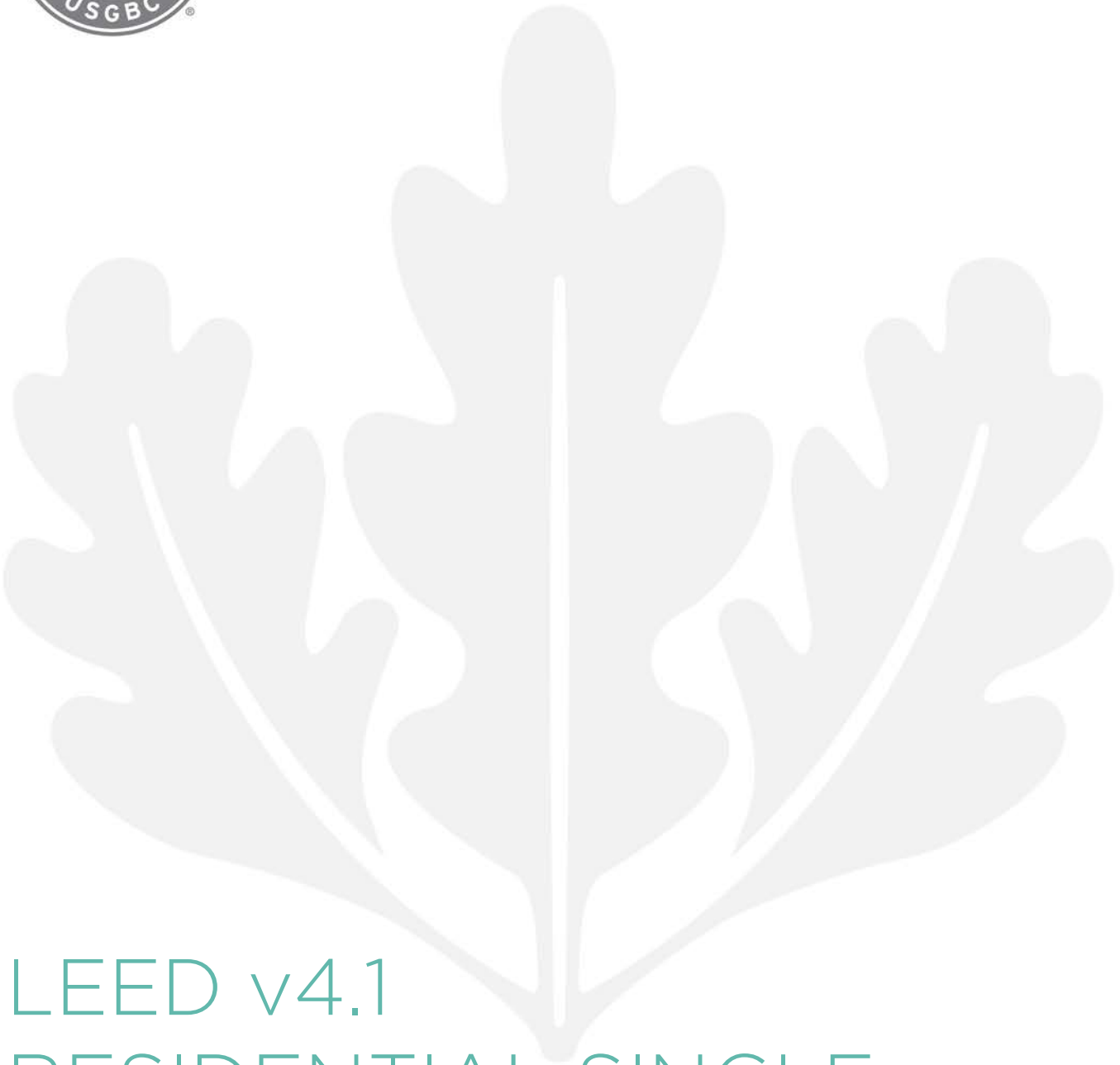


A large, light gray, stylized oak leaf graphic is centered in the background of the page. It has three main lobes and a central vein.

LEED v4.1 RESIDENTIAL SINGLE FAMILY HOMES

January 10, 2020

U.S. Green Building Council

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CREDIT: INTEGRATIVE PROCESS**2 points****Intent**

To maximize opportunities for cost-effective adoption of integrative green design and construction strategies.

Requirements

Achieve any two of the following options for a maximum of two points.

Option 1. Integrative Project Team (1 point)

Assemble and involve a project team to meet the three criteria below:

a) Include team members, whose capabilities include at least three of the following skill sets:

- architecture or residential building design;
- mechanical or energy engineering;
- building science or performance testing;
- green building or sustainable design; and
- civil engineering, landscape architecture, habitat restoration, or land-use planning.

b) Involve all team members referenced above in at least three of the following phases of the home design and construction process:

- conceptual or schematic design;
- LEED planning;
- preliminary design;
- energy and envelope systems analysis or design;
- design development;
- final design, working drawings or specifications; and
- construction.

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

AND/OR

Option 2. Design Charrette (1 point)

No later than the design development phase and preferably during schematic design, conduct at least one full-day workshop (or two half-day workshops) with the project team, as defined in Option 1. Use the workshop to integrate green strategies across all aspects of the building design, drawing on the expertise of all participants.

AND/OR

Option 3. Installation Contractor Training (1 point)

Before construction but after installation contractors have been hired for the project, conduct at least eight hours of training (extending a full day or over several days) on the green aspects of the project and how the trades can contribute to achieving each LEED for Homes prerequisite and attempted credit. Focus on

areas where trades have traditionally struggled to meet green building standards. Include at least the following trades in the training:

- plumbing;
- mechanical systems;
- insulation;
- framing; and
- air sealing.

Each installation contractor may be present only for the relevant segment, but the builder's site supervisor must be present throughout so that he or she understands the quality control duties on LEED and green building best practices.

LOCATION AND TRANSPORTATION (LT)

LT PREREQUISITE: FLOODPLAIN AVOIDANCE

Intent

To reduce the environmental impact of the development footprint.

Requirements

Do not develop buildings on land that lies within a flood hazard area shown on a legally adopted flood hazard map (such as the Federal Emergency Management Agency (FEMA) 100 year flood plain) or otherwise legally designated by the local jurisdiction or the state, unless the building is designed and built in accordance with the flood provisions of applicable building code, the local floodplain management regulations, or, at a minimum, the National Flood Insurance Program Requirements. Projects outside of the United States may use a local equivalent program to NFIP if the program is equal to or more stringent.

Hardscapes and previously developed buildings are exempt from the above requirements.

LT CREDIT: LEED FOR NEIGHBORHOOD DEVELOPMENT
10 points

Intent

To minimize the environmental damage of land development practices by building homes in LEED for Neighborhood Development–certified communities.

Requirements

Locate the project within the boundary of a development certified under LEED for Neighborhood Development (Stage 2 or Stage 3 under the Pilot or 2009 rating systems, Certified Plan or Certified Project under the v4 rating system).

Projects attempting this credit are not eligible to earn points under other Location and Transportation credits.

LT CREDIT: SITE SELECTION

6 points

Intent

To encourage construction in environmentally preferable locations and avoid development of sensitive lands.

Requirements

Pursue any of the following options for a maximum of 6 points:

Option 1. Sensitive Land Protection (3-4 points)

Path 1. Previously Developed (4 points)

Select a lot such that at least 75% of the total *buildable land* is *previously developed*.

OR

Path 2. Avoidance of Sensitive Land (3 points)

Locate the development footprint on land that does not meet the following criteria for sensitive land:

- *Prime farmland*. Prime farmland, unique farmland, or farmland of statewide or local importance as defined by the U.S. Code of Federal Regulations, Title 7, Volume 6, Parts 400 to 699, Section 657.5 (or local equivalent for projects outside the U.S.) and identified in a state Natural Resources Conservation Service soil survey (or local equivalent for projects outside the U.S.).
- *Floodplains*. A flood hazard area shown on a legally adopted flood hazard map or otherwise legally designated by the local jurisdiction or the state. For projects in places without legally adopted flood hazard maps or legal designations, locate on a site that is entirely outside any floodplain subject to a 1% or greater chance of flooding in any given year.
- *Habitat*. Land identified as habitat for the following:
 - o species listed as threatened or endangered under the U.S. Endangered Species Act or the state's endangered species act, or
 - o species or ecological communities classified by NatureServe as GH (possibly extinct), G1 (critically imperiled), or G2 (imperiled), or
 - o species listed as threatened or endangered species under local equivalent standards (for projects outside the U.S.) that are not covered by NatureServe data.
- *Water bodies*. Areas on or within 100 feet (30 meters) of a *water body*, except for minor improvements.
- *Wetlands*. Areas on or within 50 feet (15 meters) of a *wetland*, except for minor improvements.

•

AND/OR

Option 2. Infill Development (2 points)

Select a lot such that at least 75% of the land within ½ mile (800 meters) from the project boundary is *previously developed* land. Water bodies and publicly owned parks are excluded from the calculation.

For projects within city limits of towns with populations of less than 20,000, select a lot where at least 75% of the land immediately adjacent to the project boundary is *previously developed* land. A bordering street itself does not constitute previously developed land; instead, it is the status of the property on the other side of the segment of the street that matters. Any fraction of the boundary that borders a water body is excluded from the calculation.

AND/OR

Option 3. Open Space (1 point)

Select a location within ½ mile (800 meters) of a publicly accessible or community-based *open space* that is at least ¾ acre (0.3 hectare), or create publicly available open space on the project site. The open space requirement can be met with either one large open space or two smaller spaces totaling ¾ acre (0.3 hectare).

AND/OR

Option 4. Street Network (1 point)

Locate the project in an area of high intersection density, defined as an area whose existing streets and sidewalks create at least 90 intersections per square mile (35 intersections per square kilometers). When determining the number of intersections, include the following:

- intersections within a ¼ mile (400 meters) radius of project boundary;
- streets and sidewalks that are available for general public use and not gated;
- sidewalk intersections provided they are a unique right of way (i.e., a sidewalk through a city park); and
- publicly accessible *alleys*.

Exclude the following:

- intersections in gated areas, which are not considered available for public use, with the exception of education and health care campuses and military bases where gates are used for security purposes;
- water bodies and public parks; and
- intersections leading only to a dead end or cul-de-sac.

AND/OR

Option 5. Bicycle Network and Storage (1 point)

Meet both of the following requirements:

BICYCLE NETWORK

Design or locate the *project* such that a *functional entry* or bicycle storage is within a 200-yard (180-meter) *walking distance* or *bicycling distance* from a *bicycle network* that connects to at least one of the following:

- a. at least 10 uses (see LT Community Resources)

- b. a school or *employment center*
- c. A *bus rapid transit* stop, passenger rail station, or ferry terminal.

All destinations must be within a 3-mile (4800-meter) bicycling distance of the project boundary.

Planned bicycle trails or lanes may be counted if they are fully funded at the certificate of occupancy date and are scheduled for completion within one year of that date.

AND

BICYCLE STORAGE

Provide *long-term bicycle storage* for at least 15% of all regular building occupants, but no less than one storage space per three residential units. Indoor storage is acceptable as long as it meets the walking distance requirements. Vertical distance travelled by elevator is exempt from being counted towards the walking distance. On-site bicycle sharing stations within the project boundary may count for 50% of the long-term and short-term bicycle storage space.

