

Table of Contents

	Page
Introduction	3
Evergreen Sustainable Development Criteria: An Overview	4
Criteria	5
1. <u>Integrated Design Process</u>	7
1-1 Green Development Plan.....	7
2. <u>Site, Location and Neighborhood Fabric</u>	8
2-1 Smart Site Location – Proximity to Existing Development: New Construction	8
2-2 Smart Site Location – Protecting Environmental Resources: New Construction	8
2-3 Smart Site Location – Proximity to Services: New Construction.....	9
2-4 Compact Development: New Construction.....	10
2-5 Compact Development.....	10
2-6 Walkable Neighborhoods – Sidewalks and Pathways	11
2-7 Walkable Neighborhoods – Connections to Surrounding Neighborhood.....	11
2-8 Smart Site Location – Passive Solar Heating / Cooling.....	12
2-9 Smart Site Location – Grayfield, Brownfield or Adaptive Reuse Site	12
2-10 Transportation Choices	13
3. <u>Site Improvements</u>	14
3-1 Environmental Remediation.....	14
3-2 Erosion and Sedimentation Control	14
3-3 Landscaping	15
3-4 Surface Water Management.....	16
3-5 Storm Drain Labels	16
4. <u>Water Conservation</u>	17
4-1 Water-Conserving Appliances and Fixtures	17
4-2 Water-Conserving Appliances and Fixtures	17
4-3 Efficient Irrigation.....	18
5. <u>Energy Efficiency</u>	19
5-1 Efficient Energy Use: New Construction.....	19
5-2 Efficient Energy Use: Rehabilitation	20
5-3 Energy Star Appliances.....	21
5-4 Efficient Lighting – Interior	21
5-5 Efficient Lighting – Common Areas and Exterior	21
5-6 Electricity Meter: New Construction	22
5-7 Additional Reductions in Energy Use: New Construction	23
5-8 Additional Reductions in Energy Use: Rehabilitation	23
5-9 Photovoltaic (PV) Panels	23
5-10 Photovoltaic (PV) Ready.....	24
5-11 Domestic Water Heating.....	25
5-12 Domestic Water Heating.....	26
5-13 Solar Water Heating.....	26
5-14 Efficient Energy Use – Performance Tested Building Air Sealing.....	27
5-15 Efficient Energy Use – Performance Tested Duct Sealing	28
5-16 Efficient Energy Use – Space Heating and Cooling Equipment Replacement.....	28

5-17	Efficient Energy Use – Document Space Conditioning Savings of 50 percent or More Compared to National Standards.....	29
6.	<u>Materials Beneficial to the Environment</u>	31
6-1	Construction Waste Management	31
6-2	Recycled Content Material.....	31
6-3	Certified, Salvaged and Engineered Wood	32
6-4	Water-Permeable Walkways.....	33
6-5	Water-Permeable Parking Areas	33
6-6	Roofing.....	34
6-7	Reducing Heat-Island Effect – Paving	35
7.	<u>Healthy Living Environment</u>	36
7-1	Low / No VOC Paints and Primers	36
7-2	Low / No VOC Adhesives and Sealants	36
7-3	Formaldehyde-Free Composite Wood	37
7-4	Green Label Certified Floor Coverings.....	37
7-5	Exhaust Fans – Bathroom: New Construction	38
7-6	Exhaust Fans – Kitchen: New Construction	39
7-7	Ventilation.....	39
7-8	HVAC Equipment and Duct Sizing	40
7-9	Water Heaters, Condensing Boilers, Furnaces and Air Conditioning – Mold Prevention.....	41
7-10	Water Heaters – Minimizing Carbon Monoxide (CO) in the Living Space	41
7-11	Cold Water and Hot Water Pipe Insulation.....	42
7-12	Materials in Wet Areas – Surfaces	43
7-13	Materials in Wet Areas – Tub and Shower Enclosures.....	43
7-14	Basements and Concrete Slabs – Vapor Barrier	44
7-15	Radon: New Construction	44
7-16	Radon Testing: Existing Buildings	45
7-17	Radon Mitigation: Rehabilitation of Existing Buildings.....	45
7-18	Water Drainage	45
7-19	Garage Isolation	47
7-20	Clothes-Dryer Exhaust.....	47
7-21	Integrated Pest Management	48
7-22	Lead-Safe Work Practices: Rehabilitation	48
7-23	Healthy Flooring Materials – Alternative Sources.....	49
7-24	Whole House Vacuum – Reducing Dust.....	49
8.	<u>Operations and Maintenance</u>	50
8-1	Owner’s Manual.....	50
8-2	Occupant’s Manual	50
8-3	Homeowner and New Resident Orientation.....	51
	<u>Appendix A</u>	52
	<u>Appendix B</u>	58

INTRODUCTION

The Evergreen Sustainable Development Standard has been developed to comply with Chapter 39.35D.080 RCW as follows:

“Except as provided in this section, affordable housing projects funded out of the state capital budget are exempt from the provisions of this chapter. On or before July 1, 2008, the department of community, trade, and economic development shall identify, implement, and apply a sustainable building program for affordable housing projects that receive housing trust fund (under chapter 43.185 RCW) funding in a state capital budget. The department of community, trade, and economic development shall not develop its own sustainable building standard, but shall work with stakeholders to adopt an existing sustainable building standard or criteria appropriate for affordable housing. Any application of the program to affordable housing, including any monitoring to track the performance of either sustainable features or energy standards or both, is the responsibility of the department of community, trade, and economic development. Beginning in 2009 and ending in 2016, the department of community, trade, and economic development shall report to the department as required under section 3(3)(b) of this act.”

