



# 2011 ENTERPRISE GREEN COMMUNITIES CRITERIA

INTEGRATIVE DESIGN.  
LOCATION + NEIGHBOR  
HOOD FABRIC. ENERGY  
EFFICIENCY. MATERIALS  
BENEFICIAL TO THE ENVI  
RONMENT. WATER CONS  
ERVATION. SITE IMPROVE  
MENTS. HEALTHY LIVING  
ENVIRONMENT. OPERA  
TIONS + MAINTENANCE.

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## Introduction

Enterprise Green Communities is transforming the way America thinks about, designs, builds, and rehabilitates affordable housing. Green building integrates materials and methods that promote environmental quality, economic vitality, and social benefits through design, construction, and operation of the built environment. Enterprise Green Communities aligns affordable housing investment strategies with environmentally responsive building practices.

As a community of affordable housing providers, we have an opportunity to advance green building strategies that significantly reduce the impact on water quality, air pollution, and global warming, and the depletion of natural resources, while simultaneously lowering operating costs and maintenance needs. Adopting green building practices will contribute to the physical health and well-being of individuals and communities.

### HOW TO USE THIS DOCUMENT

The Enterprise Green Communities Criteria were developed collaboratively by a number of leading national organizations and experts for the purpose of providing a clear, cost-effective framework for all affordable housing development types, including New Construction and Rehabilitation in both multifamily and single-family projects.

The 2011 Enterprise Green Communities Criteria are grouped into the following eight categories:

1. Integrative Design
2. Location + Neighborhood Fabric
3. Site Improvements
4. Water Conservation
5. Energy Efficiency
6. Materials Beneficial to the Environment
7. Healthy Living Environment
8. Operations + Maintenance

All measures for all project types (**single-family**, **low-rise multifamily**, and **mid-/high-rise multifamily**) and construction types (**New Construction**, **Moderate Rehab**, and **Substantial Rehab**) are located within this set of criteria. Exemptions based on location or project or construction type are identified within each criterion as appropriate.

### DEFINITIONS OF CONSTRUCTION TYPE

A **Substantial Rehab** (or Gut Rehab) is defined as a project that includes the replacement and/or improvement of all the major systems of the building, including its envelope. The building envelope is defined as the air barrier and thermal barrier separating exterior from interior space. For Substantial Rehab projects, this could include either removing materials down to the studs or structural masonry on one side of the exterior walls and subsequently improving the building envelope to meet the whole-building energy performance levels for the project type, or creating a new thermal and air barrier around the building that allows the project to achieve Enterprise Green Communities Criteria whole-building energy performance levels for the project type.

A **Moderate Rehab** is defined as a project that does not include major systems or building envelope work as described for a Substantial Rehab. Moderate Rehab projects must meet the mandatory

measures applicable to this construction type and achieve a requisite number of optional points based on the project's scope.

Due to constraints inherent with Rehab projects, Substantial and Moderate Rehab projects are not required to complete the ENERGY STAR requirements and instead must comply with the guidelines under Criteria 5.1c and 5.1d.

### CERTIFICATION

Enterprise Green Communities offers an online process for certifying green affordable housing developments that meet the Criteria. The process is available for any affordable housing project that meets the eligibility parameters outlined on the Certification website:

[www.greencommunitiesonline.org/tools/certification/](http://www.greencommunitiesonline.org/tools/certification/)

**To achieve Enterprise Green Communities Certification, all projects must achieve compliance with the Criteria mandatory measures applicable to that construction type. Additionally, New Construction projects must achieve 35 optional points, Substantial Rehab projects must achieve 30 optional points, and Moderate Rehab projects must also achieve 30 optional points.**

Enterprise Green Communities Certification is a two-step process, with Step 1 occurring during the design phase and Step 2 occurring after the construction end date. In the first step, projects are required to submit an online certification request form and upload related documentation. These documents include a project overview, a project site plan, a context map, the energy modeling form, and the intended methods of meeting the Criteria. All documents must be submitted before the expected construction start date. Upon submission, Enterprise Green Communities conducts a review of the materials and provides feedback to the project team as necessary.

Step 2 of certification requires the project team to complete the final certification form online within 60 days of construction completion and to submit the following additional documentation: compliance report, utility release form, ENERGY STAR certificate, cost development form, and project photos. Following Step 2, Enterprise Green Communities conducts a final review and determines whether the project can be certified under the Criteria.

More information on the Enterprise Green Communities Certification process is available in Appendix A of this document.

### WEBLINKS

Enterprise Green Communities Criteria website:  
[www.greencommunitiesonline.org/tools/criteria/](http://www.greencommunitiesonline.org/tools/criteria/)

Mailbox to email questions on the 2011 Criteria:  
[greencommunities@enterprisecommunity.org](mailto:greencommunities@enterprisecommunity.org)

Enterprise Green Communities Online Discussion Forum:  
[forum.greencommunitiesonline.org/](http://forum.greencommunitiesonline.org/)

Enterprise Green Communities Certification website:  
[www.greencommunitiesonline.org/tools/certification/](http://www.greencommunitiesonline.org/tools/certification/)

Mailbox to email questions on Enterprise Green Communities Certification:  
[certification@enterprisecommunity.org](mailto:certification@enterprisecommunity.org)



M = MANDATORY  
# = AVAILABLE OPTIONAL POINTS

## 2011 Enterprise Green Communities Criteria Checklist

This checklist provides an overview of the technical requirements within the Enterprise Green Communities Criteria. **To achieve Enterprise Green Communities Certification, all projects must achieve compliance with the Criteria mandatory measures applicable to that construction type. Additionally, New Construction projects must achieve 35 optional points, Substantial Rehab projects must achieve 30 optional points, and Moderate Rehab projects must also achieve 30 optional points.**

### 1: INTEGRATIVE DESIGN

YES  NO  MAYBE

M

#### 1.1a Green Development Plan: Integrative Design Meeting(s)

Conduct one or more integrative design meetings and submit a Green Development Plan or equivalent documentation.

YES  NO  MAYBE

M

#### 1.1b Green Development Plan: Criteria Documentation

Create design and construction documentation to include information on implementation of appropriate Enterprise Green Communities Criteria.

YES  NO  MAYBE

2

#### 1.2a Universal Design *(New Construction only)*

Design a minimum of 15% of the dwelling units (no fewer than one) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines.

YES  NO  MAYBE

2 or 3

#### 1.2b Universal Design *(Substantial and Moderate Rehab only)*

Design a minimum of 10% of the dwelling units (no fewer than one) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines [2 points] and, for an additional point, the remainder of the ground-floor units and elevator-reachable units should have accessible unit entrances.

SUBTOTAL OPTIONAL POINTS

### 2: LOCATION + NEIGHBORHOOD FABRIC

YES  NO  MAYBE

M

#### 2.1 Sensitive Site Protection *(New Construction only)*

Do not locate new development, including buildings, built structures, roads, or other parking areas, on portions of sites that meet any of the following provisions:

- Land within 100 feet of wetlands, including isolated wetlands or streams
- Land on slope greater than 15%
- Land with prime soils, unique soils, or soils of state significance
- Public parkland
- Land that is specifically identified as habitat for any species on federal or state threatened or endangered lists
- Land with elevation at or below the 100-year floodplain

YES  NO  MAYBE

M

#### 2.2 Connections to Existing Development and Infrastructure *(New Construction only, except for projects located on rural tribal lands, in colonias communities, or in communities of population less than 10,000)*

Locate project on a site with access to existing roads, water, sewers, and other infrastructure within or contiguous to existing development. Connect the project to the pedestrian grid.





M = MANDATORY  
# = AVAILABLE OPTIONAL POINTS

**LOCATION + NEIGHBORHOOD FABRIC (CONTINUED)**

YES  NO  MAYBE

M

**2.3 Compact Development** *(New Construction only)*

Design and build the project to a density of at least:

- *Urban/Small Cities:* 10 dwelling units per acre, or at least 75% of surrounding net residential density, whichever is greater
- *Suburban/Mid-Size Towns:* 7 dwelling units per acre, or at least 75% of surrounding net residential density, whichever is greater
- *Rural/Tribal/Small Towns:* 5 units per acre for detached or semi-detached housing; 10 units per acre for townhomes; 15 units per acre for apartments

YES  NO  MAYBE

5 or 6

**2.4 Compact Development**

Design and build the project to a density of at least:

- *Urban/Small Cities:* 15 dwelling units per acre, or at least 75% of surrounding net residential density, whichever is greater [5 points]
- *Suburban/Mid-Size Towns:* 10 dwelling units per acre, or at least 75% of surrounding net residential density, whichever is greater [6 points]
- *Rural/Tribal/Small Towns:* 7.5 units per acre for detached or semi-detached housing; 12 units per acre for townhomes; 20 units per acre for apartments [6 points]

YES  NO  MAYBE

M

**2.5 Proximity to Services** *(New Construction only)*

Locate the project within:

- *Urban/Small Cities:* a 0.25-mile walk distance of at least two **OR** a 0.5-mile walk distance of at least four of the list of facilities
- *Suburban/Mid-Size Towns:* a 0.5-mile walk distance of at least three **OR** a 1-mile walk distance of at least six of the list of facilities
- *Rural/Tribal/Small Towns:* two miles of at least two of the list of facilities

YES  NO  MAYBE

M

**2.6 Preservation of and Access to Open Space: Rural/Tribal/Small Towns Only** *(New Construction only)*

Set aside a minimum of 10% of the total project acreage as open space for use by residents **OR** locate project within a 0.25-mile walk distance of dedicated public open space that is a minimum of 0.75 acres

YES  NO  MAYBE

3  
max

**2.7 Preservation of and Access to Open Space**

Set aside a percentage of the total project acreage as open space for use by residents: 20% [1 point]; 30% [2 points]; and 40% + written statement of preservation/conservation policy for set-aside land [3 points]

YES  NO  MAYBE

5

**2.8 Access to Public Transportation**

Locate the project within:

- *Urban/Small Cities:* a 0.5-mile walk distance of combined transit services (bus, rail, and ferry) constituting 76 or more transit rides per weekday and 32 or more transit rides on the weekend
- *Suburban/Mid-Size Towns:* a 0.5-mile walk distance of combined transit services (bus, rail, and ferry) constituting 60 or more transit rides per weekday and some type of weekend ride option
- *Rural/Tribal/Small Towns:* 5-mile distance of either a vehicle share program, a dial-a-ride program, an employer van pool, or public-private regional transportation

YES  NO  MAYBE

5

**2.9 Walkable Neighborhoods: Connections to Surrounding Neighborhood—Rural/Tribal/Small Towns**

Connect the project to public spaces, open spaces, and adjacent development by providing at least three separate connections from the project to sidewalks or pathways in surrounding neighborhoods and natural areas.



M = MANDATORY  
# = AVAILABLE OPTIONAL POINTS

**LOCATION + NEIGHBORHOOD FABRIC (CONTINUED)**

YES  NO  MAYBE

**7**  
**max**

**2.10 Smart Site Location: Passive Solar Heating/Cooling**

Demonstrate a building with a passive solar design, orientation, and shading that meet specified guidelines. *Select one:*

- Single building—New Construction [7 points]
- Multiple buildings—New Construction [7 points]
- Moderate or Substantial Rehab [7 points]

YES  NO  MAYBE

**2**

**2.11 Brownfield or Adaptive Reuse Site**

Locate the project on a brownfield or adaptive reuse site. *Select either:* adaptive reuse site [2 points] or brownfield remediation [2 points]

YES  NO  MAYBE

**6**

**2.12 Access to Fresh, Local Foods**

Pursue one of three options to provide residents and staff with access to fresh, local foods, including neighborhood farms and gardens; community-supported agriculture; proximity to farmers market.

YES  NO  MAYBE

**4**

**2.13 LEED for Neighborhood Development Certification**

Locate the project in a Stage 2 Pre-Certified LEED for Neighborhood Development plan or a Stage 3 LEED for Neighborhood Development Certified Neighborhood Development.

SUBTOTAL OPTIONAL POINTS

**3: SITE IMPROVEMENTS**

YES  NO  MAYBE

**M**

**3.1 Environmental Remediation**

Conduct an environmental site assessment to determine whether any hazardous materials are present on site.

YES  NO  MAYBE

**M**

**3.2 Erosion and Sedimentation Control** *(Except for infill sites with buildable area smaller than one acre)*

Implement EPA's Best Management Practices for erosion and sedimentation control during construction.

YES  NO  MAYBE

**M**

**3.3 Low-Impact Development** *(New Construction only)*

Projects located on greenfields must meet the list of low-impact development criteria.

YES  NO  MAYBE

**M**

**3.4 Landscaping**

Provide new plants (including trees, shrubs, and ground cover) such that at least 50% of area available for landscaping is planted with native or adaptive species, all new plants are appropriate to the site's soil and microclimate, and none of the new plants is an invasive species.

YES  NO  MAYBE

**M**

**3.5 Efficient Irrigation and Water Reuse**

If irrigation is utilized, install an efficient irrigation or water reuse system.

YES  NO  MAYBE

**2 or 6**

**3.6 Surface Stormwater Management**

Retain, infiltrate, and/or harvest stormwater on site. *Select only one:* partial stormwater retention [2 points] or full stormwater retention [6 points]

SUBTOTAL OPTIONAL POINTS



M = MANDATORY  
# = AVAILABLE OPTIONAL POINTS

**4: WATER CONSERVATION**

YES  NO  MAYBE

M

**4.1 Water-Conserving Fixtures**

Install or retrofit water-conserving fixtures in all units and any common facilities with the following specifications: Toilets—1.28 gpf; Urinals—0.5 gpf; Showerheads—2.0 gpm; Kitchen faucets—2.0 gpm; Bathroom faucets—1.5 gpm

YES  NO  MAYBE

6  
max

**4.2 Advanced Water-Conserving Appliances and Fixtures**

Install or retrofit water-conserving fixtures in all units and any common facilities with the following specifications: Toilets—1.2 gpf; Showerheads—1.5 gpm; Kitchen faucets—1.5 gpm; Bathroom faucets—0.5 gpm. *Select any, or all, of the options:*

- Toilets [2 points]
- Showerheads [2 points]
- Faucets—kitchen and bathroom [2 points]

YES  NO  MAYBE

4  
max

**4.3 Water Reuse**

Harvest, treat, and reuse rainwater and/or greywater to meet a portion of the project’s water needs.

- 10% reuse [1 point]
- 20% reuse [2 points]
- 30% reuse [3 points]
- 40% reuse [4 points]

SUBTOTAL OPTIONAL POINTS

**5: ENERGY EFFICIENCY**

YES  NO  MAYBE

M

**5.1a Building Performance Standard: Single family and Multifamily (three stories or fewer)**  
*(New Construction only)*

Certify the project under ENERGY STAR New Homes.

YES  NO  MAYBE

M

**5.1b Building Performance Standard: Multifamily (four stories or more)**  
*(New Construction only)*

Demonstrate compliance with EPA’s Multifamily High-Rise program (MFHR) using either the prescriptive or the performance pathway.

YES  NO  MAYBE

M

**5.1c Building Performance Standard: Single family and Multifamily (three stories or fewer)**  
*(Substantial and Moderate Rehab only)*

Demonstrate that the final energy performance of the building is equivalent to a Home Energy Rating System (HERS) Index of 85.

YES  NO  MAYBE

M

**5.1d Building Performance Standard: Multifamily (four stories or more)**  
*(Substantial and Moderate Rehab only)*

Demonstrate that the final energy performance of the building is equivalent to ASHRAE 90.1-2007.

YES  NO  MAYBE

15  
max

**5.2 Additional Reductions in Energy Use**

Improve whole-building energy performance by percentage increment above baseline building performance standard for additional points.

YES  NO  MAYBE

M

**5.3 Sizing of Heating and Cooling Equipment**

Size heating and cooling equipment in accordance with the Air Conditioning Contractors of America (ACCA) Manuals, Parts J and S, or ASHRAE handbooks.

YES  NO  MAYBE

M

**5.4 ENERGY STAR Appliances**

If providing appliances, install ENERGY STAR–labeled clothes washers, dishwashers, and refrigerators.



M = MANDATORY  
# = AVAILABLE OPTIONAL POINTS

**ENERGY EFFICIENCY (CONTINUED)**

<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>5.5a Efficient Lighting: Interior Units</b> Follow the guidance appropriate for the project type: install the ENERGY STAR Advanced Lighting Package (ALP); <i>OR</i> follow the ENERGY STAR MFHR program guidelines, which require that 80% of installed lighting fixtures within units must be ENERGY STAR-qualified or have ENERGY STAR-qualified lamps installed; <i>OR</i> if replacing, new fixtures and ceiling fans must meet or exceed ENERGY STAR efficiency levels.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>5.5b Efficient Lighting: Common Areas and Emergency Lighting</b> Follow the guidance appropriate for the project type: use ENERGY STAR-labeled fixtures or any equivalent high-performance lighting fixtures and bulbs in all common areas; <i>OR</i> if replacing, new common space and emergency lighting fixtures must meet or exceed ENERGY STAR efficiency levels. For emergency lighting, if installing new or replacing, all exit signs shall meet or exceed LED efficiency levels and conform to local building codes.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>5.5c Efficient Lighting: Exterior</b> Follow the guidance appropriate for the project type: install ENERGY STAR-qualified fixtures or LEDs with a minimum efficacy of 45 lumens/ watt; <i>OR</i> follow the ENERGY STAR MFHR program guidelines, which require that 80% of outdoor lighting fixtures must be ENERGY STAR-qualified or have ENERGY STAR-qualified lamps installed; <i>OR</i> if replacing, install ENERGY STAR compact fluorescents or LEDs with a minimum efficacy of 45 lumens/ watt.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>5.6a Electricity Meter</b> <i>(New Construction and Substantial Rehab only)</i> Install individual or sub-metered electric meters in all dwelling units.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>3</p>	<p><b>5.6b Electricity Meter</b> <i>(Moderate Rehab only)</i> Install individual or sub-metered electric meters in all dwelling units.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>12 max</p>	<p><b>5.7a Renewable Energy</b> Install photovoltaic (PV) panels, wind turbines, or other electric-generating renewable energy source to provide a specified percentage of the project's estimated energy demand.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>1 or 2</p>	<p><b>5.7b Photovoltaic/Solar Hot Water Ready</b> Site, design, engineer, and/or plumb the development to accommodate installation of photovoltaic (PV) or solar hot water system in the future.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>5</p>	<p><b>5.8 Advanced Metering Infrastructure</b> Site, design, engineer, and wire the development to accommodate installation of smart meters and/or be able to interface with smart grid systems in the future.</p>
<p>SUBTOTAL OPTIONAL POINTS</p>		

**6: MATERIALS BENEFICIAL TO THE ENVIRONMENT**

<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>6.1 Low/No VOC Paints and Primers</b> All interior paints and primers must be less than or equal to the following VOC levels: Flats—50 g/L; Non-flats—50 g/L; Floor—100 g/L</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>6.2 Low/No VOC Adhesives and Sealants</b> All adhesives must comply with Rule 1168 of the South Coast Air Quality Management District. All caulks and sealants must comply with regulation 8, rule 51, of the Bay Area Air Quality Management District.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>6.3 Construction Waste Management</b> Commit to following a waste management plan that reduces non-hazardous construction and demolition waste by at least 25% by weight through recycling, salvaging, or diversion strategies.</p>



M = MANDATORY  
# = AVAILABLE OPTIONAL POINTS

**MATERIALS BENEFICIAL TO THE ENVIRONMENT (CONTINUED)**

YES  NO  MAYBE

**5**  
**max**

**6.4 Construction Waste Management: Optional**

Determine percentage of waste diversion and earn all points below that threshold:

- 35% waste diversion [1 point]
- 45% waste diversion [1 point]
- 55% waste diversion [1 point]
- 65% waste diversion [1 point]
- 75% waste diversion [1 point]

YES  NO  MAYBE

**5**

**6.5 Recycling Storage for Multifamily Project**

Provide one or more easily accessible, permanent areas for the collection and storage of materials for recycling.

YES  NO  MAYBE

**5**  
**max**

**6.6 Recycled Content Material**

Incorporate building materials that are composed of at least 25% post-consumer recycled content or at least 50% post-industrial recycled content. *Select from the following:*

- Framing materials [1 point]
- Exterior materials: siding, masonry, roofing [1 point]
- Concrete/cement and aggregate [1 point]
- Drywall/interior sheathing [1 point]
- Flooring materials [1 point]

YES  NO  MAYBE

**5**  
**max**

**6.7 Regional Material Selection**

Use products that were extracted, processed, and manufactured within 500 miles of the home or building for a minimum of 50% of the building material value (based on cost). *Select any or all of these options:*

- Framing materials [1 point]
- Exterior materials: siding, masonry, roofing [1 point]
- Concrete/cement and aggregate [1 point]
- Drywall/interior sheathing [1 point]
- Flooring materials [1 point]

YES  NO  MAYBE

**5**

**6.8 Certified, Salvaged, and Engineered Wood Products**

Commit to using wood products and materials of at least 25% that are (by cost): FSC-certified, salvaged products, or engineered framing materials without urea-formaldehyde binders.

YES  NO  MAYBE

**1 or 3**

**6.9a Reduced Heat-Island Effect: Roofing**

Use Energy Star-compliant roofing or install a “green” (vegetated) roof for at least 50% of the roof area. *Select only one: cool roof [3 points] or green roof [1 point]*

YES  NO  MAYBE

**2**

**6.9b Reduced Heat-Island Effect: Paving**

Use light-colored, high-albedo materials and/or an open-grid pavement, with a minimum solar reflectance of 0.3, over at least 50% of the site’s hardscaped area.

SUBTOTAL OPTIONAL POINTS

**7: HEALTHY LIVING ENVIRONMENT**

YES  NO  MAYBE

**M**

**7.1 Composite Wood Products that Emit Low/No Formaldehyde**

All composite wood products must be certified compliant with California 93120. If using a composite wood product that does not comply with California 93120, all exposed edges and sides must be sealed with low-VOC sealants.



M = MANDATORY  
# = AVAILABLE OPTIONAL POINTS

**HEALTHY LIVING ENVIRONMENT (CONTINUED)**

<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>7.2 Environmentally Preferable Flooring</b> Do not install carpets in entryways, laundry rooms, bathrooms, kitchens / kitchenettes, utility rooms, and all rooms of ground-connected floors. Any carpet products used must meet the Carpet and Rug Institute’s Green Label or Green Label Plus certification for carpet, pad, and carpet adhesives. Any hard surface flooring products used must be either ceramic tile, unfinished hardwood floors, <b>OR</b> in compliance with the Scientific Certification System’s FloorScore program criteria.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>4</p>	<p><b>7.3 Environmentally Preferable Flooring: Alternative Sources</b> Use non-vinyl, non-carpet floor coverings in all rooms of building.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>7.4a Exhaust Fans: Bathroom</b> <i>(New Construction and Substantial Rehab only)</i> Install Energy Star–labeled bathroom fans that exhaust to the outdoors, are connected to a light switch, and are equipped with a humidistat sensor, timer, or other control (e.g., occupancy sensor, delay off switch, ventilation controller).</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>6</p>	<p><b>7.4b Exhaust Fans: Bathroom</b> <i>(Moderate Rehab only)</i> Install Energy Star–labeled bathroom fans that exhaust to the outdoors, are connected to a light switch, and are equipped with a humidistat sensor, timer, or other control (e.g., occupancy sensor, delay off switch, ventilation controller).</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>7.5a Exhaust Fans: Kitchen</b> <i>(New Construction and Substantial Rehab only)</i> Install power-vented fans or range hoods that exhaust to the exterior at the appropriate cfm rate, per ASHRAE 62.2, or install a central ventilation system with rooftop fans that meet efficiency criteria.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>6</p>	<p><b>7.5b Exhaust Fans: Kitchen</b> <i>(Moderate Rehab only)</i> Install power-vented fans or range hoods that exhaust to the exterior at the appropriate cfm rate, per ASHRAE 62.2, or install a central ventilation system with rooftop fans that meet efficiency criteria.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>7.6a Ventilation</b> <i>(New Construction and Substantial Rehab only)</i> Install a ventilation system for the dwelling unit capable of providing adequate fresh air per ASHRAE requirements for the building type.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>5</p>	<p><b>7.6b Ventilation</b> <i>(Moderate Rehab only)</i> Install a ventilation system for the dwelling unit capable of providing adequate fresh air per ASHRAE requirements for the building type.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>7.7 Clothes Dryer Exhaust</b> Clothes dryers must be exhausted directly to the outdoors using rigid-type duct work.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>7.8 Combustion Equipment</b> Specify power-vented or closed-combustion equipment when installing new space and water-heating equipment in New Construction and any Substantial and Moderate Rehab projects.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>7.9a Mold Prevention: Water Heaters</b> Provide adequate drainage for water heaters that includes drains or catch pans with drains piped to the exterior of the dwelling.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>7.9b Mold Prevention: Surfaces</b> In bathrooms, kitchens, and laundry rooms, use materials that have durable, cleanable surfaces.</p>
<input type="radio"/> YES <input type="radio"/> NO <input type="radio"/> MAYBE	<p>M</p>	<p><b>7.9c Mold Prevention: Tub and Shower Enclosures</b> Use non–paper-faced backing materials such as cement board, fiber cement board, or equivalent in bathrooms.</p>



M = MANDATORY  
# = AVAILABLE OPTIONAL POINTS

**HEALTHY LIVING ENVIRONMENT (CONTINUED)**

YES  NO  MAYBE

M

**7.10 Vapor Barrier Strategies** *(New Construction and Rehab Projects with foundation work only)*  
Install vapor barriers that meet specified criteria appropriate for the foundation type.

YES  NO  MAYBE

M

**7.11 Radon Mitigation** *(New Construction and Substantial Rehab only)*  
For New Construction in EPA Zone 1 and 2 areas, install passive radon-resistant features below the slab. For Substantial Rehab projects in those Zones, test for the presence of radon and mitigate if elevated levels exist.

YES  NO  MAYBE

M

**7.12 Water Drainage** *(New Construction and Rehab projects replacing assemblies called out in Criterion only)*  
Provide drainage of water away from windows, walls, and foundations by implementing list of techniques.

YES  NO  MAYBE

M

**7.13 Garage Isolation**  
Follow list of criteria for projects with garages, including: provide a continuous air barrier between the conditioned (living) space and any garage space to prevent the migration of any contaminants into the living space, and install a CO alarm inside the house in the room with a door to the garage and outside all sleeping areas.

YES  NO  MAYBE

M

**7.14 Integrated Pest Management**  
Seal all wall, floor, and joint penetrations with low-VOC caulking or other appropriate sealing methods to prevent pest entry.

YES  NO  MAYBE

M

**7.15 Lead-Safe Work Practices** *(Substantial and Moderate Rehab only)*  
For properties built before 1978, use lead-safe work practices consistent with the EPA's Renovation, Repair, and Painting Regulation and applicable HUD requirements.

YES  NO  MAYBE

9

**7.16 Smoke-Free Building**  
Implement and enforce a no smoking policy in all common, individual living areas, and with a 25-foot perimeter around the exterior of all residential buildings.

SUBTOTAL OPTIONAL POINTS

**8: OPERATIONS + MAINTENANCE**

YES  NO  MAYBE

M

**8.1 Building Maintenance Manual** *(All Multifamily Projects)*  
Provide a building maintenance manual that addresses maintenance schedules and other specific instructions related to the building's green features.

YES  NO  MAYBE

M

**8.2 Resident Manual**  
Provide a guide for homeowners and renters that explains the intent, benefits, use, and maintenance of green building features.

YES  NO  MAYBE

M

**8.3 Resident and Property Manager Orientation**  
Provide a comprehensive walk-through and orientation for residents and property managers using the appropriate building maintenance or resident's manual.

YES  NO  MAYBE

12

**8.4 Project Data Collection and Monitoring System**  
Collect and monitor project performance data on energy, water, and, if possible, healthy living environments for a minimum of five years.

SUBTOTAL OPTIONAL POINTS

**TOTAL OPTIONAL POINTS**

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# INTEGRATIVE DESIGN

**An integrative design process facilitates the design and development team's achievement of green objectives throughout the project life cycle.**



**1.1a***Mandatory***Green Development Plan: Integrative Design Meeting(s)****REQUIREMENTS**

Conduct one or more integrative design meeting(s) as appropriate for your project and submit a Green Development Plan or equivalent documentation that outlines the integrative design approach used for this development that demonstrates involvement of the entire project team throughout the design and development process.

**RATIONALE**

An integrative design process facilitates the design and development team's achievement of green objectives throughout the project life cycle. The outcomes of an integrative design process can include substantially lower development costs and greater health, economic, and environmental benefits for residents, property owners, and communities.

**RECOMMENDATIONS**

- Conduct a green design charrette with the full development team, including participants from the following disciplines or interests:
  - Prospective or current residents
  - Architecture or residential building design
  - Mechanical or energy engineering
  - Building science or performance testing
  - Green building or sustainable design
  - Civil engineering, landscape architecture, habitat restoration, or land-use planning
  - Building management and maintenance
  - Environmental science
  - Public health
- Best practices in documenting the integrative design charrette process required of project teams submitting for Certification include:
  - A roster of the name and role of each member of the professional design and development team
  - A statement of the overall green development goals of the project and the expected intended outcomes from addressing those goals
  - A summary of the process that was used to select the green building strategies, systems, and materials that will be incorporated into the project
  - A description of how each of the mandatory and optional items will be included in the project
  - Identification of which members of the design and development team are responsible for implementing the green features

- A description of follow-up measures to be taken through the completion of design, permitting, construction, and operation to ensure that the green features are included and correctly installed, and that the owners or tenants receive information about the function and operation of the features
- Meeting minutes or other documentation that captures and summarizes components of the integrative design process
- Consider revisiting the “Intended Methods” tab of the Certification Workbook, required under Step 1 of the Enterprise Green Communities Certification process, as the construction documents are developed to ensure that methods outlined early in the process are followed through the construction phase.
- If the project team is not seeking Enterprise Green Communities Certification, they should reference the above-mentioned information within an internal Green Development Plan.
- Project performance and durability can be dramatically affected by decisions and processes established during the integrative design phase. Advanced Energy developed the following list of recommendations for project teams to consider during integrative design, based on an evaluation of Enterprise Green Communities projects:
  - Consider adding specific energy consumption thresholds or goals for each project that will be evaluated after project completion.
  - Document your process for approaching and complying with the Criteria for use in your future green projects. Include specific options for complying with Criteria, contact information for useful resources (organizations, websites, product distributors, etc.), and lessons learned.
  - Adjust the scopes of all of the projects in your portfolio to match the Criteria in order to avoid confusion with changing expectations.
  - Add building envelope and mechanical installation details to your plans and specifications for the most critical project components, paying particular attention to: air handler closet air sealing, floor system and band air sealing, party wall air sealing, proper insulation installation, ventilation system installation, and duct sealing with “bucket” mastic. Also provide the construction team with installation guides for the measures above.
  - Consider creating incentives for your construction team based on the performance of various building components.
  - Add self-verification requirements for your construction team for certain project items that demand proper installation (e.g., testing of water fixtures, testing of bath fans, air sealing of air handler closets). Self-verification for product-based measures (submitting cut-sheets for appropriate paints, carpets, etc.) is most likely unnecessary.

## RESOURCES

- Enterprise Green Communities offers a variety of resources to support the integrative design process: [www.greencommunitiesonline.org/tools/funding/grants/charrette.asp](http://www.greencommunitiesonline.org/tools/funding/grants/charrette.asp)
- Enterprise Green Communities maintains a comprehensive registry of qualified green affordable housing TA providers that are available for support on the design, construction, rehabilitation, and operations of green affordable housing. To find a Green technical assistance (TA) provider near you, search the list found at [www.greencommunitiesonline.org/tools/resources/technical\\_assistance.asp](http://www.greencommunitiesonline.org/tools/resources/technical_assistance.asp)

- **Whole Building Design Guide:** [www.wbdg.org/wbdg\\_approach.php](http://www.wbdg.org/wbdg_approach.php)  
This website describes the core elements of “whole building design,” which includes the combination of an integrative design approach and an integrative team process. This site helps users identify design objectives and organize their processes to meet those objectives.
- *The Integrative Design Guide to Green Building: Redefining the Practice of Sustainability.* 7group and Bill Reed (2009). This book provides guidance to building professionals on incorporating integrative design into every phase of a project.

## 1.1b

*Mandatory*

### Green Development Plan: Criteria Documentation

#### REQUIREMENTS

Create design and construction documentation (e.g., plans, details, specifications) to include information on implementation of appropriate Enterprise Green Communities Criteria.

#### RATIONALE

Projects that explicitly address accountability among project team members and implementation details for Enterprise Green Communities Criteria in design and construction documentation tend to successfully implement the Criteria on site during the construction phase.

#### RECOMMENDATIONS

Using the chart on pages 21 and 22 for guidance, incorporate all Enterprise Green Communities Criteria mandatory and optional measures that the project intends to meet as indicated in the Green Development Plan.

## 1.2a

*Optional | 2 points*

### Universal Design: New Construction

#### REQUIREMENTS

Design a minimum of 15% of the dwelling units (no fewer than one) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines. The remainder of the ground-floor units and elevator-reachable units should be designed in accordance with ICC/ANSI A117.1, Type B.

#### RATIONALE

Universal design features result in a building that is sensitive to a wide range of resident needs, including those who have temporary or permanent disabilities. The creation of comfortable environments for a diverse population increases the likelihood of dynamic, diverse communities.

#### RECOMMENDATIONS

Universal design features should be considered during the integrative design process.

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**RESOURCES**

- For more information about the ICC/ANSI A117.1 standard: [webstore.ansi.org/RecordDetail.aspx?sku=ICC%2FANSI+A117.1-2003](http://webstore.ansi.org/RecordDetail.aspx?sku=ICC%2FANSI+A117.1-2003) and [www.iccsafe.org/store/Pages/Product.aspx?id=9033X03#longdesc](http://www.iccsafe.org/store/Pages/Product.aspx?id=9033X03#longdesc)
- Enterprise Green Communities offers a variety of resources to support the integrative design process, during which universal design concepts should be considered: [www.greencommunitiesonline.org/tools/funding/grants/charrette.asp](http://www.greencommunitiesonline.org/tools/funding/grants/charrette.asp)

**1.2b***Optional | 2 or 3 points***Universal Design: Substantial and Moderate Rehab****REQUIREMENTS**

- Design a minimum of 10% of the dwelling units (no fewer than one) in accordance with ICC/ANSI A117.1, Type A, Fully Accessible guidelines. *[2 points]*

**AND, for 1 additional point:**

- The remainder of the ground-floor units and elevator-reachable units should have accessible unit entrances (designed to accommodate wheelchair-bound people). *[1 point]*

**RATIONALE**

Universal design features result in a building that is sensitive to a wide range of resident needs, including those who have temporary or permanent disabilities. The creation of comfortable environments for a diverse population increases the likelihood of dynamic, diverse communities.

**RECOMMENDATIONS**

Universal design features should be considered during the integrative design process, based on the sustainability goals of the project.

