I specifications (per National Home Energy Rating Standards, see Exhibit EA3-A). 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

- b. Install above code insulation that exceeds latest national energy code requirements (i.e., IECC 2004) by at least 5% - as demonstrated using REScheck code compliance software. (1 Point).

OR

- c. Demonstrate comparable performance for alternative wall/insulation system, such as structural insulated panels or insulated concrete forms. (1 Point).

**Exhibit EA3-A
Definitions of HERS Installation Grades**

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

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

⁹ Additional information about the RESNET inspection and grading procedures can be found on page 33 of the “Adopted Enhancements to the Mortgage Industry National Home Energy Rating Standards”, located on RESNET’s website at: <http://natresnet.org/standards/enhancements.htm>

Verification / Submittals

The Provider's third-party rater shall:

- ✓ EA c 2.1 & 2.2a: Inspect of installation of insulation, per the checklist above, to affirm that the requirements above have been completed;
- ✓ EA c 2.2b & 2.2c: Confirm that the Accountability Form (in Attachment A) has been 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.

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

ENERGY AND ATMOSPHERE
Air Infiltration

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

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

Home Address: _____ City: _____ State: _____

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

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

Credit 3: Air Infiltration

Maximum Points: 2

Intent

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

Requirements

Mandatory Measures

- 3.1 Air leakage rate from envelope must meet the requirements shown in Exhibit EA3-A, verified by Provider's third party rater.¹⁰

Optional Measures

- 3.2 Air leakage rate from envelope must meet the requirements shown in Exhibit EA3-A, verified by Provider's third party rater.

OR

- 3.3 Air leakage rate from envelope must meet the requirements shown in Exhibit EA3-A, verified by Provider's third party rater.

**Exhibit EA3-A
Air Leakage Requirements (ACH50)**

LEED Criteria	Performance Requirements	
	IECC Climate Zones 1-5	IECC Climate Zones 6-8
EA 3.1 Meets ENERGY STAR (Mandatory)	7 ACH50	5 ACH50
EA 3.2 Exceeds ENERGY STAR (Optional)	5 ACH50	4 ACH50
EA 3.3 Exceeds ENERGY STAR (Optional)	3 ACH50	3 ACH50

Verification / Submittals

The Provider's third-party rater shall:

- ✓ Perform a blower door depressurization test on the home, to affirm that the requirements above have been completed;
- ✓ Place the blower door pressurization test report in the project documentation file; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

¹⁰ 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).

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.

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 meet or exceed requirements for ENERGY STAR labeled windows (or windows with equivalent performance specifications), per Exhibit EA4-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	IECC / IRC Climate Region			
			Northern CZ 5-8 (Note 1)	North Central CZ 4 (Note1)	South Central CZ 3 (Note 2)	Southern CZ 1-2 (Note 2)
<i>Credit 4.1</i>	ENERGY STAR (Required)	U-Factor SHGC	≤ 0.35 Any	≤ 0.4 ≤ 0.45	≤ 0.4 ≤ 0.4	≤ 0.55 ≤ 0.35
<i>Credit 4.2</i>	10% > ENERGY STAR (1 Point)	U-Factor SHGC	≤ 0.32 Any	≤ 0.35 ≤ 0.40	≤ 0.35 ≤ 0.35	≤ 0.55 ≤ 0.33
<i>Credit 4.3</i>	20% > ENERGY STAR (2 Points)	U-Factor SHGC	≤ 0.30 Any	≤ 0.32 ≤ 0.40	≤ 0.32 ≤ 0.30	≤ 0.55 ≤ 0.30