Twelve technical experts in the field of sustainable development were chosen to meet and recommend the best existing green building standard to apply to Housing Trust Fund (HTF) projects. They chose Green Communities™ developed by Enterprise Community Partners. It was chosen because of its focus on direct benefit to low-income tenants, its specificity and detail about what is required, its flexibility when modified, the willingness of its creators to allow the state to own and control the standard, and its reasonable documentation and process cost. Modifications were added using this standard as a basis and the Evergreen Sustainable Development Standard emerged. Modifications were needed in order to accommodate the diversity of projects that are funded by the HTF and to focus the criteria on building practices, codes, and the climate in Washington State.

The Evergreen Sustainable Development Criteria have been reviewed by stakeholders of the HTF, and there is widespread agreement that this document is the best first step in setting a standard for affordable sustainable development in Washington State.

We would like to extend a special thank you to Enterprise Community Partners for allowing the use of Green Communities™ as the basis for Evergreen.

EVERGREEN SUSTAINABLE DEVELOPMENT CRITERIA: AN OVERVIEW

The Evergreen Sustainable Development Criteria promote public health, energy conservation, operational savings and sustainable building practices in affordable housing design. The strategies in the following pages enhance affordable housing and communities as a whole.

In addition to increasing resource efficiency and reducing environmental impacts, green building strategies can yield cost savings through long-term reduction in operating expenses. The benefits include improved energy performance and thermal comfort, a healthier indoor environment, increased durability of building components, and simplified maintenance requirements that can lead to financial efficiencies for property managers and owners. Green building practices improve the economics of managing affordable housing while enhancing quality of life for residents. Green building practices inform the location of affordable housing – placing homes near community amenities such as public transportation to create walkable, livable neighborhoods. As a result, the benefits for residents and communities expand to include fewer sprawl-related transportation impacts.

The Evergreen Sustainable Development Criteria guide the construction of homes that are cost effective to build and durable and practical to maintain. The principles work together to help produce green affordable housing that:

- Results in a high-quality, healthy living environment
- Lowers residents' and owners' utility costs
- Enhances residents' connection to nature
- Protects the environment by conserving energy, water, materials and other resources
- Prevents degradation of local and regional ecosystems
- Promotes the local economy

The Evergreen Standard is a threshold that all HTF projects must reach or exceed.

To be eligible for grants or loans from the WA State Housing Trust Fund (HTF), a project must comply with all of the mandatory provisions of the Evergreen Sustainable Development Criteria. In addition, new construction must achieve 50 points from the Optional Criteria, while rehabilitation projects must achieve 40 points from the Optional Criteria.

The HTF may waive compliance with specific criteria if the applicant can demonstrate that the criterion creates a hardship or is inadvisable for a specific project and that alternative means meet the intent of the criteria. Please see [ESDS Guidelines and Procedures](#).

SECTION 1: AN INTEGRATED DESIGN PROCESS

Integrated design is critical to achieving efficiency and sustainability. An integrated design process incorporates sustainability in the pre-design phase, uses a multi-disciplinary, wholistic and total-systems approach to the development process, and promotes good health and livability throughout the building's life cycle. A written commitment to a sustainable development plan at the beginning of a project provides the framework for producing the project's objectives during the full design, construction, and operation.

Sustainable building strategies should be considered from the moment the developer initiates the project. The professional development team should include a developer, architect, engineer, landscape architect, LEED™ Accredited Professional or experienced green building design specialist, contractor, and asset and property management staff. Whenever possible, the team also should include maintenance staff and resident representatives. The team must be committed to environmentally responsive and healthy building principles and practices.

SECTION 2: SITE, LOCATION AND NEIGHBORHOOD FABRIC

A good site limits the development of open space. Location within existing communities – or contiguous to existing development – helps conserve land and slow the spread of storm-water runoff to new watersheds. It also reduces travel distances. Proper site selection avoids development of inappropriate sites and damage to or loss of fragile, scarce environmental resources. The greatest savings come from developing in areas that already have infrastructure and civic amenities in place. Site selection is also an opportunity to clean up and redevelop brownfields, restore the land, and infill segmented communities.

Compact development encourages more resource-efficient development of land, reduces development costs and conserves energy. It also can contribute to creating more walkable, livable communities, while helping restore, invigorate and sustain livable development patterns. Making the streetscape safer and more inviting for walkers and bicyclists encourages alternative transportation choices to the automobile. It also promotes physical activity and public health, while creating opportunities for social interaction and increased safety by bringing more eyes on public spaces.