Long-term bicycle storage must be within 300 feet (90meters) walking distance of any *functional entry*.

A single family dwelling unit with enclosed garage meets the bicycle storage requirement.

AND/OR

Option 6. Existing Infrastructure (1 point)

Select a lot that is within ½ mile of existing water service lines and sewer service lines. In the case of a multihome new development, each home in the development is awarded this point if the center of the development site is within ½ mile of existing water service lines and sewer service lines.

AND/OR

Option 7. Sidewalks (1 point)

Design or locate the project on lots that include sidewalks that run parallel to the road and extend across the entire width of the lot, or where equivalent sidewalks are available immediately across the street

LT CREDIT: COMPACT DEVELOPMENT**1 points****Intent**

To conserve land and promote livability, transportation efficiency, and walkability by creating compact communities.

Requirements

Construct or renovate a building that meets the dwelling unit per acre of *buildable land area density* defined in Table 1.

Table 1. Points for housing density

Single-family projects		Points
DU/acre of buildable land	DU/hectare of buildable land	
≥ 7	≥ 17	1

DU = dwelling units

LT CREDIT: COMMUNITY RESOURCES**1 points****Intent**

To encourage daily walking and bicycling and to reduce *vehicle miles traveled* (VMT) and automobile dependence.

Requirements

Construct or renovate a project such that the building's main entrance is within a 1/2-mile (800 meters) *walking distance* from at least 4 community uses.

The following restrictions apply:

- A use counts as only one type (e.g., a retail store may be counted only once even if it sells products in several categories).
- No more than two uses in each use type may be counted (e.g. if five restaurants are within walking distance, only two may be counted).
- The counted uses must represent at least three of the five categories, exclusive of the building's primary use.

LT CREDIT: ACCESS TO TRANSIT
2 points

Intent

To reduce pollution and land development effects from automobile use.

Requirements

Locate any *functional entry* of the project within a ¼-mile (400-meter) *walking distance* of existing or planned bus, *streetcar*, or *informal transit stops*, or within a ½-mile (800-meter) walking distance of existing or planned *bus rapid transit* stops, passenger rail stations (i.e. light, heavy, or commuter rail) or commuter ferry terminals. The transit service at those stops and stations in aggregate must meet the minimums listed in Table 1. Planned stops and stations may count if they are sited, funded, and under construction by the date of the certificate of occupancy and are complete within 24 months of that date.

Both weekday and weekend trip minimums must be met.

- For each qualifying transit route, only trips in one direction are counted towards the threshold.
- For weekend trips, only trips on the day with the higher number of trips are counted towards the threshold.
- If a qualifying transit route has multiple stops within the required walking distance, only trips from one stop are counted towards the threshold.
- Privately-run shuttles are only acceptable if the service is also made available to the public.

Table 1. Minimum daily transit service for projects with one or more transit types (bus, streetcar, rail, or ferry)

Weekday trips	Weekend trips	Points
72	30	1
100	70	2

If *existing* transit service is temporarily rerouted outside the required distances for less than two years, the project may meet the requirements, provided the local transit agency has committed to restoring the routes with service at or above the prior level.

SUSTAINABLE SITES (SS)

SS PREREQUISITE: CONSTRUCTION ACTIVITY POLLUTION PREVENTION

Intent

To reduce pollution from construction activities by controlling soil erosion, waterway sedimentation, and airborne dust.

Requirements

Stockpile and protect disturbed topsoil from erosion (for reuse).

Control the path and velocity of runoff with silt fencing or comparable measures.

Protect on-site storm sewer inlets, streams, and lakes with straw bales, silt fencing, silt sacks, rock filters, or comparable measures.

Provide swales to divert surface water from hillsides.

Use tiers, erosion blankets, compost blankets, filter socks, berms, or comparable measures to stabilize soils in any area with a slope of 15% (6.6:1) or more that is disturbed during construction.

Projects in locations that have construction activity air pollution rules must prevent air pollution from dust and particulate matter.

OR

Create and implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to the erosion and sedimentation requirements of the 2017 U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP) or local equivalent, whichever is more stringent. Projects must apply the CGP regardless of size. The plan must describe the measures implemented.

SS CREDIT: HEAT ISLAND REDUCTION**1 points****Intent**

To minimize effects on microclimates and human and wildlife habitats by reducing heat islands.

Requirements

Ensure that at least 50% of *roof and nonroof hardscapes*, but not including common roads that serve multiple buildings, on the project site meet one or more of the following requirements.

Option 1. Nonroof and Roof (1 point)

Use any combination of the following strategies.

Nonroof Measures

- Use the existing plant material or install plants that provide shade over paving areas (including playgrounds) on the site within 10 years of planting. Install vegetated planters. Plants must be in place at the time of occupancy permit and cannot include artificial turf.
- Provide shade with structures covered by energy generation systems, such as solar thermal collectors, photovoltaics, and wind turbines.
- Provide shade with architectural devices or structures. If the device or structure is a roof, it shall have an aged *solar reflectance (SR)* value of at least 0.28 as measured in accordance with ANSI/CRRC S100. If the device or structure is not a roof, or if aged solar reflectance information is not available, it shall have at installation an initial SR of at least 0.33 as measured in accordance with ANSI/CRRC S100.
- Provide shade with vegetated structures.
- Use paving materials with an initial *solar reflectance (SR)* value of at least 0.33.
- Use an *open-grid pavement system* (at least 50% unbound).

High-Reflectance Roof

Use roofing materials that have an aged SRI equal to or greater than the values in Table 1. If aged SRI is not available, the roofing material shall have an initial SRI equal to or greater than the values in Table 1.

Table 1. Minimum solar reflectance index value, by roof slope

	Slope	Initial SRI	Aged SRI
Low-sloped roof	≤ 2:12	82	64
Steep-sloped roof	> 2:12	39	32

Roof area that consists of functional, usable spaces (such as helipads, recreation courts, and areas covered by equipment, solar panels, and appurtenances) may meet the requirements of nonroof measures.

OR

Option 2. Tree Planting (1 point)

Install a tree with a canopy width of at least 20 feet, or smaller trees that will have a cumulative shading area of at least 315 square feet. Shading should be calculated when the sun is directly overhead (noon on the summer solstice), based on ten years' growth after installation.

SS CREDIT: RAINWATER MANAGEMENT

1-2 points

Intent

To reduce rainwater runoff volume from the site.

Requirements

Option 1. Rainwater Management (1-2 points)

Projects that must comply with local requirements of the National Pollutant Discharge Elimination System (NPDES) must follow Case 2.

Case 1. Low Impact Development

Use low-impact development (LID) techniques to minimize the amount of stormwater that leaves the site. Examples of acceptable techniques include the following:

- planting areas with *native* or *adapted* plant material (e.g. trees shrubs);
- installing a vegetated roof;
- using permeable paving, consisting of porous above-ground materials (e.g., open pavers, engineered products), a base layer designed to drain water away from the home, and (often) a 6-inch-deep (150 millimeters) subbase; and
- installing permanent infiltration or collection features (e.g., vegetated swale, rain garden, rainwater cistern) that can handle 100% of the runoff from a two-year, 24-hour storm.

To determine compliance for single-family and multifamily homes, calculate the percentage of the lot area, including the area under roof, which is permeable or can direct water to an on-site catchment or infiltration feature.

Table 1. Points for permeable area, as percentage of total lot area

Percentage	Points
50–64%	1
65%+	2

As an alternative approach to determining compliance for single-family homes only, credit is given for reducing the total impermeable area compared to the ENERGY STAR reference home, as listed in Table 2.

Table 2. Conditioned floor area of reference home, by number of bedrooms

	1	2	3	4	5	6	7	8 or more
Floor area (square feet)	1,000	1,600	2,200	2,800	3,400	4,000	4,600	+ 600 ft ² per additional bedroom
Floor area (square meters)	93	148	204	260	315	371	426	+ 55.6 square meters per additional bedrooms

Thresholds for total impermeable area are then calculated according to the values in Table 3, column 1.

Table 3. Points for reducing total impermeable area

Impermeable area (square feet)	Points
Reference home size * 1	1
Reference home size * 0.66	2

Case 2. National Pollutant Discharge Elimination System (NPDES) Projects

Using low-impact development and green infrastructure to replicate *natural site hydrology*, *manage on-site* the runoff from the developed site for the percentile regional or local rainfall events listed in Table 4.

Use daily rainfall data and the methodology in the U.S. Environmental Protection Agency's Technical Guidance on Implementing the Stormwater Runoff Requirements for Federal Projects, under Section 438 of the Energy Independence and Security Act, to determine the percentile amount to be retained.

Table 4. Points for on-site management of water from rainfall events

Percentile of Rainfall Retained	Points
80 th Percentile	1
85 th Percentile	2

OR

Option 2. Basic Landscape Design (1 point)

Meet all of the following requirements for all designed landscape softscapes:

1. Do not use turf in densely shaded areas.
2. Do not use turf in areas with a slope of 25% (i.e., 4:1 slope) or greater.
3. Introduce no *invasive plant species* into the landscape.

Invasive plant species vary by region. Consult the U.S. Department of Agriculture's GRIN Taxonomy for Plants database, the National Association of Exotic Pest Plant Councils, or local cooperative extension service or state or national exotic pest lists for plants in natural areas and wildlands. Not all nonnative species are considered invasive.

4. Add mulch or soil amendments as determined by soil testing. *Mulch* is defined as a covering placed around plants to reduce erosion and water loss and to help regulate soil temperature. In addition, upon decomposition, organic mulches serve as soil amendments. The type of mulch selected can affect soil pH.
5. All compacted soil (e.g., from construction vehicles) must be tilled to at least 6 inches.

SS CREDIT: NONTOXIC PEST CONTROL
1-2 points**Intent**

To minimize pest problems and risk of exposure to pesticides.

Requirements

Pursue any of the following measures to receive up to 2 points (Each measure is worth 1 point, except as noted):

- Install a steel mesh barrier termite control system (2 points).
- Install a physical termite barrier system (e.g., basaltic rock) approved by code (2 points).
- For below-grade walls, use solid concrete foundation walls, masonry walls with a course of solid block bond beam, or concrete-filled block.
- Install post-tension slabs.
- Treat cellulosic structural material (e.g., wood framing) with a registered pesticide containing borates, meeting the manufacturer's warranty requirements for preconstruction treatment.
- Use noncellulosic material for all structural elements.
- Install ports or openings for all plumbing elements that penetrate the slab, to allow access for inspection and treatment of pest infestations.
- Install a registered termite bait system and provide for ongoing maintenance as required by the manufacturer.
- Design a minimum 6-inch (150 millimeters) inspection space between the surface of the planned landscape grade and nonmasonry siding.
- Seal all external cracks, joints, penetrations, edges, and entry points with appropriate caulking. Install rodent- and corrosion-proof screens (e.g., copper or stainless steel mesh) on all openings greater than ¼ inch (6 millimeters), except where code prohibits their installation (e.g., dryer vents).
- Design discharge points for rain gutters, air-conditioning condensation lines, steam vent lines, or any other moisture source such that discharge is at least 24 inches (600 millimeters) from the foundation.
- Design landscape features to provide a minimum 18-inch (450 millimeters) space between the exterior wall and any plantings.