**RESOURCES**

- For more information about the ICC/ANSI A117.1 standard: [webstore.ansi.org/RecordDetail.aspx?sku=ICC%2FANSI+A117.1-2003](http://webstore.ansi.org/RecordDetail.aspx?sku=ICC%2FANSI+A117.1-2003) and [www.iccsafe.org/store/Pages/Product.aspx?id=9033X03#longdesc](http://www.iccsafe.org/store/Pages/Product.aspx?id=9033X03#longdesc)
- Enterprise Green Communities offers a variety of resources to support the integrative design process, during which universal design concepts should be considered: [www.greencommunitiesonline.org/tools/funding/grants/charrette.asp](http://www.greencommunitiesonline.org/tools/funding/grants/charrette.asp)

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CRITERION	PROJECT PLANS	SPEC BOOK
<b>1.1a–b</b> Green Development Plan: Integrative Design Meeting(s)		
<b>1.2a–b</b> Universal Design	X	X
<b>2.1</b> Sensitive Site Protection	X	
<b>2.2</b> Connections to Existing Development and Infrastructure	X	
<b>2.3</b> Compact Development (Mandatory)		
<b>2.4</b> Compact Development (Optional)		
<b>2.5</b> Proximity to Services		
<b>2.6</b> Preservation of and Access to Open Space: Rural/Tribal/Small Towns	X	
<b>2.7</b> Preservation of and Access to Open Space	X	
<b>2.8</b> Access to Public Transportation		
<b>2.9</b> Walkable Neighborhoods: Connections to Surrounding Neighborhoods	X	
<b>2.10</b> Smart Site Location—Passive Solar Heating / Cooling	X	X
<b>2.11</b> Brownfield or Adaptive Reuse Site	X	
<b>2.12</b> Access to Fresh, Local Foods	X (if meeting Option 1)	
<b>2.13</b> LEED for Neighborhood Development Certification		
<b>3.1</b> Environmental Remediation		X
<b>3.2</b> Erosion and Sedimentation Control	X	X
<b>3.3</b> Low Impact Development	X	X
<b>3.4</b> Landscaping	X	X
<b>3.5</b> Efficient Irrigation and Water Reuse		X
<b>3.6</b> Surface Stormwater Management	X	X
<b>4.1</b> Water-Conserving Appliances and Fixtures	X	X
<b>4.2</b> Advanced Water-Conserving Appliances and Fixtures	X	X
<b>4.3</b> Water Reuse	X	X
<b>5.1a–d</b> Building Performance Standards	X	X
<b>5.2</b> Additional Reductions in Energy Use	X	X
<b>5.3</b> Sizing of Heating and Cooling Equipment	X	X
<b>5.4</b> ENERGY STAR Appliances		X
<b>5.5a–c</b> Efficient Lighting		X
<b>5.6a–b</b> Electricity Meter	X	X
<b>5.7a</b> Renewable Energy	X	X
<b>5.7b</b> Photovoltaic / Solar Hot Water Ready	X	X
<b>5.8</b> Advanced Metering Infrastructure	X	X

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CRITERION (CONTINUED)		PROJECT PLANS	SPEC BOOK
6.1	Low/No VOC Paints and Primers		X
6.2	Low/No VOC Adhesives and Sealants		X
6.3	Construction Waste Management		X
6.4	Construction Waste Management: Optional		X
6.5	Recycling Storage for Multifamily Building	X	X
6.6	Recycled Content Material		X
6.7	Regional Material Selection		X
6.8	Certified, Salvaged, and Engineered Wood Products		X
6.9a–b	Reducing Heat-Island Effect		X
7.1	Composite Wood Products that Emit Low/No Formaldehyde		X
7.2	Environmentally Preferable Flooring	X	X
7.3	Environmentally Preferable Flooring: Alternative Sources	X	X
7.4	Exhaust Fans: Bathroom	X	X
7.5	Exhaust Fans: Kitchen	X	X
7.6	Ventilation	X	X
7.7	Clothes Dryer Exhaust	X	X
7.8	Combustion Equipment	X	X
7.9	Mold Prevention	X	X
7.10	Vapor Barrier Strategies	X	X
7.11	Radon Mitigation	X	X
7.12	Water Drainage	X	X
7.13	Garage Isolation	X	
7.14	Integrated Pest Management	X	X
7.15	Lead-Safe Work Practices		X
7.16	Smoke-Free Building		X
8.1	Maintenance Manual		
8.2	Resident Manual		
8.3	Resident and Property Manager(s) Orientation		
8.4	Project Data Collection and Monitoring System		

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## LOCATION + NEIGHBORHOOD FABRIC

**Locating a project within an existing neighborhood and in close proximity to infrastructure encourages more resource-efficient development of land, reduces development costs, conserves energy, and adds to the vitality of the overall community.**

## INSTRUCTIONS

The Location + Neighborhood Fabric category offers three pathways for projects, based on the location of the project and the surrounding development patterns. Project teams should first determine the appropriate category—**Urban/Small Cities**, **Suburban/Mid-Size Towns**, or **Rural/Tribal/Small Towns**—using the methodologies described below.

### Projects Seeking Certification

If the project team determines that the project should be placed in a category other than that resulting from the analysis below, the team can provide a more detailed analysis that demonstrates the rationale for inclusion within a different category. Project teams should email [certification@enterprisecommunity.org](mailto:certification@enterprisecommunity.org) to provide this information prior to submitting under Step 1 of the Enterprise Green Communities Certification process.

### Guidance for Moderate and Substantial Rehab Projects

Moderate and Substantial Rehab projects are exempt from all mandatory measures in the Enterprise Green Communities Location + Neighborhood Fabric Criteria category. These project types are eligible for any optional points that are applicable to their particular classification (either Urban/Small Cities, Suburban/Mid-Size Towns, or Rural/Tribal/Small Towns) and any optional points that are applicable to all classifications. For a Rehab project, project teams should follow the methodologies described below to determine the project's classification in one of the three pathways, and then determine whether there are optional criteria for which the project can achieve points.

## CALCULATING DENSITY

There are different ways to calculate density, and using one methodology may produce dramatically different net residential density results than another. For the purposes of this categorization exercise, Enterprise Green Communities Criteria uses the Center for Neighborhood Technology's (CNT) net residential density calculation that underlies its Housing + Transportation (H+T) Affordability Index ([htaindex.cnt.org/](http://htaindex.cnt.org/)). This calculation uses U.S. Census data to aggregate residential acreage and number of households from all blocks deemed "residential" within a census block group.

### Urban/Small Cities

Projects located within a place where the surrounding residential density is **7 dwelling units per acre or more** should follow the Urban/Small Cities pathway through the Location + Neighborhood Fabric category. Surrounding net residential density must be calculated by determining the net residential density of the census block group in which it is located using CNT's Housing + Transportation Affordability Index and multiplying that density by **1.5**.

### Suburban/Mid-Size Towns

Projects located within a place where the surrounding residential density is **fewer than 7 dwelling units per acre** should follow the Suburban/Mid-Size Towns pathway through the Location + Neighborhood Fabric category. Surrounding net residential density must be calculated by determining the net residential density of the census block group in which it is located using CNT's Housing + Transportation Affordability Index and multiplying that density by **1.5**.



### Rural/Tribal/Small Towns

Projects that meet one or more of the criteria below qualify for the Rural/ Tribal/Small Towns pathway:

- Projects classified as rural as defined in Section 520 of the Housing Act of 1949 (42 U.S.C. 1490)
  - Any open country or any town, village, city, or place that is not part of or associated with an urban area, and that:
    1. has a population in excess of 2,500 but not in excess of 10,000 if it is rural in character, or
    2. has a population in excess of 10,000 but not in excess of 20,000 and is not contained within a standard metropolitan statistical area
- Projects eligible for funding under USDA Rural Housing Services programs
- Projects located on Native American Reservations and land owned by Native Alaskans
- Projects located in colonias communities as defined by HUD and certified by one of the four border states: Texas, New Mexico, Arizona, and California

**Projects located on tribal lands in urban or suburban locations, as per the Enterprise Green Communities pathway classifications, are required to meet the Criteria in that particular pathway, rather than the Rural/Tribal/Small Towns pathway.**

### METHODOLOGY TO DETERMINE CLASSIFICATION

#### Urban/Small Cities and Suburban/Mid-Size Towns Classifications

Projects within the Urban/Small Cities and Suburban/Mid-Size Towns categories (i.e., any projects that do not meet the Rural/Tribal/Small Towns definition) should use the expanded Housing + Transportation Affordability Index online at [htaindex.cnt.org/residential-density.php](http://htaindex.cnt.org/residential-density.php). This tool was custom-developed for Enterprise Green Communities projects by CNT to determine net residential density. The tool builds on CNT's original H+T Affordability Index to provide the net residential density by census block group for the entire country.

Within the CNT tool, residential density represents household density of residential areas, in contrast to population density on land area. Blocks (within block groups) are selected on the criteria that gross density (households per land acre) must be greater than one. From these selected blocks, both households and land acres are aggregated to the block group level, at which level residential density is calculated as households per residential acre.

**Instructions: Determining the surrounding residential density of your project location**

*Note: If you are unsure if your project falls under the USDA definition of “rural,” you should follow the instructions below.*

1. Go to CNT’s Housing + Transportation Index at:  
[htaindex.cnt.org/residential-density.php](http://htaindex.cnt.org/residential-density.php)
2. In the text box, type in the address of your project. Separate the street address, city, state, and ZIP code with commas. Press the “Enter” key on your keyboard.
3. The map will refresh and show the project location identified by address in Step 2 above. Under the map, the residential density of your census block group will be displayed.
4. Once you have the residential density for your project, multiply that number by 1.5 to bring the residential density in line with traditional density calculations. That calculation is described here:

**Net Residential Density (using CNT tool) x 1.5 = Surrounding Net Residential Density**

**Rural/Tribal/Small Towns**

If a project is not eligible for USDA RHS funding, located on Federally Recognized Tribal Trust Land, or within a colonias as defined in the Glossary, then the project team should use the following instructions to determine whether the Rural/Tribal/Small Towns pathway is appropriate.

**Instructions: Determining USDA RHS funding eligibility**

Obtain information on your project site at the USDA Rural Development web page that identifies USDA RD-eligible areas, as determined by USDA’s housing programs:  
[eligibility.sc.egov.usda.gov/eligibility/welcomeAction.do](http://eligibility.sc.egov.usda.gov/eligibility/welcomeAction.do)

- Under *Property Eligibility*, select the program type. Once the page refreshes, do one of these things:
  1. Enter the project address in the appropriate fields *or* select a state from the map.
  2. Click the Text Description button for information on eligibility by state.
  3. Click on your county.

## 2.1

*Mandatory***Sensitive Site Protection**

See exemptions in Criterion

**REQUIREMENTS**

Do not locate new projects, including buildings, built structures, roads, or parking areas, on portions of sites that meet any of the following provisions:

1. Land within 100 feet of wetlands, including isolated wetlands or streams. Maintain or establish riparian buffer using native vegetation where possible. Bike and foot paths are allowed if at least 25 feet from the wetlands boundary.
2. Land on slope greater than 15%
3. Land with prime soils, unique soils, or soils of state significance
4. Public parkland
5. Land that is specifically identified as habitat for any species on federal or state threatened or endangered lists
6. Land with elevation at or below the 100-year floodplain

**EXEMPTIONS**

- Infill sites are exempt from provisions 2 and 3 above. (See Glossary for detail on what can be classified as an infill site.)
- Projects on previously developed sites are exempt from provision 1 above.
- Infill projects in the International Energy Conservation Code (IECC) Climate Zone 2 (hot/humid climates) that follow the National Flood Insurance Program requirements ([www.fema.gov/plan/prevent/floodplain/index.shtm](http://www.fema.gov/plan/prevent/floodplain/index.shtm)) are exempt from provision 6 above.

**RATIONALE**

Proper site selection avoids damage to or loss of fragile and scarce environmental resources. It also reduces the risk of building damage from flooding.

**RECOMMENDATIONS**

Protect habitat of potential endangered species. Use state and local lists to identify these habitats.

**RESOURCES**

- U.S. Department of Energy, Building Technologies Program: [www.eere.energy.gov/buildings/info/design/buildingsiting/index.html](http://www.eere.energy.gov/buildings/info/design/buildingsiting/index.html)  
Addresses methods that can help to minimize impacts to the site.
- 2009 IECC Climate Zones Map: [energycode.pnl.gov/EnergyCodeReqs/](http://energycode.pnl.gov/EnergyCodeReqs/)  
A detailed map that shows climate zones zoomed into each state and county as well as the basic 2009 IECC Building Code requirements for each climate zone.
- U.S. Department of Agriculture, Natural Resources Conservation Service's Web Soil Survey: [websoilsurvey.nrcs.usda.gov/app/](http://websoilsurvey.nrcs.usda.gov/app/)

- Digital Q3 Flood Data Availability, States Map, Federal Emergency Management Agency (FEMA), FEMA's national flood information maps: [mhc.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=productQ3Map&title=Q3%20Availability%20-%20State%20Map&parent=productInfo&parentTitle=Product%20Information](https://www.fema.gov/webapp/wcs/stores/servlet/info?storeId=10001&catalogId=10001&langId=-1&content=productQ3Map&title=Q3%20Availability%20-%20State%20Map&parent=productInfo&parentTitle=Product%20Information)

## 2.2

*Mandatory***Connections to Existing Development and Infrastructure**

Except for projects located on rural tribal lands, in colonias communities, or in communities of population less than 10,000

**REQUIREMENTS**

Locate project on a site with access to existing roads, water, sewers, and other infrastructure within or contiguous (having at least 25% of the perimeter bordering) to existing development.

Connect the project to the pedestrian grid by creating new or enhancing existing sidewalks or other all-weather pathways to link the project to public spaces, open spaces, and adjacent development.

Do not build on tracts of land that require installing a septic tank within 1,000 feet or more from the property line of the tract being developed or a sanitary sewer line extension of 2,500 feet or more from the property line of the tract being developed.

**RATIONALE**

Locating a project within an existing neighborhood and in close proximity to infrastructure encourages more resource-efficient development of land, reduces development costs, conserves energy, and adds to the vitality of the overall community.

## 2.3

*Mandatory***Compact Development****REQUIREMENTS**

Design and build the project to the density required for the location type, using the calculation for project net density described below.

**Density Requirements by Development Type:**

- **Urban/Small Cities:** A minimum of at least 10 dwelling units per acre or at least 75% of surrounding net residential density, whichever is greater.
- **Suburban/Mid-Size Towns:** A minimum of at least 7 dwelling units per acre or at least 75% of surrounding net residential density, whichever is greater.
- **Rural/Tribal/Small Towns:** A minimum net density of 5 units per acre for detached or semi-detached houses; 10 units per acre for townhomes; 15 units per acre for apartments.

## RECOMMENDATIONS

- Calculate project net density by taking the total dwelling units after construction, divided by the acreage of the entire tract down to one decimal point, minus the dedicated acreage of public street rights of way, riparian and wetland buffers, open space that has been dedicated through a conservation program, and other non-buildable areas.
- Net density calculations do not include land that is set aside for future building phases or development. For multi-phased projects, the project net density should include only the portion of the parcel that is being used for that particular phase.
- If the project has a mix of development types, then the project team should calculate net density using a weighted average.
- Surrounding net residential density should be calculated by determining the net residential density of the census block group in which it is located using CNT's Housing + Transportation Affordability Index and multiplying that density by 1.5.

## RATIONALE

Compact development encourages more resource-efficient development of land, reduces project costs, and conserves energy. Additionally, it supports demand for other infrastructure such as public transportation and commercial development.

## RESOURCES

- Congress for New Urbanism: [www.cnu.org](http://www.cnu.org)  
This nonprofit organization provides tools and resources for promoting walkable, neighborhood-based development as an alternative to sprawl.
- Smart Growth Network: [www.smartgrowth.org](http://www.smartgrowth.org)  
This website outlines smart growth principles, provides a guide through smart growth terms and technical concepts, and hosts a searchable catalogue of reports, websites, tools, and case studies.
- Urban Land Institute: [www.washington.uli.org](http://www.washington.uli.org)  
This nonprofit organization promotes the responsible use of land to enhance the total environment. ULI's online bookstore includes numerous publications regarding compact and higher-density development.

## 2.4

*Optional | 5 or 6 points***Compact Development****REQUIREMENTS**

Design and build the project to the density required for the location type, using the calculation for project net density described below.

**Density Requirements by Development Type:**

- **Urban/Small Cities:** A minimum of at least 15 dwelling units per acre [5 points]
- **Suburban/Mid-Size Towns:** A minimum of at least 10 dwelling units per acre [6 points]
- **Rural/Tribal/Small Towns:** A minimum net density of 7.5 units per acre for detached or semi-detached houses; 12 units per acre for townhomes; 20 units per acre for apartments [6 points]

**RATIONALE**

Compact development encourages more resource-efficient development of land, reduces project costs, and conserves energy. Additionally, it supports demand for other infrastructure such as public transportation and commercial development.

**RECOMMENDATIONS**

- Calculate project net density by taking the total dwelling units after construction, divided by the acreage of the entire tract down to one decimal point, minus the dedicated acreage of public street rights of way, riparian and wetland buffers, open space that has been dedicated through a conservation program, and other non-buildable areas.
- Net density calculations do not include land that is set aside for future building phases or development. For multi-phased projects, the project net density should include only the portion of the parcel that is being used for that particular phase.
- If the project has a mix of development types, then the project team should calculate net density using a weighted average.

**RESOURCES**

- **Congress for New Urbanism:** [www.cnu.org](http://www.cnu.org)  
This nonprofit organization provides tools and resources for promoting walkable, neighborhood-based development as an alternative to sprawl.
- **Smart Growth Network:** [www.smartgrowth.org](http://www.smartgrowth.org)  
This website outlines smart growth principles, provides a guide through smart growth terms and technical concepts, and hosts a searchable catalogue of reports, websites, tools, and case studies.
- **Urban Land Institute:** [www.washington.uli.org](http://www.washington.uli.org)  
This nonprofit organization promotes the responsible use of land to enhance the total environment. ULI's online bookstore includes numerous publications regarding compact and higher-density development.

## 2.5

*Mandatory*  
**Proximity to Services****REQUIREMENTS**

Locate the project within these set distances from the designated number of facilities in the table below:

- **Urban/Small Cities:** a 0.25-mile walk distance of at least two *or* a 0.5-mile walk distance of at least four facilities
- **Suburban/Mid-Size Towns:** a 0.5-mile walk distance of at least three, *or* a 1-mile walk distance of at least six facilities
- **Rural/Tribal/Small Towns:** 2 miles of at least two facilities (*except for projects located on tribal lands, in colonias communities, or in communities of population less than 10,000*)

RETAIL	SERVICES	CIVIC AND COMMUNITY FACILITIES
Supermarket	Bank	Adult or senior care (licensed)
Other food store with produce	Gym, health club, exercise studio	Child care (licensed)
Farmers market	Hair care	Community or recreation center
Clothing store or department store selling clothes	Laundry, dry cleaner	Cultural arts facility (museum, performing arts)
Hardware store	Restaurant, café, diner	Educational facility (including K–12 school, university, adult education center, vocational school, community college)
Pharmacy		Entertainment venue (theater, sports)
Other retail		Government office that serves public on-site
		Place of worship
		Medical clinic or office that treats patients
		Police or fire station
		Post office
		Public library
		Public park
		Social services center

List taken from LEED 2009 Neighborhood Development Rating System

**RATIONALE**

Compact development encourages more resource-efficient development of land, reduces project costs, and conserves energy. Additionally, it supports demand for other infrastructure such as public transportation and commercial development.

**RECOMMENDATIONS**

Provide a context map demonstrating that the center of the site is within the required walk distances of an adequate number of services. Google Maps offers a function to demonstrate walk distance. On Google Maps, go to “Directions” and select “Walk Directions” to obtain this information.



EXAMPLE OF CONTEXT MAP  
DEMONSTRATING PROXIMITY  
TO SERVICES

1. Restaurant
2. Place of Worship
3. Supermarket
4. Educational facility (college)
5. Hospital
6. Adult and senior care (licensed)

## RESOURCES

- Safe Routes to School National Partnership: [www.saferoutespartnership.org/home](http://www.saferoutespartnership.org/home)  
This network of more than 300 nonprofit organizations, government agencies, schools, and professionals works to advance the Safe Routes to School (SRTS) movement in the United States. SRTS can provide a variety of important benefits to children and their communities, including increasing physical activity, reducing traffic congestion, improving air quality, and enhancing neighborhood safety.

## 2.6

*Mandatory*

### Preservation of and Access to Open Space: Rural/Tribal/Small Towns

## REQUIREMENTS

Set aside a minimum of 10% of the total project acreage as open space for use by residents.

## OR

Locate project within a 0.25-mile walk distance of dedicated public open space that is a minimum of 0.75 acres. The open space requirement may be met by either one large open space or two smaller spaces totaling 0.75 acre.

## RATIONALE

Access to open space and natural resources improves quality of life and provides the opportunity to better understand the importance of the natural environment.



**RECOMMENDATIONS**

- Consider providing a site plan with total acres and the number of acres of the proposed open space and a narrative for a security, maintenance, and operations plan for the preservation of the open space.
- To calculate open space, deduct buildings, private outdoor areas, streets, and roadways. Open space calculations should not include streets, roadways, or private outdoor areas.
- Good design for open space should include at least one pedestrian trail or walkway, and should be improved to the extent necessary for safety.

**RESOURCES**

- U.S. Environmental Protection Agency, Smart Growth and Open Space Conservation: [www.epa.gov/smartgrowth/openspace.htm](http://www.epa.gov/smartgrowth/openspace.htm)
- Trust for Public Land: [www.tpl.org/tier2\\_kad.cfm?folder\\_id=3133](http://www.tpl.org/tier2_kad.cfm?folder_id=3133)  
This organization conducts research to acquire knowledge about conservation issues and to improve conservation practices.
- Embrace Open Space, Citizens Resources: [www.embraceopenspace.nonprofitoffice.com/index.asp?Type=B\\_LIST&SEC=%7B6F5B2EF3-C9B6-49B2-989B-DE2FBA9F4F13%7D](http://www.embraceopenspace.nonprofitoffice.com/index.asp?Type=B_LIST&SEC=%7B6F5B2EF3-C9B6-49B2-989B-DE2FBA9F4F13%7D)

2.7

Optional | 3 points maximum

**Preservation of and Access to Open Space**

Available for all projects

**REQUIREMENTS**

Set aside additional open space in the total project acreage for use by residents.

PERCENTAGE OF OPEN SPACE SET ASIDE	NUMBER OF OPTIONAL POINTS
20%	1 point
30%	2 points
40% + written statement of preservation/conservation policy for set-aside land	3 points

**RATIONALE**

Access to open space and natural resources improves quality of life and provides the opportunity to better understand the importance of the natural environment.

**RECOMMENDATIONS**

- Consider providing a site plan with total acres and the number of acres of the proposed open space and a narrative for a security, maintenance, and operations plan for the preservation of the open space.
- To calculate open space, deduct buildings, private outdoor areas, streets, and roadways. Open space calculations should not include streets, roadways, or private outdoor areas.

- Good design for open space should include at least one pedestrian trail or walkway, and should be improved to the extent necessary for safety.

### RESOURCES

- U.S. Environmental Protection Agency, Smart Growth and Open Space Conservation: [www.epa.gov/smartgrowth/openspace.htm](http://www.epa.gov/smartgrowth/openspace.htm)
- Trust for Public Land: [www.tpl.org/tier2\\_kad.cfm?folder\\_id=3133](http://www.tpl.org/tier2_kad.cfm?folder_id=3133)  
This organization conducts research to acquire knowledge about conservation issues and to improve conservation practices.
- Embrace Open Space, Citizens Resources: [www.embraceopenspace.nonprofitoffice.com/index.asp?Type=B\\_LIST&SEC=%7B6F5B2EF3-C9B6-49B2-989B-DE2FBA9F4F13%7D](http://www.embraceopenspace.nonprofitoffice.com/index.asp?Type=B_LIST&SEC=%7B6F5B2EF3-C9B6-49B2-989B-DE2FBA9F4F13%7D)

## 2.8

*Optional | 5 points*

### Access to Public Transportation

#### REQUIREMENTS

- **Urban/Small Cities:** locate project within a 0.5-mile walk distance of combined transit services (bus, rail, and ferry) constituting 76 or more transit rides per weekday, and 32 or more transit rides on the weekend
- **Suburban/Mid-Size Towns:** locate project within a 0.5-mile walk distance of combined transit services (bus, rail, and ferry) constituting at least 60 or more transit rides per weekday, and some type of weekend ride option
- **Rural/Tribal/Small Towns:** locate project within a 5-mile distance of the following transit options: 1) vehicle share program; 2) dial-a-ride program; 3) employer vanpool; or 4) public-private regional transportation

#### RATIONALE

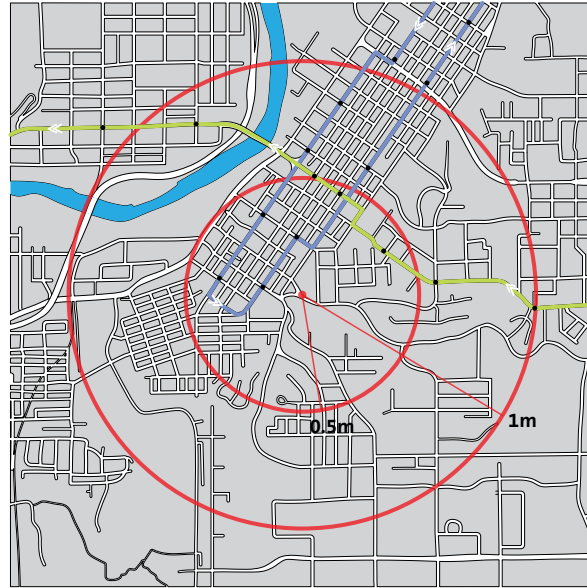
Projects located near transit reduce residents' need to own a car, thereby eliminating or lowering the costs of auto ownership. Transit use reduces related emissions of air pollutants and carbon dioxide.

#### RECOMMENDATIONS

Use a context map to demonstrate that the center of the site is within the required walk distance of combined transit options that provide an adequate number of rides per weekday.

#### RESOURCES

- Google Maps offers a function to demonstrate walk distance. On Google Maps, go to "Directions" and select "Walk Directions" to obtain this information.
- Reconnecting America: [www.reconnectingamerica.org](http://www.reconnectingamerica.org)  
This national nonprofit organization provides both the public and the private sectors with a fact-based perspective on development-oriented transit and transit-oriented development. The organization seeks to reinvent the planning and delivery system for building regions and communities around transit and walking rather than solely around the automobile.



EXAMPLE OF CONTEXT MAP  
DEMONSTRATING ACCESS TO  
PUBLIC TRANSPORTATION

**Downtown Loop Bus**

60 stops/weekday

35 stops/weekend day

**Bridge Loop Bus W**

40 stops/weekday

24 stops/weekend day

- Victoria Transportation Policy Institute: [www.vtpi.org](http://www.vtpi.org)  
This independent research organization provides consulting and publicly available research about solutions to emerging transportation issues, such as transportation demand management.
- Community Transportation Association of America, “Profiles of Innovative Rural Vanpool Programs”: [web1.ctaa.org/webmodules/webarticles/articlefiles/Profiles\\_of\\_Innovative\\_Rural\\_Vanpool\\_Programs.pdf](http://web1.ctaa.org/webmodules/webarticles/articlefiles/Profiles_of_Innovative_Rural_Vanpool_Programs.pdf)  
This paper describes several exceptional vanpool programs around the country.

## 2.9

Optional | 5 points

### Walkable Neighborhoods: Connections to Surrounding Neighborhoods — Rural / Tribal / Small Towns Only

#### REQUIREMENTS

Connect the project to public and open spaces and adjacent development by providing at least three separate connections (excluding entrances/exits from a single building) from the project to sidewalks or pathways in surrounding neighborhoods and natural areas.

Types of connections can include roadways, bike trails, sidewalks, footpaths, and the like.

#### RATIONALE

Connections to adjacent development and public and open spaces promote walking, biking, and other healthy lifestyles.

#### RECOMMENDATIONS

- Pedestrian activity and improved safety can be encouraged by placing parking underground or locating the garage in the rear or on the side of a home, creating a more traditional residential streetscape.

- Consider using porous pavement for sidewalks and other paved surfaces to reduce stormwater runoff and the distribution of pollutants to streams, rivers, and water bodies. Design sidewalks to distribute stormwater to open space for recharge and to prevent flooding.
- Integrate pedestrian and bicycle connections from the new project to the surrounding neighborhoods through sidewalks, bike lanes, or paths.
- Where possible, wait until project is occupied before laying out paved pathways/sidewalks from the project to the surrounding neighborhood. Build the pathways/sidewalks where there is visible evidence of pedestrian and bicycle use.

## 2.10

Optional | 7 points maximum

**Smart Site Location: Passive Solar Heating /Cooling**

Available for all projects

**REQUIREMENTS**

Demonstrate a project with a passive solar design, orientation, and shading that meets the following guidelines. Documentation must include sun angles and a wall section showing compliance with the project's Climate Zone (see map on next page), and a site plan indicating true north.

PROJECT TYPE	POTENTIAL POINTS	REQUIREMENTS
Stand-alone building	7	Meet all guidelines
Projects with multiple buildings	2	25% of the homes meet all guidelines
	4	50% of the homes meet all guidelines
	6	75% of the homes meet all guidelines
	7	100% of the homes meet all guidelines
Moderate or Substantial Rehab projects	2	All new windows must comply with the windows guidelines by climate zone (Item C)
	2	All south-facing elevations must comply with shading guidelines (Item D)

**Guidelines****1. Building orientation**

Elongate the building on an east–west axis with a minimum ratio of width to depth of 2:1 and orient the east–west axis of the building to be within 20 degrees of true east–west.

**2. Glazing**

*Climate Zones 1–3:* The glazing area on the north- and south-facing façade should be 50% greater than the sum of the glazing areas on the east- and west-facing walls.

*Climate Zones 4–7:* The glazing area on the south-facing façade should be 30% greater than the sum of the glazing areas on the east-, west-, and north-facing façades.

**3. Glazing type**

Provide windows with U-values and solar heat gain coefficients (SHGC) by orientation and Climate Zone that meet the requirements in the following table and map.

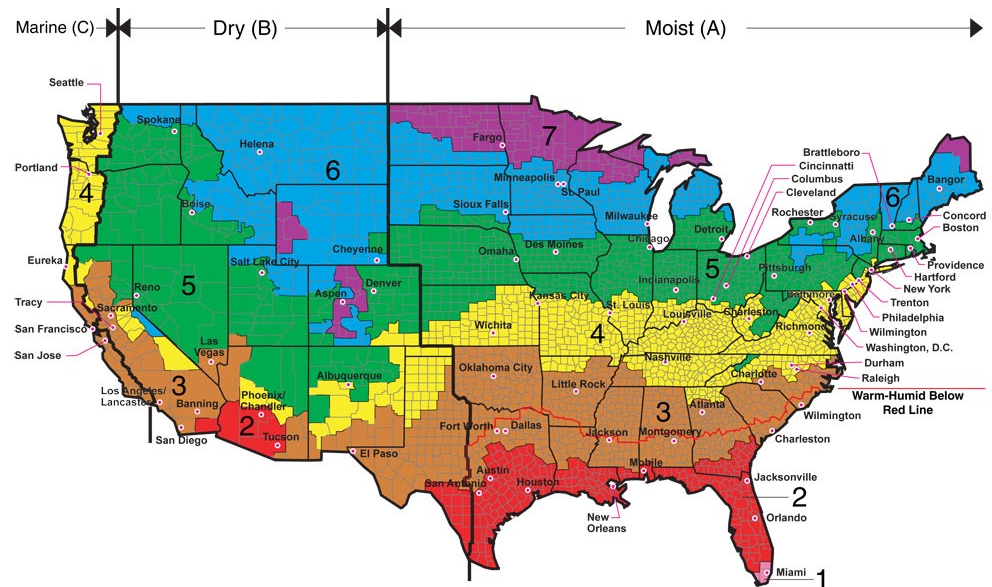
4. Shading

For south-facing windows, follow the shading requirements in the following table and map.

REQUIREMENTS FOR GLAZING AND SHADING

CLIMATE ZONE	U-FACTOR	MINIMUM SOLAR HEAT GAIN COEFFICIENT	PERCENTAGE OF WINDOW THAT NEEDS TO BE SHADED BY JUNE 21
1, 2	0.30	0.25	100%
3, 4	0.30	0.40	75%
5, 6, 7	0.25	0.50	50%

2009 IECC CLIMATE ZONES



All of Alaska is Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk. Zone 1 includes Hawaii, Guam, Puerto Rico, and the Virgin Islands.

**RATIONALE**

The utilization of passive solar energy through design minimizes reliance on mechanical heating, lowers the cooling load, and provides more residents with access to daylight.

**RECOMMENDATIONS**

- Interior spaces requiring the most lighting, heating, and cooling should be along the south face of the building.
- A narrow floor plate (less than 40 feet), single-loaded corridors, and an open floor plan optimize daylight and natural ventilation.
- Thermal Massing, Climate Zones 2–7
  - Locate a material with high thermal mass on the southern portion of the house where sunlight hits during the heating season.
  - Materials with thermal mass include brick, concrete, stone, water, and any other material of a similar high density and specific heat capacity.
  - The thermal mass location must be shown in the schematic wall section of the southern façades.
- Additional Potential Passive Cooling Strategies
  - Plant deciduous shade trees on the south façades.
  - Maximize cross ventilation by installing operable windows at the leeward and windward sides of the building.

**RESOURCES**

- U.S. Department of Energy, “Passive Solar Design,” Technology Fact Sheet: [apps1.eere.energy.gov/buildings/publications/pdfs/building\\_america/29236.pdf](https://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/29236.pdf)  
This fact sheet includes tips and techniques for passive solar heating, passive solar cooling, thermal storage, and daylighting.
- 2009 IECC Climate Zones Map: [energycode.pnl.gov/EnergyCodeReqs/](http://energycode.pnl.gov/EnergyCodeReqs/)  
A detailed map that shows climate zones zoomed into each state and county as well as the basic 2009 IECC Building Code requirements for each climate zone.
- U.S. Department of Energy, National Renewable Energy Laboratory, “Passive Solar Design for the Home,” Report #DOE/GO-102001-1105, February 2001: [www.nrel.gov/docs/fy01osti/27954.pdf](http://www.nrel.gov/docs/fy01osti/27954.pdf)
- U.S. Department of Energy, Passive Solar Design—Roof Overhangs: [www.energysavers.gov/your\\_home/designing\\_remodeling/index.cfm/mytopic=10280](http://www.energysavers.gov/your_home/designing_remodeling/index.cfm/mytopic=10280)

## 2.11

*Optional | 2 points***Brownfield or Adaptive Reuse Site**

Available for all project types

**REQUIREMENTS**

Locate the project on a brownfield or adaptive reuse site.

For brownfields, locate the project on a site, part or all of which is documented as contaminated (by means of an ASTM E1903-97 Phase II Environmental Site Assessment or a local Voluntary Cleanup Program), or on a site defined as a brownfield by a local, state, or federal government agency; and remediate site contamination such that the controlling public authority approves the protective measures and/or cleanup as effective, safe, and appropriate for the future use of the site.

**RATIONALE**

Use of brownfields or adaptive reuse sites reduces pressure on undeveloped land. Reuse of existing structures reduces the need for new materials.