SECTION 3: SITE IMPROVEMENTS

Sustainable site planning helps to achieve the following goals:

- minimize environmental site impacts
- enhance human health
- reduce construction costs
- maximize energy, water, and natural resource conservation
- improve operational efficiencies
- promote alternative transportation

SECTION 4: WATER CONSERVATION

Water efficiency conserves finite fresh water resources and reduces utility bills. Between 20 percent and 40 percent of the contiguous United States has experienced moderate to extreme drought in the late 20th and early 21st centuries. Significant water savings can be realized by specifying and installing water-efficient appliances and plumbing fixtures, implementing low-water landscape and irrigation strategies, and taking advantage of rainwater catchment and graywater sources.

SECTION 5: ENERGY EFFICIENCY

Energy efficiency helps to maximize resident comfort and health, and reduces utility bills. Conservation measures mitigate the accumulative burdens of energy production and delivery, extraction of non-renewable natural resources, degradation of air quality, global warming and the increasing concentration of pollutants.

SECTION 6: MATERIALS BENEFICIAL TO THE ENVIRONMENT

Reducing, reusing and recycling building materials conserves natural resources and reduces emissions associated with manufacturing and transporting materials. Many techniques and building products on the market contribute to more durable, healthy and resource-efficient buildings.

SECTION 7: HEALTHY LIVING ENVIRONMENT

The importance of a healthy living environment is a significant green building issue directly affecting residents and low-income households are entitled to safe housing. Safety includes using materials that do not cause negative health impacts for residents, especially for more sensitive groups such as children, seniors and individuals with existing respiratory problems and compromised immune systems. Creating a healthy living environment requires minimizing residents' and workers' exposure to toxic materials by using safe and biodegradable materials that are alternatives to hazardous materials.

SECTION 8: OPERATIONS AND MANAGEMENT

Operations and management (O&M) practices impact the building owner's costs and residents' health, comfort and safety. Sustainable building O&M practices enhance resident health and operational savings. The key to successful building performance is the integration of O&M plans, education and cost-effective, low-maintenance design.

SECTION 1: INTEGRATED DESIGN

1-1 Green Development Plan

MANDATORY

How

Submit a written development plan outlining the integrated design approach taken for this development that demonstrates involvement of the entire development team.

The plan must provide the following:

- A statement of the overall green development goals of the project and the expected intended outcomes from addressing those goals.
- A description of the integrated design process that was used to select the green building strategies, systems and materials that will be incorporated into the project. Include a summary of meeting minutes or notes with dates or another type of documentation that captures the integrated design process.
- The name, role, and telephone number of each member of the professional design and development team. Identify members of the team who are responsible for the green components and phases of sustainable development.
- An explanation regarding how all of the parties involved in the project are informed about the sustainable goals and features and how you will assure that the goals and features are fully implemented by all workers.

Intent

Integrated design involves all members of the development team and other stakeholders including maintenance personnel from the beginning to identify project goals, constraints, and priorities. An integrated design process incorporates sustainability from the very beginning, and connects the design to the regional climatic conditions. It takes into consideration the existing community context, uses a wholistic and total-systems approach to the development process, and promotes good health and livability through the building's (or development's) life cycle. The benefits of an integrated design process can include lower development costs (as compared to not having an integrated design) and greater health, economic and environmental benefits for residents, property owners and communities. It is important that the development and property management teams are committed to a written plan that they can refer to throughout the development and construction process. This plan will continue to prioritize the project's green objectives throughout the project's life cycle.

Things to Consider

- Conduct a green design workshop (charrette) with the full development team. Perhaps more than one meeting is necessary to achieve clarity of design goals and agreement with the full development team.
- Check out the life cycle and maintenance of similar purpose materials and products and consider choosing the more durable less polluting ones. This will promote the increased service life of the building envelope and its components and systems while lowering

maintenance and repair or replacement costs.

- See [ESDS user's Manual v1.3 Appendix 1.1a](#) for a sample Green Development Plan.
- Other helpful tools are: [ESDS Responsibilities Matrix v.1](#) and [ESDS User's Manual Appendix 1.1b](#).

SECTION 2: SITE, LOCATION AND NEIGHBORHOOD FABRIC

2-1 Smart Site Location – Proximity to Existing Development: New Construction

OPTIONAL – 5 Points

Except for Rehabilitation Projects

How

Provide site map demonstrating that the development is located on a site:

- With access to existing roads, water, sewers and other infrastructure within or contiguous (having at least 25 percent of the perimeter bordering) to existing development; or
- Within the Urban Growth Boundary as defined by an approved Comprehensive Plan.

Do not build on tracts of land that require installing a septic tank or a sanitary sewer line extension of 1,000 feet or greater from the property line of the tract being developed, or within critical potable watershed areas.

Intent

Locations within existing communities, within or contiguous to existing development, help to conserve land and slow the spread of storm-water runoff to new watersheds. It also reduces travel distances. Proper site selection avoids development of inappropriate sites and damage to or loss of fragile, scarce environmental resources. The greatest savings come from developing in areas that already have infrastructure and civic amenities. Site selection is also an opportunity to clean up and redevelop brownfields and to fill in gaps within the built environment.