WATER EFFICIENCY (WE)

WE PREREQUISITE: WATER USE

Intent

To reduce demand for water through high-efficiency fixtures and efficient landscaping practices.

Requirements

Option 1. Total Water Use

Reduce total indoor and outdoor water consumption by at least 20% over standard practices.

For indoor water savings, use the Water Reduction Calculator to determine the average flush or flow rate for each fixture type and the estimated daily usage. The baselines for indoor water consumption are shown in Table 1.

Table 1. Indoor water baseline consumption (per person per day)

Fixture	Baseline flush or flow rate		Estimated fixture usage	Estimated water usage	
Shower (per compartment)	2.5 gpm	9.5 lpm	6.15 minutes	15.4 gallons	58.4 liters
Lavatory, kitchen faucet	2.2 gpm	8.3 lpm	5.0 minutes	11 gallons	41.5 liters
Toilet	1.6 gpf	6 lpf	5.05 flushes	8 gallons	30.3 liters
Clothes washer	9.5 IWF	9.5 IWF	0.37 cycles @ 3.5 ft ³ (@0.1 m ³)	15.1 gallons	57.1 liters
Dishwasher	6.5 gpc	24 lpc	0.1 cycles	0.7 gallons	2.4 liters

gpm = gallons per minute

gpf = gallons per flush

IWF = integrated water factor

gpc = gallons per cycle

lpf = liters per flush

lpm = liters per minute

lpc = liters per cycle

The water pressure in the house must be tested, with no detectable water leaks. Projects are recommended, but not required, to reduce water pressure in the house to 60 pounds per square inch (414 kPa).

Any installed water softeners must be demand initiated.

For outdoor water savings, use the EPA WaterSense Water Budget Tool to calculate the baseline landscape water consumption and the design landscape water consumption.

Implement the following measures to further reduce landscape water consumption. Add the savings associated with each of the following strategies to the reduction from the landscape water requirement, as calculated in the Water Budget Tool:

- Install smart scheduling technology. This strategy counts for a maximum reduction of 30% provided all landscape water use is controlled by a soil moisture sensor control system or a weather-based irrigation control system.
- Use captured rainwater.
- Use reclaimed water.
- Use water treated on site or conveyed by a public agency specifically for nonpotable uses (water from naturally occurring surface water bodies, such as streams and rivers, and groundwater, such as well water, does not count).

Option 2. Indoor and Outdoor Water Use

Achieve 3 points in WE credit Indoor Water Use and/or WE credit Outdoor Water Use

WE PREREQUISITE: WATER METERING**Intent**

To support water efficiency efforts by monitoring and benchmarking water use over time.

Requirements

Install a whole-house water meter.

Encourage homeowners or tenants to share water usage data with USGBC via a USGBC-approved third-party.

Homes that use only well water and are not connected to a municipal water system are exempt from this prerequisite.

WE CREDIT: TOTAL WATER USE

3-15 points

Intent

To reduce demand for water through high-efficiency fixtures and efficient landscaping practices.

Requirements

Reduce total indoor and outdoor water consumption by at least 20% over standard practices.

For indoor water savings, use the Water Reduction Calculator to determine the average flush or flow rate for each fixture type and the estimated daily usage. The baselines for indoor water consumption are shown in Table 1.

Table 1. Indoor water baseline consumption (per person per day)

Fixture	Baseline flush or flow rate		Estimated fixture usage	Estimated water usage	
Shower (per compartment)	2.5 gpm	9.5 lpm	6.15 minutes	15.4 gallons	58.4 liters
Lavatory, kitchen faucet	2.2 gpm	8.3 lpm	5.0 minutes	11 gallons	41.5 liters
Toilet	1.6 gpf	6 lpf	5.05 flushes	8 gallons	30.3 liters
Clothes washer	9.5 WF	9.5 WF	0.37 cycles @ 3.5 ft ³ (@0.1 m ³)	15.1 gallons	57.1 liters
Dishwasher	6.5 gpc	24 lpc	0.1 cycles	0.7 gallons	2.4 liters

gpm = gallons per minute

gpf = gallons per flush

WF = water factor

gpc = gallons per cycle

lpf = liters per flush

lpm = liters per minute

lpc = liters per cycle

For outdoor water savings, use the EPA WaterSense Water Budget Tool to calculate the baseline landscape water consumption and the design landscape water consumption.

Implement the following measures to further reduce landscape water consumption. Add the savings associated with each of the following strategies to the reduction from the landscape water requirement, as calculated in the Water Budget Tool:

- Install smart scheduling technology. This strategy counts for a maximum reduction of 30% provided all landscape water use is controlled by a soil moisture sensor control system or a weather-based irrigation control system.
- Use captured rainwater.
- Use reclaimed water.
- Use water treated on site or conveyed by a public agency specifically for nonpotable uses (water from naturally occurring surface water bodies, such as streams and rivers, and groundwater, such as well water, does not count).

Points are awarded according to Table 2.

Table 2. Points for reducing indoor and outdoor water use

Percentage reduction	Points
20%	3
25%	4
30%	5
35%	6
40%	7
45%	8
50%	9
55%	10
60%	11
65%	12
70%	13
75%	14
80%	15

Projects attempting this credit are not eligible to earn points under other Water Efficiency credits.

WE CREDIT: INDOOR WATER USE
1-11 points**Intent**

To minimize indoor demand for water through high-efficiency fixtures and fittings.

Requirements

Each lavatory faucet or faucet aerator must be WaterSense labeled. The average rated flow volume across all lavatory faucets must not exceed 1.5 gallons per minute (5.6 liters per minute) for 2 points or 1.0 gallons per minute (3.7 liters per minute) for 3 points.

Each showerhead fixture and fitting must be WaterSense labeled. The total rated flow volume per shower compartment, averaged across all shower compartments must not exceed 2.0 gallons per minute (11.2 liters per minute) for 1 point, 1.75 gallons per minute (6.6 liters per minute) for 2 points, or 1.5 gallons per minute (5.6 liters per minute) for 3 points.

Each toilet fixture and fitting must be WaterSense labeled. The average rated flush volume across all toilets must not exceed 1.28 gallons per flush (4.8 liters) for 1 point, 1.1 gallons (4.1 liters) per flush for 2 points, or 0.8 gallons per flush (3.0 liters) for 3 points.

Each clothes washer must be ENERGY STAR qualified or performance equivalent for projects outside the U.S. (2 points)

The water pressure in the house must be tested, with no detectable water leaks. Projects are recommended, but not required, to reduce water pressure in the house to 60 pounds per square inch (414 kPa). Any installed water softeners must be demand initiated.

For projects outside the United States, a local equivalent to WaterSense may be used.

WE CREDIT: OUTDOOR WATER USE

1-4 points

Intent

To reduce outdoor water consumption through efficient landscaping practices.

Requirements

Option 1. Efficient Landscaping (1-4 points)

Landscape with plants that are *native* or *adapted* to the region. Points are awarded according to Table 1.

Table 1. Points for increasing native plantings, as percentage of total landscape area

Native or adapted plant area	Points
> 25%	1
> 50%	2
> 75%	3
100%	4

Lists of native plants are maintained by the Lady Bird Johnson Wildflower Center, the North American Native Plant Society, state agencies, and local cooperative extension service offices and offices and local native plant conservation organizations.

OR

Option 2. Efficient Irrigation (1-2 points)

Design and install a high-efficiency irrigation such that any of the following are met, up to 2 points. (Each measure is worth 1 point.)

1. Use of pressure regulation for every zone (valve or sprinkler)
2. Use of check valves on sloped irrigation zones, where needed to prevent low head drainage
3. Flow sensing with a master valve and irrigation controller that responds to a high-flow occurrence
4. Use of smart irrigation control technology (weather based, soil moisture sensors, rain sensors, etc.)
5. Create separate zones for each type of bedding area based on watering needs
6. Use of drip irrigation for at least 50% of planting area.

ENERGY AND ATMOSPHERE (EA)

EA PREREQUISITE: MINIMUM ENERGY PERFORMANCE

Intent

To improve the building's overall energy performance and reduce its greenhouse gas emissions.

Requirements

Case 1. New Construction

Meet all of the following requirements:

1. Meet the requirements of ENERGY STAR for Homes, version 3

Complete all mandatory measures of ENERGY STAR for Homes version 3.

Achieve a HERS Index rating that meets or exceeds the SAF adjusted ENERGY STAR HERS Index Target (or USGBC-approved equivalent for projects outside the U.S.).

Exception: If all requirements of the program are met except for the use of a credentialed HVAC contractor, this requirement shall be considered satisfied, even though the home may not be eligible to earn the ENERGY STAR.

2. Where installed, at least one of the following appliances must be ENERGY STAR certified (or performance equivalent for projects outside the U.S.) and installed in each dwelling unit:
 - refrigerator;
 - dishwasher; or
 - clothes washer.
3. All duct runs must be fully ducted (i.e., building cavities may not be used as ducts).

Case 2. Major Renovation

Meet all of the following requirements:

1. Meet the requirements of ENERGY STAR for Homes, version 3

Complete all mandatory measures of ENERGY STAR for Homes version 3.

Achieve a HERS Index rating that meets or exceeds the SAF adjusted HERS 85 (or USGBC-approved equivalent for projects outside the U.S.).

Exception: If all requirements of the program are met except for the use of a credentialed HVAC contractor, this requirement shall be considered satisfied, even though the home may not be eligible to earn the ENERGY STAR.

2. Where installed, at least one of the following appliances must be ENERGY STAR certified (or performance equivalent for projects outside the U.S.) and installed in each dwelling unit:
 - refrigerator;
 - dishwasher; or
 - clothes washer.
3. All duct runs must be fully ducted (i.e., building cavities may not be used as ducts).

Existing portions of an existing building are given the following allowances:

Rater Field Checklist
Thermal Enclosure System

2.1 High-Performance Fenestration not required for existing windows that are not being replaced

3.1 High-Performance Insulation not required for existing walls that aren't impacted by the renovation.

3.2. Slab insulation is strongly encouraged but not required to meet or exceed 2009 IECC levels.

3.3. Attic insulation at the intersection of existing roof and existing exterior walls does not have to meet R-value requirements.

3.4. Advanced framing is not required on existing framed walls,

4.3. Existing sill plates on top of concrete are not required to be placed on a foam gasket.

Water Management System Builder Requirements

1.3. A capillary break under an existing slab is not required unless there are visible signs of moisture damage on the slab floor.

1.5. Exterior below-grade walls are not required to be damp-proofed on the exterior surface unless there are visible signs of moisture damage on the interior of the wall.

1.8 Drain tiles surrounded with clean gravel and fabric filter are not required for existing slabs, unless there are visible signs of moisture damage on the slab floor

2.3. Water-managed wall and roof assembly requirements are not required for existing walls or roofing unless there are signs of moisture damage related to vulnerabilities in the walls or roof.

EA PREREQUISITE: ENERGY METERING**Intent**

To support energy efficiency efforts by monitoring and benchmarking energy use over time.

Requirements

Install whole-house electric and gas meters, as applicable.