**RESOURCES**

- U.S. Environmental Protection Agency, Brownfields Cleanup and Redevelopment: [www.epa.gov/brownfields/index.html](http://www.epa.gov/brownfields/index.html)  
There is information on this site about EPA's Brownfields Program, including the brownfields law, EPA Brownfields Grants, technical tools and resources, and brownfield projects across the country.
- Municipal Research and Services Center of Washington, Infill Development Strategies for Shaping Livable Neighborhoods: [www.mrsc.org/Publications/textfill.aspx](http://www.mrsc.org/Publications/textfill.aspx)  
This site contains an overview of strategies for encouraging and implementing infill development patterns.
- National Vacant Properties Campaign: [www.vacantproperties.org](http://www.vacantproperties.org)  
This website provides information, resources, tools, and assistance to support vacant property revitalization efforts.

## 2.12

*Optional | 6 points***Access to Fresh, Local Foods**

Available for all project types

**REQUIREMENTS****Option 1: Neighborhood Farms and Gardens** [6 points]

a) Dedicate permanent and viable growing space and/or related facilities (such as greenhouses) within the project equal or greater in size to 50 square feet per dwelling unit of the project. Provide solar access, fencing, watering systems, garden bed enhancements (such as raised beds), secure storage space for tools, and pedestrian access for these spaces. Ensure that the spaces are owned and managed by an entity that includes occupants of the project in its decision making, such as a community group, homeowners' association, or public body.

Established community gardens outside the project boundary but within a 0.5-mile walk distance of the project's geographic center can satisfy this option if the garden otherwise meets all of the option requirements.

b) Dedicate permanent and viable growing space and/or related facilities (such as greenhouses) within the project equal or greater in size to 50 square feet per dwelling unit of the project, and establish an agreement with a local farming operation to farm the land. Ensure in the agreement that at least 50% of the produce is made available for purchase by the project's residents. Provide solar access, fencing, watering systems, garden bed enhancements (such as raised beds), and secure storage space for tools.

**OR****Option 2: Community-Supported Agriculture** [6 points]

Offer a specified location within the project boundaries for delivery of community-supported agriculture (CSA) program shares for residents, project staff, and surrounding community members, as appropriate. The farm(s) supplying the CSA shares must be within 150 miles of the project site. Shares must be delivered to the specified delivery point on a regular schedule at least twice a month for at least four months of the year.

**OR****Option 3: Proximity to Farmers Market** [6 points]

Locate the project's geographic center within a 0.5-mile walk distance of an existing or planned farmers market that is open or will operate at least once a week for at least five months of the year. Farmers market vendors may sell only items grown within 150 miles of the project site. A planned farmers market must have firm commitments from farmers and vendors that the market will meet all of the above requirements and be in full operation by the time there is 50% occupancy of the project's dwelling units.

**RATIONALE**

Access to fresh produce offers healthy food options for residents. This measure also supports local economic development that increases the economic value and production of farmlands and community gardens.



**RECOMMENDATIONS**

- For projects pursuing Option 1a, consider bringing in an individual or group (e.g., master gardener(s) or a garden club) to work with the residents to establish the garden and maintain productivity.
- For projects pursuing Option 2 or 3, encourage the farms supplying the produce to accept food stamps.

**RESOURCES**

- Local Harvest: [www.localharvest.org](http://www.localharvest.org)  
This website offers a search function to find farmers markets, family farms, and other sources of local, sustainably grown food in a given area.
- U.S. Department of Agriculture, National Agricultural Library, Food and Nutrition Information Center, Community Food Systems: [fnic.nal.usda.gov/nal\\_display/index.php?info\\_center=4&tax\\_level=2&tax\\_subject=276&topic\\_id=1344&placement\\_default=0](http://fnic.nal.usda.gov/nal_display/index.php?info_center=4&tax_level=2&tax_subject=276&topic_id=1344&placement_default=0)  
This website links to dozens of publications, programs, and other sites.

**2.13***Optional | 4 points***LEED for Neighborhood Development Certification**

Available for all project types

**REQUIREMENTS**

Locate the project in a Stage 2 Pre-Certified LEED for Neighborhood Development plan or a Stage 3 LEED for Neighborhood Development Certified Neighborhood Development.

**RATIONALE**

Projects located in LEED for Neighborhood Development Certified Developments have taken steps to minimize the environmental impact of land development practices. LEED for Neighborhood Development is designed to certify exemplary development projects that perform well in terms of smart growth, urbanism, and green building.

**RESOURCES**

- U.S. Green Building Council, LEED for Neighborhood Development: [www.usgbc.org/DisplayPage.aspx?CMSPageID=148](http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148)  
This page has links to the LEED rating system, a project checklist, and information on certification.

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# SITE IMPROVEMENTS

**Low impact design  
and development  
principles  
minimize the site's  
environmental  
footprint.**

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## 3.1

*Mandatory***Environmental Remediation****REQUIREMENTS**

Conduct a Phase I Environmental Site Assessment, a Tier II Environmental Review Assessment per HUD funding requirements, an environmental site assessment approved by HUD through the Part 50 or Part 58 process, or an environmental site assessment approved by USDA through the 1940-G or 1794 process, and any additional assessments required to determine whether any hazardous materials are present on-site.

If an environmental site assessment reveals that mitigation is necessary, perform the appropriate mitigation steps as required.

**RATIONALE**

The environmental site assessment determines the potential environmental liabilities associated with property acquisition and ownership.

**RESOURCES**

- HUD, Environmental Review Procedures for Entities Assuming HUD Environmental Responsibilities (24 CFR Part 58 process):  
[www.hud.gov/offices/pih/ih/codetalk/onap/docs/24cfr58.pdf](http://www.hud.gov/offices/pih/ih/codetalk/onap/docs/24cfr58.pdf)
- HUD, Part 50 process: [www.hud.gov/offices/pih/ih/codetalk/docs/24cfr50.pdf](http://www.hud.gov/offices/pih/ih/codetalk/docs/24cfr50.pdf)
- USDA, Environmental Review Process, 1940-G and 1794 processes:  
[www.rurdev.usda.gov/pa/environmental.htm](http://www.rurdev.usda.gov/pa/environmental.htm)

## 3.2

*Mandatory***Erosion and Sedimentation Control**

Except for infill sites with buildable area smaller than one acre

**REQUIREMENTS**

Implement EPA's Best Management Practices for erosion and sedimentation control during construction, referring to the EPA document "Storm Water Management for Construction Activities" (EPA 832-R-92-005), or state or local requirements, whichever is more stringent.

**RATIONALE**

Erosion and sedimentation control during site development keeps valuable topsoil on-site and reduces pollution, stormwater runoff, and sedimentation associated with construction activities into local waterways. Soils compacted from construction activities are less able to absorb water, resist plant root penetration, and lack the porosity needed for adequate aeration.

## RECOMMENDATIONS

Common erosion control measures include:

- 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.
- If soil in a sloped area is disturbed during construction, use tiers, erosion blankets, compost blankets, filter socks and berms, or some comparable approach to keep soil stabilized.
- Consider opting for one of the following methods—phasing, seeding, grading, protecting on-site vegetation, directing runoff to on-site depressions, or swales—instead of using silt fencing. Additionally, the measures that are employed should result in no visible off-site discharge.

## RESOURCES

- U.S. Environmental Protection Agency, “Storm Water Management for Construction Activities” (EPA 832-R-92-005) may be downloaded from the National Service Center for Environmental Publications at [www.epa.gov/nscep/](http://www.epa.gov/nscep/) or purchased as item PB 922 359 51 from the National Technical Information Service at [yosemite.epa.gov/water/owrcatalog.nsf](http://yosemite.epa.gov/water/owrcatalog.nsf)
- CPESC™ Inc.: [www.cpesc.net](http://www.cpesc.net)  
Search the directory on this website to find certified erosion and sedimentation control professionals in your state.
- U.S. Environmental Protection Agency, Erosion and Sediment Control Model Ordinances: [www.epa.gov/owow/nps/ordinance/erosion.htm](http://www.epa.gov/owow/nps/ordinance/erosion.htm)  
This resource is geared toward helping municipalities draft ordinances for erosion and sedimentation control and might serve as a helpful tool in developing company policies for meeting this measure.

### 3.3

*Mandatory*

### Low-Impact Development

Mandatory for New Construction projects located on greenfield development

## REQUIREMENTS

Projects located on greenfields must meet the following low-impact development criteria:

- Achieve **Option 1** of Criterion 3.6, Surface Stormwater Management.
- Design roadways to be along topographic contours and ridge lines so as to avoid erosion and unnecessary cut and fill.
- Do not locate projects on sites with a grade of 15% or more.
- Design roadway plans to utilize the minimum necessary pavement required by code, such as narrower roads, minimized parking, and thoughtful road layout. Consult with local fire department(s) regarding roadway sizing as needed.

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- Design roadway sections with localized retention such as swales, retention basins, plantings, and permeable paving to convey, capture, infiltrate, and/or reuse stormwater. This can be demonstrated through achieving Criterion 3.6, Surface Stormwater Management.
- For projects located in Rural/Tribal/Small Towns as defined in the Location + Neighborhood Fabric category, do not implement a curb and gutter system. Minimize sidewalks or pathways to one side of the road where people would naturally travel. Projects located in municipalities that require curb and gutter infrastructure for all developments are exempt from this sub-requirement.

**EXEMPTIONS**

Projects built on greyfields or brownfields (previously developed sites) or infill sites, defined as those that have at least 75% of the perimeter bordering existing development or roads and with access to existing infrastructure, are not required to meet this measure.

**RATIONALE**

Low impact design and development principles minimize the site's environmental footprint.

**RECOMMENDATIONS**

Keep existing trees and vegetation to the extent feasible.

**RESOURCES**

- U.S. Environmental Protection Agency, *Low-Impact Development Design Strategies: An Integrated Design Approach*: [www.epa.gov/owow/NPS/lidnatl.pdf](http://www.epa.gov/owow/NPS/lidnatl.pdf)

**3.4****Mandatory  
Landscaping**

Only if providing landscaping

**REQUIREMENTS**

Provide plants (including trees, shrubs, and groundcover) such that at least 50% of the area available for landscaping is planted with native or adaptive species. Also, all new plants must be appropriate to the site's soil and microclimate, and none of the new plants should be invasive species.

**RATIONALE**

Native and adaptive plants are well suited to the climate and provide excellent erosion, sediment, dust, and pollution control. Native and adaptive plants are more resistant to naturally occurring disease, insects, and low levels of nutrients, thereby reducing or eliminating the need for fertilizers, pesticides, or herbicides.

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**RECOMMENDATIONS**

- Consider “naturescaping,” a landscaping strategy that conserves water and reduces runoff while providing habitat for beneficial insects, birds, and other wildlife. In areas where water shortages are common, consider “xeriscaping,” a landscaping strategy that uses drought-resistant plants to significantly reduce or eliminate the need for irrigation.
- Consult a local arborist and consider involving a landscape architect in the architectural design process to identify appropriate areas for landscaping and shading.
- Consider integrating the landscape plan with the stormwater management plan to provide water and drainage that is complementary with plants.
- While turf may be appropriate for some landscaping, such as for play areas, it should be minimized wherever possible, except in climates where no irrigation is needed. Non-native turf needs about 35 inches of water per year to thrive, whereas native turf needs much less. Turf grass also requires mowing, and the cumulative effects of electric and gas mowing equipment contribute to the deterioration of local air quality.
- The project team should strive to use only organic and non-toxic fertilizers, pesticides, herbicides, fungicides, and pre-emergents.

**RESOURCES**

- U.S. Environmental Protection Agency, GreenScapes:  
[www.epa.gov/epawaste/consERVE/rrr/greenscapes/index.htm](http://www.epa.gov/epawaste/consERVE/rrr/greenscapes/index.htm)  
This “naturescaping” program provides cost-efficient and environmentally friendly solutions for landscaping. Designed to help preserve natural resources and prevent waste and pollution, GreenScapes encourages holistic decisions regarding waste generation and disposal and the associated impacts on land, water, air, and energy use.
- USDA Agricultural Cooperative Extension System: [www.csrees.usda.gov/Extension/index.html](http://www.csrees.usda.gov/Extension/index.html)  
Lists of local drought-tolerant plants may be available from local USDA Agricultural Cooperative Extension System offices, as well as through numerous online resources.
- Native Plant Information Network: [www.wildflower.org/explore/](http://www.wildflower.org/explore/)  
The site, maintained by the Lady Bird Johnson Wildflower Center, includes a database of native wildflowers, plants, and landscapes throughout North America. The website also includes a National Suppliers Directory.
- USDA National Invasive Species Information Center:  
[www.invasivespeciesinfo.gov/plants/main.shtml](http://www.invasivespeciesinfo.gov/plants/main.shtml)  
As part of the USDA’s National Agricultural Library, NISIC serves as a reference gateway to information, organizations, and services about invasive species.
- U.S. Forest Service “Celebrating Wildflowers”:  
[www.fs.fed.us/wildflowers/nativegardening/instructions.shtml](http://www.fs.fed.us/wildflowers/nativegardening/instructions.shtml)  
This site has extensive information on native gardening, selecting appropriate native plants, and invasive plant species, and has basic instructions for restoration and native landscaping projects.

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## 3.5

*Mandatory***Efficient Irrigation and Water Reuse**

If irrigation is utilized

**REQUIREMENTS**

If irrigation is utilized, install an efficient irrigation or water reuse system. These irrigation requirements are mandatory only for permanent landscaping that requires regular irrigation.

**Option 1**

An efficient irrigation system must include the following at a minimum:

- a drip irrigation system for at least 50% of landscape planting beds
- separately zoned turf and each type of bedding area, based on watering needs
- a timer/controller that activates the valves for each watering zone at the best time of day to minimize evaporative losses while maintaining healthy plants and obeying local regulations and water-use guidance
- a moisture sensor controller or rain delay controller

**Option 2**

Reuse water for irrigation from one of the following sources:

- treated greywater
- rainwater, collected from the roof or site
- water from a municipal recycled water system

For all projects, watering tubes for trees are allowed for a period of two years.

**RATIONALE**

Accurate delivery of water reduces evaporation and eliminates overspray. Proper scheduling eliminates fluctuations between wet and dry states that stress plants.

**RECOMMENDATIONS**

Use high-efficiency irrigation nozzles with an average distribution uniformity (DU) of at least 0.70. This may include conventional rotors, multi-stream rotors, or high-efficiency spray heads, but the DU must be verified by manufacturer documentation or third-party tests.

**RESOURCES**

- American Society of Landscape Architects (ASLA): [www.asla.org](http://www.asla.org)  
ASLA is the national professional association representing landscape architects. Their site provides information about members, products, services, publications, and events.
- U.S. Environmental Protection Agency, WaterSense: Efficiency Made Easy: [www.epa.gov/watersense/index/html](http://www.epa.gov/watersense/index/html)  
This site provides information on the EPA WaterSense labeling program for water-efficient landscape irrigation products, plus tips and recommendations for water-efficient irrigation. Follow the link to *Weather- or Sensor-Based Irrigation Control Technologies* for related information on high-efficiency irrigation controllers.

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- U.S. Environmental Protection Agency, *Water-Efficient Landscaping: Preventing Pollution and Using Resources Wisely*: [www.epa.gov/owm/water-efficiency/docs/water-efficient\\_landscaping\\_508.pdf](http://www.epa.gov/owm/water-efficiency/docs/water-efficient_landscaping_508.pdf)  
This manual provides information about reducing water consumption through creative landscaping techniques.
- American Water Works Association, WaterWiser®: The Water Efficiency Clearinghouse: [www.awwa.org/waterwiser/](http://www.awwa.org/waterwiser/)  
This clearinghouse provides articles, reference materials, and papers on all forms of water efficiency.

## 3.6

Optional | 2 or 6 points

**Surface Stormwater Management****REQUIREMENTS****Option 1** [2 points]

Retain, infiltrate, and/or harvest the first 0.5 inch of rain that falls on the entire site in a 24-hour period.

**Option 2** [6 points]

Retain, infiltrate, and/or harvest all stormwater, as calculated for a one-year storm event, on-site or on adjacent site(s), so that no stormwater is discharged to drains/inlets.

For either option, assure that the project plans and specifications call for permanent labeling of all storm drains or storm inlets to clearly indicate where the drain or inlet leads.

**RATIONALE**

Reducing or eliminating stormwater runoff through design and management techniques increases on-site filtration, reduces total suspended solids (TSS) and other pollutants from entering waterways, and reduces soil erosion. Water storage and nutrient collection processes reduce the need for irrigation and contribute to forming a healthier ecological community within the landscape.

**RECOMMENDATIONS**

- This criterion may be met by using a combination of multiple strategies and technologies, as long as there exists the capacity to retain the first 0.5 inch of rainfall that falls on the entire site. Stormwater management strategies could include disconnected downspouts, permeable paving, swales, retention basins, green roofs, sidewalk planters, xeriscaping, and nature-scaping. See Criteria 3.4–3.6 for synergistic measures.
- For Option 2, local resources can be used to determine the projected rainfall for a one-year storm event at the project site.
- If a rainwater harvesting and storage strategy is considered in addition to infiltration, check with state and local governments to verify that capture and/or reuse of rainwater is permitted. If not, consider appealing local rules.



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- Attempt to make use of innovative, low-impact techniques such as disconnected downspouts, permeable paving, swales, retention basins, rain gardens, ecoroofs, rain barrels, and cisterns to convey, capture, infiltrate, and/or reuse stormwater.
- Strive to minimize impervious areas (surfaces that do not allow stormwater infiltration), including roofs, driveways, sidewalks, and streets, or use porous materials for such areas. Water-permeable materials include pervious interlocking concrete paving blocks, concrete grid pavers, perforated brick pavers, and compacted gravel.
- To provide a visual reminder that storm sewer inlets connect to area waterways and ground-water storages, use a plaque, tile, painted, or pre-cast message such as “No Dumping. Drains to [name of water source].” If project is unable to label storm inlets due to jurisdictional constraints, the project team must provide documentation.

**RESOURCES**

- U.S. Environmental Protection Agency, Storm Drain Marking: [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=15](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=15)
- U.S. Environmental Protection Agency, *Low-Impact Development Design Strategies: An Integrated Design Approach*: [www.epa.gov/owow/NPS/lidnatl.pdf](http://www.epa.gov/owow/NPS/lidnatl.pdf)
- National Association of Home Builders Research Center ToolBase Services: Permeable Pavement: [www.toolbase.org/Technology-Inventory/Sitework/permeable-pavement](http://www.toolbase.org/Technology-Inventory/Sitework/permeable-pavement)  
In a resource provided through a partnership with the Department of Housing and Urban Development, the Partnership for Advancing Technology in Housing, and the National Association of Home Builders Research Center, this site provides details, lists of manufacturers, and related information on permeable paving options.

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# WATER CONSERVATION

**Water conservation translates into direct utility savings for residents and building owners and lowers infrastructure costs associated with stormwater management and water treatment facilities.**

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## 4.1

*Mandatory***Water-Conserving Fixtures**

For all projects

**REQUIREMENTS**

Install water-conserving fixtures in all units and any common facilities with the following specifications:

- Toilets—1.28 gpf (gallons per flush) or less, including dual-flush toilets and pressure-assisted toilets (Note that there are both dual-flush and single-flush models of 1.28 gpf toilets available.)
- Urinals—0.5 gpf or less
- Showerheads—2.0 gpm (gallons per minute) or less
- Kitchen faucets—2.0 gpm or less
- Bathroom faucets—1.5 gpm or less

Substantial and Moderate Rehab projects must replace or retrofit all fixtures to meet the flow rates above.

**RATIONALE**

Water conservation translates into direct utility savings for residents and building owners and lowers infrastructure costs associated with stormwater management and water treatment facilities.

**RECOMMENDATIONS**

- Certain existing fixtures, such as bathroom faucets, can be retrofitted with an aerator to reduce water flow to the requisite level.
- Dual-flush toilets typically have an average flow rate calculated and provided by the manufacturer. However, if this information is not available, use a 2:1 ratio to determine the average flow rate.

For example, with a dual-flush toilet that has a 0.8 low-volume flush to a 1.6 high-volume flush, the calculation would be:

$$\frac{0.8}{1.6} \times \frac{2}{1} \div 3 = 1.067 \text{ average gpf}$$

- For senior projects, consider using single-flush toilets that meet the criterion flow rates, rather than dual-flush toilets. Feedback from past Enterprise Green Communities projects suggests that senior populations may be unsure of the dual-flush technology, which may lead to their having difficulty in operating the toilets in an effective and appropriate way.
- For projects using bathtubs rather than showers, the tub faucet is exempt from this measure.
- Consider conducting a WaterSense water pressure test at the street level, given that a project's water pressure and the distance between the source of water and the fixture(s) may allow a fixture to release more or less water than its rating indicates.

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## RESOURCES

- Not all high-efficiency toilets operate equally well, and poor design can lead to ineffective flushing and the need for multiple flushes. The EPA's WaterSense program certifies toilets that achieve both water efficiency and operational effectiveness. The WaterSense label identifies high-efficiency products that have been verified for performance. WaterSense currently has a specification for high-efficiency toilets and bathroom faucets, and specification for showerheads is under development. Information is available at: [www.epa.gov/owm/water-efficiency](http://www.epa.gov/owm/water-efficiency)
- Maximum Performance (MaP™) Testing California Urban Water Conservation Council: [www.cuwcc.org/maptesting.lasso](http://www.cuwcc.org/maptesting.lasso)  
The MaP™ testing project was initiated in 2003 to test toilet models' performance. This testing protocol simulates real-world use to help consumers identify high-efficiency toilets that not only save water but also work well. The current MaP testing report provides performance information on 470 toilet models. This site provides access to the complete listings of the tested toilets.

## 4.2

*Optional | 6 points maximum***Advanced Water-Conserving Appliances and Fixtures**

## REQUIREMENTS

Install water-conserving fixtures in all units and any common space bathrooms with the following specifications. Inclusion of each type of fixture is worth two optional points.

- **Option 1** [2 points]: All toilets—1.2 gpf (gallons per flush) or less
- **Option 2** [2 points]: All showerheads—1.5 gpm (gallons per minute) or less
- **Option 3** [2 points]: All faucets for kitchens and bathrooms
  - Kitchen faucets — 1.5 gpm or less
  - Bathroom faucets—0.5 gpm or less

Substantial and Moderate Rehab projects can replace or retrofit all fixtures to meet the flow rates above to achieve these optional points.

## RATIONALE

Water conservation translates into direct utility savings for residents and building owners and lowers infrastructure costs associated with stormwater management and water treatment facilities.

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**RECOMMENDATIONS**

- Certain existing fixtures, such as bathroom faucets, can be retrofitted with an aerator to reduce water flow to the requisite level.
- Dual-flush toilets typically have an average flow rate calculated and provided by the manufacturer. However, if this information is not available, use a 2:1 ratio to determine the average flow rate.

$$\frac{\text{low flow volume rate}}{\text{high flow volume rate}} \times \frac{2}{1} \div 3 = \text{average flow rate}$$

For example, with a dual-flush toilet that has a 0.8 low-volume flush to a 1.6 high-volume flush, the calculation would be:

$$\frac{0.8}{1.6} \times \frac{2}{1} \div 3 = 1.067 \text{ average gpf}$$

- For senior projects, consider using single-flush toilets that meet the criterion flow rates, rather than dual-flush toilets. Feedback from past Enterprise Green Communities projects suggests that senior populations may be unsure of the dual-flush technology, which may lead to their having difficulty in operating the toilets in an effective and appropriate way.
- For projects using bathtubs rather than showers, the tub faucet is exempt from this measure.
- Consider conducting a WaterSense water pressure test at the street level, given that a project's water pressure and the distance between the source of water and the fixture(s) may allow a fixture to release more or less water than its rating indicates.

**RESOURCES**

- Not all high-efficiency toilets operate equally well, and poor design can lead to ineffective flushing and the need for multiple flushes. The EPA's WaterSense program certifies toilets that achieve both water efficiency and operational effectiveness. The WaterSense label identifies high-efficiency products that have been verified for performance. WaterSense currently has a specification for high-efficiency toilets and bathroom faucets, and specification for shower-heads is under development. Information is available at: [www.epa.gov/owm/water-efficiency](http://www.epa.gov/owm/water-efficiency)
- Maximum Performance (MaP™) Testing California Urban Water Conservation Council: [www.cuwcc.org/maptesting.lasso](http://www.cuwcc.org/maptesting.lasso)  
The MaP™ testing project was initiated in 2003 to test toilet models' performance. This testing protocol simulates real-world use to help consumers identify high-efficiency toilets that not only save water but also work well. The current MaP testing report provides performance information on 470 toilet models. This site provides access to the complete listings of the tested toilets.

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## 4.3

*Optional | 4 points maximum***Water Reuse****REQUIREMENTS**

Harvest, treat, and reuse rainwater and/or greywater to meet a portion of the project's water needs.

To achieve optional points, provide the defined percentage of the project's total water needs through rainwater and/or greywater (using either one or a combination of both strategies). Total water needs include all exterior and interior water use.

TOTAL WATER NEEDS SUPPLIED BY RAINWATER AND/OR GREYWATER	NUMBER OF OPTIONAL POINTS
10%	1 point
20%	2 points
30%	3 points
40%	4 points

**RATIONALE**

Rainwater and greywater reuse strategies reduce the need for municipal water supplies and sewage treatment.

**RECOMMENDATIONS**

- Rainwater can be harvested from impervious surfaces such as roofs and carried via gutters and downspouts to a storage tank or cistern where it can be treated or filtered for potable uses. Untreated rainwater may be used for non-potable uses.
- Greywater may be stored and treated for non-potable uses such as toilet flushing and irrigation.
- Rainwater and greywater systems are subject to state and local regulations and special requirements. In some jurisdictions, rainwater or greywater systems may not be allowed. Check with your local building code officials for requirements.
- Consider striving for rainwater and greywater utilization beyond 20%. In some cases, employing rainwater and greywater harvesting, treatment, and reuse can provide for all of a project's water needs.

**RESOURCES**

- American Water Works Association, WaterWiser®: The Water Efficiency Clearinghouse: [www.awwa.org/waterwiser/](http://www.awwa.org/waterwiser/)  
This clearinghouse provides articles, reference materials, and papers on water recycling, greywater, and rainwater reuse.
- International Living Building Institute, Achieving Water Independence in Buildings: [ilbi.org/resources/reports/water/oregon](http://ilbi.org/resources/reports/water/oregon)  
This downloadable publication explains water reuse systems and regulatory barriers, and provides information for those wishing to explore the possibilities of water reuse in buildings and to reform limiting regulation.

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## ENERGY EFFICIENCY

**Improvements in building energy performance result in utility cost savings from more efficient heating, cooling, hot water, lights and appliances, which improves residents' comfort and lowers operating costs.**

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**5.1a***Mandatory***Building Performance Standard**

New Construction: Single-family and multifamily buildings, three stories or fewer

**REQUIREMENTS**

Certify the project under ENERGY STAR New Homes Version 2, 2.5, or 3 depending on when the project is permitted. See the “Recommendations” section for additional information on the registration timeline and pathways for projects to achieve ENERGY STAR.

The following project types are subject to this requirement:

- Single-family detached homes (includes detached homes, townhomes, rowhomes, duplexes, and triplexes)
- Units in multifamily buildings that are three stories or fewer
- Units in multifamily buildings that are four or five stories and have their own heating, cooling, and hot water systems, separate from other units

Projects in Oregon, Washington state, Idaho, and Montana must meet the performance requirements of Northwest ENERGY STAR Homes Program.

For other states with an energy code exceeding the 2009 IECC, EPA regional program requirements have been developed. Go to [www.energystar.gov/homes](http://www.energystar.gov/homes) for the latest list.

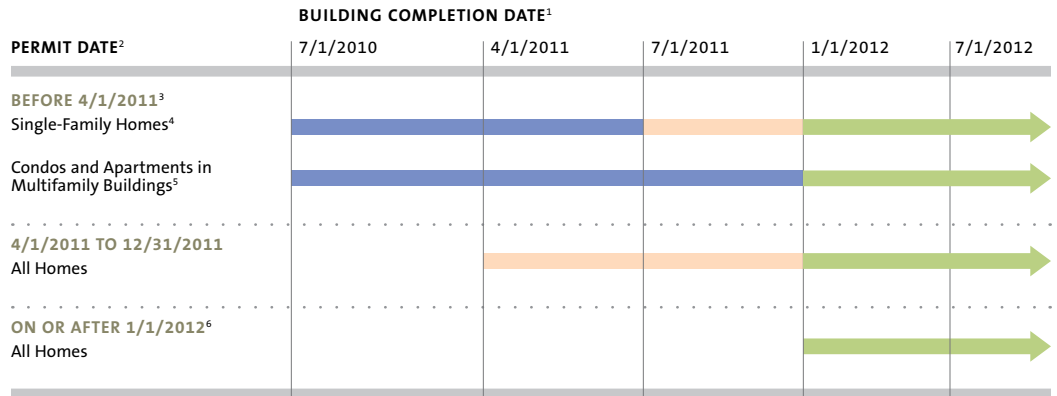
**RATIONALE**

ENERGY STAR-qualified homes are independently verified to be energy efficient and durable. These high-performance homes achieve energy savings in heating, cooling, hot water, lighting, and appliance efficiencies, which improve resident comfort, reduce operating costs, and decrease greenhouse gas emissions.



RECOMMENDATIONS

ENERGY STAR FOR NEW HOMES PROGRAM IMPLEMENTATION



- The completion date is the date of the rating, which will be listed on the ENERGY STAR label for each qualified home.
- The permit date is the date of the permit or the date of the contract on the home.
- Homes can be qualified under the Version 2.5 guidelines in advance of the dates above at the discretion of builders and their raters. However, homes may not be qualified as Version 3 until January 1, 2012.
- Single-family homes include detached homes, townhomes, rowhomes, duplexes, and triplexes.
- All multi-family homes financed through low-income housing agencies may earn the ENERGY STAR under the last iteration of the guidelines, Version 2, until January 1, 2013 as long as the application for funding for those homes was received by the low-income housing agency before April 1, 2011. If the application for funding is received between April 1, 2011 and December 31, 2011, then the homes must earn the ENERGY STAR under the Version 2.5 guidelines if completed before January 1, 2012, and under the Version 3 guidelines if completed after January 1, 2012. If the application for funding is received on or after January 1, 2012 then the homes must earn the ENERGY STAR under the Version 3 guidelines.
- Where a utility or state sponsor is mandating or incentivizing early adoption of Version 3 in their area, EPA will allow the labeling of ENERGY STAR Version 3 prior to January 1, 2012 on a pilot program basis, provided that the sponsor meets certain requirements.

- **Version 2**  
2006 Guidelines
- **Version 2.5**  
Version 3 ENERGY STAR Reference Design with Air Barriers and Air Sealing sections of Thermal Enclosure Checklist. Other Checklists completed but not enforced.
- **Version 3**  
Version 3 ENERGY STAR Reference Design with All Checklists

- Projects permitted before April 1, 2011 can certify under ENERGY STAR New Homes Version 2 or higher using either the performance or prescriptive pathway.
- Projects permitted between April 1, 2011 and December 31, 2011 must certify under ENERGY STAR New Homes Version 2.5 or higher using either the performance or prescriptive pathway.
- Projects permitted on or after January 1, 2012 must certify under ENERGY STAR New Homes Version 3.
- ENERGY STAR New Homes Version 2.5 and 3 are designed to be at least 15% more stringent than the 2009 IECC for all new single-family detached and low-rise multifamily residential structures under four stories. Multifamily residential buildings that are four or five stories and have their own heating, cooling, and hot water systems, separate from other units, may also qualify for ENERGY STAR. Residential buildings can achieve this by using a prescriptive or a performance path.
- For the prescriptive path, projects must meet the ENERGY STAR Reference Design, a set of design specifications compiled by ENERGY STAR.

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- For the performance path, projects will utilize the ENERGY STAR Reference Design and a Size Adjustment Factor to determine an ENERGY STAR HERS Index Target for each home.
  - The baseline building performance standard can only be met through building performance improvements, and not through the addition of electric-generating renewable energy systems. Other “renewable” technologies such as solar domestic hot water collectors and geothermal H/AC systems (ground source heat pumps) can be included.
- Under ENERGY STAR Version 2.5, both paths are required to complete sections 3 and 5 of the “Thermal Enclosure System Rater Checklist.” The other checklists must be completed, but are not enforced.
- Under ENERGY STAR Version 3, both paths are required to complete the “Thermal Enclosure System Rater Checklist,” as well as:
  - HVAC System Quality Installation Contractor Checklist
  - HVAC System Quality Installation Rater Checklist
  - Water Management System Building Checklist (or Indoor airPLUS Verification Checklist)
- During the design phase, work with a qualified Home Energy Rater to set energy efficiency goals that comply with ENERGY STAR Version 2.5 and 3. After the project team has decided on an “energy package,” build the finalized building performance threshold and measures into the project plans and specs, work with the HERS Rater to create and implement a verification plan during the construction processes, and conduct building performance tests post-construction.
- ENERGY STAR Version 2.5 and 3 offers a sampling protocol that allows a builder with a large volume of projects to qualify a group of new homes to meet ENERGY STAR guidelines based on pre-analysis of building plans and subsequent random testing and inspections of a sample set of the homes as-built. For more information on the U.S. EPA sampling protocols, see the adopted 2006 Enhancements to National Home Energy Ratings Standards at [www.resnet.us/standards/sampling\\_standard.pdf](http://www.resnet.us/standards/sampling_standard.pdf)

## RESOURCES

- For more information regarding ENERGY STAR standards: [www.energystar.gov/homes](http://www.energystar.gov/homes)
- For more information regarding Pacific Northwest ENERGY STAR for New Homes, visit [www.northwestenergystar.com/partner-resources/index.html](http://www.northwestenergystar.com/partner-resources/index.html)
- To identify a Home Energy Rater in your area visit [www.energystar.gov/index.cfm?fuseaction=new\\_homes\\_partners.locator](http://www.energystar.gov/index.cfm?fuseaction=new_homes_partners.locator) or call the ENERGY STAR toll-free hotline: 888.STAR.YES
- New guidelines for ENERGY STAR Version 2.5 and 3.0 prescriptive and performance path: [www.energystar.gov/index.cfm?c=bldrs\\_lenders\\_raters.nh\\_2011\\_comments](http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_2011_comments)
- The EPA provides additional guidance for qualifying units in multifamily buildings (including buildings with four or five stories): [www.energystar.gov/index.cfm?c=bldrs\\_lenders\\_raters.nh\\_multifamily\\_units](http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.nh_multifamily_units)
- The California Advanced Homes Program (CAHP) offers California projects financial incentives and best-practice resources at [www.californiaadvancedhomes.com/](http://www.californiaadvancedhomes.com/)
- 2009 IECC Climate Zones Map: [energycode.pnl.gov/EnergyCodeReqs/](http://energycode.pnl.gov/EnergyCodeReqs/)  
A detailed map that shows climate zones zoomed into each state and county as well as the basic 2009 IECC Building Code requirements for each climate zone.

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## 5.1b

*Mandatory*

### Building Performance Standard

New Construction: Multifamily buildings, four stories or more

#### REQUIREMENTS

- Meet the ENERGY STAR Multifamily High-Rise program (MFHR) guidelines. Projects permitted on or after January 1, 2012 must be certified through the ENERGY STAR MFHR program. See the “Recommendations” section for the Enterprise Green Communities implementation timeline for the ENERGY STAR MFHR program.

**OR**

- Multifamily buildings that are four or five stories, in which all units have their own heating, cooling, and hot water systems, separate from other units, may choose to comply with Criterion 5.1a and meet the requirements of ENERGY STAR New Homes Version 2.5 or 3.
- Projects in California, regardless of size, must exceed by 15% the version of Title 24 under which the project is permitted.