2-2 Smart Site Location – Protecting Environmental Resources: New Construction

OPTIONAL – 5 Points

Except for Infill Sites or Rehabilitation Projects

How

Provide a site map and documentation demonstrating that the new development is not located on:

- Land within 100 feet of wetlands or wetland protection buffer zones
- Land within 100 feet of steep slopes
- Prime farmland
- Park land
- Land within 1,000 feet of a critical habitat

Intent

Proper site selection avoids development of inappropriate sites and damage to or loss of fragile and scarce environmental resources.

Definitions

- “Prime farmland” is defined by the U.S. Department of Agriculture (USDA) in the *U.S. Code of Federal Regulations, Title 7, Volume 6, Parts 400-699, Section 657.5*. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber and oilseed crops, and is available for these uses. This restriction covers cropland, pastureland, rangeland, forestland and other land, and excludes urban built-up land.
- “Critical habitat” is an area that the U.S. Fish and Wildlife Service or a state or tribal authority designates as occupied by a threatened or endangered species, or essential to the conservation of a threatened or endangered species. See, for example, Endangered Species Act, 16 U.S.C. 1523(5).
- “Wetlands” is defined by the *U.S. Code of Federal Regulations, 40 CFR, Parts 230-233 and Part 22*.
- “Critical slope area” is an area within a tract of land that has a greater than 15 percent change in elevation or an erodability factor of greater than 0.4 as determined by the Natural Resources Conservation Service of the USDA.

2-3 Smart Site Location—Proximity to Services: New Construction

OPTIONAL – 5 Points

Except for Infill Sites or Rehabilitation Projects

How

Provide a location map with exact distances indicating that the project is located within a ¼ mile of at least two, or ½ mile of at least four, of the following facilities: adequate (see definition below) public transportation, supermarket, public school, library, licensed child care center, usable park space, post office, convenience store, laundry/dry cleaner, pharmacy, place of worship, community or civic center that is open to residents.

Intent

Locating projects in communities with services strengthens those communities and residents’ ties to society. It also prevents leapfrog development, which carries numerous negative consequences, including fragmented ecosystems, the spread of polluted runoff to new watersheds, strain on municipal budgets that must stretch to accommodate longer service routes and infrastructure lines, and damage to landscapes that nourish the connection between humans and the natural world.

Pedestrian- and transit-oriented neighborhoods inspire smaller streets with less land relegated to the automobile, and create a more livable, efficient community. These neighborhoods offer residents a range of services, parks and employment opportunities within walking and biking distance. They also offer opportunities for a healthier quality of life while lowering residents’

dependence on cars, thereby reducing the costs of owning a car and the need for garages and other parking areas.

Definitions

Adequate transportation means at least half-hourly bus service or hourly rail, subway or ferry service during peak periods.

2-4 Compact Development: New Construction

OPTIONAL – 5 Points

Except for Infill Sites or Rehabilitation Projects

How

The project architect must complete the density calculation as defined below and certify its correctness. The minimum density for new construction must be:

- Six units per acre for detached or semi-detached houses
- Ten units per acre for town homes
- Fifteen units per acre for apartments

Density is measured by taking the total dwelling units after construction, divided by the acreage of the entire tract down to one decimal point, minus dedicated acreage of public street rights of way, buffered wetlands and open space that has been dedicated through a conservation program.

Intent

Compact development encourages more resource-efficient development of land, reduces development costs, and can reduce automobile dependence. It also can contribute to creating more walkable communities, while helping restore, invigorate and sustain livable development patterns.

2-5 Compact Development: New Construction

OPTIONAL – 5 Points (5 points for an increase over the requirements in 2-4 of at least five units per acre for multifamily buildings, at least two per acre for town homes, or at least one unit per acre for single-family houses)

How

Increase average minimum density for new construction to meet or exceed the following guidelines:

- Seven units per acre for detached or semi-detached
- Twelve units per acre for town homes
- Twenty units per acre for apartments

Intent

Compact development encourages more resource-efficient development of land, reduces

development costs and, can reduce automobile dependence. It also can contribute to creating more walkable communities, while helping restore, invigorate and sustain livable development patterns.

2-6 Walkable Neighborhoods – Sidewalks and Pathways

MANDATORY

How

Provide a site map indicating that sidewalks or all-weather pathways will be created or preserved within a multifamily property or single-family subdivision to link the residential development to public spaces, open spaces and adjacent development.

Intent

Making the streetscape safer and more inviting for walkers and bicyclists encourages alternative transportation choices to the automobile. This promotes physical activity and public health, while creating opportunities for social interaction and increased safety by bringing more eyes on public spaces.

Things to Consider

Use porous pavement for sidewalks and other paved surfaces to reduce storm-water runoff and the distribution of pollutants to streams, rivers and water bodies. Design sidewalks to distribute storm water to open space for recharge and to prevent flooding.