Encourage homeowners or tenants to share energy usage data with USGBC via a USGBC-approved third-party by describing the benefits of participation in the Homeowner Education Manual.

EA PREREQUISITE: EDUCATION OF HOMEOWNER, TENANT, OR BUILDING MANAGER

Intent

To sustain the performance of the home by training its occupants in the operation and maintenance of LEED features and equipment.

Requirements

Provide to all individuals or organizations responsible for ongoing maintenance of the home (e.g., occupants, building managers, maintenance contractors) an operations and maintenance manual, binder, or CD that includes all the following items:

- the completed checklist of LEED for Homes features;
- copies of all ENERGY STAR for Home, version 3, checklists;
- product manufacturers' manuals for all installed equipment, fixtures, and appliances;
- general information on efficient use of energy, water, and natural resources;
- operations and maintenance guidance for any installed equipment, including space heating and cooling, mechanical ventilation, humidity control, radon protection, renewable energy, and irrigation, rainwater harvesting, or graywater systems (following 2009 EPA WaterSense Single-Family New Home Specifications, item 5.0, Homeowner Education);
- guidance on occupants' activities and choices, including cleaning materials and methods, water-efficient landscaping, integrated pest management, effects of chemical fertilizers and pesticides, irrigation, lighting selection, and appliance selection;
- information on local green power options; and
- information on sharing utility data with USGBC via a USGBC-approved third party.

In addition, conduct a minimum one-hour walkthrough of the home with the occupants. For buildings with building managers, include the building manager. The walkthrough must feature the following:

- identification of all installed equipment;
- instruction in how to use and operate the equipment; and
- information on its maintenance.

EA CREDIT: ANNUAL ENERGY USE

1-36 points

Intent

To improve the home's overall energy performance and reduce its greenhouse gas emissions.

Requirement

Single family homes with *major energy users not included in the HERS Index*, including pools, spas, heated driveways, and heated garages, or other major energy users not included in the HERS index must use Option 1.

Option 1. LEED Energy Budget

Design and construct a building whose modeled annual energy usage is lower than the LEED energy budget. The LEED energy budget is based on the ENERGY STAR for Homes, HERS Index Target Procedure for National Program Requirements, version 3, with the following modifications:

- The size adjustment factor is always 1.
- The building is a slab-on-grade ranch whose floor area is equal to the ENERGY STAR reference home's conditioned floor area.
- There are no floors over unconditioned spaces.
- The gross exterior wall area is as shown in Table 1.
- There are two exterior half-lite doors, unshaded, one on the south wall, one on the west wall.
- Glazing is 15% of the floor area.
- The ceiling is insulated, and its gross area equals the conditioned floor area.
- The storage water heater has an energy factor of 0.59 for gas, 0.92 for electric.
- The thermal distribution system is 100% in the attic, above insulation.
- The LEED energy budget shall be displayed in MBtu/year, and is based on source energy.
- Any major energy users not covered by the energy model, including heated driveways, pools, spas, and heated garages, must be added to the annual energy consumption of the Rated Home.

Table 1. Exterior wall area of LEED reference home, by number of bedrooms

	1	2	3	4	5	6	7	8 or more
Area (square feet)	1,300	1,667	1,957	2,200	2,411	2,600	2,773	+ 150 ft ² per additional bedroom
Area (square meters)	120	154	181	204	223	241	257	+ 14 square meters per additional bedroom

Points are awarded according to Table 2.

Table 2. Points for reducing energy usage below LEED energy budget

Percentage reduction	Points	Percentage reduction	Points
1%	1	19%	19
2%	2	20%	20

3%	3	21%	21
4%	4	23%	22
5%	5	25%	23
6%	6	27%	24
7%	7	29%	25
8%	8	31%	26
9%	9	33%	27
10%	10	36%	28
11%	11	40%	29
12%	12	45%	30
13%	13	50%	31
14%	14	60%	32
15%	15	70%	33
16%	16	80%	34
17%	17	90%	35
18%	18	100%	36

OR

Option 2. HERS Index

Case 1. New construction

Design and construct a home whose modeled annual energy usage achieves a HERS index rating of 70 or better, or whose HERS index rating is at or below the ENERGY STAR HERS Index Target (or USGBC-approved equivalent for projects outside the U.S.). Points are awarded according to Table 3.

Homes that are subject to the ENERGY STAR Size Adjustment Factor must subtract the HERS adjustment of this factor from their HERS score.

Table 3. Points for achieving HERS index ratings

HERS index	HERS points below ENERGY STAR HERS Index Target	Points	HERS Index	HERS points below ENERGY STAR HERS Index Target	Points
70	0	10	56	14	23
69	1	11	54	16	24
68	2	12	52	18	25
67	3	13	50	20	26
66	4	14	45	25	27
65	5	15	40	30	28
64	6	16	35	35	29
63	7	17	30	40	30
62	8	18	25	45	31
61	9	19	20	50	32
60	10	20	15	55	33

59	11	21	10	60	34
58	12	22	5	65	35

Case 2. Major Renovation

Design and construct a home whose modeled annual energy usage achieves a HERS index rating better than 85 (or USGBC-approved equivalent for projects outside the U.S.). Points are awarded according to Table 4.

Homes that are subject to the ENERGY STAR Size Adjustment Factor must subtract the HERS adjustment of this factor from their HERS score.

Table 4. Points for achieving HERS index ratings

HERS index	Points	HERS Index	Points
84	1	61	19
82	2	60	20
80	3	59	21
78	4	58	22
76	5	56	23
74	6	54	24
73	7	52	25
72	8	50	26
71	9	45	27
70	10	40	28
69	11	35	29
68	12	30	30
67	13	25	31
66	14	20	32
65	15	15	33
64	16	10	34
63	17	5	35
62	18	0	36

EA CREDIT: EFFICIENT HOT WATER DISTRIBUTION SYSTEM**1-2 points****Intent**

To reduce energy consumption and the burden on water supply and wastewater systems by increasing the efficiency of hot water distribution.

Requirements**Option 1. Efficient Hot Water Distribution (1 point)**

Design and install an energy-efficient hot water distribution system, based on either maximum pipe length requirements (Path 1) or maximum pipe volume limits (Path 2). The source of hot water is assumed to be a water heater, boiler, circulation loop piping, or electric heat-traced piping. Multiple water heaters and multiple distribution systems may be used to comply with this credit.

- . All heat traced piping must be insulated.

Path 1. Maximum Allowable Pipe Length

Do not exceed the maximum allowable pipe length from the source of hot water to the termination of the fixture supply pipe, as listed in Table 1a or Table 1b. If a branch consists of more than one size of pipe, use the largest size when determining the maximum allowable length.

Branch length requirements do not apply to cold water demand loads (e.g., toilets), tubs without showerheads, or stovetop pot-fillers.

Table 1a. Maximum length of pipe

Nominal pipe size (inch)	Maximum pipe or tube length	
	Hot water source is a water heater or boiler with no circulation loop or heat traced pipe or in multifamily buildings a central circulation loop or heat traced pipe (feet)	Hot water source is a circulation loop or heat traced pipe serving a single unit or house (feet)
1/4	50	16
5/16	50	16
3/8	50	16
1/2	43	16
5/8	32	12
3/4	21	8
7/8	16	6
1	13	5
1 1/4	8	3
1 1/2	6	2
2 or larger	4	1

Table 1b. Maximum length of pipe (SI)

Nominal pipe size (mm)	Maximum pipe or tube length	
	Hot water source is a water heater or boiler with no circulation loop or heat traced pipe or in multifamily buildings a central circulation loop or heat traced pipe (meters)	Hot water source is a circulation loop or heat traced pipe serving a single unit or house (meters)
6	15	5
8	15	5
9	15	5
13	13	5
16	10	4
19	6	2
22	5	2
25	4	2
32	2	1
38	2	1
50 or larger	1	0.3

OR

Path 2. Maximum Allowable Pipe Volume

Do not exceed a maximum volume of hot or tempered water of 64 ounces (1.89 L) from a water heater or boiler with no circulation loop or heat traced pipe or in multifamily buildings a central circulation loop or heat traced pipe to the fixture, or 24 ounces (0.71 L) for hot water from a circulation loop pipe or an heat-traced pipe serving a single unit or house to the fixture.

Pipe volume is the sum of the internal volumes of pipe, fittings, valves, meters, and manifolds between the source of hot water and the termination of the fixture supply pipe. To determine the volume, refer to Table 2, which lists the volumes for specific types of tubing.

Branch volume requirements do not apply to cold water demand loads (e.g., toilets), tubs without showerheads, or stovetop pot-fillers.

Table 2. Volume of water distribution pipes, by tubing type

Internal Volume of Various Water Distribution Tubing

Ounces of Water Per Foot Length of Hot Water Tubing								
Nominal Size (Inches)	Copper M	Copper L	Copper K	CPVC CTS SDR 11	CPVC SCH 40	PEX-Al-PEX ASTM F 1281	PE-AL-PE	PEX CTS SDR 9
$\frac{3}{8}$	1.06	0.97	0.84	N/A	1.17	0.63	0.63	0.64
$\frac{1}{2}$	1.69	1.55	1.45	1.25	1.89	1.31	1.31	1.18
$\frac{3}{4}$	3.43	3.22	2.90	2.67	3.38	3.39	3.39	2.35
1	5.81	5.49	5.17	4.43	5.53	5.56	5.56	3.91
1 $\frac{1}{4}$	8.70	8.36	8.09	6.61	9.66	8.49	8.49	5.81
1 $\frac{1}{2}$	12.18	11.83	11.45	9.22	13.20	13.88	13.88	8.09
2	21.08	20.58	20.04	15.79	21.88	21.48	21.48	13.86

Source: Modified from 2009 International Plumbing Code Table E202.1. International Code Council. January

Conversions: 1 gallon (3.8 liters) = 128 ounces
 1 ounce = 0.00781 gallons (0.0296 liters)
 0.5 gallons (1.9 liters) = 64 ounces
 0.6 gallons (2.3 liters) = 76.8 ounces

Paths 1 and 2, Pumps and Controls for Hot Water Circulation Loops

Circulating systems must meet the following requirements.

1. Circulating pump may not operate continuously, on a timer control, or on a water temperature (aquastat) sensors. Gravity and thermo-syphon circulation systems are prohibited.
2. Circulating pump must be demand activated by a momentary contact switch, motion sensor, flow switch, door switch or voice command.
3. After the pump starts, the controls shall allow the pump to operate until the water temperature in the return pipe rises not more than 10°F (6 °C) above the initial temperature of the water in the pipe. Controls shall further limit the water temperature to a maximum of 105°F (40 °C). Controls shall limit pump operation to not more than 5 minutes per activation in the event that both means of shutting off the pump have failed.
4. Circulating hot water systems must be provided with an *automatic* or readily accessible *manual* switch to turn off the hot water circulating pump when not in use.

OR

Option 2. Performance Test (1 point)

Case 1. Hot water source is a water heater or boiler with no circulation loop or heat traced pipe; or in multifamily buildings a central circulation loop or heat traced pipe.