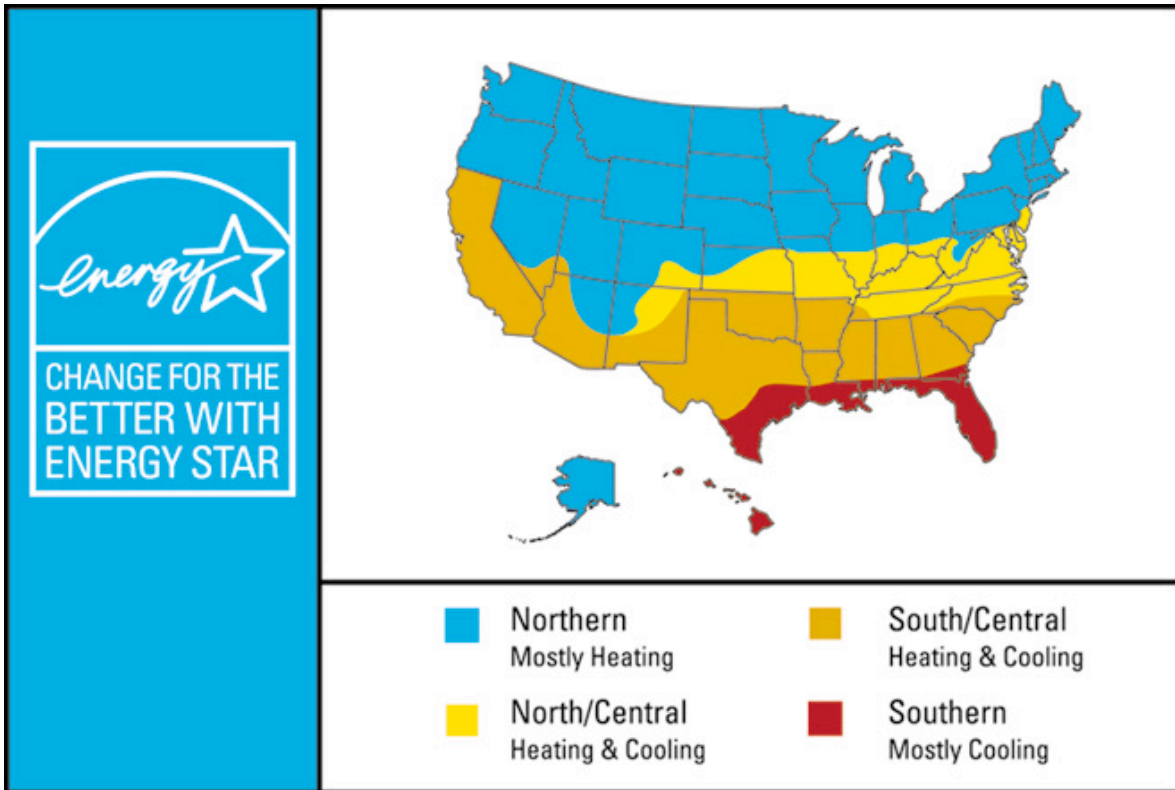
Note 1: For homes with a window to floor area (WFA) ratio >= 18% in cold climates, the following additional requirement applies:

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

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

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

Exhibit EA4-B
Climate Zone Map for ENERGY STAR Windows



Verification / Submittals

The Provider's third-party rater shall:

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

Synergies and Trade-Offs

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

The following special conditions are allowed:

- 1) Up to 5% of total window area may be used for windows with decorative glass or skylights (i.e., glass does not meet U-value or SHGC requirements).
- 2) Solar window screens may be used to meet SHGC requirements. The overall SHGC for a window unit with solar screen is determined by the following equation:

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

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

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: Space Heating and Cooling Distribution System

Maximum Points: 2

Intent

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

Requirements

a. Forced Air Systems

Mandatory Measures

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

AND

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

AND

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

Optional Measures

- 5.2 Limit the air leakage rate from air ducts to outdoors to ≤ 3.0 CFM at 25 Pascals per 100 square feet of conditioned floor area (for each installed system), verified by Provider's third-party rater. (1 Point)

OR

- 5.3 Limit the air leakage rate from air ducts to outdoors to ≤ 1.0 CFM at 25 Pascals per 100 square feet of conditioned floor area, (including systems with all ducts in conditioned space), verified by Provider's third-party rater. (2 points)

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

Mandatory Measures

- 5.1 Exempt

Optional Measures

- 5.2 See EA 5.3 below.
- 5.3 Since non-ducted HVAC systems have minimal distribution losses, they automatically qualify for the same number of points as very tight air distribution ducts (i.e., EA 5.3: ≤ 1.0 cfm at 25 Pascals per 100 square feet). (2 Points)

Verification / Submittals

The Provider's third-party rater shall:

a. Forced Air Systems

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

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

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

Synergies and Trade-Offs

If using 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 at 25 Pascals per 100 square feet requirements above) are:

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

Resources and References

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

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

ACCA Manual D – Residential Duct Systems

Project Phase: Design: Programming

Construction: HVAC / Ducts

Trades: Rater

Credit 6: Space Heating and Cooling Equipment

Maximum Points: 3

Intent

Reduce energy consumption associated with heating and cooling systems.

Requirements

Special Note: Both the space heating and cooling equipment must meet the requirements of this credit. If only one type of equipment qualifies, then ½ points should be taken. Homes that do not need air conditioning should be modeled under EA 1, using the default (minimum efficiency allowed) in both the reference and rated homes.

Mandatory Measures

- 6.1 Design (using ACCA 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 (except heat pumps and hydronic systems),
- 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.
- ✓ Confirm that the Accountability Form (in Attachment A) has been signed by the engineer or responsible party, declaring that the HVAC system meets the credit requirements, and place in Project Documentation File; and
- ✓ Check the appropriate box on signed LEED for Homes checklist.

Synergies and Trade-Offs

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

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

Additional Information

Rationale

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

Potential Technologies and Strategies

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