2-7 Walkable Neighborhoods – Connections to Surrounding Neighborhood

OPTIONAL – 5 Points

How

Provide a site map demonstrating at least three separate connections to sidewalks or all-weather pathways in surrounding neighborhoods.

Intent

Providing easy access to sidewalks or all-weather pathways promotes walking, biking and other healthier lifestyles. Walkable neighborhoods reduce dependence on automobile travel and possibly automobile ownership, while reducing auto-related emissions.

Things to Consider

- Integrate pedestrian and bicycle connections from the new development to the surrounding neighborhood through sidewalks, bike lanes or paths.
- Consider using porous pavement for sidewalks and other paved surfaces to reduce storm-water runoff and the distribution of pollutants to streams, rivers and water bodies. Design sidewalks to distribute storm water to open space for recharge and to eliminate flooding.

2-8 Smart Site Location – Passive Solar Heating/Cooling

OPTIONAL – 5 Points

How

Orient building to make the greatest use of passive solar heating and cooling. Demonstrate that the design reduces space heating and/or space cooling energy use by comparing the space heating and cooling energy of the proposed structure to the planned design that meets Criterion 5-1 using the methodology described in the Washington State Energy Code Chapter 4.

Use software capable of performing the needed calculations. Examples include:

- For single family: Energy Gauge USA.
- For multi-family: EQuest.

Intent

Solar energy is a radiant heat source that causes natural processes on which all life depends. Some of the natural processes can be managed through building design to help heat and cool the building. The basic natural processes used in passive solar energy are the thermal energy flows associated with radiation, conduction and natural convection. When sunlight strikes a building, the building materials can reflect, transmit or absorb the solar radiation. Additionally, the heat produced by the sun causes air movement that can be predictable in designed spaces. These basic responses to solar heat lead to design elements, material choices and placements that can provide heating and cooling effects in a home. Passive solar energy means that mechanical means are not employed to utilize solar energy.

Things to Consider

- Elongate building on an east-west axis.
- Interior spaces requiring the most light, heating and cooling should be along the south face of the building.
- A narrow floor plan (less than 40 feet), single-loaded corridors, and an open floor plan optimize daylight penetration and passive ventilation.
- Shading through overhangs and canopies on the south and trees on the west prevent the summer sun from entering the interior.

2-9 Smart Site Location – Grayfield, Brownfield or Adaptive Reuse Site

OPTIONAL – 10 Points

How

Locate the project on a grayfield, brownfield, or adaptive reuse site.

Intent

Use of previously developed sites, including those where development is complicated by real or perceived environmental contamination or physical constraints, reduces pressure on undeveloped

land and the spread of pavement to new watersheds. Many such sites are otherwise prime locations for redevelopment and provide potential economic and location benefits to citizens, neighborhoods and regions. Reuse of existing structures reduces the need for new materials and utilizes embodied energy.

Definitions

- Grayfields are previously developed abandoned sites, such as parking lots and shopping centers.
- Brownfields are real property where the expansion, redevelopment, or reuse may be complicated by the presence of a hazardous substance, pollutant, or contaminant including petroleum. These sites require a Phase II Environmental Site Assessment and a remediation plan.
- A Phase II Environmental Site Assessment is an investigation that collects original samples of soil, groundwater, or building materials to analyze for quantitative values of various contaminants and includes a report of the results.
- An adaptive reuse site is one that was previously developed for non-residential purposes, in which at least 25 percent of the proposed development will reuse existing non-residential structures.

2-10 Transportation Choices

OPTIONAL – (Up to 10 Points)

How

- For five points, provide a context map demonstrating that the site is within one quarter mile radius of public transit service.
- For ten points, provide a context map demonstrating that the site is within one quarter mile radius of two or more public transit lines, or one half mile radius from a fixed rail or ferry station.

Intent

Encouraging the use of public transportation minimizes dependence on car ownership. Transit-oriented neighborhoods reduce residents' needs to own a car, eliminating or lowering the costs of auto ownership, and controlling the area needed for car use and storage. Transit use reduces related emissions of air pollutants and climate-change gasses.

Definitions

Adequate transportation means at least half-hourly bus service or hourly rail, subway or ferry service during peak periods.

SECTION 3: SITE IMPROVEMENTS

3-1 Environmental Remediation

MANDATORY

How

- Conduct and provide a Phase I Environmental Site Assessment according to the *American Society for Testing and Materials (ASTM) E1527-2000* standard and any additional assessments required to determine whether any hazardous materials are present on site.
- If hazardous substances are considered to be present, conduct and provide a Phase II Environmental Site Assessment.
- For all existing buildings, limited surveys for asbestos, lead-based paint, and mold are required to be submitted with the application.
- For all vacant land, a limited wetland survey is required.

Definitions

- A Phase I Site Assessment is an investigation and a report regarding a specific site to satisfy the due-diligence requirements of an acquisition. The site assessment identifies existing or potential environmental contamination liabilities addressing both the underlying land and any physical improvements.
- A Phase II Environmental Site Assessment is an investigation that collects original samples of soil, groundwater, or building materials to analyze for quantitative values of various contaminants and includes a report of the results.
- A Phase III Environmental Site Assessment is an investigation regarding the remediation of a contaminated site including a report that documents the steps in the cleanup and the monitoring of residual hazardous substances.