#### RATIONALE

Buildings meeting the Multifamily High-Rise program guidelines are designed to be energy efficient and durable. These high-performance buildings achieve energy savings in heating, cooling, hot water, lighting, and appliance efficiencies, which improve resident comfort, reduce operating costs, and decrease greenhouse gas emissions.

#### RECOMMENDATIONS

##### ENERGY STAR MULTIFAMILY HIGH-RISE PROGRAM IMPLEMENTATION

	PERMIT DATE*	
	BEFORE 01/01/2011	ON OR AFTER 01/01/2012
MULTIFAMILY MID-RISE OR HIGH-RISE BUILDINGS	Project must meet the ENERGY STAR MFHR guidelines, but does not need to certify through the MFHR program	Project must certify through the ENERGY STAR MFHR program

\*The permit date is the date of the permit or the date of the contract on the building.

- Projects participating in the ENERGY STAR MFHR program are designed to perform at least 15% better than ASHRAE 90.1-2007. A project can achieve this by using a prescriptive or a performance path.
  - **Prescriptive Path:** The project must meet the MFHR Mandatory Prescriptive Path Requirements, and be verified and field-tested according to the ENERGY STAR MFHR Testing and Verification Protocols.
  - **Performance Path:** The project must meet the MFHR Mandatory Requirements, a 15% energy performance target over ASHRAE 90.1-2007, and be verified and field-tested in accordance with the ENERGY STAR Testing and Verification Protocols.

- To calculate the energy performance target required to meet the Performance Path requirements, the project team must:
  - Identify a qualified professional with experience performing energy modeling per ASHRAE Standard 90.1, Appendix G. In the early design stage, the qualified professional should prepare the energy model and work with the integrative design team to identify cost-effective strategies for meeting the performance target.
  - Calculate the baseline building performance rating according to the EPA’s Multifamily High-Rise Simulation Guidelines building performance rating method, which is based on Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda).
- Appendix G of Standard 90.1-2007 is the method for calculating the baseline and projected energy consumption of a building. This method includes all energy costs associated with the building project.
  - The baseline building performance standard (5.1b) can only be met through building performance improvements, and not through the addition of electric-generating renewable energy systems. Other “renewable” technologies such as solar domestic hot water collectors and geothermal H/AC systems (ground source heat pumps) can be included.

**Software approved by the EPA’s Multifamily High-Rise program includes:**

- DOE2
- eQuest
- VisuasDOE
- EZDOE
- TRACE
- HAP
- TRNSYS
- EnergyPlus

**California projects following Title 24 must use the approved list of energy modeling software:**

- Energy Pro 5.1
- Micropas 8.1
- CALRES 2008 v1.1

**RESOURCES**

- EPA’s Multifamily High-Rise program details, including the prescriptive and performance path guidelines and the testing and verification protocols: [www.energystar.gov](http://www.energystar.gov)

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## 5.1c

*Mandatory***Building Performance Standard**

Substantial and Moderate Rehab: Single-family and multifamily, three stories or fewer

**REQUIREMENTS**

Demonstrate that the energy performance of the completed building is equivalent to a HERS Index of 85 through energy modeling that generates a Home Energy Rating certificate.

**RATIONALE**

Buildings rehabilitated to a HERS Index of 85 will achieve approximately 2009 IECC energy performance levels in heating, cooling, hot water, lighting, and appliance efficiencies, which improve resident comfort, reduce operating costs, and decrease greenhouse gas emissions.

**RECOMMENDATIONS**

- To demonstrate energy performance equivalent to a HERS Index 85, contract with a certified Home Energy Rater (HERS). The HERS rater will perform energy modeling and generate the HERS certificate.
- The HERS rater will be responsible for:
  - creating an energy model to the building plans and specified building plans and specifications to show the building’s projected energy performance in the design stage
  - conducting a mid construction pre-drywall thermal enclosure, using the ENERGY STAR version 3 “Thermal Enclosure System Rater Checklist”
  - verifying the final performance of the building with post-construction performance testing, including a blower door and duct blaster test of the home and/or units
- The energy rating software used must be accredited by either RESNET or the California Energy Commission.
- Any method or strategy (except for electric-generating renewable energy systems) can be implemented to satisfy the targeted minimum energy performance.
- If rehabilitating a multifamily low-rise building, generate a HERS certificate for each unique floorplan within the project or subdivision.

**RESOURCES**

- U.S. Department of Energy, Air Sealing, Technology Fact Sheet: [apps1.eere.energy.gov/buildings/publications/pdfs/building\\_america/26290.pdf](https://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/26290.pdf)  
This fact sheet describes the importance of sealing air leaks and providing controlled ventilation.
- To identify a Home Energy Rater in your area, call the ENERGY STAR toll-free hotline: 888.STAR.YES or [www.energystar.gov/index/cfm?fuseaction=new\\_homes\\_partners.locator](http://www.energystar.gov/index/cfm?fuseaction=new_homes_partners.locator)

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- Enterprise Green Communities Single-Family Rehabilitation Specifications: [www.greencommunitiesonline.org](http://www.greencommunitiesonline.org)  
A set of green single-family specifications for insulation, air-sealing, and other details that can be customized to your project.
- Enterprise Green Communities Neighborhood Stabilization Program: [www.greenbuildingadvisor.com/green-communities-nsp](http://www.greenbuildingadvisor.com/green-communities-nsp)  
Enterprise and BuildingGreen have partnered to offer technical resources that build on Enterprise's Green Rehabilitation Specifications. These resources are largely focused on the application of building science concepts that are critical to a building's performance.
- The city of Fort Collins, Colorado, provides audit standards for their Home Efficiency Program: [www.fcgov.com/conservation/res-home-efficiency.php](http://www.fcgov.com/conservation/res-home-efficiency.php)
- Building Performance Institute, Combustion Safety Procedures: [www.bpi.org/tools\\_downloads.aspx?selectedTypeID=1&selectedID=2](http://www.bpi.org/tools_downloads.aspx?selectedTypeID=1&selectedID=2)  
This site provides a set of guidelines regarding combustion safety when conducting audits and diagnostic testing.
- 2009 IECC Climate Zones Map: [energycode.pnl.gov/EnergyCodeReqs/](http://energycode.pnl.gov/EnergyCodeReqs/)  
A detailed map that shows Climate Zones zoomed into each state and county as well as the basic 2009 IECC Building Code requirements for each Climate Zone.
- Residential Energy Services Network (RESNET): [www.resnet.us](http://www.resnet.us)  
A resource where residents can learn about the energy audit and rating process and search the RESNET directory to find certified energy auditors and raters.

## 5.1d

*Mandatory***Building Performance Standard**

Substantial and Moderate Rehab: Multifamily, four stories or more

**REQUIREMENTS**

Demonstrate that the energy performance of the completed building will be equivalent to ASHRAE 90.1-2007 using an energy model created by a qualified energy services provider.

This performance requirement can only be met through building performance improvements, and not through the addition of electric-generating renewable energy systems.

**RATIONALE**

Buildings rehabilitated to ASHRAE 90.1-2007 energy performance levels achieve energy savings in heating, cooling, hot water, lighting, and appliance efficiencies, which improve resident comfort, lower operating costs, and decrease greenhouse gas emissions.

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**RECOMMENDATIONS**

- To demonstrate energy performance equivalent to ASHRAE 90.1-2007, contract with an energy services provider. The energy services provider will be responsible for:
  - creating an energy model with the building plans and specifications to show the building's projected energy performance in the design stages
  - conducting a mid-construction pre-drywall thermal enclosure inspection
  - verifying the final performance of the building with performance testing
- The energy services provider must use an energy rating software approved through EPA's MFHR program.
  - The project does not have to follow the code requirements of the ASHRAE 90.1 2007; it is only required to meet the minimum energy performance target that was calculated from the energy model. Any method or strategy (except for electric-generating renewable energy systems) can be implemented to satisfy the targeted minimum energy performance.
  - Projects in California must use the version of Title 24 under which the project is permitted to calculate the targeted minimum energy performance.

**Software approved by the EPA's Multifamily High-Rise program includes:**

- DOE2
- eQuest
- VisualDOE
- EZDOE
- TRACE
- HAP
- TRNSYS
- EnergyPlus

**California projects following Title 24 must use the approved list of energy modeling software:**

- Energy Pro 5.1
- Micropas 8.1
- CALRES 2008 v1.1

**RESOURCES**

- U.S. Department of Energy, Air Sealing, Technology Fact Sheet: [apps1.eere.energy.gov/buildings/publications/pdfs/building\\_america/26290.pdf](https://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/26290.pdf)  
This fact sheet describes the importance of sealing air leaks and providing controlled ventilation.
- Enterprise Green Communities Multifamily Rehabilitation Specifications: [www.greencommunitiesonline.org](http://www.greencommunitiesonline.org)  
A set of model green building specifications for Moderate Rehab projects that includes details on insulation, air sealing, and performance testing that can be customized for your project.
- For more information on ASHRAE 90.1-2007: [www.ashrae.org](http://www.ashrae.org) or 800.527.4723

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## 5.2

*Optional | 15 points maximum***Additional Reductions in Energy Use****REQUIREMENTS**

**5.2a. New Construction—Single-Family and Multifamily Buildings** (three stories or fewer): 1 point for each additional 1 point decrease in the targeted HERS Index as outlined in Criterion 5.1a

**5.2b. New Construction—Multifamily Buildings** (four stories or more): 1 point for each additional 1% energy improvement from the required energy performance target calculated in Criterion 5.1b

**5.2c. Substantial and Moderate Rehab—Single-Family and Multifamily Buildings** (three stories or fewer): 1 point for each additional 1 point decrease in the targeted HERS Index as outlined in Criterion 5.1c

**5.2d. Substantial and Moderate Rehab—Multifamily Buildings** (four stories or more): 1 point for each additional 1% energy improvement from the required energy performance target calculated in Criterion 5.1d

**RATIONALE**

Improvements in building energy performance result in utility cost savings from more efficient heating, cooling, hot water, lights and appliances, which improve residents comfort, lower operating costs, and decrease greenhouse gas emissions.

**RECOMMENDATIONS**

- Using the baseline energy model created in Criteria 5.1a–5.1d, analyze and adopt energy improvements to achieve additional energy reductions beyond the mandatory levels.
- Projects that use a prescriptive path for Criteria 5.1a–5.1d will not be able to obtain points under this credit.
- Additional reductions in energy use must be captured by energy conservation measures associated with improved building component systems, and not through the addition of electric-generating renewable energy systems. See Criterion 5.7 for renewable energy points.

**RESOURCES**

- Projects can reference the Passive House Institute US standard as a means to go above and beyond in energy performance. Information about Passive House concepts and standards can be found at: [www.passivehouse.us](http://www.passivehouse.us)
- The Building America program offers free research publications, webinars, and newsletters on cost-effective, energy efficient building strategies: [www1.eere.energy.gov/buildings/building\\_america/](http://www1.eere.energy.gov/buildings/building_america/)



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## 5.3

*Mandatory***Sizing of Heating and Cooling Equipment****REQUIREMENTS**

Size heating and cooling equipment in accordance with the Air Conditioning Contractors of America (ACCA) Manuals, Parts J and S, or ASHRAE handbooks.

**RATIONALE**

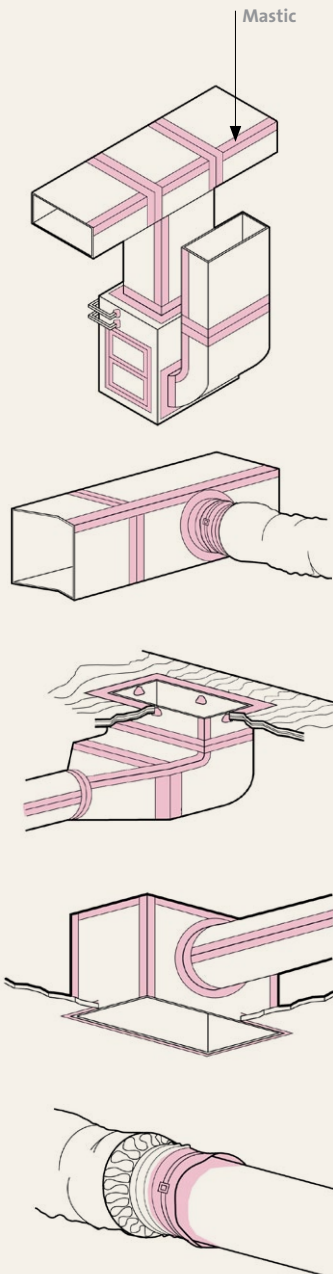
Appropriately sized equipment can save money, ensure adequate dehumidification, and prevent short-cycling that can lead to excess moisture in the air.

**RECOMMENDATIONS**

- The HVAC contractor generates a Manual J load calculation to ensure proper sizing of the cooling system. This calculation accounts for factors such as the home's orientation with respect to the sun, window design and insulation R-value, installation quality, and building air leakage. The contractor can use one of the HVAC industry-adopted software programs, based upon Manual J, which assists with these designs. Consult [www.acca.org](http://www.acca.org) for a list of software programs to perform Manual J calculations.
- Consider locating air handler and ductwork within the building envelope. Do not locate air handler or ductwork within the garage space (see Criterion 7.14 for more information).

**RESOURCES**

- Air Conditioning Contractors of America, Manual J: Residential Load Calculation: [www.acca.org/store/product.php?pid=286](http://www.acca.org/store/product.php?pid=286)
- Air Conditioning Contractors of America, "HVAC Quality Installation Specification: Residential and Commercial Heating, Ventilating, and Air Conditioning Applications": [www.acca.org/tech](http://www.acca.org/tech)  
The site also includes links to various articles and other ANSI and ACCA standards.
- California Energy Commission, Procedures for HVAC System Design and Installation: [www.energy.ca.gov/efficiency/qualityhomes/procedures.html](http://www.energy.ca.gov/efficiency/qualityhomes/procedures.html)  
This site provides an overview of good practices for designing and installing the HVAC system, as well as detailed strategies and measures for the "house as a system" approach to construction.
- For additional information on duct sealing details: [www.energystar.gov/index.cfm?c=home\\_improvement.hm\\_improvement\\_ducts](http://www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_ducts)



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## 5.4

*Mandatory***ENERGY STAR Appliances**

If providing appliances

**REQUIREMENTS**

If providing appliances, install ENERGY STAR–labeled clothes washers, dishwashers, and refrigerators.

**RATIONALE**

ENERGY STAR products meet strict energy-efficiency criteria set by EPA. These products reduce utility costs and greenhouse gas emissions.

**RECOMMENDATIONS**

The specifications of the installed appliances should be reflected in the energy modeling building input data report.

**RESOURCES**

- For bulk orders of ENERGY STAR products, use the web-based purchasing tool “Quantity Quotes”: [www.quantityquotes.net](http://www.quantityquotes.net)  
This site connects purchasing groups with suppliers.
- When preparing project specifications, find ENERGY STAR product information, including model numbers, at [www.energystar.gov/index.cfm?c=products.pr](http://www.energystar.gov/index.cfm?c=products.pr)

## 5.5a

*Mandatory***Efficient Lighting: Interior Units****REQUIREMENTS**

**New Construction — Single-Family and Multifamily Buildings** (three stories or fewer): Install the ENERGY STAR Advanced Lighting Package (ALP) in all buildings. ENERGY STAR–qualified LED fixtures can qualify in the place of ENERGY STAR–labeled fixtures. Fixtures with screw-base lamps are permitted only in uninhabited spaces such as closets and storage areas.

**New Construction — Multifamily Buildings** (four stories or more): Projects must follow the ENERGY STAR MFHR program guidelines, which require that 80% of installed light fixtures within units must be ENERGY STAR qualified or have ENERGY STAR–qualified lamps installed. Fixtures with screw-base lamps are permitted only in uninhabited spaces such as closets and storage areas.

**Substantial and Moderate Rehab:** If being replaced, new fixtures and ceiling fans are required to meet or exceed ENERGY STAR efficiency levels. If reusing existing fixtures in a rehab, projects must install screw-in compact fluorescent light bulbs (CFLs).

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**RATIONALE**

Energy reductions through efficient lighting products contribute to lower utility costs and lower greenhouse gas emissions.

**RECOMMENDATIONS**

- The ENERGY STAR ALP requires that a minimum of 60% ENERGY STAR–qualified fixtures and 100% ENERGY STAR–qualified ceiling fans and ceiling fans with lighting are installed.
- Screw-in adapters that convert incandescent light sockets into pin-type sockets can be used to meet the requirement.

**RESOURCES**

- ENERGY STAR Advanced Lighting Package (ALP) specifications: [www.energystar.gov/index.cfm?c=bldrs\\_lenders\\_raters.ALP\\_Builder](http://www.energystar.gov/index.cfm?c=bldrs_lenders_raters.ALP_Builder)  
This site includes complete information on EPA's ALP specifications and requirements, along with extensive technical resources, qualified product and manufacturer lists and locators, case studies, and marketing support resources.
- For more information on lighting: [www.energystar.gov](http://www.energystar.gov)
- The Lighting Research Center: [www.lrc.rpi.edu/](http://www.lrc.rpi.edu/)  
This university-based, independent lighting research and education group provides objective and timely information about lighting technologies and applications, and about human response to light.

**5.5b***Mandatory***Efficient Lighting: Common Areas and Emergency Lighting**

Multifamily buildings

**REQUIREMENTS****Common Area Lighting**

**New Construction — Multifamily Buildings:** Projects should use ENERGY STAR–labeled fixtures, LEDs, T8 fixtures with electronic ballasts or better, or any equivalent high-performance lighting fixtures and bulbs in all common areas. Non-apartment spaces, except those intended for 24-hour operation, or where automatic shutoff would endanger the safety of the occupants, must have occupancy sensors or automatic bi-level lighting controls.

Projects following the ENERGY STAR MFHR prescriptive path must install fixtures that meet the following requirements: 80% of installed fixtures in common spaces must be ENERGY STAR–qualified or have ENERGY STAR–qualified lamps installed.

**Substantial and Moderate Rehab — Multifamily Buildings:** If being replaced, new common space and emergency lighting fixtures must be ENERGY STAR–labeled fixtures, LEDs, T8 fixtures with electronic ballasts or better, or any equivalent high-performance lighting fixtures and bulbs. If reusing existing fixtures in a rehab, projects must install screw-in compact fluorescent light bulbs (CFLs) where applicable.

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**Emergency Lighting**

**All Multifamily Buildings:** If installing new or replacing, all exit signs shall meet or exceed LED efficiency levels and conform to local building codes; fixtures located above stairwell doors and other forms of egress shall contain a battery backup feature. Photoluminescent exit signs may be used as an alternative to LED signs only if all local code requirements are satisfied.

**RATIONALE**

Energy reductions through efficient lighting products contribute to lower utility costs and lower greenhouse gas emissions.

**5.5c***Mandatory***Efficient Lighting: Exterior****REQUIREMENTS**

**New Construction — Single-Family and Multifamily Buildings** (three stories or fewer): Install ENERGY STAR qualified fixtures or LEDs with a minimum efficacy of 45 lumens/watt, equipped with daylight sensors on all outdoor lighting, including front and rear porch lights in single-family homes.

- Fixtures should include automatic switching on timers or photocell controls for all lighting not intended for 24-hour operation or required for security.
- All fixtures must be full cut-off fixtures that shield light pollution from the night sky.

**New Construction — Multifamily Buildings** (four stories or more): Projects must follow the ENERGY STAR MFHR program guidelines, which require that 80% of outdoor lighting fixtures must be ENERGY STAR-qualified or have ENERGY STAR-qualified lamps installed. Fixtures must include automatic switches on timers or photocell controls except fixtures intended for 24-hour operation, required for security or located on apartment balconies.

**Substantial and Moderate Rehab — Single-Family and Multifamily Buildings:** If being replaced, install ENERGY STAR compact fluorescents or LEDs with a minimum efficacy of 45 lumens/watt, equipped with daylight sensors on all outdoor lighting, including front and rear porch lights in single-family homes.

- Fixtures should include automatic switching on timers or photocell controls for all lighting not intended for 24-hour operation or required for security.
- All fixtures must be full cut-off fixtures that shield light pollution from the night sky.

**RATIONALE**

Energy reductions through efficient lighting products contribute to lower utility costs and lower greenhouse gas emissions.

**RECOMMENDATIONS**

Design outdoor lighting to eliminate light trespass from the project site and to minimize impact on nocturnal environments.

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**RESOURCES**

- Illuminating Engineering Society of North America's Recommended Practice Manual: Lighting for Exterior Environments
- Full Cut-off Dark Sky Approved Fixtures: [www.darksky.org](http://www.darksky.org)

**5.6a***Mandatory***Electricity Meter**

For New Construction and Substantial Rehab, except for single-room occupancy and designated supportive housing dwelling units

**REQUIREMENTS**

Install individual or sub-metered electric meters in all dwelling units.

**RATIONALE**

Providing information to residents on the cost and usage associated with the electricity consumption in their unit may reduce energy use.

**RECOMMENDATIONS**

Individual metering and/or sub-metering should be specified in the Integrative Design stage.

**5.6b***Optional | 3 points***Electricity Meter**

For Moderate Rehab projects

**REQUIREMENTS**

Install individual or sub-metered electric meters in all dwelling units.

**RATIONALE**

Providing information to residents on the cost and usage associated with the electricity consumption in their unit may reduce energy use.

**RECOMMENDATIONS**

Individual meters or sub-meters should be specified in the Integrative Design stage.

5.7a

Optional | 12 points maximum  
**Renewable Energy**

**REQUIREMENTS**

Install photovoltaic (PV) panels, wind turbines, or other electric-generating renewable energy source to provide a specified percentage of the project’s estimated energy demand. Refer to the table below for the point structure.

	5%	10%	20%	30%	40%
Single-Family	—	—	4	8	12
Low-Rise (2–3 stories)	—	4	8	12	—
Mid-Rise / High-Rise (4 stories or more)	4	8	12	—	—

**RATIONALE**

Renewable energy reduces environmental impacts such as greenhouse gas emissions that are associated with energy sourced and produced from fossil fuels. Use of on-site renewable energy technologies can also result in energy cost savings.

**RECOMMENDATIONS**

- When calculating points for Criterion 5.7a, use the total energy consumption of the building(s) estimated in the energy model for Criteria 5.1a–5.1d.
- Projects that use a prescriptive path for Criteria 5.1a–5.1d will not be able to obtain points under Criterion 5.7a.
- To provide a higher percentage of the project’s estimated annual energy consumption with electric-generating renewable energy sources, focus on reducing the building’s overall energy consumption in Criteria 5.1a–5.1d and 5.2 with energy-efficiency measures. Energy-efficiency measures are generally more cost-effective than renewables.

**RESOURCES**

- American Solar Energy Society: [www.ases.org](http://www.ases.org)  
 ASES is a nonprofit organization committed to a sustainable energy economy. ASES accelerates the development and use of solar and other renewable energy resources through advocacy, education, research, and collaboration among professionals, policymakers, and the public.
- American Wind Energy Association: [www.awea.org](http://www.awea.org)  
 AWEA is a national trade association representing wind power plant developers, wind turbine manufacturers, utilities, consultants, insurers, financiers, researchers, and others involved in the wind industry.
- Database of State Incentives for Renewable Energy: [www.dsireusa.org](http://www.dsireusa.org)  
 The North Carolina Solar Center developed this database to collect information on state financial and regulatory incentives (e.g., tax credits, grants, and special utility rates) designed to promote the application of renewable energy technologies. DSIRE also offers additional features, such as preparing and printing reports that detail the incentives on a state-by-state basis.

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- **Florida Solar Energy Center:** [www.fsec.ucf.edu/en/consumer/solar\\_electricity/index.htm](http://www.fsec.ucf.edu/en/consumer/solar_electricity/index.htm)  
This is a resource for basic information on types of photovoltaic solar electric systems, sizing, installation, and system ratings. FSEC also has an industry resources page that includes its *Photovoltaic System Design Course Manual*, available at [www.fsec.ucf.edu/en/education/cont\\_ed/manuals/orderform\\_pvmanual.htm](http://www.fsec.ucf.edu/en/education/cont_ed/manuals/orderform_pvmanual.htm)
- **National Renewable Energy Laboratory:** [www.nrel.gov/ncpv](http://www.nrel.gov/ncpv)  
NREL photovoltaic research provides a clearinghouse on all aspects of photovoltaic solar cell systems.
- **National Renewable Energy Laboratory:** [www.nrel.gov](http://www.nrel.gov)  
NREL is a leader in the U.S. Department of Energy's effort to create a secure energy future for the nation that is environmentally and economically sustainable.
- **U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy:** [www.eere.energy.gov](http://www.eere.energy.gov)  
This website provides information on renewable energy technologies and energy efficiency.

## 5.7b

Optional | 1 or 2 points

**Photovoltaic / Solar Hot Water Ready****REQUIREMENTS**

Site, design, engineer, and/or plumb the development to accommodate installation of photovoltaic (PV) or solar hot water system in the future.

Minimum required south-facing exposure:

- **Single-Family and Low-Rise Buildings:** 250 square feet of unobstructed roof area that is oriented within 15 degrees of true south
- **Mid- and High-Rise Multifamily Buildings:**  $\geq$  30% of unobstructed roof area or maximum that is oriented within 15 degrees of true south

**RATIONALE**

Designing for the future installation of photovoltaics or solar hot water systems allows a building owner the flexibility to transition to increased energy generation through renewable energy sources, as resources become available. Installation of renewable energy systems is a hedge against rising costs for purchased energy.

**RECOMMENDATIONS**

- When designing a photovoltaic or solar hot water ready system, include the following in the project plans and specifications (as applicable to each technology):
  - Site map showing that the building(s) have a southern orientation and unobstructed access to sunlight
  - A design schematic of the future solar array, indicating the south face, slope, and any rooftop equipment that could obstruct the array
  - The type of roof to be installed (e.g., asphalt, standing seam metal, tile)
  - The future location within the building for the inverter

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- For solar hot water, run piping from the designed or current location of the water heater up to the prospective solar hot water collectors.
- Check the local zoning laws to ensure that future buildings will not be able to shade your array.
- Work with an engineer to calculate that the roof can carry the dead load of the solar equipment and withstand the wind loads.
- Determine if the roof has a warranty and if the placement of the solar equipment voids the warranty.
- General contractor, PV, and/or solar hot water contractor must document the information on the roof load, location of conduit, piping, and the potential location of the dash box. GC, PV, and solar hot water contractor should provide documentation to building owner and manager.
- The first cost of PV can be high, but grants and subsidies are available in many states.

## RESOURCES

- National Renewable Energy Laboratory, “Solar Ready Buildings Planning Guide,” NREL Technical Report (NREL/TP-7A2-46078): [www.nrel.gov/docs/fy10osti/46078.pdf](http://www.nrel.gov/docs/fy10osti/46078.pdf)  
A paper published by NREL in December 2009 that details design guidelines and checklists for designing solar-ready buildings.
- Database of State Incentives for Renewables & Efficiency: [www.dsireusa.org](http://www.dsireusa.org)  
The North Carolina Solar Center developed this database to collect information on state financial and regulatory incentives (e.g., tax credits, grants, and special utility rates) designed to promote the application of renewable energy technologies. DSIRE also offers additional features, such as preparing and printing reports that detail the incentives on a state-by-state basis.

## 5.8

Optional | 5 points

## Advanced Metering Infrastructure

## REQUIREMENTS

Site, design, engineer, and wire the development to accommodate installation of smart meters and/or be able to interface with smart grid systems in the future.

## RATIONALE

Installation of smart meters allows for more control over a project’s electricity use, to realize savings associated during off-peak times. Education on energy consumption habits will allow residents, building staff, and owners to fully realize the environmental and economic benefits that green housing offers.

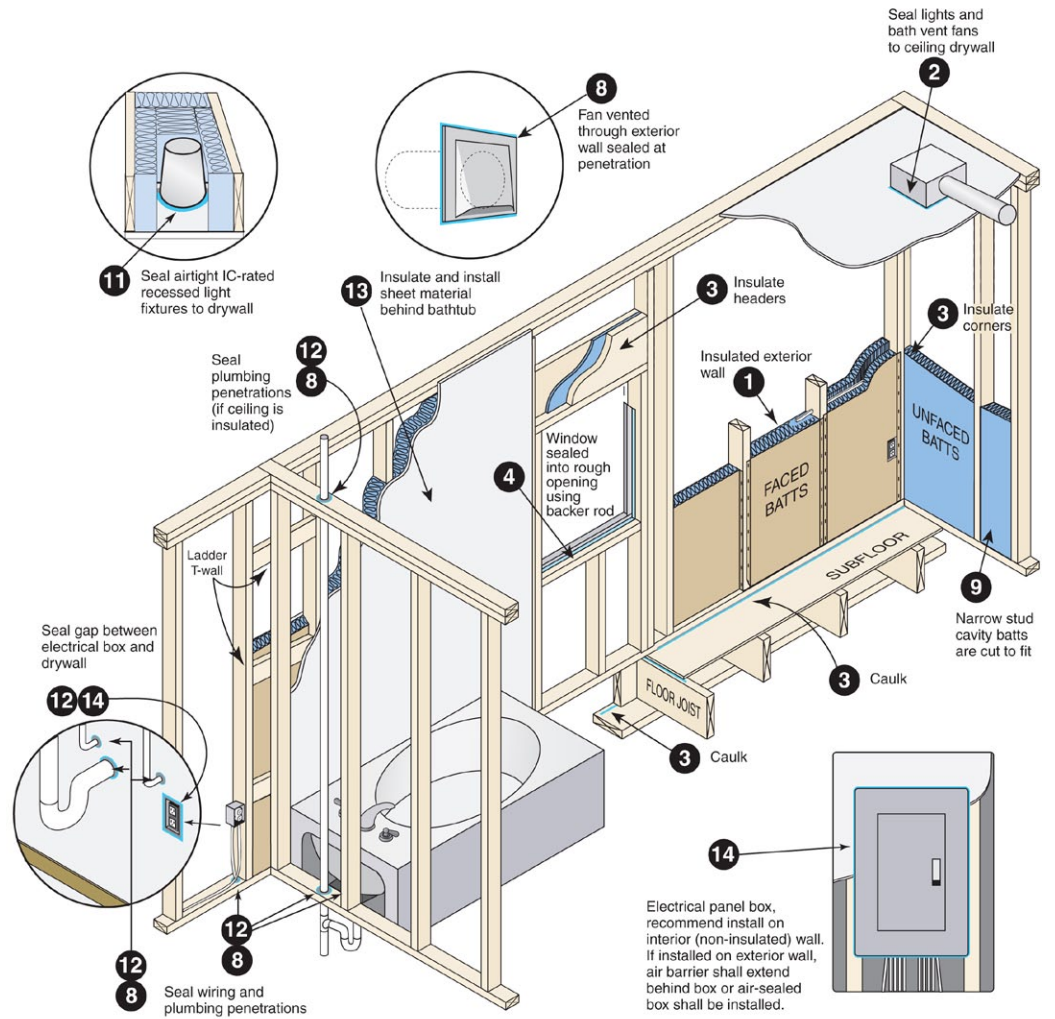
## RESOURCES

- Smart Grid Information Clearinghouse: [www.sgiclearinghouse.org/](http://www.sgiclearinghouse.org/)
- U.S. Department of Energy, “The Smart Grid: An Introduction”:  
[www.oe.energy.gov/DocumentsandMedia/DOE\\_SG\\_Book\\_Single\\_Pages\(1\).pdf](http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf)



**AIR SEALING KEY POINTS**

*Note: Additional air sealing details are available in Appendix B*



Disclaimer: This document is intended solely to help graphically demonstrate the air leakage provisions of section 402.4 of the 2009 IECC. It does not cover all air sealing locations or techniques. Other code provisions may be applicable as well.

Image courtesy of Southface. Reprinted with permission.

**AIR BARRIER AND INSULATION INSPECTION COMPONENT GUIDE**

COMPONENT	CRITERIA
Air barrier and thermal barrier	<p>Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier</p> <p>Breaks or joints in the air barrier are filled or repaired</p> <p>Air-permeable insulation is not used as a sealing material</p> <p>Air-permeable insulation is inside of an air barrier</p>
Ceiling/attic	<p>Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed</p> <p>Attic access (except unvented attic), knee-wall door, or drop-down stair is sealed</p>
Walls	<p>Corners and headers are insulated; junction of foundation and sill plate is sealed</p>
Windows and doors	<p>Space between window/door jambs and framing is sealed</p>
Rim joists	<p>Rim joists are insulated and include an air barrier</p>
Floors (including above-garage cantilevered floors)	<p>Insulation is installed to maintain permanent contact with underside of and subfloor decking</p> <p>Air barrier is installed at any exposed edge of insulation</p>
Crawl space walls	<p>Insulation is permanently attached to walls</p> <p>Exposed earth in unvented crawl spaces is covered with Class I vapor retarder with overlapping joints taped</p>
Shafts, penetrations	<p>Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed</p>
Narrow cavities	<p>Batts in narrow cavities are cut to fit, or narrow cavities are filled with sprayed/blown insulation</p>
Garage separation	<p>Air sealing is provided between the garage and conditioned spaces</p>
Recessed lighting	<p>Recessed light fixtures are airtight, IC rated, and sealed to drywall</p> <p>Exception—fixtures in conditioned space</p>
Plumbing and wiring	<p>Insulation is placed between outside and pipes</p> <p>Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring</p>
Shower/tub on exterior wall	<p>Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall</p>
Electrical/phone box	<p>Air barrier extends behind boxes or air-sealed-type boxes are installed exterior walls</p>
Common wall	<p>Air barrier is installed in common wall between dwelling units</p>
HVAC register boots	<p>HVAC register boots that penetrate building envelope are sealed to subfloor or drywall</p>
Fireplace	<p>Fireplace walls include an air barrier</p>

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# MATERIALS BENEFICIAL TO THE ENVIRONMENT

**Purchasing green construction materials, diverting construction debris and recycling and reusing materials whenever possible reduces waste and disposal costs.**

## 6.1

*Mandatory***Low / No VOC Paints and Primers****REQUIREMENTS**

All interior paints and primers must be less than or equal to the following VOC levels, in grams per liter, based on a combination of the MPI and GreenSeal standards.

PAINT TYPE	MAXIMUM VOC LIMIT
Flats	50 g/L
Non-flats	50 g/L
Floor	100 g/L
Anti-corrosive	250 g/L

**RATIONALE**

Interior paints and primers may release VOCs, particularly when wet. Exposure to individual VOCs and mixtures of VOCs can cause or aggravate health conditions, including allergies, asthma, and irritation of the eyes, nose, and airways; however, no health-based standards for indoor non-occupational exposure have been set.

**RECOMMENDATIONS**

Avoid epoxy-based paints, even those that comply with VOC standards, as these contain the chemical Bisphenol A. Bisphenol A was identified by the EPA on March 29, 2010, as a “chemical of concern.” See [www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html](http://www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html)

**RESOURCES**

Products do not have to meet MPI or Green Seal standards per this criterion, but these standards may be helpful in locating products that meet the maximum VOC levels.