To minimize wasted water before hot water is delivered, using EPA WaterSense testing procedures, verify that no more than 0.5 gallons (1.9 liters) of water is stored in any piping between the hot water source and any fixture, and that no more than 0.6 gallons (2.3 liters) of water is collected from the hot water fixture before hot water is delivered. Heat traces are only allowed in situations to prevent freezing.

Projects that meet WaterSense Labeled New Homes requirements automatically achieve this credit.

Case 2. Hot water source is a circulation loop or heat traced pipe serving a single unit or house

To minimize wasted water before hot water is delivered, using EPA WaterSense testing procedures, verify that no more than 0.25 gallons (1 liter) of water can be collected from the hot water fixture furthest from the recirculation loop,

All heat traced piping must be insulated.

AND/OR

Option 3. Pipe Insulation (1 point)

Install at least R-4 insulation on all domestic hot water piping, including subslab pipes. Insulation on all piping elbows and tees must adequately insulate changes in direction.

Run buried piping in a slab or below grade through a protective, waterproof raceway, channel, sleeve, or path whose internal dimensions and changes of direction are large enough that the piping and insulation can be removed and replaced without damaging the piping's dimensional integrity.

The waterproof sleeve is not required for below-grade piping if the insulation manufacturer stipulates that the pipe insulation will maintain its insulating value in underground applications in damp soil when installed according to the manufacturer's instructions. This exception does not apply to piping that runs through or under building slabs.

EA CREDIT: HVAC START-UP CREDENTIALING**1 point****Intent**

To reduce energy consumption by ensuring that heating and cooling systems operate at peak efficiency.

Requirements

Have all heating, cooling, and ventilation systems commissioned by a technician with North American Technician Excellence certification, HVAC contractor credentialed by an EPA-recognized HVAC Quality Installation Training and Oversight Organization (H-QUITO) (or equivalent as defined by USGBC). The technician must complete the ENERGY STAR for Homes, version 3, HVAC system quality installation contractor checklist, or equivalent as defined by USGBC.

EA CREDIT: REFRIGERANT MANAGEMENT

1 point

Intent

To reduce stratospheric ozone depletion.

Requirements

Option 1. Refrigerant Selection

In all heating, ventilating, air-conditioning, and refrigeration (HVAC&R) systems, use refrigerants with a global warming potential equal to or less than that of R-410a (1890), and an ozone depletion potential of 0. The following refrigerants comply:

- Carbon Dioxide
- R-1233zd(E)
- R-1234yf
- R-1234ze(E)
- R-134a
- R-245fa
- R-32
- R-407C
- R-407F
- R-410A
- R-452B
- R-513A
- R-514A

Existing small HVAC&R units (defined as containing less than 0.5 pound (225 grams) of refrigerant) and other equipment, such as standard refrigerators, small water coolers, and any other equipment that contains less than 0.5 pound (225 grams) of refrigerant, are exempt.

To achieve this credit plus an exemplary performance credit, do not use refrigerants, or use only refrigerants (naturally occurring or synthetic) that have an ozone depletion potential (ODP) of zero and a global warming potential (GWP) of less than 50.

OR

Option 2. Calculation Approach

Select refrigerants that are used in heating, ventilating, air-conditioning, and refrigeration (HVAC&R) equipment to minimize or eliminate the emission of compounds that contribute to ozone depletion and climate change. The refrigerant charge may not exceed the maximum refrigerant charge noted for each type of system and refrigerant for all new and existing base building and tenant HVAC&R equipment; OR the weighted average ratio of refrigerant charge to maximum refrigerant charge for all new and existing HVAC&R must not exceed 1.00.

	Maximum Refrigerant Charge			
Refrigerant	Room or Window AC		Split or Unitary DX	
	IP units (lb/ton)	SI units (kg/kW)	IP units (lb/ton)	SI units (kg/kW)

R-123	1.60	0.20	1.80	0.23
R-134a	2.52	0.32	2.84	0.36
R-22	0.57	0.07	0.64	0.08
R-245fa	3.26	0.42	3.67	0.47
R-32	4.93	0.64	5.55	0.72
R-404A	0.85	0.11	0.96	0.12
R-407A	1.58	0.20	1.78	0.23
R-407C	1.96	0.25	2.20	0.28
R-407F	1.83	0.23	2.06	0.26
R-410A	1.76	0.22	1.98	0.25
R-434A	1.02	0.13	1.15	0.15
R-452B	4.93	0.64	5.55	0.72
R-507A	0.85	0.11	0.96	0.12
R-513A	5.81	0.75	6.54	0.85
Carbon dioxide	No Maximum	No Maximum	No Maximum	No Maximum
Propane	No Maximum	No Maximum	No Maximum	No Maximum
R-1233zd(E)	No Maximum	No Maximum	No Maximum	No Maximum
R-1234yf	No Maximum	No Maximum	No Maximum	No Maximum
R-1234ze(E)	No Maximum	No Maximum	No Maximum	No Maximum
R-514A	No Maximum	No Maximum	No Maximum	No Maximum

Equipment, such as standard refrigerators, small water coolers, and any other equipment that contains less than 0.5 pound (225 grams) of refrigerant, are exempt.

MATERIALS AND RESOURCES (MR)

MR PREREQUISITE: CERTIFIED TROPICAL WOOD

Intent

To encourage environmentally responsible forest management.

Requirements

All wood in the building must be nontropical, reused or reclaimed, or certified by the Forest Stewardship Council, or USGBC-approved equivalent.

For the purposes of this prerequisite, a tree species is considered *tropical* if it is grown in a location that lies between the Tropic of Cancer and the Tropic of Capricorn.

Projects located between the Tropic of Cancer and the Tropic of Capricorn are exempted from meeting this prerequisite.

MR PREREQUISITE: DURABILITY MANAGEMENT

Intent

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

Requirements

Meet the ENERGY STAR for Homes, version 3, water management system builder requirements (with the exceptions for existing homes listed in EA Prerequisite Minimum Energy Performance).

AND

Install all the applicable indoor moisture control measures listed in Table 1.

Table 1. Required interior moisture control measures

<i>Location or equipment</i>	<i>Required measure</i>
Area directly above bathtub, spa, or shower (extending to ceiling), exposed wall or area behind fiberglass enclosure if wallboard is installed	Use moisture-resistant backing materials such as cement board, fiber cement board or nonpaper-faced backer board. Materials that meet ASTM #D3273 are deemed equivalent. Projects using a one-piece fiberglass tub/shower enclosure are exempt from this requirement unless they are installing wallboard behind the enclosure.
Kitchen, bathroom, laundry room, spa area	Use water-resistant flooring; do not install carpet
Entryway within 3 feet (900 mm) of exterior door accessible from ground	Use water-resistant flooring; do not install carpet (carpet tiles are permitted)
Tank water heater in or over living space	Install drain and drain pan, drain pan and automatic water shut-off or flow restrictor, or floor drain with floor sloped to drain
Clothes washer in or over living space	Install a braided washer hose or one of the following: drain and drain pan; drain pan and automatic water shut-off or flow restrictor; or floor drain with floor sloped to drain
Conventional clothes dryer	Exhaust directly to outdoors
Plumbing systems for building and irrigation	After completion of construction, test to verify that there are no detectable water leaks

MR CREDIT: DURABILITY MANAGEMENT VERIFICATION
3 points**Intent**

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

Requirements**Option 1: Water Management System (1 point)**

Inspect and verify each measure listed in the ENERGY STAR for Homes, version 3, Water Management System Builder Requirements.

AND/OR

Option 2: Overhangs (1 point)

Each exterior door (and any side lights) is protected from precipitation by an overhang, porch roof or awning. The overhang must extend at least 2 feet beyond the exterior wall, and the width must extend at least one foot past the exterior door (and any side lights).

AND/OR

Option 3: Plumbing Condensation Control (1 point)

Install at least R-4 insulation on all domestic cold water piping in unconditioned spaces, or do not install cold water piping in unconditioned spaces.

MR CREDIT: ENVIRONMENTALLY PREFERABLE PRODUCTS

1-5 points

Intent

To increase demand for products or building components that minimize material consumption through recycled and recyclable content, reclamation, or overall reduced life-cycle impacts.

Requirements

Pursue any of the following options for a maximum of 5 points:

Option 1. Local Production (1-3 Points)

Use products that were extracted, processed, and manufactured locally for the following components.

Meet the thresholds in Table 1:

- framing;
- aggregate for concrete and foundation;
- drywall or interior sheathing.

Table 1: Percentage of component to meet local credit

Maximum distance from extraction, processing and manufacturing to project site:	% of building component required to meet criteria (1 point per component)
Locally: 100 miles (160 km)	50%

For renovation projects, existing components automatically meet the requirement for local production.

AND/OR

Option 2. Environmentally Preferable Products (1-5 Points)

Use products that meet one or more of the following criteria. At least 50% of each compliant building component (listed in Table 2), by weight or volume, must meet one of the requirements below. A single component that meets more than one criterion does not earn additional credit.

- The product contains at least 25% reclaimed material, including salvaged, refurbished, or reused materials. For renovation projects, existing components are considered reclaimed. Wood by-products can be counted as reclaimed material. These include items from secondary manufacturers; felled, diseased, or dead trees from urban or suburban areas; orchard trees that are unproductive and cut for replacement; and wood recovered from landfills or water bodies.
- The product contains at least 25% *postconsumer* or 50% *preconsumer* content.
- Wood products must be Forest Stewardship Council (FSC) Certified, or USGBC-approved equivalent.
- *Bio-based materials*. Bio-based products must meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials must be tested using ASTM Test Method D6866 and be legally harvested, as defined by the exporting and receiving country. Exclude hide products, such as leather and other animal skin material.
- Concrete that consists of at least 30% fly ash or slag used as a cement substitute and 50% recycled content or reclaimed aggregate OR 90% recycled content or reclaimed aggregate.
- *Extended producer responsibility*. Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility

Table 2. Maximum points for compliant building components

Component	Maximum points	
	50-89%	>90%
Floor covering*	1 point	2 points
Insulation**	1 point	2 points
Sheathing	1 point	2 points
Framing	1 point	2 points
Drywall, interior finish	1 point	2 points
Concrete: cement and / or aggregate	1 point	2 points
Roofing	1 point	2 points
Siding	1 point	2 points
Additional components • Doors (not including insulated doors or garage door) • Cabinets • Counters (kitchens and bathrooms) • Interior trim • Decking or patio material • Windows		1 point

* Floor areas with no floor covering ((i.e., exposed sealed concrete) automatically meet credit requirements

** Excluding HVAC and pipe insulation. Exterior rigid foam products may be omitted from credit calculations.

MR CREDIT: CONSTRUCTION WASTE MANAGEMENT**2 points****Intent**

To reduce construction waste generation and to reuse and recycle debris.

Requirements

Recycle and/or salvage nonhazardous construction and demolition materials. Calculations can be by weight or volume but must be consistent throughout.

Exclude excavated soil, land-clearing debris from calculations. Include materials destined for alternative daily cover (ADC) in the calculations as waste (not diversion). Include wood waste converted to fuel (bio-fuel) in the calculations; other types of waste-to-energy are not considered diversion for this credit.

However, for international projects that cannot meet credit requirements using reuse and recycling methods, waste-to-energy systems may be considered waste diversion if the European Commission Waste Framework Directive 2008/98/EC and Waste Incineration Directive 2000/76/EC are followed and Waste to Energy facilities meet applicable European Committee for Standardization (CEN) EN 303 standards.