3-2 Erosion and Sedimentation Control

MANDATORY

How

Implement EPA's Best Management Practices (BMP) for erosion and sedimentation control during construction, referring to the EPA document, *Storm Water Management for Construction Activities (EPA 832-R-92-005)*.

Or, comply with local erosion and sedimentation control standards if the local standards are more stringent than EPA.

Clearly state which BMP or local controls are or will be incorporated into construction and site development plans and contracts.

Erosion control measures must include all of the following:

- a) Stockpile and protect disturbed topsoil from erosion (for reuse).
- b) Control the path and velocity of runoff with silt fencing or comparable measures.
- c) Protect onsite storm sewer inlets, streams and lakes with straw bales, silt fencing, silt sacks, rock filters or comparable measures.
- d) Provide swales to divert surface water from hillsides.
- e) If soil in a sloped area (i.e., 25 percent, or 4:1 slope) is disturbed during construction, use tiers, erosion blankets, compost blankets, filter socks and berms, or some comparable approach to keep soil stabilized.

Intent

Erosion and sedimentation control during site development keeps valuable top soils on site and reduces pollution, storm-water runoff and sediment runoff associated with construction activities into local waterways. Compacted soils resulting from construction are less able to absorb water and resist plant root penetration, and lack the porosity needed for adequate aeration. Erosion and sedimentation control helps to avoid storm-water-related problems that can delay construction, cause environmental degradation (to creeks, streams and coastal waters) and damage public and private properties downstream. The goal of this criterion is no visible off-site discharge.

Things to Consider

The EPA's document, *Storm Water Management for Construction Activities*, may be purchased as item PB 922 359 51 from the National Technical Information Service at www.ntis.gov.

3-3 Landscaping

OPTIONAL – 5 Points

If Providing Landscaping

How

Provide a landscape plan showing that the selection of trees and plants are native species appropriate to the site's soils and microclimate, and how newly planted trees are located to provide shading in the summer and allow for heat gain in the winter. Do not install an irrigation system.

Intent

Native vegetation is well adapted to the climate and provides excellent erosion, sediment, dust and pollution control. Native plants are more resistant to naturally occurring disease, insects and low levels of nutrients, thereby reducing the need for fertilizers, pesticides or herbicides. Native vegetation is likely to need little to no irrigation, thereby reducing maintenance and water usage.

Things to Consider

- Consult a local arborist and involve a landscape architect in the architectural design process to identify appropriate areas for landscaping including energy and water savings.
- Combine landscape plan with storm-water management to provide surface water filtration and aesthetic benefits.
- Non-native turf needs about 35 inches of water per year to thrive, whereas native turf

needs much less water per year.

- While lawns are appropriate for some landscaping, such as for play areas, they should be minimized wherever possible, except in climates where they need no irrigation.
- In areas where water shortages are common, xeriscape (a landscaping method that uses drought-resistant plants to conserve resources, especially water) should be considered.
- With native vegetation, the installation of an irrigation system is not needed.

3-4 Surface Water Management

OPTIONAL – 5 Points

How

Capture, retain, infiltrate, and/or harvest the first one-half ($\frac{1}{2}$) inch of rainfall that falls in a 24-hour period modeled over the site area using the proposed types of land cover.

Intent

Reducing storm-water runoff through design and management techniques increases on-site filtration, prevents 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.

Things to Consider

- Check with local governments to verify that capture of rainwater is permitted.
- Make use of low-impact techniques such as rain gardens, green roofs, rain barrels and cisterns to capture and re-use storm water.
- Minimize impervious areas (surfaces that do not allow storm-water infiltration), including roofs, driveways, sidewalks and streets, or use porous materials for such areas.

3-5 Storm Drain Labels

OPTIONAL – 2 Points

How

Label all storm drains or storm inlets to clearly indicate where the drain or inlet leads.

Intent

Provide a visual reminder that storm sewer inlets connect to area waterways and groundwater storages, and should not be used to dump garbage of any kind.

Things to Consider

Use a simple painted stencil that reads: “Caution – leads to [name of body of water]!”

SECTION 4: WATER CONSERVATION

4-1 Water-Conserving Appliances and Fixtures

MANDATORY

How

In new construction and when fixtures are replaced in rehabilitation, install water-conserving fixtures with the following specifications:

- Toilets – 1.6 GPF (gallons per flush) 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

Intent

Showers and faucets account for approximately 25 percent of indoor water use. Toilets account for approximately 30 percent of indoor water use. Saving water translates into utility savings, both by conserving water and reducing the energy required for water heating. Compared with pre-1992 fixtures, water-conserving fixtures can reduce the amount of water used in showers and sinks by 75 percent and 50 percent, respectively.