- The MPI Green Performance Standard for Paints & Coatings GPS-2-08 list of products: [www.specifygreen.com/APL/Introduction.html](http://www.specifygreen.com/APL/Introduction.html)
- Green Seal standard and locator for finding products: [www.greenseal.org/certification/standards/GS-11\\_paints\\_and\\_coatings\\_standard.pdf](http://www.greenseal.org/certification/standards/GS-11_paints_and_coatings_standard.pdf) and [www.greenseal.org/findaproduct/index.cfm](http://www.greenseal.org/findaproduct/index.cfm)

6.2

*Mandatory*

**Low / No VOC Adhesives and Sealants**

**REQUIREMENTS**

All adhesives must comply with Rule 1168 of the South Coast Air Quality Management District. All caulks and sealants must comply with Regulation 8, Rule 51, of the Bay Area Air Quality Management District (BAAQMD).

**VOC Limits**

South Coast Air Quality Management District (AQMD), Rule 1168, establishes VOC limits for adhesives: [www.aqmd.gov/rules/reg/reg11/r1168.pdf](http://www.aqmd.gov/rules/reg/reg11/r1168.pdf)

**AQMD ARCHITECTURAL APPLICATIONS CURRENT VOC LIMIT**

*Less water and less exempt compounds in grams per liter*

PRODUCT TYPE	VOC LIMIT (G / L)
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesives	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Drywall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single-ply roof membrane adhesives	250

Bay Area Air Quality Management District Regulation 8, Rule 51, establishes VOC limits for sealants: [www.baaqmd.gov/](http://www.baaqmd.gov/)

Bay Area Air Quality Management District Regulation 8, Rule 51, establishes VOC limits for sealants: [www.baaqmd.gov/](http://www.baaqmd.gov/)

**8-51-301 Adhesive Product, Application Limits:** Except as provided in Section 8-51-305, a person shall not use in the following applications any adhesive product with a VOC content, as defined in Section 8-51-226, that exceeds the following VOC limits (expressed as grams of VOC per liter):

#### BAAQMD VOC STANDARDS

Indoor floor covering installation	150
Multipurpose construction	200
Nonmembrane roof installation / repair	300
Outdoor floor covering installation	250
Single-ply roof material installation / repair	250
Structural glazing	100
Ceramic tile installation	130
Cove base installation	150
Perimeter bonded sheet vinyl flooring installation	660

More information can be found online at [www.baaqmd.gov/~media/Files/Planning%20and%20Research/Rules%20and%20Regs/reg%2008/rg0851.ashx](http://www.baaqmd.gov/~media/Files/Planning%20and%20Research/Rules%20and%20Regs/reg%2008/rg0851.ashx)

#### RATIONALE

Interior adhesives and sealants may release VOCs, particularly when wet. Exposure to individual VOCs and mixtures of VOCs can cause or aggravate health conditions, including allergies, asthma, and irritation of the eyes, nose, and airways; however, no health-based standards for indoor non-occupational exposure have been set.

#### RECOMMENDATIONS

- Many construction adhesives are not capable of adhering at temperatures below 40°F. Projects located in cold climates only (Climate Zones 6 and 7, based on IECC 2006) may be exempted from the required low-VOC adhesives and sealants if they prove problematic due to the above reason. In this instance, please identify in the project submittal documents if other adhesives and/or sealants were needed and at what stage of construction the project team was unable to use required low-VOC products.
- Avoid epoxy-based caulks and epoxy-based sealants, as these contain Bisphenol A. Bisphenol A was listed on March 29, 2010 by the EPA as a “chemical of concern.” See: [www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html](http://www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html)

#### RESOURCES

- U.S. Department of Energy, National Renewable Energy Laboratory, “Weatherize Your Home—Caulk and Weather Strip”: [www.nrel.gov/docs/fy01osti/28039.pdf](http://www.nrel.gov/docs/fy01osti/28039.pdf)
- 2009 IECC Climate Zones Map: [energycode.pnl.gov/EnergyCodeReqs/](http://energycode.pnl.gov/EnergyCodeReqs/)  
A detailed map that shows Climate Zones zoomed into each state and county as well as the basic 2009 IECC Building Code requirements for each Climate Zone.

## 6.3

*Mandatory***Construction Waste Management****REQUIREMENTS**

Commit to following a waste management plan that reduces non-hazardous construction and demolition waste by at least 25% by weight through recycling, salvaging, or diversion strategies.

**RATIONALE**

Diverting construction debris and recycling and reusing materials whenever possible reduces waste and disposal costs. In addition, construction waste management reduces the project's impact on landfills.

**RECOMMENDATIONS**

- Investigate and document local options for recycling or reusing all anticipated major constituents of the project waste stream, including cardboard packaging and “household” recyclables (e.g., beverage containers).
- Consider creating detailed framing plans or scopes of work and accompanying architectural details for use on the job site. Consider creating a detailed cut list and lumber order prior to construction.
- For projects with limited access to recycling centers, consider waste diversion strategies such as using panelized walls and roof trusses to minimize total materials.
- Consider recycling carpet for rehab projects when carpeting is being removed. The specification language below may be customized and included to determine whether carpet recycling is feasible and cost-effective in your locale.
  - Vendor shall supply a price quote to recycle carpet and carpet components at 100%, 50%, and 30% of product tonnage.
  - Property manager shall identify the carpet product and polymer, nylon, polypropylene (which is documented on carpet specification). This will enable the carpet vendor to ascertain the recyclability of the product.
- Some manufacturers of drywall and certain types of ceiling tiles will accept the return of old materials for re-processing.

**RESOURCES**

- NAHB Research Center, Toolbase.org, Best Practices for Construction Waste Management: [www.toolbase.org/Best-Practices/Construction-Waste/waste-mgmt-field-guide](http://www.toolbase.org/Best-Practices/Construction-Waste/waste-mgmt-field-guide)  
This site includes frequently asked questions, case studies, reports, and various links. It includes *A Builder's Field Guide*, which includes guidance for creating a step-by-step construction waste management and recovery plan.
- U.S. Environmental Protection Agency, WasteWise Program: [www.epa.gov/wastewise/targeted/challenge/cbres.htm](http://www.epa.gov/wastewise/targeted/challenge/cbres.htm)  
This site has information about the WasteWise Building Challenge program, including articles, publications, and various links and resources for more information.

- U.S. Environmental Protection Agency, Construction and Demolition Debris: [www.epa.gov/epaoswer/non-hw/debris-new/index.htm](http://www.epa.gov/epaoswer/non-hw/debris-new/index.htm)  
This site includes basic information on construction and demolition debris disposal practices, regional and state programs, publications, and links.
- Construction Materials Recycling Association: [www.cdrecycling.org](http://www.cdrecycling.org)  
This site includes links to websites on recycling concrete, asphalt roof shingles, and drywall, as well as a state-by-state listing of construction waste reusers and recyclers.

## 6.4

*Optional | 5 points maximum***Construction Waste Management****REQUIREMENTS**

Commit to following a waste management plan that reduces non-hazardous construction and demolition waste by more than 25% by weight through recycling, salvaging, or waste diversion strategies.

**RATIONALE**

Diverting construction debris and recycling and reusing materials whenever possible reduces waste and disposal costs. In addition, construction waste management reduces the project's impact on landfills.

**RECOMMENDATIONS**

The following tables provides the point calculations for construction waste management:

PERCENTAGE OF CONSTRUCTION WASTE RECYCLED, SALVAGED, OR DIVERTED	POINTS AWARDED
25%	Mandatory
35%	1
45%	2
55%	3
65%	4
75%	5

- Investigate and document local options for recycling or reuse of all anticipated major constituents of the project waste stream, including cardboard packaging and “household” recyclables (e.g., beverage containers).
- Consider creating detailed framing plans or scopes of work and accompanying architectural details for use on the job site. Consider creating a detailed cut list and lumber order prior to construction.
- For projects with limited access to recycling centers, consider waste diversion strategies such as using panelized walls and roof trusses to minimize overall material use.



- Consider recycling carpet for rehab projects when carpeting is being removed. The specification language below may be customized and included to determine whether carpet recycling is feasible and cost-effective in your locale.
- Vendor shall supply a price quote to recycle carpet and carpet components at 100%, 50%, and 30% of product tonnage.
- Property manager shall identify the carpet product and polymer, nylon, polypropylene (which is documented on carpet specification). This will enable the carpet vendor to ascertain the recyclability of the product.

### RESOURCES

- NAHB Research Center, Toolbase.org, Best Practices for Construction Waste Management: [www.toolbase.org/Best-Practices/Construction-Waste/waste-mgmt-field-guide](http://www.toolbase.org/Best-Practices/Construction-Waste/waste-mgmt-field-guide)  
This site includes frequently asked questions, case studies, reports, and various links. It includes *A Builder's Field Guide*, which includes guidance for creating a step-by-step construction waste management and recovery plan.
- U.S. Environmental Protection Agency, WasteWise Program: [www.epa.gov/wastewise/targeted/challenge/cbres.htm](http://www.epa.gov/wastewise/targeted/challenge/cbres.htm)  
This site has information about the WasteWise Building Challenge program, including articles, publications, and various links and resources for more information.
- U.S. Environmental Protection Agency, Construction and Demolition Debris: [www.epa.gov/epaoswer/non-hw/debris-new/index.htm](http://www.epa.gov/epaoswer/non-hw/debris-new/index.htm)  
This site includes basic information on construction and demolition debris disposal practices, regional and state programs, publications, and links.
- Construction Materials Recycling Association: [www.cdrecycling.org](http://www.cdrecycling.org)  
This site includes links to websites on recycling concrete, asphalt roof shingles, and drywall, as well as a state-by-state listing of construction waste reusers and recyclers.

6.5

Optional | 5 points

### Recycling Storage for Multifamily Project

#### REQUIREMENTS

Provide one or more easily accessible, permanent, and dedicated areas for the collection and storage of materials for recycling for the entire project. Materials must include, at a minimum, paper, corrugated cardboard, glass, plastics, and metals.

#### RATIONALE

Recycling prevents usable materials from entering the waste stream.

#### RECOMMENDATIONS

- Ensure that the recycling program has management support.
- Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area.

- Identify local waste handlers and buyers for glass, plastic, metals, office paper, newspaper, cardboard, and organic wastes.
- Instruct occupants on recycling procedures through clear and visible signs that include pictures and/or languages of residents. Also, include the recycling plan in the Resident Manual.
- Ensure that the recycling program is monitored and improved to address contamination, low participation, and the like.
- Ensure that project staff follow procedures for collecting recyclables for your recycling hauler, and include those procedures in the project maintenance manual.

## 6.6

*Optional | 5 points maximum*  
**Recycled Content Material**

**REQUIREMENTS**

A building material must make up at least 90% of the project component either by weight or by volume to qualify under this measure.

A qualifying building material must be composed of at least 25% post-consumer recycled content or at least 50% post-industrial recycled content to achieve 1 point.

The following table lists the project components and example materials that a team can incorporate for optional points. Each material that meets the requirements of this Criterion is worth 1 point.

PROJECT COMPONENT	BUILDING MATERIAL (EXAMPLES)
Framing	Wood, concrete, steel, aluminum
Siding or masonry	Wood, metal, masonry
Flooring (non-structural)	Linoleum, cork, bamboo, reclaimed wood, sealed concrete, carpet
Concrete / cement and aggregate	Urbanite
Roofing	Wood shingles, asphalt shingles, tile, metal
Insulation	Fiberglass batt, cellulose, rigid panel
Sheathing	Plywood, OSB

**RATIONALE**

Use of building materials with recycled content reduces the negative environmental impact resulting from extraction and processing of virgin materials.

**RECOMMENDATIONS**

Consider the incorporation of recycled content building materials from the early stages of project design.

**RESOURCES**

- Federal Trade Commission, “Guides for the Use of Environmental Marketing Claims,” 16 CFR 260.7(e): [www.ftc.gov/bcp/grnrule/guides980427.htm](http://www.ftc.gov/bcp/grnrule/guides980427.htm)  
Many commonly used products, such as metals, concrete, masonry, acoustic tile, drywall, carpet, ceramic tile, and insulation, are now available with recycled content.
- GreenSpec Directory, Building Green: [www.buildinggreen.com](http://www.buildinggreen.com)  
The online GreenSpec® Directory lists product descriptions for more than 2,000 environmentally preferable products.
- Pharos Project, Healthy Building Network: [www.pharosproject.net](http://www.pharosproject.net)  
The Pharos Project provides health and environmental data about the manufacture, use, and end of life of building materials specified in a web-based tool.

**6.7***Optional | 5 points maximum***Regional Material Selection****REQUIREMENTS**

Use products that were extracted, processed, and manufactured within 500 miles of the project for a minimum of 50%, based on cost, of the building materials’ value.

Building material types that can qualify for these points include the following (*each material can qualify for 1 point*):

- Framing materials
- Exterior materials—siding, masonry, roofing
- Concrete/cement and aggregate
- Drywall/interior sheathing
- Flooring materials

**RATIONALE**

Building materials that are extracted, processed, and manufactured locally to the project site minimize the energy embedded in their transportation and contribute to the local economy.

**RECOMMENDATIONS**

Natural building materials that are approved by HUD or USDA can qualify for points under this measure.

**RESOURCES**

- GreenSpec Directory, Building Green: [www.buildinggreen.com](http://www.buildinggreen.com)  
The online GreenSpec® Directory lists product descriptions for more than 2,000 environmentally preferable products.
- Pharos Project, Healthy Building Network: [www.pharosproject.net](http://www.pharosproject.net)  
The Pharos Project provides health and environmental data about the manufacture, use, and end of life of building materials specified in a web-based tool.

## 6.8

*Optional | 5 points***Certified, Salvaged, and Engineered Wood Products****REQUIREMENTS**

Commit to using wood products and materials of at least 25%, by cost, that are either:

- Certified in accordance with the Forest Stewardship Council
- Salvaged products
- Engineered framing materials that do not include urea formaldehyde-based binders (see Criterion 7.3)

The percentage of certified, salvaged, and engineered wood products is based on cost or value.

**RATIONALE**

Less than 10% of the old growth forest remains in the United States. The use of salvaged wood and engineered wood products precludes the need to use old-growth lumber. Forest Stewardship Council-certified wood encourages forestry practices that are environmentally responsible.

**EQUATION**

$$\frac{\text{Sum of the value of all certified, salvaged, or engineered wood products}}{\text{The value of all wood products as structural components}} = \text{Percentage of total wood products that meet this criterion}$$

**RESOURCES**

- For help in locating FSC-certified products, fill out the form found at [www.fscus.org/faqs/fsc\\_products.php](http://www.fscus.org/faqs/fsc_products.php) and at [www.findfsc.org](http://www.findfsc.org). FSC will circulate it to certified companies, and these companies will contact you if they have the desired product(s) available.
- Rainforest Alliance, “SmartGuide to Green Building Wood Sources”: [www.rainforestalliance.org/smartguides](http://www.rainforestalliance.org/smartguides). This site lists U.S. suppliers, manufacturers, and distributors of FSC-certified building products.

## 6.9a

Optional | 1 or 3 points

## Reduced Heat-Island Effect: Roofing

## REQUIREMENTS

## Option 1 [3 points]

Use ENERGY STAR–compliant roofing, which requires:

	ROOF SLOPE	INITIAL SOLAR REFLECTANCE	MAINTAINED SOLAR REFLECTANCE	EMISSIVITY
Low slope	≤ 2 : 12	≥ 0.65	≥ 0.50	0.8
Steep slope	> 2 : 12	≥ 0.25	≥ 0.15	0.8

Emissivity should be greater than or equal to 0.8 when tested in accordance with ASTM 408.

For Option 1, 100% of the roof area must meet the requirements above to achieve optional points.

## OR

## Option 2 [1 point]

Install a “green” (vegetated) roof for at least 50% of the roof area.

*Combinations of ENERGY STAR–compliant and vegetated roofing can be used, providing they collectively cover 75% of the roof area.*

## RATIONALE

Urban heat islands increase local air temperatures due to the absorption of solar energy by the built environment. Reducing the heat island effect decreases energy consumption by decreasing loads on cooling systems.

## RECOMMENDATIONS

Avoid PVC membrane roofing, which is manufactured using phthalates, a chemical listed on December 30, 2009 by EPA as a “chemical of concern” to human health: [www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html](http://www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html)

## RESOURCES

- Cool Roof Rating Council, Directory of Rated Products: [www.coolroofs.org/products/search.php](http://www.coolroofs.org/products/search.php)  
CRRC maintains a third-party rating system of radiative properties of roof surfacing materials.
- U.S. Environmental Protection Agency, Heat Island Effect: [www.epa.gov/heatisland](http://www.epa.gov/heatisland)  
This site contains information about heat island effect, its social and environmental costs, and strategies to minimize its prevalence, including shading and coloration of hardscapes.
- Lawrence Berkeley National Laboratory, Heat Island Group: [eetd.lbl.gov/HeatIsland](http://eetd.lbl.gov/HeatIsland)  
The Lawrence Berkeley National Laboratory conducts research to find, analyze, and implement solutions to minimizing heat island effects; its current efforts focus on the study and development of more reflective surfaces for roadways and buildings.

## 6.9b

*Optional | 2 points***Reducing Heat-Island Effect: Paving****REQUIREMENTS**

Use light-colored, high-albedo materials and/or an open-grid pavement, with a minimum solar reflectance of 0.3, over at least 50% of the site's hardscaped area.

**RATIONALE**

Urban heat islands increase local air temperatures due to the absorption of solar energy by the built environment. Reducing the heat island effect decreases energy consumption by decreasing loads on cooling systems.

**RESOURCES**

- U.S. Environmental Protection Agency, Heat Island Effect: [www.epa.gov/heatisland](http://www.epa.gov/heatisland)  
This site contains information about heat island effect, its social and environmental costs and strategies to minimize its prevalence, including shading and coloration of hardscapes.
- Lawrence Berkeley National Laboratory, Heat Island Group: [www.eetd.lbl.gov/HeatIsland](http://www.eetd.lbl.gov/HeatIsland)  
The Lawrence Berkeley National Laboratory conducts research to find, analyze, and implement solutions to minimizing heat island effects. Its current efforts focus on the study and development of more reflective surfaces for roadways and buildings.

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# HEALTHY LIVING ENVIRONMENT

**Optimal ventilation improves indoor air quality and the flow of fresh air throughout the home, contributing to a healthier living environment.**

## 7.1

*Mandatory***Composite Wood Products that Emit Low or No Formaldehyde****REQUIREMENTS**

All composite wood products (plywood, OSB, MDF, cabinetry) must be certified compliant with California 93120. If using a composite wood product that does not comply with California 93120, all exposed edges and sides must be sealed with low-VOC sealants, per Criterion 6.2.

**RATIONALE**

Composite wood products using formaldehyde-based binders will emit formaldehyde, which is a volatile organic compound. Symptoms of exposure vary widely and include a host of bodily reactions. Avoiding products that emit formaldehyde will reduce the quantity of harmful indoor air contaminants.

**RECOMMENDATIONS**

- Make this requirement part of the specifications for sub-contractor submittals. Obtain the manufacturer's specifications to determine whether materials meet this requirement. Seek composite wood products compliant with California 93120. California 93120 is a regulation issued by the California Air Resources Board (CARB) limiting allowable formaldehyde emissions from composite wood products.
- Seek composite wood products with no added formaldehyde-based compounds in the contents. Seek composite wood products with CARB No Added Formaldehyde (NAF) certification. Also, Scientific Certification Systems offers a Formaldehyde Free certification, and product listings are available at [www.scscertified.com/products/index.php](http://www.scscertified.com/products/index.php)
- If feasible, specify formaldehyde-free hardwood, plywood, particleboard, or medium-density fiberboard.

**RESOURCES**

- In July 2010, the U.S. Congress passed Public Law No: 111–199, the S. 1660: Formaldehyde Standards for Composite Wood Products Act, which updates the Toxic Substances Control Act of 1976 to align with the recent California legislation 93120. More information on Public Law No: 111–199 S.1660 can be found online at [www.govtrack.us/congress/bill.xpd?bill=s111-1660](http://www.govtrack.us/congress/bill.xpd?bill=s111-1660). A summary of the Toxic Substances Control Act of 1976 can be found online at the EPA's website at [www.epa.gov/lawsregs/laws/tsca.html](http://www.epa.gov/lawsregs/laws/tsca.html)
- The California Air Resources Board approved an Airborne Toxic Control Measure in April 2007 to reduce formaldehyde emissions from composite wood products including hardwood plywood, medium-density fiberboard, and particleboard (Title 17, California Code of Regulations 93120-93120.12). California 93120. More information can be found at: [www.arb.ca.gov/regact/2007/compwood07/fro-final.pdf](http://www.arb.ca.gov/regact/2007/compwood07/fro-final.pdf)



## 7.2

*Mandatory***Environmentally Preferable Flooring**

If project scope includes provision of flooring

**REQUIREMENTS****Prohibited Locations**

Do not install carpets in entryways, laundry rooms, bathrooms, kitchens/kitchenettes, utility rooms, or any rooms of ground-connected floors.

**Products**

Any hard surface flooring products used must be either ceramic tile *or* unfinished hardwood floors *or* meet the Scientific Certification System's FloorScore program criteria (including pre-finished hardwood flooring).

The use of reclaimed flooring is encouraged, and such flooring need not meet the FloorScore certification. Reclaimed wood flooring should be free of lead-based paint, and tiles should be free of asbestos.

Any carpet products used must meet the Carpet and Rug Institute's Green Label or Green Label Plus certification for carpet, pad, and carpet adhesives.

**RATIONALE**

Carpets have a short lifespan (studies suggest 3–5 years), and thus may need frequent replacement. More durable flooring options that last longer and wear better than carpet promote resource conservation through their longevity. New carpets, padding, and adhesives also release VOCs that may pose health hazards to residents and workers. In addition, carpets trap dust and other allergens.

**RECOMMENDATIONS**

- Throughout the home, consider non-carpet flooring alternatives such as natural linoleum; Forest Stewardship Council (FSC)–certified or salvaged hardwoods; cork; bamboo; ceramic or stone tile; or sealed concrete.
- Make this requirement part of the specifications for sub-contractor submittals.

**RESOURCES**

- The SCS FloorScore program website includes information about the program, as well as a list of certified products that is updated regularly: [www.scs-certified.com/iaq/floorscore.html](http://www.scs-certified.com/iaq/floorscore.html) and [www.rfci.com/index.php?option=com\\_content&view=article&id=101&Itemid=100](http://www.rfci.com/index.php?option=com_content&view=article&id=101&Itemid=100)
- The Carpet and Rug Institute maintains a list of manufacturers and products meeting the Green Label Plus standard: [www.carpet-rug.org/residential-customers/selecting-the-right-carpet-or-rug/green-label.cfm](http://www.carpet-rug.org/residential-customers/selecting-the-right-carpet-or-rug/green-label.cfm)
- For online comparison of flooring alternatives, see the Healthy Building Network's Pharos Project: [www.pharosproject.net](http://www.pharosproject.net)

## 7.3

*Optional | 4 points***Environmentally Preferable Flooring: Alternative Sources****REQUIREMENTS**

Use non-vinyl, non-carpet floor coverings in all rooms of the building.

**RATIONALE**

Natural and renewable alternative flooring materials have demonstrated environmental benefits, including low levels of VOC emissions and environmentally friendly production methods. These products are good substitutes for standard products linked with certain health hazards.

**RECOMMENDATIONS**

- Whenever possible, select resilient flooring that has passed a California 01350 test (FloorScore, CHPS) or NSF/ANSI 332. For California 01350, give highest preference to those that pass the residential version of the test, as the residential test is more stringent.
- Use alternative flooring materials such as natural linoleum, ceramic tile, bamboo, cork, or hardwood (especially salvaged wood).
- For basements, leave the slab exposed and stained with low-VOC material rather than providing any floor treatments.

**RESOURCES**

- BuildingGreen, “Green Building Products: The GreenSpec Guide to Residential Building Materials”: [www.buildinggreen.com/ecommerce/gbp.cfm](http://www.buildinggreen.com/ecommerce/gbp.cfm)
- For online comparison of flooring alternatives, see the Healthy Building Network’s Pharos Project: [www.pharosproject.net](http://www.pharosproject.net)
- The U.S. Environmental Protection Agency identified phthalates, a chemical used to make sheet vinyl pliable, as a “chemical of concern” on December 30, 2009: [www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html](http://www.epa.gov/oppt/existingchemicals/pubs/ecactionpln.html)

## 7.4a

*Mandatory***Exhaust Fans: Bathroom**

New Construction and Substantial Rehab

**REQUIREMENTS**

Install ENERGY STAR–labeled intermittent bathroom fans that exhaust to the outdoors, are connected to a light switch, and are equipped with a humidistat sensor, timer, or other control (e.g., occupancy sensor, delay off switch, ventilation controller). Intermittent bathroom fans should operate at an exhaust rate of 50 cubic feet per minute (cfm) to the outdoors, per ASHRAE 62.2-2010.

**OR**

Install ENERGY STAR–labeled continuous bathroom fans that exhaust to the outdoors and operate continuously at a rate of 20 cfm, per ASHRAE 62.2-2010.

**OR**

Install central ventilation systems to meet ASHRAE requirements (see Criteria 7.6a and 7.6b) with rooftop fans that meet the following criteria:

- Roof fans up to 300 design cfm must be direct-drive and variable-speed control with speed controller mounted near the fan.
- Roof fans between 300–2000 design cfm must be direct-drive, variable-speed control, and electronically commutated motors (ECM), with speed controllers mounted near the fan.

### RATIONALE

Properly sized and controlled exhaust fans in bathrooms reduce moisture condensation, lowering the potential for indoor mold growth that may yield odors and pose health hazards to residents. ENERGY STAR–qualified fans use 65% less energy on average than standard models and move more air per unit of energy used with less noise. Timers and humidistat sensors help ensure that fans regularly remove moisture and provide increased ventilation.

### RECOMMENDATIONS

- If the continuous bathroom fan option is used to meet the ventilation requirements for whole house ventilation under Criterion 7.6 or 7.7, project teams should be careful not to exceed the cfm requirements for whole building/unit ventilation (i.e., the fan should have the capability to be set to a low-speed condition or controlled by a cycle timer to meet the requirement).
- Placing a single multi-port, in-line fan in each apartment to exhaust air from the kitchen and bathroom(s) is an acceptable ventilation strategy. In addition to meeting local code requirements for the minimum distance of thru-wall exhaust vents from windows, the in-line fan must be ENERGY STAR–labeled, and the kitchen and bathroom exhaust ventilation rates must comply with ASHRAE 62.2-2010.
- Consider performing the following test to determine if an installed bathroom exhaust fan is pulling roughly the appropriate amount of air. Tear off single squares of toilet paper, hold the toilet paper square up to the fan grill, and turn the fan on. If a bathroom fan can hold one square of toilet paper, then it is pulling about 25 cfm; if a bathroom fan can hold two squares on top of each other, then it is pulling about 50 cfm.

### RESOURCES

- ENERGY STAR: [www.energystar.gov/index.cfm?c=vent\\_fans.pr\\_vent\\_fans](http://www.energystar.gov/index.cfm?c=vent_fans.pr_vent_fans)  
This website describes the advantages of ENERGY STAR–labeled bathroom, utility room, and kitchen exhaust fans, and provides product and manufacturer lists.
- Home Ventilating Institute, Ventilation Systems and Controls: [www.hvi.org/](http://www.hvi.org/) and [www.hvi.org/assets/pdfs/Ventilation\\_Controls\\_for\\_Life-Styles.pdf](http://www.hvi.org/assets/pdfs/Ventilation_Controls_for_Life-Styles.pdf)  
The HVI provides consumers an assurance of product performance. It also works to increase public awareness of the need for good ventilation and provides resources for selecting the proper ventilation products.

- Building Science Information, “Review of Residential Ventilation Technologies”: [www.buildingscience.com/documents/guides-and-manuals/gm-review-residential-ventilation-technologies/view?searchterm=Residential%20Ventilation%20Technologies](http://www.buildingscience.com/documents/guides-and-manuals/gm-review-residential-ventilation-technologies/view?searchterm=Residential%20Ventilation%20Technologies)  
This page provides a link to a report that reviews current and potential ventilation technologies for residential buildings with particular emphasis on North American climates and construction.

## 7.4b

Optional | 6 points

### Exhaust Fans: Bathroom

Moderate Rehab

#### REQUIREMENTS

Install ENERGY STAR–labeled intermittent bathroom fans that exhaust to the outdoors, are connected to a light switch, and are equipped with a humidistat sensor, timer, or other control (e.g., occupancy sensor, delay off switch, ventilation controller). Intermittent bathroom fans should operate at an exhaust rate of 50 cfm to the outdoors, per ASHRAE 62.2-2010.

#### OR

Install ENERGY STAR–labeled continuous bathroom fans that exhaust to the outdoors and operate continuously at a rate of 20 cfm, per ASHRAE 62.2-2010.

#### OR

Install central ventilation systems to meet ASHRAE requirements (see Criteria 7.6a and 7.6b) with rooftop fans that meet the following criteria:

- Roof fans up to 300 design cfm must be direct-drive and variable-speed control with speed controller mounted near the fan.
- Roof fans between 300–2000 design cfm must be direct-drive, variable-speed control, and ECM, with speed controllers mounted near the fan.

#### RATIONALE

Properly sized and controlled exhaust fans in bathrooms reduce moisture condensation, lowering the potential for indoor mold growth that may yield odors and pose health hazards to residents. ENERGY STAR–labeled fans use 65% less energy on average than standard models and move more air per unit of energy used with less noise. Timers and humidistat sensors help ensure that fans regularly remove moisture and provide increased ventilation.

#### RECOMMENDATIONS

- If the continuous bathroom fan option is used to meet the ventilation requirements for whole house ventilation under Criterion 7.6 or 7.7, project teams should be careful not to exceed the cfm requirements for whole project ventilation (i.e., the fan should have the capability to be set to a low-speed condition or controlled by a cycle timer to meet the requirement).

- Placing a single multi-port, in-line fan in each apartment to exhaust air from the kitchen and bathroom(s) is an acceptable ventilation strategy. In addition to meeting local code requirements for the minimum distance of thru-wall exhaust vents from windows, the in-line fan must be ENERGY STAR–labeled, and the kitchen and bathroom exhaust ventilation rates must comply with ASHRAE 62.2-2010.
- Consider performing the following test to determine if an installed bathroom exhaust fan is pulling roughly the appropriate amount of air. Tear off single squares of toilet paper, hold the toilet paper square up to the fan grill, and turn the fan on. If a bathroom fan can hold one square of toilet paper, then it is pulling about 25 cfm; if a bathroom fan can hold two squares on top of each other, then it is pulling about 50 cfm.

### RESOURCES

- For more information on bathroom fans, go to the products section of the ENERGY STAR homepage: [www.energystar.gov/index.cfm?c=vent\\_fans.pr\\_vent\\_fans](http://www.energystar.gov/index.cfm?c=vent_fans.pr_vent_fans)  
This website describes the advantages of ENERGY STAR–labeled bathroom, utility room, and kitchen exhaust fans, and provides product and manufacturer lists.
- Home Ventilating Institute, Ventilation Systems and Controls: [www.hvi.org/](http://www.hvi.org/) and [www.hvi.org/assets/pdfs/Ventilation\\_Controls\\_for\\_Life-Styles.pdf](http://www.hvi.org/assets/pdfs/Ventilation_Controls_for_Life-Styles.pdf)  
The HVI provides consumers an assurance of product performance. It also works to increase public awareness of the need for good ventilation and provides resources for selecting the proper ventilation products.
- Building Science Information, “Review of Residential Ventilation Technologies”: [www.buildingscience.com/documents/guides-and-manuals/gm-review-residential-ventilation-technologies/view?searchterm=Residential%20Ventilation%20Technologies](http://www.buildingscience.com/documents/guides-and-manuals/gm-review-residential-ventilation-technologies/view?searchterm=Residential%20Ventilation%20Technologies)  
This page provides a link to a report that reviews current and potential ventilation technologies for residential buildings with particular emphasis on North American climates and construction.

## 7.5a

*Mandatory*

### Exhaust Fans: Kitchen

New Construction and Substantial Rehab

### REQUIREMENTS

Install power-vented fans or range hoods that exhaust to the outdoors at an intermittent rate of 100 cfm, per ASHRAE 62.2-2010.

**OR**

Install power-vented fans or range hoods that exhaust to the outdoors at a continuous rate of five air changes per hour based on kitchen volume.

**OR**

Install central ventilation systems to meet ASHRAE requirements (see Criteria 7.6a and 7.6b) with rooftop fans that meet the following criteria:

- Roof fans up to 300 design cfm must be direct-drive and variable-speed control with speed controller mounted near the fan.
- Roof fans between 300–2000 design cfm must be direct-drive, variable-speed control, and ECM with speed controllers mounted near the fan.

#### RATIONALE

Properly sized and controlled exhaust fans in kitchens reduce moisture condensation, lowering the potential for indoor mold growth that may yield odors and pose health hazards to residents. Besides helping to reduce moisture, kitchen fans also help remove carbon dioxide and carbon monoxide over fuel-burning appliances and other air contaminants that may be by-products of cooking.

#### RECOMMENDATIONS

- There is currently no ENERGY STAR labeling program for kitchen range fans. Avoid oversized range fans, which can depressurize homes and cause back-drafting of combustion appliances.
- Placing a single multi-port, in-line fan in each apartment to exhaust air from the kitchen and bathroom(s) is an acceptable ventilation strategy. In addition to meeting local code requirements for the minimum distance of thru-wall exhaust vents from windows, the in-line fan must be ENERGY STAR–labeled, and the kitchen and bathroom exhaust ventilation rates must comply with ASHRAE 62.2-2010. Ensure that the placement of the exhaust grill meets code requirements for kitchen ventilation.

#### RESOURCES

- For more information on kitchen fans or range hoods, go to the products section of the ENERGY STAR homepage: [www.energystar.gov](http://www.energystar.gov)

## 7.5b

*Optional | 6 points*

### Exhaust Fans: Kitchen

Moderate Rehab

#### REQUIREMENTS

Install power-vented fans or range hoods that exhaust to the exterior at an intermittent rate of 100 cfm, per ASHRAE 62.2-2010.

**OR**

Install power-vented fans or range hoods that exhaust to the exterior at a continuous rate of five air changes per hour based on kitchen volume.

**OR**

Install central ventilation systems to meet ASHRAE requirements (see Criteria 7.6a and 7.6b) with rooftop fans that meet the following criteria:

- Roof fans up to 300 design cfm must be direct-drive and variable-speed control with speed controller mounted near the fan.
- Roof fans between 300–2000 design cfm must be direct-drive, variable-speed control, and ECM, with speed controllers mounted near the fan.

### RATIONALE

Properly sized and controlled exhaust fans in kitchens reduce moisture condensation, lowering the potential for indoor mold growth that may yield odors and pose health hazards to residents. Besides helping to reduce moisture, kitchen fans also help remove carbon dioxide and carbon monoxide over fuel-burning appliances and other air contaminants that may be by-products of cooking.

### RECOMMENDATIONS

- There is currently no ENERGY STAR labeling program for kitchen range fans. Avoid oversized range fans, which can depressurize homes and cause back-drafting of combustion appliances.
- Placing a single multi-port, in-line fan in each apartment to exhaust air from the kitchen and bathroom(s) is an acceptable ventilation strategy. In addition to meeting local code requirements for the minimum distance of thru-wall exhaust vents from windows, the in-line fan must be ENERGY STAR–labeled, and the kitchen and bathroom exhaust ventilation rates must comply with ASHRAE 62.2-2010. Ensure that the placement of the exhaust grill meets code requirements for kitchen ventilation.