Option 1. Diversion (1-2 points)**Path 1a. Divert 50% and Three Material Streams (1 point)**

Divert at least 50% of the total construction and demolition material; diverted materials must include at least three material streams.

OR

Path 1b. Divert 50% using Certified Commingled Recycling Facility and One More Material Stream (1 Point)

Divert at least 50% of the total construction and demolition material; diverted materials must include at least two material streams. All commingled recycling is required to be one of the streams and must be sent to offsite sorting facility (ies) certified by the Recycling Certification Institute or approved equivalent.

OR

Path 2a. Divert 75% and Four Material Streams (2 points)

Divert at least 75% of the total construction and demolition material; diverted materials must include at least four material streams.

OR

Path 2b. Divert 75% using Certified Commingled Recycling Facility and Two More Materials Streams (2 points)

Divert at least 75% of the total construction and demolition material; diverted materials must include at least three material streams. All commingled recycling is required to be one of the streams and

must be sent to offsite sorting facility (ies) certified by the Recycling Certification Institute or approved equivalent.

Option 2. Reduction of total waste material (2 points)

Reduce total construction waste or divert from landfills and incinerators a large proportion of the waste generated from new construction. Use the tables below to calculate the percentage of waste avoided or *recycled*. Exclude excavated soil, land-clearing debris from calculations. Include materials destined for alternative daily cover (ADC) in the calculations as waste (not diversion).

Table 1. Baseline waste for LEED reference home

<i>Bedrooms</i>	<i>Conditioned floor area (sf)</i>	<i>Waste (lbs)</i>
1	1,000	4,200
2	1,600	6,720
3	2,200	9,240
4	2,800	11,760
5	3,400	14,280
6	4,000	16,800
7	4,600	19,320
8 or more	—	Area (sf) * 4.2

Table 1a. Baseline waste for LEED reference home

<i>Bedrooms</i>	<i>Conditioned floor area (sq. m)</i>	<i>Waste (kg)</i>
1	93	1 905
2	148	3 048
3	204	4 191
4	260	5 334
5	315	6 477
6	371	7 620
7	427	8 763
8 or more	—	Area (sq. m) * 20.5

Calculate the waste generated by the project according to the following equation:

$$\text{Project construction waste} = \text{Total waste} - (\text{Recycled waste} * 0.25)$$

To convert volume to weight, assume 500 pounds per cubic yard (296 kg per cubic meter) of mixed construction waste, or use Table 2 to calculate the weights of specific waste products.

Table 2. Volume-to-weight conversion for construction and demolition debris

Material	LB/CY	TONS/CY	CY/TON	KG/cubic meter
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Aluminum (scrap, whole)	175	0.09	11.1	103.8
Asphalt	1,380	0.69	1.4	818.7
Brass (scrap)	906	0.45	2.2	537.5
Brick (common hard)	3,024	1.5	0.67	1794
Cardboard (uncompacted)	100	0.05	20	59.3
Carpet & Padding (loose)	84	0.04	25	50
Concrete	1,855	0.92	1.4	1100.5
Copper (scrap)	1,094	0.56	1.8	649
Dirt (loose, dry)	1,890	0.94	1.1	1121.2
Drywall	500	0.25	4	296.6
Glass (broken)	2,160	1.1	0.91	1281.4
Metal (scrap)	906	0.45	2.2	537.5
Mixed C&D Debris	900	0.45	2.2	533.9
Mixed Waste/Trash	350	0.17	5.9	207.6
Rock (loose)	2,570	1.28	0.78	1631.5
Roofing (wood shake, shingle)	435	0.22	4.5	258
Tree Limbs & Stumps	1,080	0.54	1.9	640.7
Wood (scrap, loose)	330	0.17	5.9	195.7
Yard Trimmings (mixed)	108	0.05	20	64

Construction & Demolition Debris Weight Conversion Table			
MATERIAL	LBS/CY	TONS/CY	CY/TON
Aluminum (scrap, whole)	175 lbs/cy	0.09 tons/cy	11.1 cy/ton
Asphalt	1,380 lbs/cy	0.69 tons/cy	1.4 cy/ton
Brass (scrap)	906 lbs/cy	0.45 tons/cy	2.2 cy/ton
Brick (common hard)	3,024 lbs/cy	1.50 tons/cy	0.67 cy/ton
Cardboard (uncompacted)	100 lbs/cy	0.05 tons/cy	20 cy/ton
Carpet & Padding (loose)	84.4 lbs/cy	0.04 tons/cy	25 cy/ton
Concrete	1,855 lbs/cy	0.92 tons/cy	1.4 cy/ton
Copper (scrap)	1,094 lbs/cy	0.56 tons/cy	1.8 cy/ton
Dirt (loose, dry)	1,890 lbs/cy	0.94 tons/cy	1.1 cy/ton
Drywall	500 lbs/cy	0.25 tons/cy	4 cy/ton
Glass (broken)	2,160 lbs/cy	1.10 tons/cy	0.91 cy/ton
Metal (scrap)	906 lbs/cy	0.45 tons/cy	2.2 cy/ton
Mixed C&D Debris	900 lbs/cy	0.45 tons/cy	2.2 cy/ton
Mixed Waste/Trash	350 lbs/cy	0.17 tons/cy	5.9 cy/ton
Rock (loose)	2,570 lbs/cy	1.28 tons/cy	0.78 cy/ton
Roofing (wood shake, shingle)	435 lbs/cy	0.22 tons/cy	4.5 cy/ton
Tree Limbs & Stumps	1,080 lbs/cy	0.54 tons/cy	1.9 cy/ton
Wood (scrap, loose)	330 lbs/cy	0.17 tons/cy	5.9 cy/ton
Yard Trimmings (mixed)	108 lbs/cy	0.05 tons/cy	20 cy/ton

Source: Contra Costa Waste Authority

Table 3. Points for reducing construction waste below baseline

Percentage reduction	Points
20%	1.0
40%	2.0

MR CREDIT: MATERIAL-EFFICIENT FRAMING
1-2 points**Intent**

To conserve resources by reducing the use of unnecessary framing materials.

Requirements

Implement any two of the following advanced framing techniques for at least 90% of each component, for a maximum of two points.

1. Implement one of the following optimum value engineering measures in exterior walls and common walls (1 point):
 - Install no more than one horizontal 2x top plate on walls by aligning studs with joists and roof rafters.
 - Place window and door headers in the rim joist.
 - Install raised (directly beneath the top plate), single-ply headers not more than 2 inches nominal thickness in a 2x4 wall or 4 inches nominal thickness in a 2x6 wall, in accordance with International Residential Code 2012.
 - Install structural insulated panels (SIPs) for walls.
2. Implement any two of the following for all interior and exterior walls (1 point):
 - Size headers for actual loads.
 - Use ladder blocking or drywall clips.
 - Use two-stud corners or California corners.
3. Space interior wall studs greater than 16 inches o.c. (400 mm o.c.) (1 point).
4. Space floor joists greater than 16 inches o.c. (400 mm o.c.) or SIPs (1 point).
5. Space roof rafters greater than 16 inches o.c. (400 mm o.c.) or SIPs (1 point).

For renovation projects, existing components may be excluded from the calculation.

Modular, panelized, or other prefabricated wall or structural systems must comply with the requirements.

INDOOR ENVIRONMENTAL QUALITY (EQ)

EQ PREREQUISITE: VENTILATION

Intent

To reduce moisture problems and occupants' exposure to indoor pollutants from kitchens, bathrooms and other sources by exhausting pollutants to outside and ventilating with outdoor air.

Requirements

Meet all of the following requirements for local exhaust and outdoor air ventilation including the requirements of ASHRAE 62.2 – 2016, sections 4, 5, 6 and 7 and Section 1503.4 of the 2009 International Residential Code (IRC), including:

1. **Local Exhaust.** Meet all the following requirements:

Design and install local mechanical exhaust systems in each kitchen and bathroom (including half-baths) that comply with Sections 5 and 7 of ASHRAE 62.2-2016 (with errata) or local equivalent, whichever is more stringent. Sample requirements that relate to minimum intermittent local exhaust flow rates are shown in Table 1.

Exhaust air to the outdoors. Do not route exhaust ducts to terminate in attics or interstitial spaces. Recirculating range hoods or recirculating over-the-range microwaves do not satisfy the kitchen exhaust requirements. For exhaust hood systems capable of exhausting in excess of 400 cubic feet per minute (188 liters per second), provide makeup air at a rate approximately equal to the exhaust air rate. Makeup air systems must have a means of closure and be automatically controlled to start and operate simultaneously with the exhaust system.

Use ENERGY STAR-labeled bathroom exhaust fans in all bathrooms (including half-baths) or performance equivalent for projects outside the U.S. A heat recovery ventilator (HRV) or energy recovery ventilator (ERV) may be used to exhaust single or multiple bathrooms if it has an efficacy level meeting the ENERGY STAR Technical Specifications for Residential Heat-Recovery Ventilators and Energy-Recovery Ventilators (H/ERVs) Version 2.0 as certified by the Home Ventilating Institute (HVI).

Sample requirements that relate to minimum intermittent local exhaust flow rates are shown in Table 1.

Table 1. Minimum air-flow requirements for intermittent local exhaust

	<i>Minimum air flow</i>
Kitchen	100 cfm (47 liters per second); vented range hood required if continuous exhaust fan flow rate is less than 5 kitchen air changes per hour
Bathroom, half-bath	50 cfm (23 liters per second)

AND

2. **Whole House Mechanical Ventilation.**

Design and install a dwelling-unit ventilation system that complies with Section 4, Section 6.7, and Section 6.8 of ASHRAE 62.2-2016 (with errata) or local equivalent, whichever is more stringent.

Whole house ventilation fans must be rated for sound at a maximum of 1.0 sone per ASHRAE 62.2-2016, Section 7.2.1. Remote mounted fans need not meet these sound requirements.

Dwelling unit ventilation systems are not required for projects that meet exception 1 or 2 in Section 4.1.1 of ASHRAE 62.2-2016 or projects that meet section 6.4 of ASHRAE 62.1-2016.

In addition, do not use systems that rely on transfer air from pressurized hallways or corridors, adjacent dwelling units, attics, etc.

Simplified minimum air-flow requirements are shown in Table 2. These values do not include the infiltration credit, which is limited to 2/3 of the total required ventilation rate.

Table 2a. Simplified minimum air-flow requirements (cfm) for continuous ventilation systems

Conditioned floor area (ft ²)	Bedrooms				
	0, 1	2, 3	4, 5	6, 7	
≤ 1,500	60	75	90	105	
1,501–3,000	105	120	135	150	
3,001–4,500	150	165	180	195	
4,501–6,000	195	210	225	240	
6,001–7,500	240	255	270	285	

Table 2b. Simplified minimum air-flow requirements (liters per second) for continuous ventilation systems

Conditioned floor area (m ²)	Bedrooms				
	0, 1	2, 3	4, 5	6, 7	
≤ 139	28	35	42	49	
140 – 279	49	56	63	70	
280 – 418	70	77	84	91	
419 – 557	91	98	105	112	
558 – 697	112	119	126	113	

Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite.