Reference: Code of Federal Regulations, March 18, 1998, Page 13307

4-2 Water Conserving Appliances and Fixtures

OPTIONAL – 2 Points (for each of the fixtures listed)

How

Install water-conserving fixtures with the following specifications:

- Toilets – 1.3 GPF (maximum gallons per flush) or less, or a toilet with dual flush, one of the options being less than 1 GPF
- Showerheads – 1.75 GPM (gallons per minute) or less
- Kitchen faucets – 1.5 GPM or less
- Bathroom faucets – 1.0 GPM or less

Intent

Showers and faucets account for approximately 25 percent of indoor water use. Toilets account for approximately 30 percent of indoor water use. Saving water translates into utility savings, both by conserving water and reducing the energy required for water heating. Compared with pre-1992 fixtures, water-conserving fixtures can reduce the amount of water used in showers and sinks by 75 percent and 50 percent, respectively.

Things to Consider

High Efficiency Toilets (HETs) are toilets that use 1.3 GPF or less. These include dual flush toilets that are rated based on the average flush volume of the two settings. Both single and dual flush toilets are now available with flush volumes as low as 1 GPF. The WaterSense label will be on HETs that are certified by independent laboratory testing to meet rigorous criteria for both performance and efficiency. See <http://www.epa.gov/owm/water-efficiency/pubs/het.htm>.

4-3 Efficient Irrigation**OPTIONAL – 5 Points (if irrigation is necessary)**

How

If irrigation is necessary, use recycled gray water, roof water, collected site run-off or an efficient irrigation system that will deliver the water only to the plants needing it, like drip irrigation, and not in the air with sprinklers.

Intent

On average, outdoor water use accounts for about 40 percent of residential water use. Native landscapes or carefully selected plantings can tolerate no irrigation once they have been established, even in dry periods. Accurate delivery of water reduces evaporation and eliminates overspray. Proper scheduling eliminates wet/dry fluctuations that stress plants.

Things to Consider

Watering tubes may be used to water trees for the first few years if necessary.

SECTION 5: ENERGY EFFICIENCY

5-1 Efficient Energy Use: New Construction

MANDATORY

How

Provide verification demonstrating energy efficiency by meeting or exceeding one of the following:

- Energy Star Homes Northwest standards for single family homes, including duplexes, townhouses, and condominiums
Use the Energy Star Northwest Builder Options Packages.
- 15% above the Washington State Energy Code (WSEC) for multi-family units
Use the prescriptive or performance options identified in **Appendix A**, page 52, or the systems analysis approach.

Intent

In 1992, the EPA introduced Energy Star as a voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Energy Star is an accepted standard for single-family residential new construction projects.

Energy Star-qualified homes are independently verified to be energy efficient. These savings are based on heating, cooling and hot water energy use and are typically achieved through a combination of building-envelope upgrades, high-performance windows, controlled air infiltration, upgraded heating and air conditioning systems, tight duct systems and upgraded water-heating equipment. These features contribute to improved home quality and homeowner comfort, and to lower energy demand and reduced air pollution.

The Energy Star Homes Northwest Builder Option Packages (NWBOP1 and NWBOP2) are used to determine components of an Energy Star-qualified new home. BOPs represent sets of construction specifications for a particular climate zone, measuring performance levels for the thermal envelope, insulation, windows, orientation, HVAC system and water-heating efficiency.

All new multi-family buildings need to exceed the current Washington State Energy Code by at least 15 percent.

Things to Consider

Energy Star for New Single Family Homes

Specific prescriptive options for Energy Star compliance have been developed for the Pacific Northwest climate. These have been accepted as equivalent to the national Energy Star standard. The Northwest options are based on this region's State energy codes, with additional upgrades specified to meet the Energy Star goals. Prescriptive builder option packages are detailed on the web site listed below. The builder will also want to identify a Participating Verifier who will provide required third party certification.

- <http://www.northwestenergystar.com/index.php?cID=119>

Basic Steps:

- Use Energy Star Northwest Specifications.
- Use or sign up as an Energy Star Builder.
- Identify and use an Energy Star Homes Northwest Performance Contractor.
- Describe the Energy Star Qualification Method.
- Complete construction, testing, verification, and certification.

New Multi-Family Construction: Appendix A, page 52

Appendix A has been developed to streamline the 15% requirement for multi-family construction. Appendix A includes methodology to demonstrate compliance using either the prescriptive, component performance, or systems analysis approach available through the WSEC.

Basic Steps:

- Review **Appendix A** and identify the selected compliance option.
- Develop and provide associated documentation.
- Facilitate verification of insulation, windows, and air sealing during construction.

5-2 Efficient Energy Use: Rehabilitation

MANDATORY

How

Provide insulation and air sealing improvements as prescribed in **Appendix B**, page 58.

Three methods for addressing a successful energy efficiency strategy for rehabilitation are detailed in Appendix B. This includes a prescriptive list of measures, a method for calculating a simple 10-year payback, and a more complex savings-to-investment ratio (SIR) calculation. It is worth noting that all three methods tend to result in a similar if not identical list of energy efficiency measures. Unless there are special conditions in the existing building, it is likely that conducting a simple payback or SIR calculation will not be needed.