### RESOURCES

- For more information on kitchen fans or range hoods, go to the products section of the ENERGY STAR homepage: [www.energystar.gov](http://www.energystar.gov)

## 7.6a

### Mandatory Ventilation

New Construction and Substantial Rehab

### REQUIREMENTS

#### Single-Family and Low-Rise Multifamily

Install a ventilation system for the dwelling unit capable of providing adequate fresh air per ASHRAE 62.2-2010 requirements for single-family and low-rise multifamily dwellings.

Use the following formula, or refer to the table on the next page as a reference for calculating the ventilation rate.

$$[7.5 \text{ cfm per } (\# \text{ of bedrooms} + 1)] + [1 \text{ cfm per } 100 \text{ ft}^2 \text{ of floor area}] = (\text{ASHRAE 62.2-2010})$$

**Multifamily, four stories or more**

Install a ventilation system capable of providing adequate fresh air per ASHRAE 62.2-2010 for all dwelling units, and ASHRAE 62.1-2010 for all hallways and common spaces.

**[7.5 cfm per (# of bedrooms + 1)] + [1 cfm per 100 ft² of floor area] = (ASHRAE 62.2-2010)**

**AND**

**[0.06 cfm per ft² of common corridors + 25 cfm / 1000 ft²] = (ASHRAE 62.1-2010)**

Alternatively, project teams can use the table below from ASHRAE 62.2-2010 to determine required ventilation rates. Note that the table provides ventilation air requirements for a single-family or a multifamily unit. Thus, the floor area and number of bedrooms listed should be used to derive the required cfm for each unit. Then the units should be aggregated along with the required cfm for the common space to reach the total required cfm for the project.

VENTILATION AIR REQUIREMENTS (IN CFMS)

FLOOR AREA (BY UNIT) FT²	BEDROOMS (BY UNIT)				
	0-1	2-3	4-5	6-7	> 7
< 1500	30	45	60	75	90
1501-3000	45	60	75	90	105
3001-4500	60	75	90	105	120
4501-6000	75	90	105	120	135
6001-7500	90	105	120	135	150

For Substantial Rehab projects, consult Appendix A of ASHRAE 62.2-2010, which provides options relevant to existing buildings.

**Multifamily Projects with Central Ventilation Systems**

Establish ventilation rates for bathrooms, kitchens, and units based on ASHRAE 62.2-2010 requirements. Using these ventilation levels, install a centralized ventilation system that is balanced to run at the required ASHRAE 62.2-2010 levels for each unit and 62.1-2010 levels for common spaces. Provide Enterprise Green Communities with information on the central systems and controls used to achieve the residential in-unit ventilation requirements per ASHRAE 62.2-2010.

**RATIONALE**

Optimal ventilation improves indoor air quality and the flow of fresh air throughout the home, contributing to a healthier living environment.



## RECOMMENDATIONS

- With continuous, demand-controlled, or other centralized ventilation systems, the project team (specifically, the designer, installer, and maintenance staff) should ensure that the systems are balanced from unit to unit to meet the requirements of ASHRAE 62.2-2010. Also, consider the following guidance:
  - For fans designed to exhaust more than 250 cfm, consider using ECM with speed controllers mounted near the fan for ease of balancing.
  - For fans designed to exhaust less than 250 cfm, consider using direct drive with speed controller mounted near the fan for ease of balancing.
- For climate-specific strategies, project teams should consult ASHRAE 62.2-2010.
- For projects located in hot and humid climates, systems should be designed to be capable of ASHRAE 62.2 ventilation levels. Supplemental dehumidification is likely necessary for compliance in these climates to maintain comfort during times of high ambient relative humidity. Additionally, the goal should be to design a system to meet ASHRAE requirements and then provide for additional accommodations to adjust the amount of outside air flow being introduced.
- Consider the following controls for introducing outside air:
  - Flow control/butterfly damper to allow for control over the amount of air being introduced through the outside air intake.
  - Shut-off damper (electronic or barometric) to close off the outside air intake when the HVAC system is not calling for air.
  - Fan timer/cycler on the system that allows for control over how many minutes of a “system run cycle” the outside air intake remains open.
  - Per ASHRAE ventilation requirements, reliance on operable windows is not permitted as a strategy to meet ASHRAE 62.2 whole-project ventilation requirements.

## RESOURCES

- Specify a mechanical whole-house ventilation system per ASHRAE 62.2-2010 and the EPA ENERGY STAR with Indoor Air Package Specifications.
- ASHRAE Standard 62.2-2010: [www.ashrae.org/technology/page/548](http://www.ashrae.org/technology/page/548)  
This site provides a viewable version of ASHRAE Standard 62.2-2010. The online version cannot be printed or saved but can be previewed.
- University of Minnesota, Common Questions about Heat and Energy Recovery Ventilators: [www.extension.umn.edu/distribution/housingandclothing/DK7284.html](http://www.extension.umn.edu/distribution/housingandclothing/DK7284.html)  
This site provides a brief, easy-to-understand overview of heat- and energy-recovery ventilators.
- Building Science.com, Review of Residential Ventilation Technologies: [www.buildingscience.com/documents/reports](http://www.buildingscience.com/documents/reports)  
This page provides a link to “Review of Residential Ventilation Technologies,” a report that reviews current and potential ventilation technologies for residential projects, with particular emphasis on North American climates and construction.

**7.6b***Optional | 5 points***Ventilation**

Moderate Rehab

**REQUIREMENTS****Single-Family and Low-Rise Multifamily**

Install a ventilation system for the dwelling unit capable of providing adequate fresh air per ASHRAE 62.2 requirements for single-family and low-rise multifamily dwellings.

$$[7.5 \text{ cfm per } (\# \text{ of bedrooms} + 1)] + [1 \text{ cfm per } 100 \text{ ft}^2 \text{ of floor area}] = (\text{cfm requirements per ASHRAE 62.2-2010})$$

**Multifamily, four stories or more**

Install a ventilation system capable of providing adequate fresh air per ASHRAE 62.2 for all dwelling units, and ASHRAE 62.1 for all hallways and common spaces.

$$[7.5 \text{ cfm per } (\# \text{ of bedrooms} + 1)] + [1 \text{ cfm per } 100 \text{ ft}^2 \text{ of floor area}] = (\text{cfm requirements per ASHRAE 62.2-2010})$$

**AND**

$$[0.06 \text{ cfm per } 100 \text{ ft}^2 \text{ of common corridors} + 25 \text{ cfm per } 1000 \text{ ft}^2] (\text{ASHRAE 62.1-2010})$$

For Moderate Rehab projects, consult Appendix A of ASHRAE 62.2, which provides options relevant to existing buildings that enable owners to take credit for existing ventilation.

**Multifamily Projects with Central Ventilation Systems**

Establish ventilation rates for bathrooms, kitchens, and units, based on ASHRAE 62.2-2010 requirements. Using these ventilation levels, install a centralized ventilation system that is balanced to run at the required ASHRAE 62.2-2010 levels for each unit and 62.1-2010 levels for common spaces. Provide Enterprise Green Communities with information on the central systems and controls used to achieve the residential in-unit ventilation requirements per ASHRAE 62.2-2010.

**RATIONALE**

Optimal ventilation improves indoor air quality and the flow of fresh air throughout the home, contributing to a healthier living environment.

**RECOMMENDATIONS**

- With continuous, demand-controlled, or other centralized ventilation systems, the project team (specifically, the designer, installer, and maintenance staff) should ensure that the systems are balanced from unit to unit to meet the requirements of ASHRAE 62.2-2010. Also, consider the following guidance:
  - For fans designed to exhaust more than 250 cfm, consider using ECM with speed controllers mounted near the fan for ease of balancing.
  - For fans designed to exhaust less than 250 cfm, consider using direct drive with speed controller mounted near the fan for ease of balancing.

- For climate-specific strategies, project teams should consult ASHRAE 62.2-2010.
- For projects located in hot and humid climates, systems should be designed to be capable of ASHRAE 62.2 ventilation levels. Supplemental dehumidification is likely necessary for compliance in these climates to maintain comfort during times of high ambient relative humidity. Additionally, the goal should be to design a system to meet ASHRAE requirements and then provide for additional accommodations to adjust the amount of outside air flow being introduced.
- Consider the following controls for introducing outside air:
  - Flow control/butterfly damper to allow for control over the amount of air being introduced through the outside air intake.
  - Shut-off damper (electronic or barometric) to close off the outside air intake when the HVAC system is not calling for air.
  - Fan timer/cycler on the system that allows for control over how many minutes of a “system run cycle” that the outside air intake remains open.
  - Per ASHRAE ventilation requirements, reliance on operable windows is not permitted as a strategy to meet ASHRAE 62.2 whole-building ventilation requirements.

### RESOURCES

- National Center for Healthy Housing, Ventilation Fact Sheets:  
[www.nchh.org/Training/Green-and-Healthy-Housing.aspx](http://www.nchh.org/Training/Green-and-Healthy-Housing.aspx)
  - Improving Ventilation in Multifamily Buildings that Do Not Have Fan-Powered Ventilation
  - Improving Ventilation in Existing or New Buildings with Central Roof Exhaust
  - Improving Ventilation in New and Existing Multifamily Unit Buildings with Individual Unit Ventilation Systems

## 7.7

### Mandatory Clothes Dryer Exhaust

### REQUIREMENTS

Clothes dryers must be exhausted directly to the outdoors using rigid-type duct work.

### RATIONALE

Outdoor venting of clothes dryers substantially reduces air moisture that can lead to mold growth.

### RECOMMENDATIONS

- It is important to minimize the duct run to avoid buildup of moisture and particles that can inhibit the flow of air through the duct. Rigid duct materials are preferred to help ensure clean ducts and reduce buildup of particles and moisture.
- Locating the dryer on an exterior wall will allow a minimized duct run for the exhaust.

## 7.8

*Mandatory***Combustion Equipment**

For projects with combustion equipment

**REQUIREMENTS**

Specify power-vented or closed-combustion equipment when installing new space and water-heating equipment in New Construction and any Substantial and Moderate Rehab projects.

Projects should install one hard-wired carbon monoxide (CO) alarm for each sleeping area, minimum one per floor. Multifamily projects should follow state law requirements for location of CO alarms, if respective state law addresses CO alarm placement in multifamily projects and conflicts with the Enterprise Green Communities requirement.

Projects without combustion equipment (i.e., space and water heating equipment, cook tops, and any other combustion equipment) or attached garages are exempt from this measure. Also, projects with combustion equipment located in detached utility building(s) or open-air facilities are exempt from this measure.

**RATIONALE**

Direct-vent systems draw all the air needed directly from the outside so there is no risk of spilling combustion contaminants into the residence. Power-vented equipment uses a fan or blower to create the pressure difference that causes air to flow from inside the house, through the combustion device, and out an approved chimney or vent system, to the outdoors.

**RESOURCES**

- U.S. Environmental Protection Agency, Combustion Products and Carbon Monoxide: [www.epa.gov/iaq/combust.html](http://www.epa.gov/iaq/combust.html) and [www.epa.gov/iaq/co.html](http://www.epa.gov/iaq/co.html)  
These two extensive EPA sites describe the sources of carbon monoxide and other combustion gases, their health effects, steps to reduce exposure, related standards and guidelines, and additional resources and links.
- Canada Mortgage and Housing Corporation: [www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/inaiqu/inaiqu\\_004.cfm](http://www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/inaiqu/inaiqu_004.cfm)  
This site is part of CMHC's "About Your House" series of educational articles. It includes information about combustion gases, the effects of exposure, and strategies for limiting exposure.
- Underwriters Laboratories, Product Safety Tips: CO Alarms: [www.ul.com/global/eng/pages/corporate/newsroom/storyideas/carbonmonoxide/tips/](http://www.ul.com/global/eng/pages/corporate/newsroom/storyideas/carbonmonoxide/tips/)  
This site provides a basic overview of the problems associated with carbon monoxide, as well as tips about purchasing and installing carbon monoxide alarms.
- U.S. Consumer Product Safety Commission: "Carbon Monoxide Questions and Answers": [www.cpsc.gov/cpscpub/pubs/466.html](http://www.cpsc.gov/cpscpub/pubs/466.html)

**7.9a***Mandatory***Mold Prevention: Water Heaters****REQUIREMENTS**

Provide adequate drainage for water heaters that includes drains or catch pans with drains piped to the exterior of the dwelling.

Water heaters should be located in rooms with non-water sensitive floor coverings. Drain pans should be sloped and corrosion resistant (e.g., stainless or plastic) with drains at the low point. Condensate lines should be drained to a drainage system, and not just deposited under slab.

**RATIONALE**

The use of heaters with drains and catch pans prevents moisture problems caused by leakage or overflow. This prevents water from sitting idle, creating excess moisture and allowing mold to germinate.

**RECOMMENDATIONS**

- Tankless water heaters, by virtue of the product type, meet the intent of this measure.
- If local code does not permit draining to the exterior of the project, water heaters can be drained directly to the sewer line.

**RESOURCES**

- American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., Standard 62.1-2007 User's Manual:  
[www.techstreet.com/cgi-bin/detail?product\\_id=1571685](http://www.techstreet.com/cgi-bin/detail?product_id=1571685)
- International Code Council, "Mold: Tips on Prevention and Control":  
[www.iccsafe.org/Store/Pages/Product.aspx?id=7310S](http://www.iccsafe.org/Store/Pages/Product.aspx?id=7310S)
- Canada Mortgage and Housing Corporation's "Fighting Mold":  
[www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/momo/momo\\_005.cfm](http://www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/momo/momo_005.cfm)  
For information on mold identification and remediation in existing homes.

**7.9b***Mandatory***Mold Prevention: Surfaces****REQUIREMENTS**

In bathrooms, kitchens, and laundry rooms, use materials that have durable, cleanable surfaces.

**RATIONALE**

The use of moisture-resistant materials in wet areas reduces moisture buildup, diminishing the potential for indoor mold growth that may yield odors and pose health hazards to residents.

**RECOMMENDATIONS**

When possible, avoid materials that facilitate the growth of mold spores, such as vinyl wallpaper and unsealed grout.

**RESOURCES**

- BuildingGreen: [www.buildinggreen.com](http://www.buildinggreen.com)  
Resources on product composition and performance.
- Canada Mortgage and Housing Corporation, Fighting Mold—The Homeowners' Guide: [www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/momo/momo\\_005.cfm](http://www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/momo/momo_005.cfm)  
For information on mold identification and remediation in existing homes.

**7.9c***Mandatory***Mold Prevention: Tub and Shower Enclosures**

Except for projects that do not have shower or bathroom work in scope

**REQUIREMENTS**

Use non-paper-faced backing materials such as cement board, fiber cement board, or equivalent in bathrooms.

**RATIONALE**

The use of moisture-resistant materials in wet areas reduces moisture buildup, diminishing the potential for indoor mold growth that may yield odors and pose health hazards to residents.

**RESOURCES**

- Canada Mortgage and Housing Corporation, Fighting Mold—The Homeowners' Guide: [www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/momo/momo\\_005.cfm](http://www.cmhc-schl.gc.ca/en/co/maho/yohoyohe/momo/momo_005.cfm)  
For information on mold identification and remediation in existing homes.

## 7.10

*Mandatory*

### Vapor Barrier Strategies

For all New Construction and any Rehab projects with foundation work in scope

#### REQUIREMENTS

##### Beneath Concrete Slabs, Including Basements

- Provide vapor barriers under all slabs.
- Install a capillary break as follows:
  - Install a 4-inch layer of ½-inch diameter or greater clean aggregate, covered with 6 mil (or thicker) polyethylene sheeting, overlapped 6 to 12 inches at the seams, and in direct contact with the concrete slab above.

#### OR

- Install a 4-inch uniform layer of sand, overlain with a layer or strips of geotextile drainage matting installed according to the manufacturer's instructions, and covered with polyethylene sheeting overlapped 6 to 12 inches at the seams.
- On interior below-grade walls, avoid using separate vapor barrier or a below-grade vertical insulation (such as polyethylene sheeting, vinyl wallpaper, or foil faced), which can trap moisture inside wall systems. Semi-vapor-permeable rigid insulation is not considered a vapor barrier.

##### Beneath Crawl Spaces

- Install 8-mil minimum thickness cross-laminated polyethylene on the crawl floor, extended at least 12 inches up on piers and foundation walls, and with joints overlapping at least 12 inches. (The 8-mil polyethylene and the cross-lamination ensure longevity of the poly.)
- Line the likely "high-traffic" areas of the crawl space with foam board, so the polyethylene beneath will not be disturbed.

#### RATIONALE

Water can migrate through concrete and most other masonry materials. Proper foundation drainage prevents water from saturated soils from being pushed by hydrostatic pressure through small cracks. Vapor barriers and waterproofing materials can greatly reduce the migration of moisture that can occur even in non-saturated soils.

#### RECOMMENDATIONS

Ensure that other trades' work does not puncture the vapor barrier.

**RESOURCES**

- **Advanced Energy:** [www.crawlspaces.org/](http://www.crawlspaces.org/)
- **Building Science Corporation:** [www.buildingscience.com/resources/cond-crawlspaces](http://www.buildingscience.com/resources/cond-crawlspaces)  
Features a good article on conditioned crawl spaces.
- **The Energy & Environmental Building Alliance:** [www.eeba.org/resources/climate/index.html](http://www.eeba.org/resources/climate/index.html)  
This organization provides links to building science topics by climate.
- **U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, Building America:** [www1.eere.energy.gov/buildings/building\\_america/about.html](http://www1.eere.energy.gov/buildings/building_america/about.html)  
Free downloads on best building practices.
- **The Partnership for Advanced Technology in Housing:** [www.pathnet.org](http://www.pathnet.org)  
This site has an extensive, searchable resource section with pertinent information about construction solutions.

**7.11***Mandatory***Radon Mitigation**

New Construction and Substantial Rehab

**REQUIREMENTS****New Construction**

In EPA Zone 1 and 2 areas, install passive radon-resistant features below the slab. Also, install a vertical vent pipe with junction box within 10 feet of an electrical outlet, in case an active system should prove necessary in the future.

**Substantial Rehab**

Substantial Rehab projects located in EPA Zone 1 and 2 areas should be tested for the presence of radon. If the radon level is elevated, above 4 pCi/L (pico curies per liter), install radon-reduction measures.

Follow EPA guidance for conducting a radon test.

**Underground Garages Serving Multifamily Projects**

Follow the prescriptive measure below taken from EPA's Indoor airPLUS program, as well as Criteria 7.11 and 7.14:

- *IAP 2.1 Radon control:* Foundation air sealing with polyurethane caulk or the equivalent at all slab openings, penetrations, and control or expansion joints. Sump covers also shall be air sealed (e.g., mechanically attached with full gasket seal or equivalent).

**RATIONALE**

Exposure to radon is the second leading cause of lung cancer in the United States. Testing and mitigation if necessary will reduce concentrations of radon that can leak into homes through cracks in the slab and foundation.



## RECOMMENDATIONS

- Additional guidance for dealing with underground garages:
  - International Mechanical Code (IMC), which requires 0.75 cfm/sf for garages serving multifamily projects, and ASHRAE Standard 62.1-2010 section 5.15, which encourages maintaining attached garage air pressure at or below adjacent occupiable spaces.
  - If the pressure management strategy is not designed to continually maintain negative pressure in the underground garage space relative to the occupied spaces (i.e., if a timer is used for exhaust fan control), then radon control is not assured. In such situations, use either the radon-resistant New Construction techniques summarized in IAP spec 2.1 ([www.epa.gov/indoorairplus/construction\\_specifications.html#moisture%20control](http://www.epa.gov/indoorairplus/construction_specifications.html#moisture%20control)) and detailed further in EPA guidance and/or test the occupied space for radon.
  - If the underground garage does not cover the entire foundation (i.e., some living space is directly above a slab or crawlspace), then those portions of the project should be handled per Indoor airPLUS specs.
  - Any mechanical or service closets in the garage area that are connected to the conditioned enclosure should be aggressively sealed between the garage and the conditioned space.
- For projects located on brownfields or proximate to industrial operations that are not in EPA Zone 1 or 2 areas, consider testing for radon to determine if elevated levels exist on-site. If the radon level is elevated above 4 pCi/L (pico curies per liter), install radon-reduction measures.

## RESOURCES

- U.S. Environmental Protection Agency: [www.epa.gov/radon/zonemap.html](http://www.epa.gov/radon/zonemap.html)  
Or contact your state radon coordinator through the state health office, to determine if your project is located in a Zone 1 or 2 radon area.
- U.S. Environmental Protection Agency, “Protocols for Radon and Radon Decay Product Measurements in Homes”: [www.epa.gov/radon/pdfs/homes\\_protocols.pdf](http://www.epa.gov/radon/pdfs/homes_protocols.pdf)
- National Center for Healthy Housing, “Radon-Resistant Construction: Low-Rise Multi-Family Housing”: [www.nchh.org/Training/Green-and-Healthy-Housing.aspx](http://www.nchh.org/Training/Green-and-Healthy-Housing.aspx)
- U.S. Environmental Protection Agency, “Building Radon Out,” 2006 (#EPA/402-K-01-002): [www.epa.gov/radon/pdfs/buildradonout.pdf](http://www.epa.gov/radon/pdfs/buildradonout.pdf)
- U.S. Environmental Protection Agency, “Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Buildings”: [www.epa.gov/radon/pubs/mitstds.html](http://www.epa.gov/radon/pubs/mitstds.html)
- American Lung Association, Radon Fact Sheet: [www.lungusa.org/healthy-air/home/resources/radon.html](http://www.lungusa.org/healthy-air/home/resources/radon.html)  
This is a general overview of the health risks associated with radon exposure.
- Washington State, Extension Energy Program, “Builder’s Field Guide”: [www.energy.wsu.edu/Documents/Builders\\_Field\\_Guide-2006.pdf](http://www.energy.wsu.edu/Documents/Builders_Field_Guide-2006.pdf)  
Chapter 2 of this field guide provides tips, procedures, and schematics for understanding how to mitigate radon risks during new construction.

## 7.12

*Mandatory***Water Drainage**

This measure applies to Moderate and Substantial Rehab projects only when replacing particular assemblies called out in the prescriptive requirements below.

**REQUIREMENTS**

Provide drainage of water away from windows, walls, and foundations by implementing the following techniques.

**Water Management — Walls**

- Provide a housewrap/weather-resistive barrier with sheets lapped, shingle-style, especially over windows, doors, and other penetrations to prevent rainwater that penetrates the finished exterior cladding system from entering the wall assembly or being introduced into window or door openings.
- Provide a pathway for liquid water that has penetrated the cladding system or accumulates due to daily or seasonal changes in thermal and humidity levels behind the cladding system to safely exit the exterior wall assembly.
- Flashing and/or weather-resistive barriers installed in rough window and door openings must integrate with window and door unit flashings, particularly at the sill and head.

**OR**

- Install pan flashing, side flashing that extends over pan flashing, and head flashing (top flashing) that extends over side flashing on windows and exterior door openings. Apply window pan flashing over building paper at sill and corner patches.
- Flashings at roof/wall intersections and at penetrations through the wall (i.e., plumbing, electrical, vents, HVAC refrigerant lines, and the like) that are provided by other trades must be integrated with the drainage plane to keep water from entering the wall assembly.

**Water Management — Roof Systems**

- Installation of drip edge at entire perimeter of roof.
- Install flashing where sloped roofs meet gable wall end and integrate all vertical walls into project drainage plane.
- Use kick-out flashings at all wall/eave intersections and integrate into drainage plane.
- At wall/roof intersections, maintain  $\geq 2$ " clearance between wall cladding and roofing materials.

**Integrity and Continuity of the Thermal Barrier**

- The drainage plane, when properly sealed, can also reduce airflow through the wall assembly, which improves the thermal performance of the cavity insulation.

### RATIONALE

Diverting water from the project prevents bulk water entry into foundations and basements, which can contribute to moisture-related problems such as mold and the deterioration of wood and other building materials. Flashing helps direct water away from wall cavities to the drainage plane.

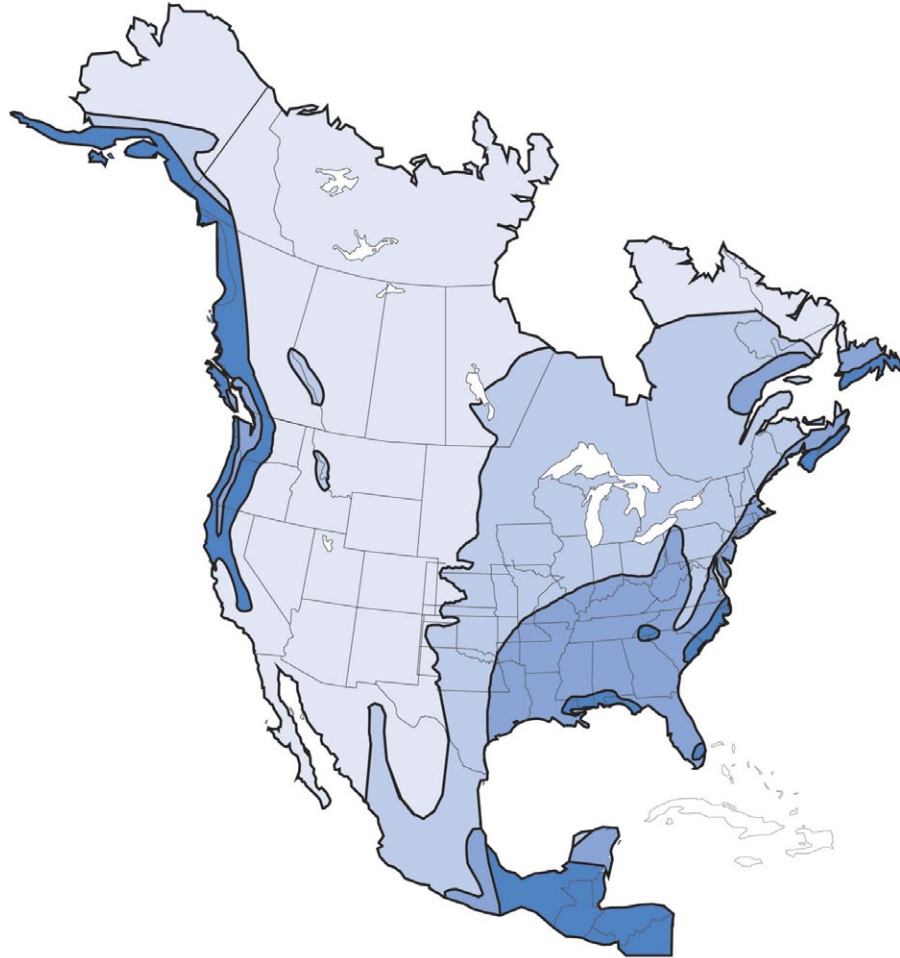
### RECOMMENDATIONS

- Where a high water table is anticipated or observed, or has been documented in the soil boring report, or where specifically recommended by the geotechnical engineer, provide subsurface drain tile or other drainage system in strict accordance with the geotechnical engineer's or other qualified professional's recommendations, to divert underground water away from the structure. Coordinate these requirements with those of Criteria 7.10a and 7.10b as modified herewith.
- Ensure that a vapor barrier with the appropriate permeability rating is installed on the correct side of the wall assembly, based on climatic considerations.
- Best practices include a grade of one-half inch per foot, or approximately a 4% pitch. EPA recommends a 2% pitch (one-quarter inch per foot) for hard surfaces such as patio slabs, walks, and driveways.

### RESOURCES

- U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, Building America: [www1.eere.energy.gov/buildings/building\\_america/about.html](http://www1.eere.energy.gov/buildings/building_america/about.html)  
Free downloads on best building practices.
- U.S. Environmental Protection Agency, Indoor airPLUS Construction Specifications: [www.epa.gov/indoorairplus/construction\\_specifications.html#moisture%20control](http://www.epa.gov/indoorairplus/construction_specifications.html#moisture%20control)  
Includes detailed construction specifications, several of which are focused on moisture management.
- The Energy & Environmental Building Alliance, Water Management Guide (for purchase only): [www.eeba.org/bookstore/prod-Water\\_Management\\_Guide-9.aspx](http://www.eeba.org/bookstore/prod-Water_Management_Guide-9.aspx)

## ANNUAL PRECIPITATION MAP OF NORTH AMERICA

**Exposure**

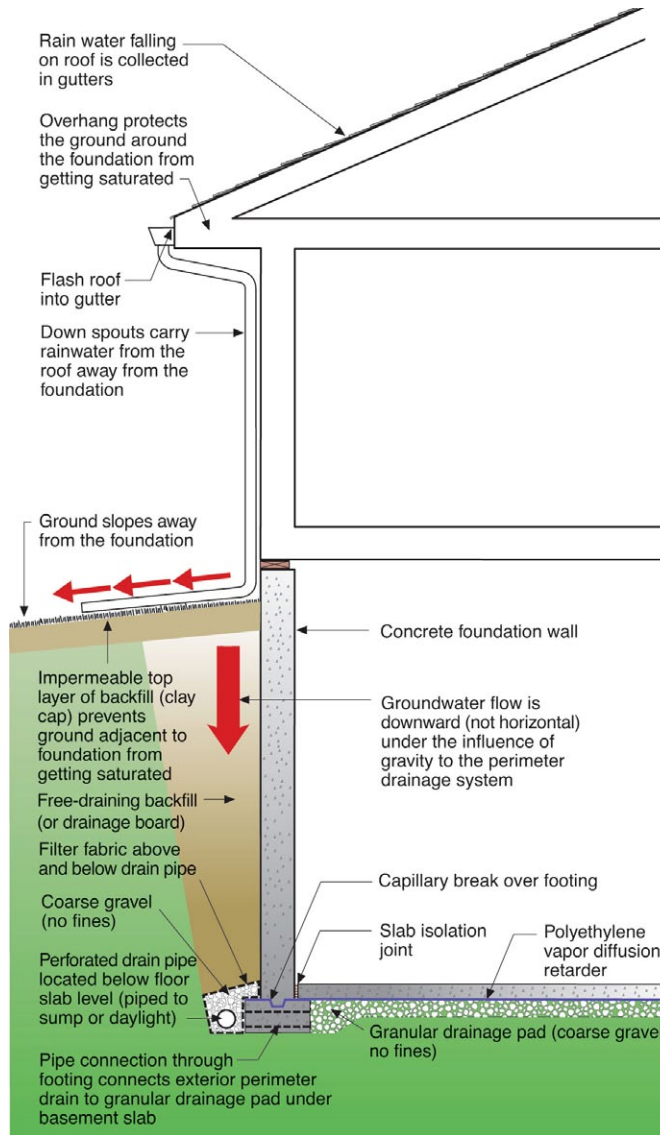
- Extreme (over 60" ventilated\* rain screen)
- High (40"–60" rain screen/vented\*\* cladding/vented drainage space)
- Moderate (20"–40" drainage plane/drainage space)
- Low (under 20" face seal)

\*Ventilated means insect-protected air holes in the top and bottom of the cladding assembly, creating the potential for directional air flow in the air space behind the cladding.

\*\*Vented means insect-protected holes in the cladding assembly not located at the top and bottom, so that while limited air exchange in this air space is possible, air flow is not.

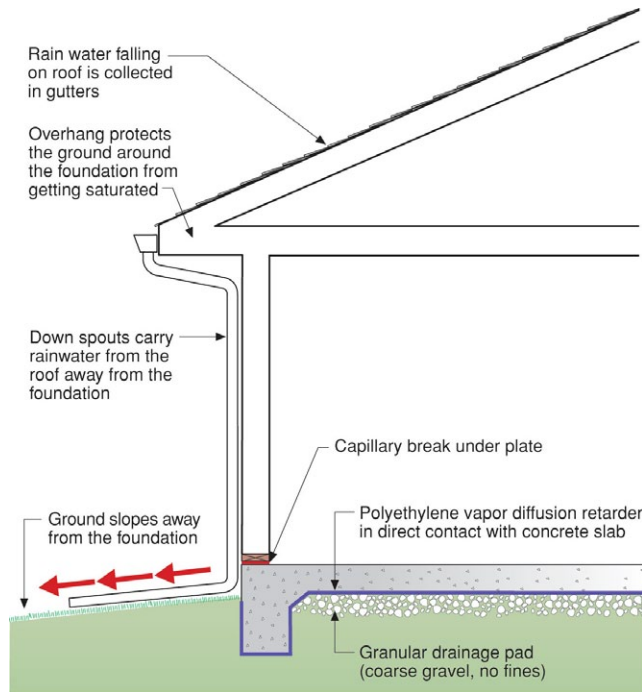
- 1 INTEGRATIVE DESIGN
- 2 LOCATION + NEIGHBORHOOD FABRIC
- 3 SITE IMPROVEMENTS
- 4 WATER CONSERVATION
- 5 ENERGY EFFICIENCY
- 6 MATERIALS BENEFICIAL TO THE ENVIRONMENT
- 7 HEALTHY LIVING ENVIRONMENT
- 8 OPERATIONS + MAINTENANCE

**WATER DRAINAGE: BASEMENT**

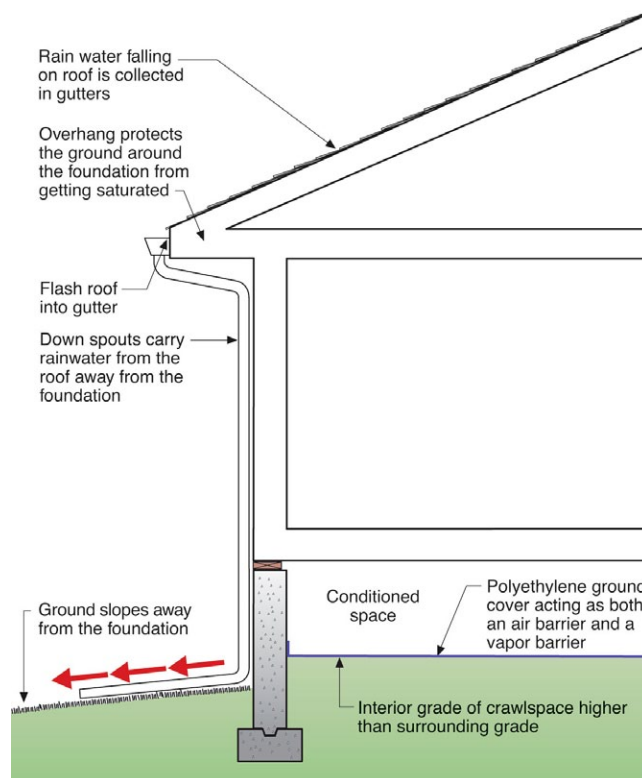


- 1 INTEGRATIVE DESIGN
  - 2 LOCATION + NEIGHBORHOOD FABRIC
  - 3 SITE IMPROVEMENTS
  - 4 WATER CONSERVATION
  - 5 ENERGY EFFICIENCY
  - 6 MATERIALS BENEFICIAL TO THE ENVIRONMENT
  - 7 HEALTHY LIVING ENVIRONMENT
  - 8 OPERATIONS + MAINTENANCE
- APPENDICES  
GLOSSARY

**WATER DRAINAGE: SLAB ON GRADE**



**WATER DRAINAGE: CONDITIONED CRAWLSPACE**



## 7.13

*Mandatory*  
**Garage Isolation****REQUIREMENTS**

- Provide a continuous air barrier between the conditioned (living) space and any garage space to prevent the migration of any contaminants into the living space.
- Do not install ductwork or air handling equipment in a garage.
- All connecting doors between living space and garage must include an automatic closer / spring hinges, and be fixed with gaskets or otherwise made substantially airtight with weather stripping.
- In single-family and multifamily buildings with garages, install a CO alarm inside the house in the room with a door to the garage AND outside all sleeping areas.
- Common walls and ceilings between attached garages and living spaces must be visually inspected to ensure that they are air-sealed before insulation is installed (requirement taken from EPA's Indoor airPLUS program 5.5).