EQ PREREQUISITE: COMBUSTION VENTING**Intent**

To limit the leakage of combustion gases into the occupied space of the home.

Requirements

Do not install any unvented combustion appliances (ovens and ranges excluded).

Install a carbon monoxide (CO) monitor on each floor, hard-wired with a battery backup. CO monitors are required in all types of units, regardless of the type of equipment installed in the unit.

For all fireplaces and woodstoves inside the building, provide doors that close or a solid glass enclosure.

Space- and water-heating equipment that involves combustion must meet one of the following:

1. it must be designed and installed with closed combustion (i.e., sealed supply air and exhaust ducting);
2. it must be designed and installed with power-vented exhaust; or
3. it must be located in a detached utility building or open-air facility.

Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite.

EQ PREREQUISITE: GARAGE POLLUTANT PROTECTION**Intent**

To reduce occupants' exposure to indoor pollutants originating from an adjacent garage.

Requirements

Place all air-handling equipment and ductwork outside the fire-rated envelope of the garage. Ductwork that serves the garage itself, or elevator vestibules or storage areas that are directly attached to or inside the garage are exempt from this requirement, as are ducts that are positively pressurized that are run continuously.

Tightly seal shared surfaces between the garage and conditioned spaces, including all of the following:

- In conditioned spaces above the garage, seal all penetrations and all connecting floor and ceiling joist bays.
- In conditioned spaces next to the garage, weather-strip all doors, install carbon monoxide detectors in rooms that share a door with the garage, seal all penetrations, and seal all cracks at the base of the walls.

Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite.

EQ PREREQUISITE: RADON-RESISTANT CONSTRUCTION

Intent

To reduce occupants' exposure to radon gas and other soil gas contaminants.

Requirements

Case 1. New Construction

For projects in high-risk areas for radon, EPA radon zone 1 (or local equivalent for projects outside the United States), design and build with radon-resistant construction techniques, as prescribed by American Association of Radon Scientist and Technologists (AARST), Reducing Radon in New Construction of 1 & 2 Family (RRNC 2.0) or Soil Gas Control Systems in New Construction (CC-1000 2018); EPA Building Radon Out; NFPA 5000, Chapter 49; International Residential Code, Appendix F; CABO, Appendix F; or a local equivalent, whichever is more stringent. Follow all the requirements listed in Indoor airPLUS, 2.1:

- Provide a capillary break, installed according to Indoor airPLUS version 1 (rev. 04), section 1.2.
- Provide a minimum 3- or 4-inch (or approximately 80- or 100- millimeters) diameter gas-tight vertical vent pipe, clearly labeled as a component of a radon reduction system. The vent pipe must with no bends greater than 45 degrees, connected to an open T-fitting in the aggregate layer, extending up through the conditioned spaces and terminating at least 12 inches (300 millimeters) above the roof opening.
- Provide a radon fan or an electrical receptacle in an accessible attic location near the vent pipe to facilitate future fan installation if needed.

The requirements for radon protection are automatically satisfied if the building is elevated by at least 2 feet (600 millimeters), with open air space between the building and ground. An enclosed vented crawlspace does not qualify. A garage under a building is an acceptable alternative.

For mixed-use buildings, nonresidential space is exempted.

Case 2. Renovation of Existing Building

If the building is in EPA radon zone 1 (or local equivalent for projects outside the United States), and if no slab work is being performed (i.e., an existing slab is not being demolished, and no new slab floor is being built), test the building for radon. If the results are greater than 4 pCi/L, install an active ventilation system. If the results are less than 4 pCi/L, no radon-resistant construction techniques are required.

Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite.

Cities that have been proven to have an average radon concentration of 4 pCi/L (150 Bq/m³) or less through testing (with a minimum of 50 tests) are considered equivalent to EPA radon zone 2. Projects located in these cities are therefore are exempted from the radon requirements of this prerequisite.

EQ PREREQUISITE: AIR FILTERING**Intent**

To protect occupants' health by reducing particulate matter from the air supply system.

Requirements

Install air filters with a minimum efficiency reporting value (MERV) of 8 or higher on all recirculating space conditioning systems. Design ductwork and specify the central blower to account for the pressure drop across the filter. Air filter housings must be airtight to prevent bypass or leakage.

Nonducted systems are exempt from the minimum MERV 8 requirements but must have an internal air filter in the air-handling unit.

Install air filters rated MERV 6 or higher for mechanically supplied outdoor air for systems with 10 feet (3 meters) of ductwork or more, per ASHRAE 62.2–2016, Section 6.7.

Projects may use equivalent filtration media class of F5 or higher for MERV 8 and G4 or higher for MERV 6, as defined by CEN standard EN779—2002.

Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this prerequisite.

EQ PREREQUISITE: COMPARTMENTALIZATION**Intent**

To limit occupants' exposure to indoor air pollutants by minimizing the transfer of air between units.

Requirements**Attached Single-Family Projects Only**

Compartmentalize each residential unit to minimize leakage between units. Minimize uncontrolled pathways for environmental tobacco smoke and other indoor air pollutants between units by sealing penetrations in walls, ceilings, and floors and by sealing vertical chases (including utility chases, garbage chutes, mail drops, and elevator shafts) adjacent to the units.

Weather-strip all doors in the residential units leading to common hallways to minimize air leakage into the hallway. Weather-strip all exterior doors and operable windows to minimize leakage from outdoors.

Demonstrate a maximum leakage of 0.30 cubic feet per minute per square foot (1.53 liters per second per square meter) at 50 Pa of enclosure area (i.e., all surfaces enclosing the apartment, including exterior and party walls, floors, and ceilings).

Renovation projects that retain their existing envelope must meet an allowable maximum leakage of 0.50 cfm50 per square foot (2.54 liters per second per square meter) of enclosure area.

EQ CREDIT: ENHANCED VENTILATION
1-3 points**Intent**

To minimize moisture problems and occupants' exposure to indoor pollutants through enhanced exhaust and ventilation systems.

Requirements

Pursue any of the following options for a maximum of 3 points:

Option 1. Enhanced Local Exhaust (1 point)

Use one of the following strategies in every bathroom with a shower, bathtub, or spa (i.e., half-baths are exempt) to control the use of the local exhaust fan:

- an occupancy sensor;
- an automatic humidistat controller;
- a continuously operating exhaust fan; or
- a delay timer that operates the fan for at least 20 minutes.

AND/OR

Option 2. Enhanced Whole-House Ventilation (2 points)

Install a balanced whole-house ventilation system (not just exhaust only or supply only) that meets the minimum ventilation requirements of ASHRAE Standard 62.2–2016, Section 4, or local equivalent, whichever is more stringent.

AND/OR

Option 3. Humidity Control (1 point)

Install dehumidification controls for the whole-house ventilation system.

EQ CREDIT: CONTAMINANT CONTROL

1-3 points

Intent

To reduce occupants' exposure to indoor airborne contaminants through source control and removal.

Requirements

Pursue any of the following options for a maximum of 3 points:

Option 1. Walk-off Mats (1 point)

At each *primary entryway* from the outdoors, design and install a permanent walk-off mat that is at least 4 feet (1.2 meters) long and allows access for cleaning (e.g., grating with catch basin). Permanent walk-off mats are required only for primary exterior entryways, but nonpermanent walk-off mats are strongly recommended for other entryways.

Acceptable entryway systems include permanently installed grates, grilles, and slotted surfaces that allow for cleaning underneath. Roll-out mats are acceptable only if maintained on a weekly basis by a contracted service organization.

AND/OR

Option 2. Shoe Removal and Storage (1 point)

Design a shoe removal and storage space near the primary entryway, separated from living areas. This space must be a permanent architectural feature and it must be large enough to accommodate a bench and at least two pairs of shoes per bedroom and must not have conventional carpet. Carpet tile is acceptable if it's specifically designed for entryway systems or similar use, including performance attributes equivalent to other acceptable entryway systems.

AND/OR

Option 3. Preoccupancy Flush (1 points)

At installation, seal all permanent ducts and vents to minimize contamination from construction. Remove seals after all phases of construction are completed.

After construction ends and before occupancy, flush the home with fresh air, according to the following guidelines:

- Remove any dust and debris from ducts.
- Flush the entire home for 48 hours, keeping all windows and interior doors open; the 48 hours may be nonconsecutive if necessary.
- Keep all windows open and run a fan (e.g., HVAC system fan) continuously, or flush the home with all HVAC fans and exhaust fans operating continuously at the highest flow rate.

Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of Option 3.

AND/OR

Option 4. Exhaust Fan in Laundry Room, Utility Room or Garage (1 point)

Meet one of the following:

Case 1. Garage Exhaust

Install in the garage an exhaust fan that is rated at least 75 cfm (35 liters per second) and meets ENERGY STAR cfm/w performance requirements.

The fan must vent directly to the outdoors and have an automatic timer control linked to an occupant sensor, a light switch, a garage door opening-closing mechanism, a carbon monoxide sensor that turns on the fan when ambient CO levels reach 35 ppm, or equivalent. The timer must be set to provide at least three air changes each time the fan is turned on.

OR

Case 2. No attached garage

Select one of the following strategies:

- Do not construct a garage.
- Install a detached garage, defined as a structure that does not share a wall with the home.
- Install a carport, defined as an open-air space with one complete wall, which may be shared with the home.

OR

Case 3. Utility room exhaust

Install in the laundry or utility room an exhaust fan that meets ENERGY STAR cfm/w performance requirements. The fan must vent directly to the outdoors, and be sized to provide at least three air changes per hour in the utility room.

Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of Case 1.

AND/OR

Option 5. Filtration (1 point)

Install air filters with a minimum efficiency reporting value (MERV) of 10 or higher on all recirculating space conditioning systems. Design ductwork and specify the central blower to account for the pressure drop across the filter. Air filter housings must be airtight to prevent bypass or leakage.

AND/OR

Option 6. Enhanced Combustion Venting Measures (1 point)

For any wood- or pellet-burning stoves, install equipment that is EPA certified. For wood-burning fireplaces, install equipment that is EPA qualified. Provide power or direct venting.

For any natural gas, propane, or alcohol stoves, install equipment listed by an approved safety testing facility. The stove must have a permanently fixed glass front or gasketed door and an electronic pilot. Provide power or direct venting.

OR

Do not install any fireplaces or woodstoves.

Projects that earn the EPA Indoor airPLUS label automatically meet the requirements of this option.

EQ CREDIT: BALANCING OF HEATING AND COOLING DISTRIBUTION SYSTEMS

6 points

Intent

To improve thermal comfort and energy performance by ensuring appropriate distribution of space heating and cooling in the home.

Requirements

Pursue any of the following options for a maximum of 6 points:

Option 1. Multiple Zones (1 point)

Install a system with at least two space-conditioning zones with independent thermostatic controls. In houses with both a heating system and a cooling system, each must have at least two zones. Single-family houses with less than 800 square feet (74 square meters) of conditioned floor area and multifamily buildings whose average unit size is less than 1,200 square feet (110 square meters) automatically meet the requirements of this credit.

AND/OR

Option 2. Supply Air-Flow Testing (1 point)

Have the measured space heating and cooling system fan airflow tested to confirm it is either within 10% of the installer's measured fan airflow, or within 15% of design HVAC fan airflow.