**RATIONALE**

Carbon monoxide inhalation can be dangerous to human health. The air barrier and air sealing will help prevent carbon monoxide migration from the garage to the living space, and the CO alarm will help ensure that residents are alerted in the case of accidental accumulation of the gas.

**RECOMMENDATIONS**

Refer to ASHRAE 62.2 to specify garage contaminant isolation measures.

**RESOURCES**

- National Institute of Standards and Technology, "Air and Pollutant Transport from Attached Garages to Residential Living Spaces": [www.fire.nist.gov/bfrlpubs/build03/art068.html](http://www.fire.nist.gov/bfrlpubs/build03/art068.html)  
This report provides an overview of the major issues, as well as a review of relevant scientific studies and a series of field studies.
- The Energy & Environmental Building Alliance, "Builder's Guide" series for specific North American climate zones: Cold Climates, Mixed Humid Climates, Hot-Humid Climates, and Hot-Dry & Mixed Dry Climates, by Joseph Lstiburek, Ph.D., P.Eng. Building Science Press: [www.eeba.org/bookstore/cat-Builders\\_Guides-4.aspx](http://www.eeba.org/bookstore/cat-Builders_Guides-4.aspx)  
Refer to the discussion and construction details regarding air sealing and connected garages.

## 7.14

*Mandatory*

### Integrated Pest Management

#### REQUIREMENTS

Seal all wall, floor, and joint penetrations with low-VOC caulking or other appropriate non-toxic sealing methods to prevent pest entry. Provide rodent- and corrosion-proof screens (e.g., copper or stainless steel mesh or rigid metal cloth) for openings greater than ¼ inch.

Develop an integrated pest management (IPM) policy and, as part of that, develop resident guidance related to pesticide use, housekeeping, and prompt reporting of pest problems to be included in the Maintenance and Resident Manuals for cockroaches, rodents, and bedbugs.

#### RATIONALE

Sealing of cracks and penetrations will minimize entry points for pests such as rodents and cockroaches. Avoiding unnecessary pesticides, improving resident housekeeping, and promptly responding to pest problems will reduce the chemicals needed to treat pests and will keep homes pest-free longer than a routine chemical treatment program.

#### RECOMMENDATIONS

- For guidance on low-VOC caulk, see Criterion 7.2.
- Integrated pest management work should be completed in conjunction with air sealing. Project teams should work with an air sealing contractor to ensure that IPM strategies are part of scope.

#### RESOURCES

- “How to Control Pests Safely: Getting Rid of Cockroaches and Mice,” New York City Department of Health and Mental Hygiene, under the header “Guide to Safe Pest Control in the Home”: [www.nyc.gov/html/doh/html/pest/pest3.shtml](http://www.nyc.gov/html/doh/html/pest/pest3.shtml)
- The National Center for Healthy Housing, Integrated Pest Management in Affordable Housing: [www.healthyhomestraining.org/IPM/](http://www.healthyhomestraining.org/IPM/)  
This webpage has resources dedicated to IPM in affordable housing, including model RFPs and contract language for greener pest control, case studies, and training.



## 7.15

*Mandatory***Lead-Safe Work Practices****REQUIREMENTS**

For properties built before 1978, use lead-safe work practices consistent with the EPA's Renovation, Repair, and Painting Regulation (RRP) (40 CFR 745) and applicable HUD requirements at 24 CFR 35.

**RATIONALE**

Any activity that disturbs painted surfaces or project components in pre-1978 dwellings that contain lead-based paint may generate and spread lead dust and debris, increasing the risk of lead poisoning for exposed children and families. Controlling lead dust and debris helps minimize lead in the environment.

**RECOMMENDATIONS**

- Consider undertaking a lead inspection to determine if the property or surfaces to be disturbed contain lead-based paint. Properties built from 1960 through 1978 are more likely to be free of lead-based paint. Housing and painted components documented to be free of lead-based paint (using EPA-approved methods) are exempt from EPA Renovation, Repair and Painting Regulation. In housing built before 1940, it is very likely that lead-based paint is present.
- Undertake the appropriate training and certification for in-house maintenance staff and ensure that contractors are meeting the lead RRP requirements.

**RESOURCES**

- U.S. Environmental Protection Agency: [www.epa.gov/lead/pubs/traincert.htm](http://www.epa.gov/lead/pubs/traincert.htm) and U.S. Department of Housing and Urban Development: [www.hud.gov/offices/lead/training/index.cfm](http://www.hud.gov/offices/lead/training/index.cfm)  
Information about lead-safe work practices.
- U.S. Environmental Protection Agency, Small Entity Compliance Guide to Renovate Right EPA's Lead-Based Paint Renovation, Repair, and Painting Program: [www.epa.gov/lead/pubs/sbcomplianceguide.pdf](http://www.epa.gov/lead/pubs/sbcomplianceguide.pdf) and [www.epa.gov/lead/pubs/renovation.htm](http://www.epa.gov/lead/pubs/renovation.htm)  
General information on compliance with these requirements.

## 7.16

*Optional | 9 points*  
**Smoke-Free Building**

**REQUIREMENTS**

Implement and enforce a no-smoking policy in all common and individual living areas, and with a 25-foot perimeter around the exterior of all residential projects. The lease language must prohibit smoking in these locations and specify that it is a violation of the lease to smoke. The no-smoking restriction applies to all owners, tenants, guests, and servicepersons.

**RATIONALE**

Secondhand smoke is the third leading cause of preventable death in the country. Air filtration and ventilation systems do not eliminate the health hazards caused by secondhand smoke. Tobacco smoke from one unit may seep through the cracks, be circulated by a shared ventilation system, or otherwise enter the living space of another. In addition to the negative health effects, smoking significantly increases fire hazard and increases cleaning and maintenance costs.

**RECOMMENDATIONS**

- Many property insurance companies offer a discount for projects with no-smoking policies.
- Project owners and property managers should inform residents that they are prohibited from smoking in the project. A designated outdoor smoking area should be provided as an alternative arrangement for those who smoke.
- Provide suitable receptacles in the designated outdoor smoking area for the disposal of cigarette butt litter. Ensure that the receptacles are inside the project line and do not encroach into public space.

**RESOURCES**

- National Center for Healthy Housing, “Reasons to Explore Smoke-Free Housing Fact Sheet”: [www.nchh.org/Training/Green-and-Healthy-Housing.aspx](http://www.nchh.org/Training/Green-and-Healthy-Housing.aspx)
- American Lung Association, Air Quality in the Home: [www.lungusa.org](http://www.lungusa.org)  
This site includes an entire section devoted to indoor air quality in the home. Choose “Air Quality” at the bottom of the screen and then click “Indoor Air Quality” and “Air Quality in the Home” to find numerous articles and educational pieces about maintaining a healthy indoor environment.
- U.S. Environmental Protection Agency, Indoor Air Quality Division: [www.epa.gov/iaq](http://www.epa.gov/iaq)  
This site has numerous resources related to indoor air quality in homes, including reports and web links.

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## OPERATIONS + MAINTENANCE

**An orientation to the project helps educate residents and property managers on the green features that were designed to deliver health, economic, and environmental benefits, as well as their role in realizing those benefits in their own lives and the lives of future residents.**

## 8.1

*Mandatory***Building Maintenance Manual**

For all multifamily projects

**REQUIREMENTS**

Provide a manual that addresses the following:

- operations and maintenance guidance for all appliances
- HVAC operation and maintenance schedule
- location of water-system turnoffs
- lighting equipment
- paving materials and landscaping
- green cleaning products and schedule(s)
- pest control
- any other systems within the project, including renewable energy systems if applicable
- an occupancy turnover plan that describes the turnover process, including all materials that are frequently replaced at turnover and the process of educating the residents about proper use and maintenance of all project systems

**RATIONALE**

Regular building maintenance using green methods helps minimize utility consumption and provides a healthy and durable living environment for residents.

**RECOMMENDATIONS**

- During the design process, keep a running list of how maintenance and landscaping teams and residents may need to be involved with the building in order to ensure that its lifespan is maximized and that it will perform as intended. Once the project team has completed the integrative design process (see Criterion 1.1), amend templates of the Operations and Maintenance documents with project-specific information for maintenance and residents. By working in this manner, Operations and Maintenance documents will be informed by the development process and completed at the same time the project is ready for occupancy.
- Manuals and other training materials are most effective when presented in conjunction with training sessions. These educational sessions give the project maintenance staff an opportunity to share best practices and troubleshoot project performance problems together.
- Consider developing an integrated pest management (IPM) policy and, as part of that, develop guidance related to pesticide use, housekeeping, and prompt reporting of pest problems to be included in maintenance manuals.
- If the project is utilizing greywater, design and institute a policy that requires biodegradable soaps, cleaners, and other products that are flushed down the drains.
- Provide maintenance staff with local information for handling hazardous waste, including fluorescent and compact fluorescent lighting (CFLs).

**RESOURCES**

- Enterprise Green Communities, Building Maintenance Manual Templates in Information Resources: [www.greencommunitiesonline.org/tools/resources/index.asp](http://www.greencommunitiesonline.org/tools/resources/index.asp)
- For language on residential IPM policy, the University of Minnesota offers the following resource: [www.entomology.umn.edu/cues/em/index.html](http://www.entomology.umn.edu/cues/em/index.html)
- National Center for Healthy Housing, “Healthy Homes Maintenance Checklist”: [www.nchh.org/Portals/0/Contents/Maintenance\\_Checklist2009.pdf](http://www.nchh.org/Portals/0/Contents/Maintenance_Checklist2009.pdf)

**8.2***Mandatory*  
**Resident Manual****REQUIREMENTS**

Provide a guide for homeowners and renters that explains the intent, benefits, use, and maintenance of green building features. The guide also should include the location of transit stops and other neighborhood amenities, and encourage additional green activities such as recycling, gardening, use of healthy cleaning materials, alternative measures to pest control, and purchase of green power.

For single-family projects, and multifamily projects as applicable, include these additional instructions within the Resident Manual:

- a routine maintenance plan
- operations and maintenance guidance for all appliances and special plumbing fixtures (e.g., dual-flush toilets)
- HVAC operation
- cautions or appropriate maintenance on renewable energy systems
- location of water-system turnoffs
- lighting equipment
- interior finish materials, including paints, caulks, and flooring
- paving materials and landscaping
- pest control
- special health considerations if greywater is used indoors (e.g., do not drink from the toilet in emergency situations)
- any other systems that are part of the home

**RATIONALE**

Education on the operations and maintenance of the home will allow residents to fully realize the environmental, health, and economic benefits that green housing offers. This resource is intended to familiarize residents with the green features and methods used in their new home and additional activities they could initiate to realize the home’s benefits.

## RECOMMENDATIONS

- During the design process, keep a running list of how maintenance and landscaping teams and residents may need to be involved with the building in order to ensure that its lifespan is maximized and that it will perform as intended. Once the project team has completed the integrative design process (see Criterion 1.1), amend templates of the Operations and Maintenance documents with project-specific information for maintenance and residents. By working in this manner, Operations and Maintenance documents will be informed by the development process and completed at the same time the project is ready for occupancy.
- If the project is utilizing greywater, design and institute a policy that requires biodegradable soaps, cleaners, and other products that are flushed down the drains.
- Provide homeowners/tenants with two radon test kits designed for 48-hour exposure, and include instructions for use and follow-up action, per EPA's Indoor Air Package.
- Provide residents with local information for handling household hazardous waste, including CFLs.
- Consider including ENERGY STAR "Best Practices" information in the Resident Manual. See the following websites:
  - For washers and dryers: [www.energystar.gov/index.cfm?c=clotheswash.clothes\\_washers\\_performance\\_tips](http://www.energystar.gov/index.cfm?c=clotheswash.clothes_washers_performance_tips)
  - For refrigerators: [www.energystar.gov/index.cfm?c=refrig.pr\\_best\\_practices\\_refrigerators](http://www.energystar.gov/index.cfm?c=refrig.pr_best_practices_refrigerators)
  - For dishwashers: [www.energystar.gov/index.cfm?c=dishwash.pr\\_best\\_practices](http://www.energystar.gov/index.cfm?c=dishwash.pr_best_practices)
- For additional best practices on ENERGY STAR products: [www.energystar.gov/index.cfm?c=products.pr\\_find\\_es\\_products](http://www.energystar.gov/index.cfm?c=products.pr_find_es_products)  
Select a product type, click on "Buying Guidance," and scroll down to the bottom of the page to select "Best Practices" products.

## RESOURCES

- Refer to the Enterprise Green Communities Resident Manual Templates: [www.greencommunitiesonline.org/tools/resources/index.asp](http://www.greencommunitiesonline.org/tools/resources/index.asp)
- Connecticut Department of Environmental Protection, "A Green Home Is a Healthy Home": [www.ct.gov/dep/lib/dep/p2/individual/healthyhome.pdf](http://www.ct.gov/dep/lib/dep/p2/individual/healthyhome.pdf)  
This is a simple brochure with a readable layout and good presentation.
- Home Energy Resource MN: [www.homeenergyresource.mn.org/index.aspx](http://www.homeenergyresource.mn.org/index.aspx)  
This site provides information for homeowners on maintaining their home. It includes seasonal checklists and step-by-step instructions for general maintenance, as well as special instructions for new home buyers on maintaining their home during its first year.

8.3

*Mandatory*

**Resident and Property Manager Orientation**

**REQUIREMENTS**

Provide a comprehensive walk-through and orientation for the residents and property manager(s) using the appropriate manual (see Criteria 8.1 and 8.2) to review the project’s green features, operations, and maintenance, and, for the resident orientation, the neighborhood amenities that may facilitate a healthy lifestyle.

**RATIONALE**

An orientation to the project helps educate residents and property manager(s) on the green features that were designed to deliver health, economic, and environmental benefits, as well as their role in realizing those benefits in their own lives and the lives of future residents.

8.4

*Optional | 12 points*

**Project Data Collection and Monitoring System**

**REQUIREMENTS**

Collect and monitor project performance data on energy, water, and, if possible, healthy living environments for a minimum of five years. Allow Enterprise access to that data.

For sub-metered projects, property owner/developer must agree to collect utility release forms from a percentage of residents to track actual utility data of a sample of homes. The following table identifies the percentage of residents for which the property owner/developer must collect and track utility data, as based on the project size in total number of units.

NUMBER OF UNITS	PERCENTAGE OF UNITS
0–25 units	50%
25–100 units	25%
100+ units	15%

**RATIONALE**

A data collection and monitoring system helps project owners, on-site staff, and residents to understand project performance issues. Once an issue is identified, appropriate actions can be taken to maximize cost savings and health benefits associated with green building features.

**RECOMMENDATIONS**

- Provide Enterprise with access to the performance data annually for a five-year period through the Utility Release Form (submitted as part of the Enterprise Green Communities Certification process) and/or the EPA’s Portfolio Manager account information to help populate its database intended to collect national information on green affordable housing.

- Ensure that the training for residents and building maintenance staff includes information on how to effectively use the data collection, monitoring, and reporting system.
- Multifamily building data can be tracked and analyzed using EPA's Portfolio Manager tool.
- Property owners have indicated that the best time to collect tenant release forms is during tenant lease-up.
- Whole-project energy monitoring systems (also known as smart meters) are a strategy that can help a project attain optional points under Criterion 5.8.

### RESOURCES

- Environmental Protection Agency, Portfolio Manager Overview:  
[www.energystar.gov/index.cfm?c=evaluate\\_performance.bus\\_portfoliomanager](http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager)  
The Portfolio Manager Overview is an interactive energy management tool that allows the project team to track and assess energy and water consumption across its entire portfolio of buildings in a secure online environment.



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# APPENDICES

## Appendix A: The Enterprise Green Communities Certification and Verification Process

Enterprise offers a free, online green building certification program to all types of qualified affordable housing projects, including single-family and multifamily buildings that are New Construction, Substantial Rehab, and Moderate Rehab.

All projects seeking Certification are required to meet the following eligibility parameters:

1. Qualify under Enterprise's definition of affordable housing: rental projects serving residents at or below 60% AMI (area median income) and for-sale projects serving residents at or below 80% AMI.
2. Apply for Certification during the design phase prior to the construction start date.
3. Participate in the Enterprise Green Communities verification process if project is selected.

At a minimum, the development must meet the Enterprise Green Communities Criteria mandatory measures and achieve the requisite number of optional points applicable to the construction type. Under the 2011 Criteria, New Construction projects are required to achieve 35 optional points, Substantial Rehab projects must achieve 30 optional points, and Moderate Rehab projects must achieve 30 optional points.

Any project team submitting a request for certification to Enterprise Green Communities may be subject to on-site verification by a third party from the Enterprise Green Communities Technical Assistance Provider Network. Developments will be selected quarterly for on-site verification, using a sampling approach based on the number of certification requests submitted in a given quarter. Enterprise Green Communities covers the cost of this verification for development teams.

### ENTERPRISE GREEN COMMUNITIES ONLINE CERTIFICATION PROCESS

Certification is a two-step online submittal and review process that aligns with the design and construction process of the development. Development teams apply for Step 1 review during the design phase before the construction start date. Within 60 days of the construction end date, they proceed to the final (Step 2) review. The Certification process can be found at [www.greencommunitiesonline.org/tools/certification/](http://www.greencommunitiesonline.org/tools/certification/)

#### Step 1

During the design phase and before the construction start date, developments seeking Certification are required to submit a set of online forms and submittals for Step 1. Upon receiving completed submittal documents, Enterprise Green Communities will conduct a review of the materials and approve the project or, in some instances, request additional information from the development team.

The following submittals must be completed by the development team:

- **Development Registration Form.** General information including but not limited to the location, developer, construction schedule, building type, and size.
- **Development Overview Form.** A brief description of the development's mechanical systems and building envelope, as well as building code(s) and green building program(s) the development will meet.
- **Intended Methods Form.** Indicates how a development plans to comply with the mandatory and optional points of the Criteria. It also requires that responsibility for meeting an individual criterion is identified among the team and signatures are obtained from team members.
- **Site Plan.** Indicates the development's proximity to existing infrastructure and its integration into the adjacent pedestrian grid.
- **Context Map.** Indicates the development's proximity to community amenities and public transportation.
- **Energy Modeling Form.** Demonstrates improved energy performance of the building and how it will be met.

#### Waiver Request Process

Enterprise Green Communities provides a formal waiver request process for teams with extenuating circumstances that may preclude the full integration of a mandatory criterion. To maintain the technical integrity of the Criteria, Enterprise Green Communities offers this waiver request process on a limited basis in response to situations in which an alternative approach or an explicit waiver for a single measure may be acceptable. The waiver request is available online.

#### Step 2

Within 60 days of the completion of construction, the team completes the online Final Certification Form and submits a Compliance Report, a Cost Development Form, any ENERGY STAR certificates, a Utility Release Form, and project photos. Following Step 2, Enterprise Green Communities conducts a final review and determines whether development will be certified in accordance with meeting the Criteria. Enterprise Green Communities issues notification of certification to the primary project contact via email within 30 days of receiving a completed submission.

The following submittals must be completed by the development team:

- **Compliance Report.** A revised version of the Intended Methods Form from Step 1 requiring project teams to document any changes in their strategy to meet the Criteria.
- **ENERGY STAR Certificate(s).** Official certificates from ENERGY STAR detailing compliance with the program. (Not required for Moderate Rehab projects.)
- **Cost Development Form.** Documents the incremental costs that project teams incurred when meeting the Criteria.
- **Photos.** Before, during, and after photos of the project, uploaded by the team.
- **Utility Release Form(s).** A series of forms that authorize Enterprise Green Communities to conduct energy data monitoring after the completion of the project.

## VERIFICATION PROTOCOL

The Enterprise Green Communities Verification Protocol is designed to bring the benefits of third-party, on-site assessment and performance testing to developments seeking Certification. Each quarter, Enterprise Green Communities selects a group of projects that apply for Certification to participate in the Verification Protocol. All developments that apply for Certification may be subject to verification by Enterprise Green Communities. Costs for this verification are covered by Enterprise. The developer is connected with the technical assistance (TA) provider assigned by Enterprise Green Communities to work with the team. The TA providers selected to perform the verification work are local or regional organizations with expertise in green building assessments.

The Verification Protocol consists of three review stages:

### Desktop review

In this initial stage, the TA provider reviews all criteria that can be documented and verified prior to site visits. The TA provider uses information submitted in Step 1 of the Certification process as well as additional information from the team, including the specifications book, construction schedule, project drawings, and HVAC sizing summary.

### Pre-drywall site visit

During the first site visit, the TA provider conducts a pre-drywall inspection and documents the results in a related checklist. If the development team is working with an ENERGY STAR rater, the TA provider will not duplicate the rater's scope of work.

### Post-construction site visit

During this site visit, the TA provider conducts a series of energy and water performance testing procedures appropriate for the building and construction type of the development and documents the results in a related checklist.

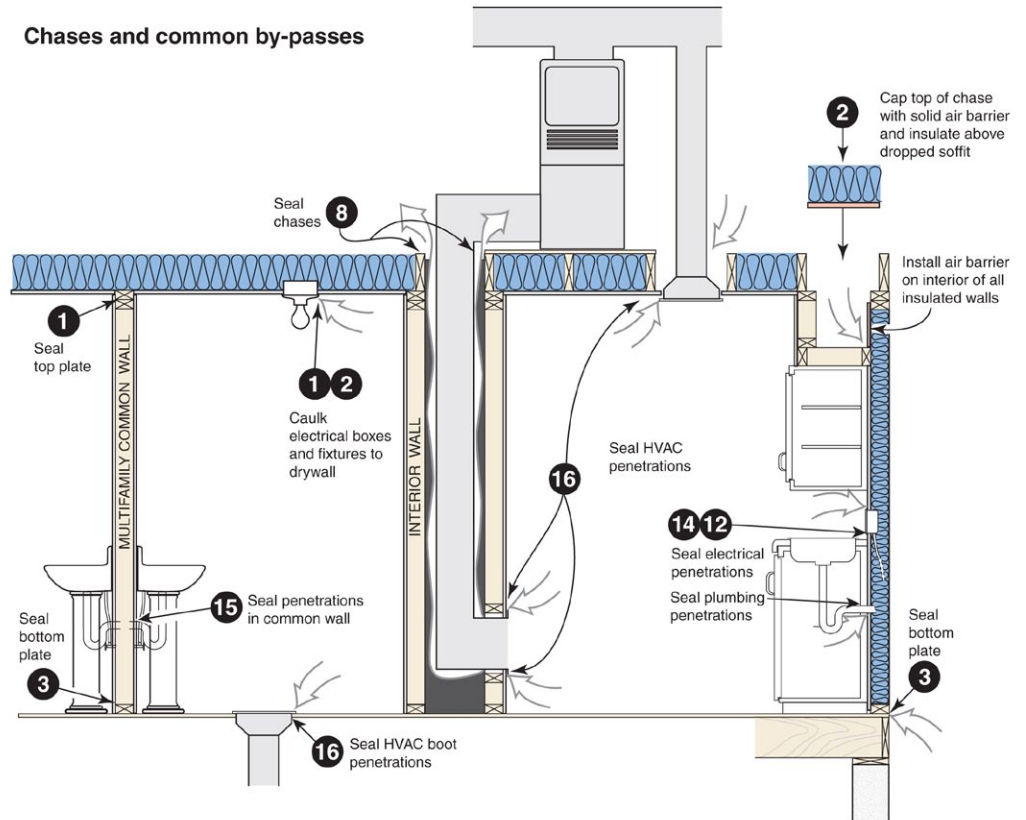
If the desktop review or site visits reveal deficiencies, the TA provider will notify the appropriate team member, and provide recommendations and guidelines on how to correct the issue(s). Development teams will be required to fix accordingly.

Following completion of verification review, the TA provider submits a brief report to Enterprise Green Communities and the development team describing the development's compliance with the Criteria, any recommendations made to the team for improvement, and performance testing results. The information gathered by the TA provider informs Enterprise Green Communities of how best to assist development teams seeking certification.

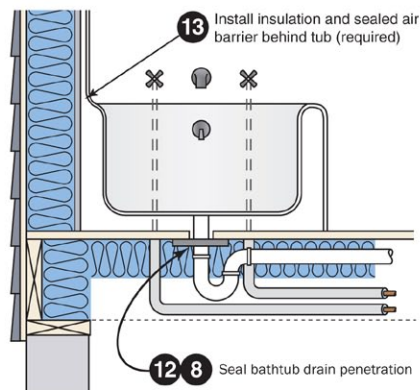
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## Appendix B: Air Sealing Key Points

### Chases and common by-passes



### Shower/tub drain rough opening

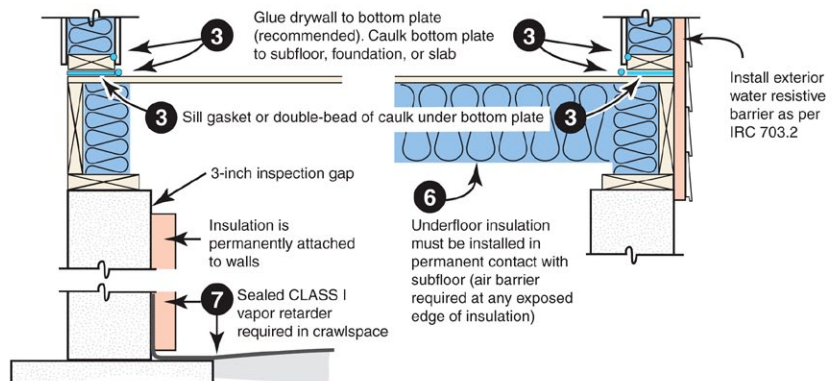
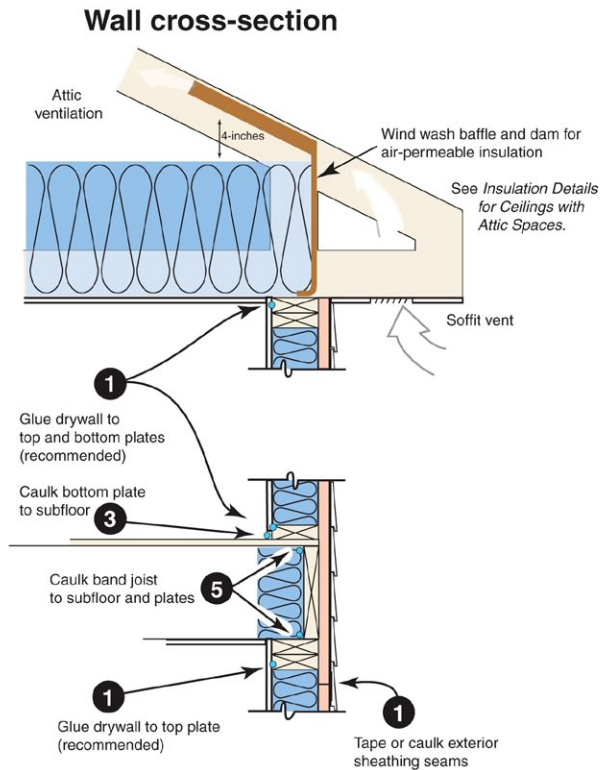
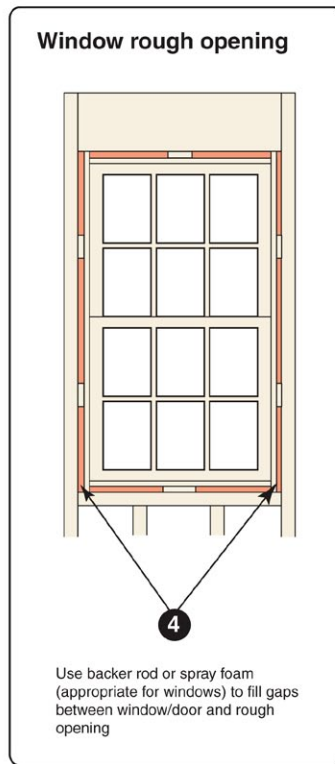


Disclaimer: This document is intended solely to help graphically demonstrate the air leakage provisions of section 402.4 of the 2009 IECC. It does not cover all air sealing locations or techniques. Other code provisions may be applicable as well.

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**AIR SEALING KEY POINTS (CONTINUED)**

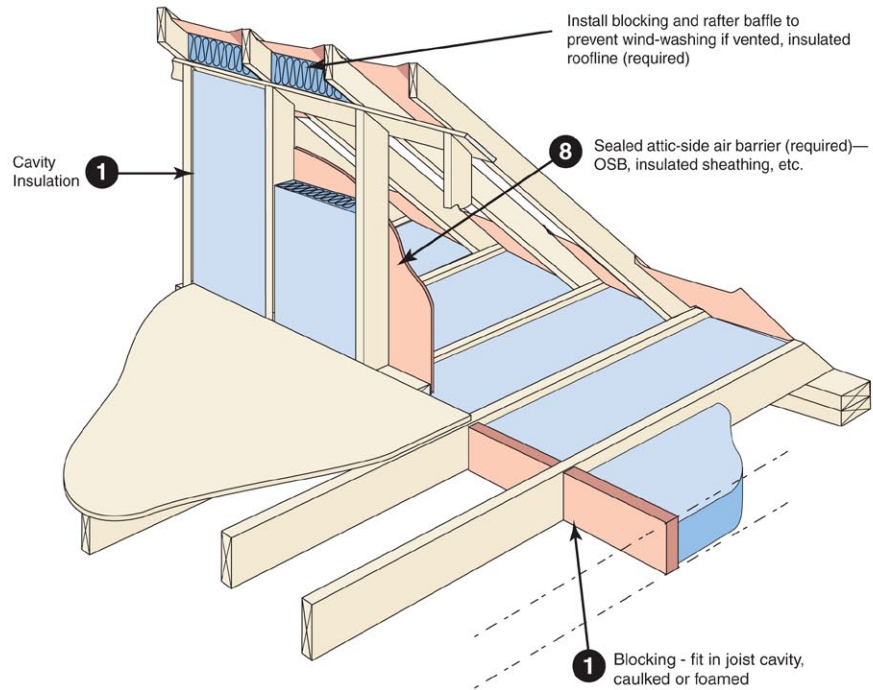


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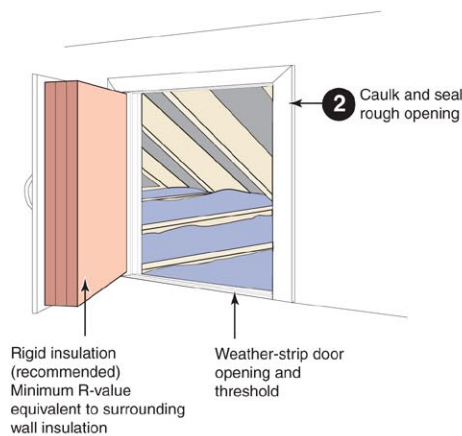
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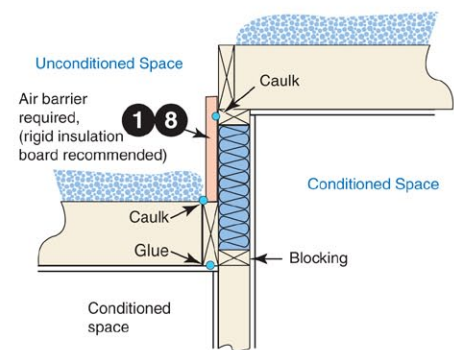
**AIR SEALING KEY POINTS (CONTINUED)**



**Attic knee-walls**



**Two-level attic**



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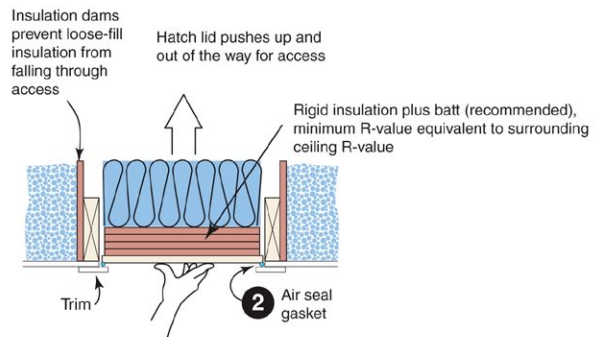
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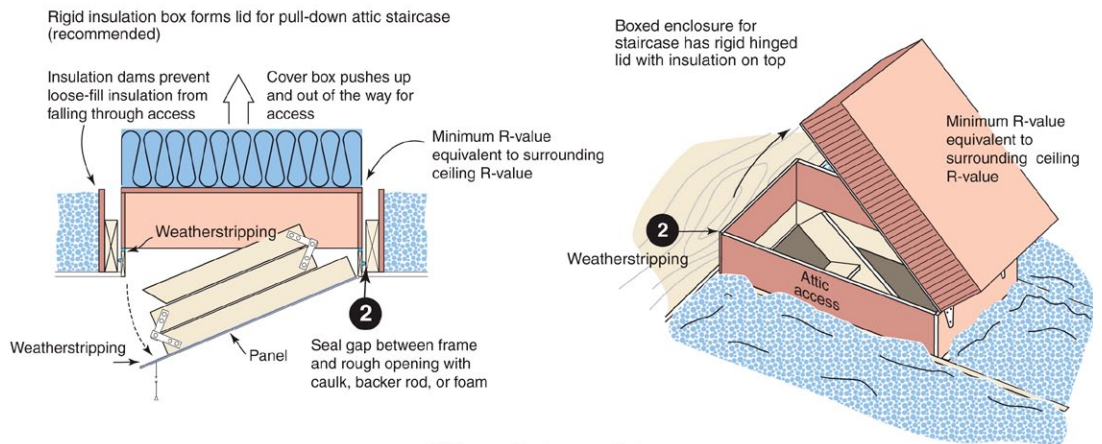
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**AIR SEALING KEY POINTS (CONTINUED)**

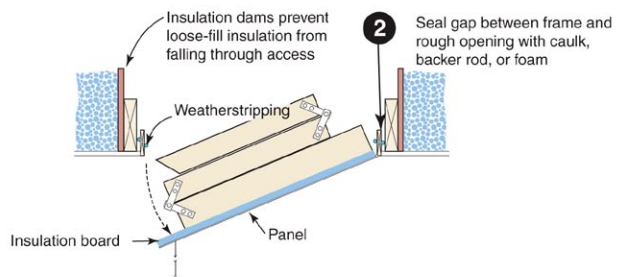
**Attic scuttle**



**Attic pull-down stairs**



**Attic pull-down stairs**



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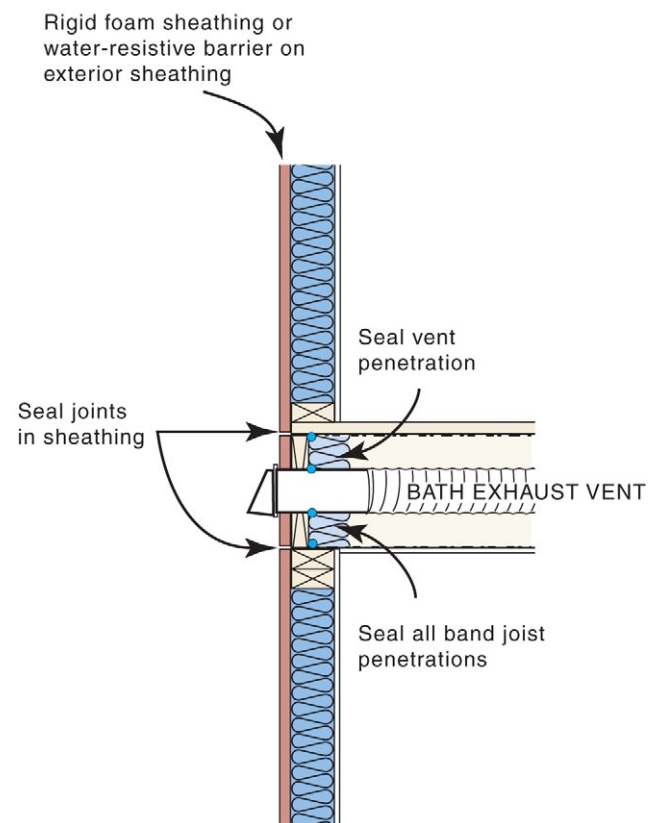
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## AIR SEALING KEY POINTS (CONTINUED)

## Multifamily

1. Cap and seal all chases, including chases for grouped utility lines and radon vents.
2. Seal penetrations in mechanical closet, including penetrations for the:
  - supply plenum
  - outside air ventilation
  - refrigerant line
  - plumbing
  - electrical
  - gas fuel
3. Seal band area at exterior sheathing side and all penetrations through band.
4. Air seal at drywall finishing for any wall adjacent to stairwell or elevator. Air seal this gap at every change in floor level.
5. Seal miscellaneous clustered penetrations through building envelope (e.g., refrigerant lines).



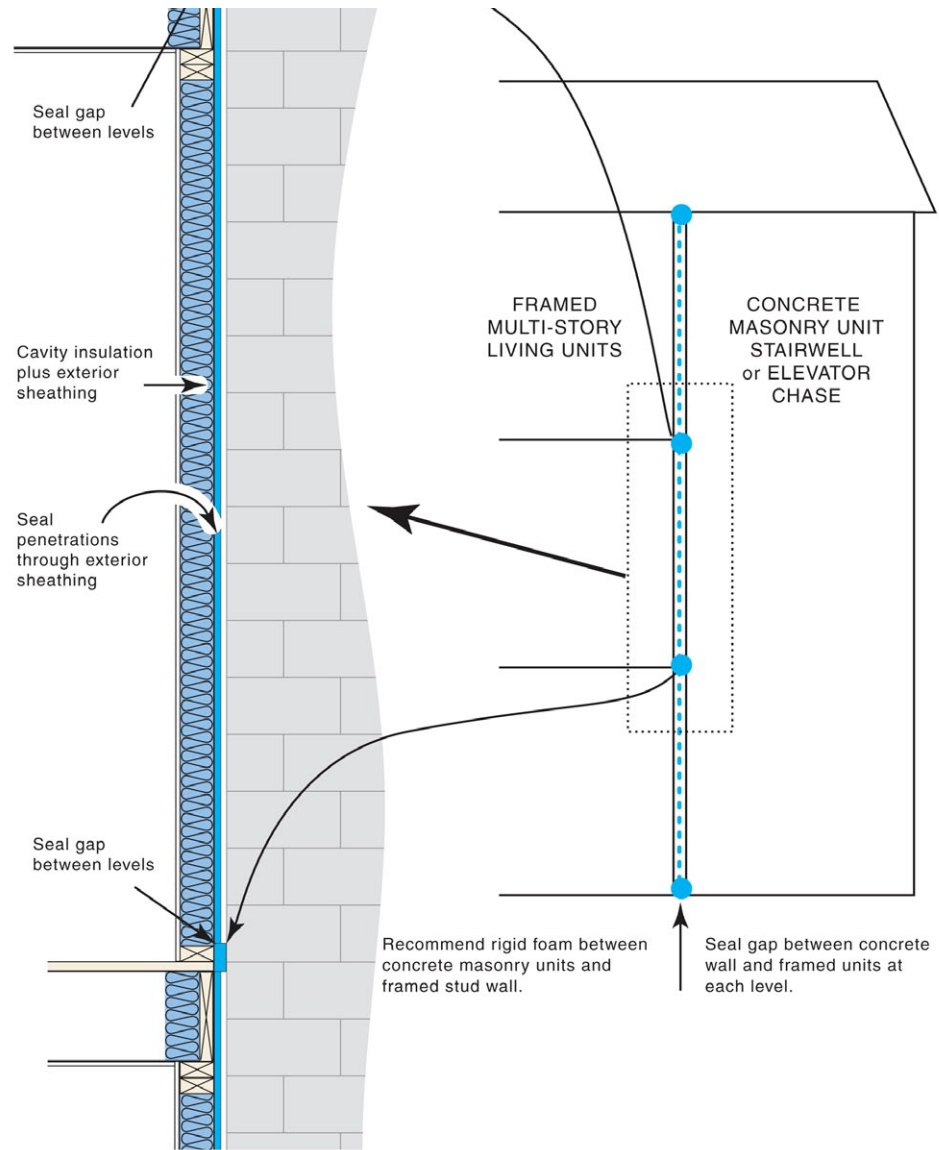
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- 4 WATER CONSERVATION
- 5 ENERGY EFFICIENCY
- 6 MATERIALS BENEFICIAL TO THE ENVIRONMENT
- 7 HEALTHY LIVING ENVIRONMENT
- 8 OPERATIONS + MAINTENANCE

**AIR SEALING KEY POINTS (CONTINUED)**

**Multifamily**



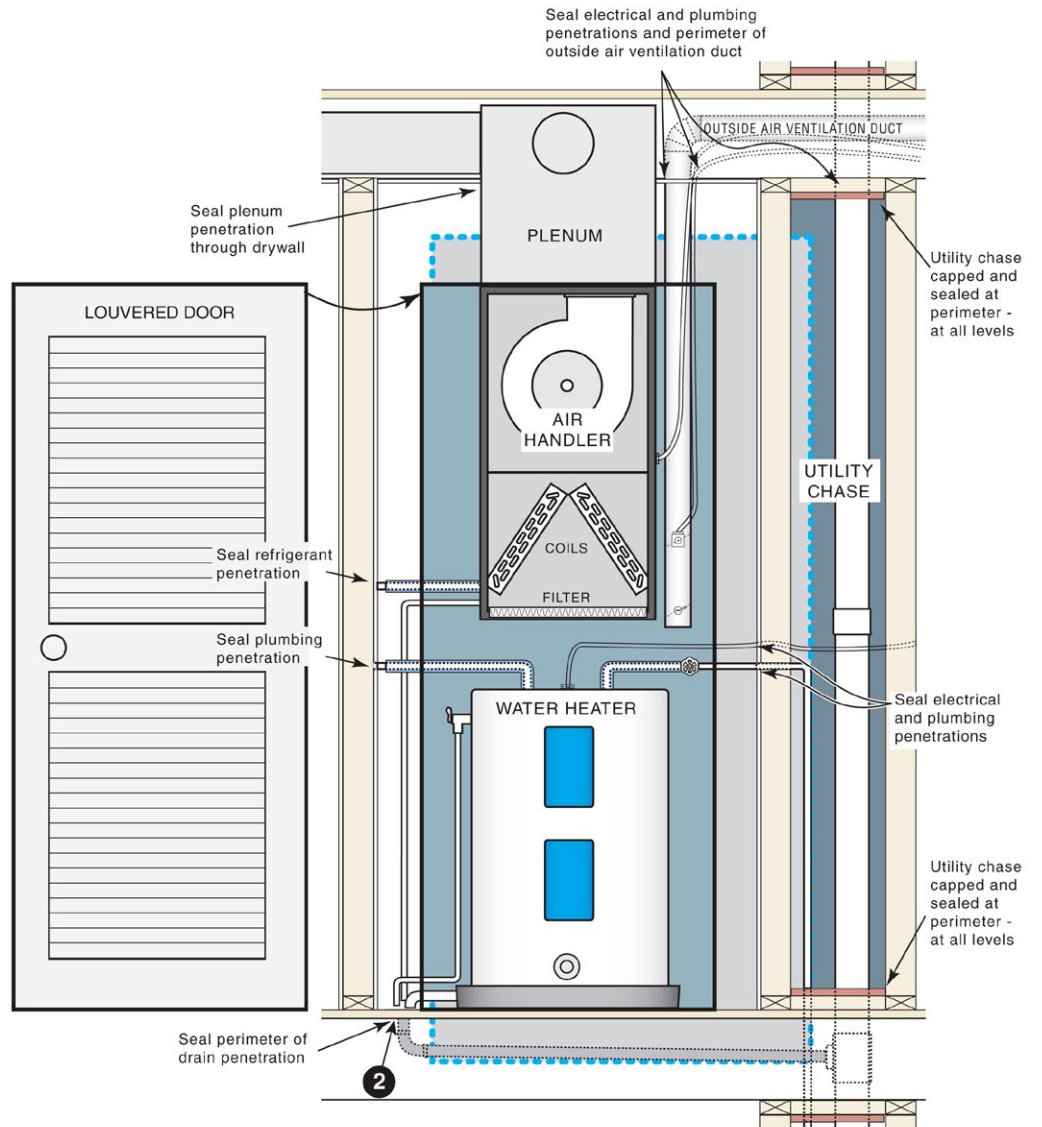
Disclaimer: This document is intended solely to help graphically demonstrate the air leakage provisions of section 402.4 of the 2009 IECC. It does not cover all air sealing locations or techniques. Other code provisions may be applicable as well.

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- 1 INTEGRATIVE DESIGN
- 2 LOCATION + NEIGHBORHOOD FABRIC
- 3 SITE IMPROVEMENTS
- 4 WATER CONSERVATION
- 5 ENERGY EFFICIENCY
- 6 MATERIALS BENEFICIAL TO THE ENVIRONMENT
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**AIR SEALING KEY POINTS (CONTINUED)**

**Mechanical closet**



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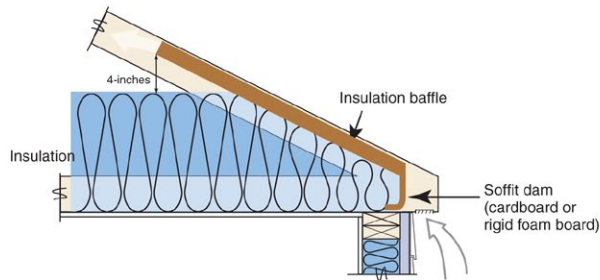
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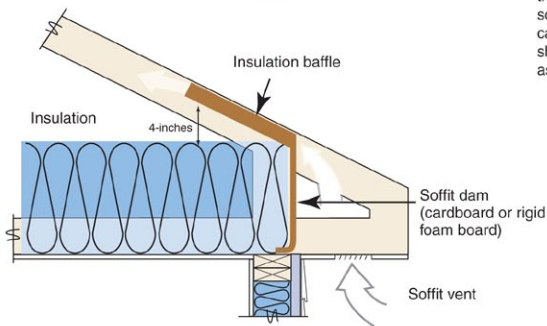
**AIR SEALING KEY POINTS (CONTINUED)**

**Roof and truss**

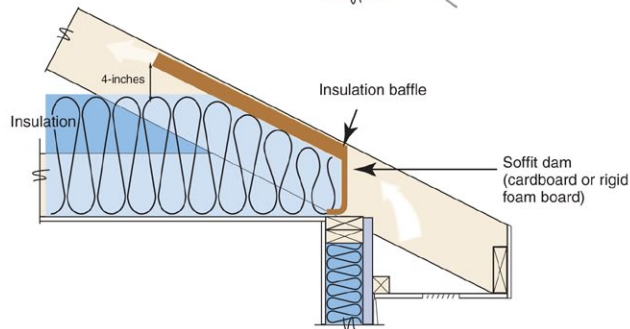
**Standard Truss with tapered insulation depth**



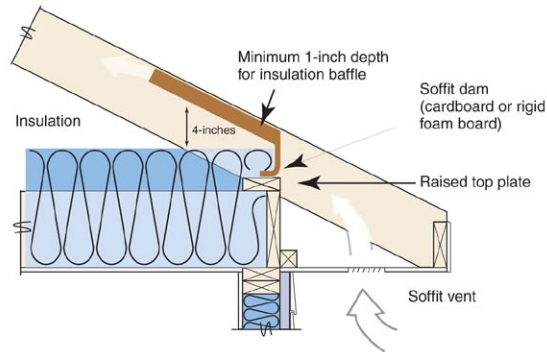
**Energy Truss with full height insulation (recommended)**



**Standard rafter and top plate with tapered insulation depth**



**Rafter on raised top plate with full height insulation (recommended)**



**Note: Wind wash baffle and air-permeable insulation dam.** For air permeable insulation in vented attics, baffles shall be installed adjacent to soffit and eave vents. A minimum of a 1-inch of space shall be provided between the insulation and the roof sheathing and at the location of the vent. The baffle shall extend over the top of the insulation inward until it is at least 4 inches vertically above the top of the insulation. Any solid material such as cardboard or thin insulating sheathing shall be permissible as the baffle.

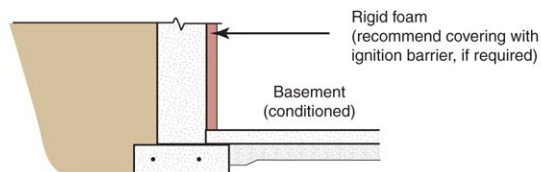
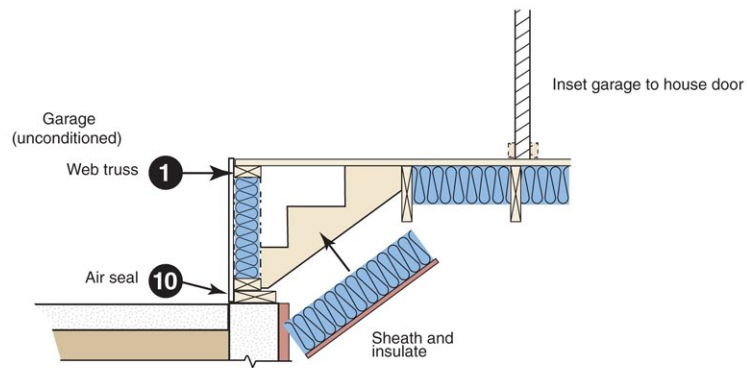
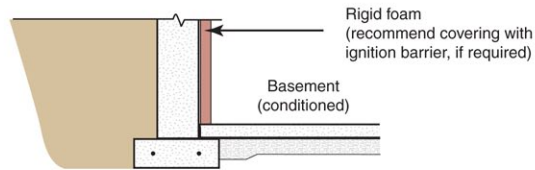
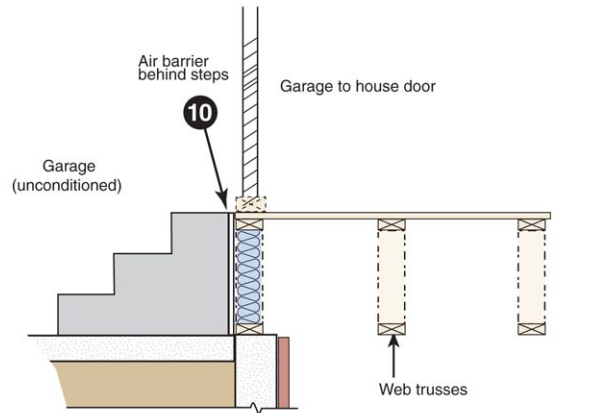
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AIR SEALING KEY POINTS (CONTINUED)

Garage



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## Glossary

*Websites listed were last accessed December 1, 2010.*

**Adaptive plant species:** A non-native plant species that performs similarly to a native species in a particular region, state, ecosystem, and habitat, and that 1) can survive temperature/ weather extremes in the microclimate; 2) requires little irrigation or fertilization, once established; 3) is resistant to local pests and diseases; and 4) does not displace other plants, as invasives do.

**Adaptive reuse site:** A site that was previously developed for non-residential purposes in which at least 25% of the proposed development will reuse existing non-residential structures.

**ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) Standard 62.2-2010:** Establishes minimum requirements for ventilation and acceptable indoor air quality in low-rise residential building. [www.ashrae.org/technology/page/548](http://www.ashrae.org/technology/page/548))

**ASHRAE Standard 90.1-2007:** Establishes minimum requirements for the energy-efficient design of buildings, except single-family houses, multifamily structures of three stories or fewer above grade, and manufactured houses (mobile and modular). This standard is also the basis of Chapter 7 of the International Code Council's International Energy Conservation Codes. State energy codes that may be more stringent than ASHRAE 90.1 are identified on the U.S. Department of Energy's Building Energy Codes website, [www.energycodes.gov](http://www.energycodes.gov).

**Berm:** A sloped wall or embankment, typically constructed of earth, hay bales, or timber framing, used to prevent inflow or outflow of material into or out of an area. [www.epa.gov/OUST/pubs/tum\\_appx.pdf](http://www.epa.gov/OUST/pubs/tum_appx.pdf)

**Building Performance Institute (BPI):** A national standards development and credentialing organization for residential energy-efficiency retrofit work that provides training through a network of affiliate organizations, individual certifications, company accreditations, and quality assurance programs.

**California 01350:** A Special Environmental Requirements standard specification developed by the State of California to cover key environmental performance and public health considerations for building projects. Contains guidelines for energy, materials, water efficiency, indoor air quality (IAQ), nontoxic performance standards for cleaning and maintenance products, and sustainable site planning and landscaping considerations, among other measures. [www.calrecycle.ca.gov/greenbuilding/specs/section01350/](http://www.calrecycle.ca.gov/greenbuilding/specs/section01350/)

**CFM (cubic feet per minute):** A standard unit of measurement for airflow that indicates how many cubic feet of air are passing through a fixed point per minute.

**Charrette:** A focused and collaborative brainstorming session held at the beginning of a project to bring people from different disciplines and backgrounds together to explore design options for a particular area or site. All stakeholders are encouraged to exchange ideas and information beyond their areas of expertise so as to allow truly integrative design solutions to take form. [www.wbdg.org/wbdg\\_approach.php](http://www.wbdg.org/wbdg_approach.php)

**Colonias community:** Any identifiable community in the U.S.–Mexico border regions of Arizona, California, New Mexico, and Texas that is determined to be a colonia on the basis of objective criteria, including lack of a potable water supply, inadequate sewage systems, and a shortage of decent, safe, and sanitary housing. The border region means the area within 150 miles of the U.S.–Mexico border excluding Metropolitan Statistical Areas with populations exceeding one million (according to the National Affordable Housing Act of 1990, Section 916).

**Common area:** An area available for use by more than one person, including rental or sales offices, entrances, hallways, shared leisure rooms, resident services areas, and laundry rooms.

**CSA (Community-Supported Agriculture):** A community of individuals who pledge support to a farm operation so that the farmland becomes the community's farm, with the growers and consumers providing mutual support and sharing the risks and benefits of food production. Typically, members of the farm or garden pledge in advance to cover the anticipated costs of the farm operation and the farmer's salary. In return, they receive shares in the farm's bounty throughout the growing season. Members also share in the risks of farming, including poor harvests due to unfavorable weather or pests. [www.nal.usda.gov/afsic/pubs/csa/csadef.shtml](http://www.nal.usda.gov/afsic/pubs/csa/csadef.shtml)

**Compost blanket:** A layer of loosely applied compost or composted material that is placed on the soil in disturbed areas to control erosion and retain sediment resulting from sheet-flow runoff. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=118&minmeasure=4](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=118&minmeasure=4)

**CO (carbon monoxide):** A colorless, odorless, and tasteless gas that greatly affects indoor air quality. Because it is impossible to see, taste, or smell the toxic fumes, CO can kill you before you are aware it is in your home. At lower levels of exposure, CO causes mild effects that are often mistaken for the flu. These symptoms include headaches, dizziness, disorientation, nausea, and fatigue. [www.epa.gov/iaq/co.html](http://www.epa.gov/iaq/co.html)

**Dial-a-ride program:** A privately or publicly operated program that provides an on-demand ride service, requiring passengers to call ahead to reserve a ride. These programs usually provide connections between different transportation systems and/or employment centers, and must operate at least Monday through Friday to qualify.

**Distribution Uniformity:** A measure of the evenness of irrigation water coverage over a given area. [www.epa.gov/watersense/docs/ws\\_water\\_budget\\_approach508.pdf](http://www.epa.gov/watersense/docs/ws_water_budget_approach508.pdf)

**DU (distribution uniformity):** A standard unit of measurement that looks at how uniformly water is applied to a defined area.

**ECM (electronically commutated motor):** A DC electric motor that uses electricity efficiently, particularly at lower speeds. Also known as a "brushless DC motor."

**Emissivity:** A unitless measure, describing the relative ability of a surface to emit heat through radiation, ranging from 0.00 (minimum radiation of heat) to 1.00 (maximum radiation of heat). Generally, more reflective materials have a lower emissivity.

**Employer vanpool:** A program in which 5 to 15 people (over the age of 16) ride together to and from work. The vanpool may be public or private, but must carry all passengers more than half the distance to work to qualify. Vanpools may be employer-operated, sponsored by transit agencies, or administered by third-party operators.

**ENERGY STAR:** A voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Introduced by the EPA in 1992, ENERGY STAR is an accepted, national standard for single-family and low-rise residential New Construction projects. ENERGY STAR New Homes Version 3 will be expanded to include mid-rise multifamily buildings with their own heating, cooling, and hot water systems.

**Engineered wood products:** Wood building materials manufactured by gluing particles, fibers, or veneers to increase strength. For the purposes of Criterion 6.8, Green Communities considers prefabricated and precut wood products as "engineered wood products." [www.astm.org/SNEWS/JUNE\\_2003/yeh\\_jun03.html](http://www.astm.org/SNEWS/JUNE_2003/yeh_jun03.html)



**Entryway:** Threshold separating the indoor space from the outdoor space.

**Environmental site assessment:** An investigation of the site's conditions often performed before acquisition of a property to satisfy the due-diligence requirements of a property transaction.

**Erosion blankets:** Porous fabrics used for a variety of purposes, including separators, reinforcement, filtration and drainage, and erosion control. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=45&minmeasure=4](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=45&minmeasure=4)

**Filter sock:** A mesh tube filled with composted material that is placed perpendicular to sheet-flow runoff to control erosion and retain sediment in disturbed areas. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=120&minmeasure=4](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=120&minmeasure=4)

**Formaldehyde:** A chemical used widely by industry to manufacture building materials and numerous household products. Formaldehyde is also a by-product of combustion and certain other natural processes, and thus may be present in substantial concentrations both indoors and outdoors. Health effects include eye, nose, and throat irritation; wheezing and coughing; fatigue; skin rash; and severe allergic reactions. May cause cancer. [www.epa.gov/iaq/formalde.html](http://www.epa.gov/iaq/formalde.html)

**Greenfield:** A previously undeveloped parcel of land.

**Green roof:** A planted roof that reduces stormwater runoff. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=114&minmeasure=5](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=114&minmeasure=5)

**Greywater:** Wastewater produced from baths and showers, clothes washers, and lavatories. Greywater gets its name from its cloudy appearance and from its status as being neither fresh (as in potable water) nor heavily contaminated (as in blackwater from toilet waste). [greywater.sustainablesources.com/](http://greywater.sustainablesources.com/)

**HERS Index (Home Energy Rating System Index):** A scoring system established by the Residential Energy Services Network (RESNET) in which a home built to the specifications of the HERS Reference Home (based on the 2006 International Energy Conservation Code) scores a HERS Index of 100, while a net zero energy home scores a HERS Index of 0. The lower a home's HERS Index, the more energy-efficient it is in comparison to the HERS Reference Home. Each 1-point decrease in the HERS Index corresponds to a 1% reduction in energy consumption compared to the HERS Reference Home; thus a home with a HERS Index of 85 is 15% more energy-efficient than the HERS Reference Home, and a home with a HERS Index of 80 is 20% more energy-efficient.

**Home Energy Rating:** An analysis of a home's construction plans and onsite inspections. Based on the home's plans, the Home Energy Rater uses an energy-efficiency software package to perform an energy analysis of the home's design. This analysis yields a projected, pre-construction HERS Index. Upon completion of the plan review, the rater will work with the builder to identify the energy-efficiency improvements needed to ensure that the house will meet ENERGY STAR performance guidelines. The rater then conducts on-site inspections, typically including a blower door test (to test the leakiness of the house) and a duct test (to test the leakiness of the ducts). Results of these tests, along with inputs derived from the plan review, are used to generate the HERS Index score for the home.

**IECC (International Energy Conservation Code):** A model building energy code created by the International Code Council to set a minimum standard for energy efficiency. [www.iccsafe.org/Pages/default.aspx](http://www.iccsafe.org/Pages/default.aspx)

**Infill:** A site with 75% of its perimeter bordering existing development or roads and with access to existing infrastructure.



**Integrative design:** A design approach that brings together at an early stage in project planning all the members of the building stakeholder community, and the technical planning, design, and construction team (including green building consultants such as the green rater, mechanical engineer/energy expert, and others) to look at the project objectives, building materials, systems, and assemblies from many different perspectives. This approach is a deviation from the typical planning and design process of relying on the expertise of specialists who work in their respective specialties somewhat isolated from each other. [www.wbdg.org/wbdg\\_approach.php](http://www.wbdg.org/wbdg_approach.php)

**Intermittent rate:** Ventilation that stops and starts at regular intervals (i.e., the opposite of continuous ventilation).

**LED (light-emitting diode):** Energy-efficient lights that produce less initial heat per lumen, consume less energy, and last longer than conventional incandescent and fluorescent lights.

**Low-impact development:** A strategy of site design where the goal is to restore the natural, pre-developed ability of an urban site to absorb stormwater. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=124&minmeasure=5](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=124&minmeasure=5)

**Maintained solar reflectance:** A measure of a material's ability to maintain its initially rated solar reflectance. Products are tested over a period of three years.

**Manual D:** Manual prepared by the Air Conditioning Contractors of America (ACCA) on residential duct sizing.

**Manual J:** Manual prepared by ACCA on residential load calculations. [www.acca.org/store/product.php?pid=172](http://www.acca.org/store/product.php?pid=172)

**Manual S:** Manual prepared by ACCA on residential equipment selection. [www.acca.org/store/product.php?pid=154](http://www.acca.org/store/product.php?pid=154)

**Moderate rehabilitation:** Enterprise Green Communities defines a moderate rehab as a project that does not fully gut and expose the structure and air barrier of the building envelope or replace/improve all major systems of the building.

**Native plant species:** A plant species that occurs naturally in a particular region, state, ecosystem, and habitat without direct or indirect human actions. [web4.audubon.org/bird/at\\_home/PlantNativeSpecies.html](http://web4.audubon.org/bird/at_home/PlantNativeSpecies.html)

**Naturescaping:** A method of landscaping that reduces water use, energy consumption, and chemical needs by using climate-appropriate plants and maintenance techniques.

**Non-buildable land:** Land that is not economically feasible to be developed, such as easements, utility fall zones, unsuitable soil, steep grades, water features, wetlands, or natural preserves.

**Open space:** Undeveloped land that is permanently set aside for public use. Open space may be used as community open space or preserved as green space, and includes parcels in conservation easement or land trust, park or recreation areas, and community gardens.

**Permeable paving:** A porous cover system that encourages groundwater recharge and infiltration. [www.epa.gov/oaintrnt/stormwater/pavers.htm](http://www.epa.gov/oaintrnt/stormwater/pavers.htm) and [www.epa.gov/greeningepa/stormwater/best\\_practices.htm](http://www.epa.gov/greeningepa/stormwater/best_practices.htm)

**Phenol-formaldehyde:** A resin used in the manufacture of composite wood products primarily for outdoor use, including softwood plywood and flake or oriented strand board. Composite wood products that contain phenol-formaldehyde generally emit formaldehyde at lower rates than those containing urea formaldehyde resin. [www.epa.gov/iaq/formalde.html](http://www.epa.gov/iaq/formalde.html)

**Photocell:** A light-sensitive device that detects ambient light and controls exterior fixtures accordingly.

**Photovoltaics:** Composite materials that convert sunlight directly into electrical power.

**Post-consumer waste:** Materials or finished products that have served their intended use and so have been diverted or recovered from waste destined for disposal. [www.epa.gov/OCEPaterms/pterm.html](http://www.epa.gov/OCEPaterms/pterm.html)

**Post-industrial waste (also called pre-consumer waste):** Materials generated in manufacturing and converting processes such as manufacturing scrap and trimmings and cuttings. [www.epa.gov/OCEPaterms/pterm.html](http://www.epa.gov/OCEPaterms/pterm.html)

**Public-private regional transportation:** Private company offering public transit services through a public funding stream, based on a regular schedule and permanent stops.

**Radon:** A colorless, odorless, and tasteless gas that greatly affects indoor air quality. According to the EPA, radon exposure is the second leading cause of lung cancer in the United States. [www.epa.gov/radon/pubs/citguide.html](http://www.epa.gov/radon/pubs/citguide.html)

**Resilient flooring:** Flooring products in which the wearing surface is non-textile, including but not limited to rubber, polymeric, and linoleum. [webstore.ansi.org/RecordDetail.aspx?sku=NSF%2FANSI+332-2010](http://webstore.ansi.org/RecordDetail.aspx?sku=NSF%2FANSI+332-2010)

**RESNET (Residential Energy Services Network):** A national, nonprofit corporation that certifies raters to evaluate building energy performance using HERS. [www.resnet.us](http://www.resnet.us)

**Retention basin:** A shallow impoundment designed to infiltrate stormwater into the soil. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=69](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=69)

**Road section:** The cross-section through a street, with particular attention paid to the width of the street and its hydrology. Carefully planned road sections can decrease the amount of impervious surfaces and can improve the overall stormwater management for the project site. More information can be found in the document *Low-Impact Development Design Strategies: An Integrated Design Approach*, found at [www.epa.gov/OWOW/nps/lidnatl.pdf](http://www.epa.gov/OWOW/nps/lidnatl.pdf).

**Rock filter:** A permanent or temporary stone structure installed to serve as a sediment-filtering device in drainage ways. Allows a pool to form in an excavated or natural depression, where sediment can settle. The pool is then dewatered through the gravel rock dam. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=57&minmeasure=4](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=57&minmeasure=4)

**Silt fencing:** A temporary fabric barrier surrounding a site to control stormwater runoff. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=56](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=56)

**Silt sacks:** Tube-shaped erosion-control devices. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=121&minmeasure=4](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=121&minmeasure=4)

**Smart grid:** A modern electrical grid that integrates a digital communication overlay on the electro-mechanical grid from the power plant to the end-use appliance.

**Smart meter:** A system that collects energy usage data (both energy consumption and production, if renewable systems are present) from a home or building.

**Solar hot water system:** Captures, converts, and transfers heat from direct and indirect sunlight to heat an auxiliary water tank and provide hot water for a building's occupants.

**Solar reflectance (or albedo):** A measure of a material's ability to reflect sunlight (including the visible, infrared, and ultraviolet wavelengths) on a scale of 0 to 1. A solar reflectance value of 0.0 indicates that the surface absorbs all solar radiation, and a 1.0 solar reflectance value represents total reflectivity.

**Solar south:** A measurement of the sun's true position based on its path across the sky. It is different from magnetic south, which is taken from a compass reading. Methods for calculating solar south include the solar noon method or a compass using a magnetic declination chart to correct for magnetic declination.

**Straw bale:** A bound block of straw and organic material used to control stormwater runoff.

[cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=122&minmeasure=4](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=122&minmeasure=4)

**Substantial rehabilitation:** Enterprise Green Communities defines a substantial rehab (or gut rehab) as a project that guts and exposes the building envelope to expose the structure and air barrier and replaces or improves major systems of the building.

**Supportive housing dwelling units:** Permanent housing with attached intensive services targeted to populations that have special needs, including people who are currently or formerly homeless; those with serious, chronic mental health issues; people in various stages of recovery from substance abuse; people with HIV/AIDS, or physical or developmental disabilities; the formerly incarcerated, the frail elderly, homeless or emancipated youth, and victims of domestic violence; and other groups that would not be able to live independently and maintain housing without intensive support.

**Swales:** Shallow grass-covered hydraulic conveyance channels that help to slow runoff and facilitate infiltration. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet\\_results&view=specific&bmp=75&minmeasure=5](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=75&minmeasure=5)

**T8 fixture:** A fixture made up of a tubular fluorescent bulb and an electronic ballast, both operating with a higher efficacy than traditional tubular fluorescent design technology, such as the T12 bulb and magnetic ballast.

**Tiers:** Earthen embankments that reduce erosion by slowing, collecting, and redistributing surface runoff to stable outlets that increase the distance of overland runoff flow. [cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=46&minmeasure=4](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=46&minmeasure=4)

**Title 24 (2008 Building Energy Efficiency Standards, Title 24, Part 6):** The building energy performance standards for the State of California. [www.energy.ca.gov/title24/2008standards/index.html](http://www.energy.ca.gov/title24/2008standards/index.html)

**Transit ride:** A scheduled stop along a defined route of one form of public transportation (bus, rail, or ferry).

**Universal design:** The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. The principles of universal design are as follows: 1) equitable use, 2) flexibility in use, 3) simple and intuitive use, 4) perceptible information, 5) tolerance for error, 6) low physical effort, and 7) size and space for approach and use. [www.design.ncsu.edu/cud/about\\_ud/udprinciples.htm](http://www.design.ncsu.edu/cud/about_ud/udprinciples.htm)

**Urea-formaldehyde:** A toxic resin created from formaldehyde that causes similar side effects. Composite wood products made for indoor use, such as particleboard, hardwood plywood paneling, and medium-density fiberboard, often contain this resin. [www.epa.gov/iaq/formalde.html](http://www.epa.gov/iaq/formalde.html)

**Vehicle share program:** A private system in which a company or a group of individuals share vehicles on a reservation basis and pay for the use on the basis of time or mileage. Programs that qualify under Criterion 2.15 must have an established formal agreement among participants.

**Ventilation:** The process of supplying outdoor air to, or removing indoor air from, a dwelling by natural or mechanical means. Such air may or may not have been conditioned.

**VOCs (Volatile Organic Compounds):** A large group of carbon-based chemicals that easily evaporate at room temperature. [www.epa.gov/iaq/voc.html](http://www.epa.gov/iaq/voc.html)

**Walk distance:** The distance a pedestrian must travel between origins and destinations without obstruction, in a safe and comfortable environment on a continuous network of sidewalks, all-weather-surface footpaths, crosswalks, or equivalent pedestrian facilities. Any crossing of a street with speeds at or greater than 30 miles per hour requires controlled crossing (e.g., a stop sign or stop light).

**Watershed:** The area of land where all of the water that is under it or drains off of it goes into the same place. [www.epa.gov/owow/watershed/whatis.html](http://www.epa.gov/owow/watershed/whatis.html)

**Weekend ride options:** A public transit option of either bus, rail, or ferry service. Employer-assisted vanpools and dial-a-ride programs are examples of qualifying weekend service.

**Xeriscaping:** A method of landscaping aimed at reducing or eliminating excess water from irrigation by using drought-tolerant plants. [www.epa.gov/epawaste/consERVE/rrr/greenscapes/index.htm](http://www.epa.gov/epawaste/consERVE/rrr/greenscapes/index.htm)



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