Test multirate or multispeed HVAC systems at the rate for which they were designed. Supply air-flow requirements must meet the higher of the cooling or heating designed air flow for each room.

Ductless systems qualify for this credit.

For radiative systems, design the HVAC system with room-by-room thermostatic controls, such as flow-control valves on every radiator.

For an exemplary performance point, have the total supply air-flow rates in each room tested using a flow hood with doors closed, or another acceptable method, per RESNET or ACCA Quality Installation Specifications. Supply air-flow rates must be within +/- 20% (or +/- 25 cfm or 11 lps) of calculated values from ACCA Manual J.

AND/OR

Option 3. Pressure Balancing (1 point)

For each bedroom, demonstrate a pressure difference of no more than 3 Pa (0.012 inch w.c.) with respect to the main body of the house when doors are closed and the air handler is operating on highest speed.

As an alternative to the 3 Pa limit, a pressure differential ≤ 5 Pa is permitted to be used for bedrooms with a design airflow ≥ 150 CFM

For an HVAC system with a multi-speed fan, the highest design fan speed shall be used when verifying this requirement

AND/OR

Option 4. Moisture load control (1 point).

Install dehumidification equipment with sufficient latent capacity to maintain relative humidity at or below 60%. This must be achieved through one of the following:

1. Additional dehumidification system(s).
2. A central HVAC system equipped with additional controls to operate in dehumidification mode.

AND/OR

Option 5. Remote Access Thermostat (1 point)

Install a remote access thermostat for all space heating and cooling systems. Thermostat must allow occupants the ability to control the system remotely.

For an Exemplary Performance point, install an ENERGY STAR qualified smart thermostat.

AND/OR

Option 6. Multistage Equipment (2 points)

All installed space heating and cooling systems must qualify to earn this credit.

Case 1. Two stage equipment. (1 point)

Install space heating and cooling systems that have at least 2 speeds.

OR

Case 2. Multi-stage equipment (2 points)

Install variable stage space heating and cooling systems that have more than 2 speeds.

AND/OR

Option 7. Static Pressure Test (1 point)

Demonstrate external static pressure no greater than 0.1 IWC compared to the design total external static pressure, tested at contractor-provided test locations.

Non-ducted and radiative systems automatically meet credit requirements.

AND/OR

Option 8. Quiet Heating and Cooling Systems (1 point)

Install quiet space heating and cooling and whole-house ventilation systems. In each room, achieve maximum background noise levels from heating and cooling systems to ensure they are at or below the following thresholds:

35 dBA for living areas

45 dBA for kitchens and baths

Measurements shall be taken at roughly 6 feet off the floor, from the center of each room. Systems with multiple speeds may be tested at the lowest fan speed.

EQ CREDIT: LOW-EMITTING PRODUCTS**4 points****Intent**

To reduce occupants' exposure to airborne chemical contaminants through product selection.

Requirements

Use materials on the building interior (everything within the waterproofing membrane) that meet the low-emitting criteria below. At least 50% of a component must meet the requirements to earn 1 point, or 90% for 2 points.

Paints and Coatings

Paint and coating must meet the *VOC emissions evaluation* AND the *VOC content evaluation*.

The paints and coatings product category includes all interior paints and coatings applied on site.

Adhesives and Sealants

Adhesives and sealants must meet the *VOC emissions evaluation* AND the *VOC content evaluation*.

The adhesives and sealants product category includes all interior adhesives and sealants applied on site.

Flooring

Flooring must meet the *VOC emissions evaluation* OR *inherently nonemitting sources criteria*, OR *salvaged and reused materials criteria*.

The flooring product category includes all types of hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), wall base, underlayments, and other floor coverings.

Subflooring is excluded.

Insulation

Insulation must meet the *VOC emissions evaluation*.

The insulation material category includes all thermal and acoustic boards, batts, rolls, blankets, sound attenuation fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation.

Insulation for HVAC ducts and plumbing piping excluded, as is exterior insulation.

Low-emitting criteria**Inherently nonemitting sources**

Products is an inherently nonemitting source of VOCs (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood) and has no integral organic-based surface coatings, binders, or sealants.

Salvaged and reused materials

Product is more than one year old at the time of use. If finishes are applied to the product on-site, the finishes must meet the *VOC emissions evaluation* AND *VOC content evaluation* requirements.

VOC emissions evaluation

Option 1. Product has been tested according to California Department of Public Health (CDPH) Standard Method v1.2–2017 and complies with the VOC limits in Table 4-1 of the method. Use the Appendix B, New Single-Family Residence Scenario or the default private office scenario. Additionally, the range of total VOCs after 14 days (336 hours) was measured as specified in the CDPH Standard Method v1.2 and is reported (TVOC ranges: 0.5 mg/m³ or less, between 0.5 and 5 mg/m³, or 5 mg/m³ or more). Laboratories that conduct the tests must be accredited under ISO/IEC 17025 for the test methods they use.

The statement of product compliance must include the exposure scenario used, the amount of wet-applied product applied in mass per surface area (if applicable), and follow guidelines in CDPH Standard Method v1.2-2017, Section 8. Organizations that certify manufacturers' claims must be accredited under ISO Guide 17065.

Option 2. Product has been tested according to CEN TS 16516 and complies with the LCI values from Table 1 of the German AqBB Testing and Evaluation Scheme (2015) and a formaldehyde limit of 10 micrograms per cubic meter. Additionally, the range of total VOCs after 28 days was measured as specified in EN 16516 and reported (TVOC ranges: 0.5 mg/m³ or less, between 0.5 and 5 mg/m³, or 5 mg/m³ or more). Laboratories that conduct the tests must be accredited under ISO/IEC 17025 for the test methods they use.

The statement of product compliance must include the amount of wet-applied product applied in mass per surface area (if applicable) and the range of total VOCs. Organizations that certify manufacturers' claims must be accredited under ISO Guide 17065.

VOC content evaluation

Product meets the VOC content limits outlined in one of the applicable standards and for projects in North America, methylene chloride and perchloroethylene may not be intentionally added.

Statement of product compliance must be made by the manufacturer. Any testing must follow the test method specified in the applicable regulation. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.

- Paints and coatings:
 - o California Air Resource Board (CARB) 2007 Suggested Control Measure (SCM) for Architectural Coatings
 - o South Coast Air Quality Management District (SCAQMD) Rule 1113, effective February 5, 2016
 - o European Decopaint Directive (2004/42/EC)

- o Hong Kong Air pollution control (VOC) Regulation for regulated architectural paints (January 2010)
- Adhesives and sealants:
 - o SCAQMD Rule 1168, October 6, 2017
 - o Canadian VOC Concentration Limits for Architectural Coatings (SOR/2009-264)
 - o Hong Kong Air Pollution Control (VOC) Regulation for regulated adhesives and regulated sealants (April 2012)
 - o Free of solvents, as defined in TRGS 610 (January 2011)

Formaldehyde Emissions Evaluation

Product meets one of the following:

- EPA TSCA Title VI or California Air Resources Board (CARB) ATCM for formaldehyde requirements for ultra-low-emitting formaldehyde (ULEF) resins or
- EPA TSCA Title VI or CARB ATCM formaldehyde requirements for no added formaldehyde resins (NAF).
- Tested per EN 717-1:2014 for formaldehyde emissions and complies with emissions class E1. Structural composite wood product made with moisture resistant adhesives meeting ASTM 2559, no surface treatments with added urea-formaldehyde resins or coatings, and certified according to one of the following industry standards:
 - o Plywood: compliant in accordance with *Voluntary Product Standard - Structural Plywood (PS 1-09)*, *Voluntary Product Standard – Performance Standard for Wood-Based Structural-Use Panels (PS 2-10)*, or one of the standards considered by CARB to be equivalent to PS 1 or PS 2: (AS/NZS 2269, EN 636 3S (including CE label), Canadian Standards Association CSA O121 for Douglas fir plywood, CSA O151 for Canadian softwood plywood, for CSA O153 Poplar plywood, or CSAO325 for Construction sheathing)
 - o Oriented strand board: specified with the Exposure 1 or Exterior bond classification in accordance with *Voluntary Product Standard – Performance Standard for Wood-Based Structural-Use Panels (PS 2-10)*
 - o Structural composite lumber: compliant in accordance with *Standard Specification for Evaluation of Structural Composite Lumber Products (ASTM D 5456-13)*
 - o Glued laminated timber: compliant in accordance with *Structural Glued Laminated Timber (ANSI A190.1-2012)*
 - o I-joists compliant in accordance with *Standard Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists (ASTM D 5055-13)*
 - o Cross-laminated timber: compliant in accordance with *Standard for Performance-Rated Cross-Laminated Timber (PRG 320-15)*
 - o Finger-jointed lumber labeled “Heat Resistant Adhesive (HRA)” in accordance with the *American Softwood Lumber Standard (DOC PS-20 2015)*

INNOVATION (IN)

IN PREREQUISITE: PRELIMINARY RATING

Intent

To maximize opportunities for integrative, cost-effective adoption of green design and construction strategies.

Requirements

As early as practicable, conduct a preliminary LEED for Homes meeting. As part of the meeting, create an action plan that identifies the following:

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

IN CREDIT: INNOVATION
1-5 points

Intent

To encourage exceptional performance for current credits and promote innovative performance in pioneering areas.

Requirements

To achieve all five innovation points, a project team must achieve at least one pilot credit, at least one innovation credit and no more than two exemplary performance credits.

Option 1. Innovation (1 point)

Achieve significant, measurable environmental performance using a strategy not addressed in the LEED Green Building Rating System.

Identify the following in writing:

- the intent of the proposed innovation credit;
- the proposed requirement for compliance;
- the proposed submittals to demonstrate compliance; and
- the design approach (strategies) used to meet the requirements.

AND/OR

Option 2. Pilot (1 point)

Attempt and achieve one pilot credit from the USGBC's LEED Pilot Credit Library.

AND/OR

Option 3. Additional Strategies (1–3 points)

- Innovation (1–3 points)
Defined in Option 1 above.
- Pilot (1–3 points)
Defined in Option 2 above.
- Exemplary Performance (1–2 points)
Achieve exemplary performance in an existing LEED v4 prerequisite or credit that allows exemplary performance, as specified in the LEED Reference Guide, v4 edition. An exemplary performance point is typically earned for achieving double the credit requirements and/or achieving the next incremental percentage threshold of an existing credit.

IN CREDIT: LEED ACCREDITED PROFESSIONAL
1 point

Intent

To encourage the project team integration required by a LEED project and to streamline the application and certification process.

Requirements

At least one principal participant of the project team must be a LEED Accredited Professional (AP) with a specialty appropriate for the project.

REGIONAL PRIORITY (RP)

RP CREDIT: REGIONAL PRIORITY

4 points

Intent

To address geographically specific environmental, social equity, and public health priorities.

Requirements

Six Regional Priority credits have been identified by the USGBC regional councils and chapters as having special importance for the project's region. A database of these credits and their geographic applicability is available on the USGBC website, at <http://www.usgbc.org>.

One point is awarded for each Regional Priority credit achieved, up to a maximum of four.

Alternative regional priority credits can be used if justification is provided.