A typical set of improvements will include:

- Air sealing
- Wall, floor, and ceiling insulation
- Duct sealing

Intent

Implementing air sealing and insulation measures to existing buildings improves occupant comfort, reduces life cycle costs, lowers utility bills, and helps meet the basic objectives of Washington State's green building legislation. In almost all cases, implementation of a basic air sealing and insulation package is cost effective in the Pacific Northwest climate. Other than new construction, the prime opportunity to accomplish this is during a building rehabilitation project. Integrating insulation and air sealing projects during rehabilitation achieves the objectives at the lowest cost possible.

5-3 Energy Star Appliances

OPTIONAL – 3 Points for clothes washers, 1 Point for dishwashers, 1 Point for refrigerators, if providing appliances.

How

If providing appliances, install Energy Star appliances.

- Install Energy Star clothes washers and claim three points.
- Install Energy Star dishwashers and claim one point.
- Install Energy Star refrigerators and claim one point.

Intent

In 1992, EPA introduced Energy Star, a voluntary labeling program designed to identify and promote energy-efficient products to reduce greenhouse gas emissions. Energy Star products must meet strict energy efficiency criteria set by EPA. These products reduce utility costs and greenhouse gas emissions.

Things to Consider

For more information on Energy Star labeled appliances go to:

- Products section of the Energy Star homepage, <http://energystar.gov/>,
- Appliances section of www.northwestenergystar.com.

5-4 Efficient Lighting – Interior

OPTIONAL – 5 Points

Except for single family new construction

How

Install Energy Star-labeled lighting fixtures or the Energy Star Advanced Lighting Package in all interior units with compact florescent bulbs in all non-Energy Star fixtures.

Or, use compact florescent bulbs or straight or round florescent tubes for all interior lighting.

Note: Emergency lighting is exempt from this requirement.

Intent

Energy Star-qualified lighting uses 2/3 less energy and lasts six to 10 times longer than traditional lighting. Reduced energy use lowers utility costs and greenhouse gas emissions.

Things to Consider

For more information on lighting, go to

- Products section of the Energy Star homepage, www.energystar.gov
- Technical Information Center of Northwest Energy Star, [Northwest ENERGY STAR](#)

5-5 Efficient Lighting – Common Areas and Exterior

MANDATORY

How

Use Energy Star or high-efficiency commercial grade fixtures in all common areas and outdoors. Install daylight sensors or timers on all outdoor lighting.

Intent

Daylight sensors or properly programmed lighting timers automatically turn off the exterior lighting when sufficient day lighting is available or lighting is otherwise not required. Occupancy sensors will turn off lights when rooms are no longer occupied. Proper aiming of exterior fixtures, cut-off fixtures, and the use of shade trees and plants help prevent unwanted glare (light trespass) into neighboring buildings and natural areas, and limit disturbance of the night sky (light pollution).

Things to Consider

- Design outdoor lighting to eliminate light trespass from the building and site, and to minimize impact on nocturnal environments.
- Use downlighting instead of uplighting outside to minimize light pollution.
- Consult the Illuminating Engineering Society of North America's Recommended Practice Manual: Lighting for Exterior Environments.

Requirements of the Washington State Energy Code (2006)

HIGH EFFICACY LUMINAIRE: *A lighting fixture that does not contain a medium screw base socket*

(E24/E26) and whose lamps have a minimum efficiency of:

- 60 lumens per watt for lamps over 40 watts;*
- 50 lumens per watt for lamps over 15 watts to 40 watts;*
- 40 lumens per watt for lamps 15 watts or less.*

505.3 Outdoor Lighting: *Luminaires providing outdoor lighting and permanently mounted to a residential building or to other buildings on the same lot shall be high efficacy luminaires.*

5-6 Electricity Meter: New Construction

MANDATORY

Except for Shelters

How

Install an individual or a sub-metered electric meter for each individual unit.

Intent

This makes each household responsible for its own energy use and raises residents' awareness of the cost associated with electricity consumption, which may reduce energy use.

5-7 Additional Reductions in Energy Use: New Construction

OPTIONAL – 5 Points (for each 5 percent change in energy efficiency)

How

Basic steps:

- Forecast the annual energy efficiency of the entire project to meet Energy Star standards for single family homes or to exceed the Washington State Energy Code (2006) by 15% for multi-family units.
- Analyze and assess additional energy improvements.
- Reforecast annual energy usage with additional improvements. Use that figure to determine the percentage of energy savings over the Washington State Energy Code (2006).
- Claim 5 points starting at 20% over the Washington State Energy Code (2006) and an additional 5 points for each 5% increment over that.
- Specify those improvements in the design and construct those improvements.
- Facilitate verification during the construction process.

Intent

For new construction, adding incremental improvements will improve energy efficiency while reducing utility and operating costs for residents and building owners. Energy conservation lessens smog, acid rain and greenhouse gas emissions.

NOTE: If this option is chosen, option 5-17 cannot also be claimed.

5-8 Additional Reductions in Energy Use: Rehabilitation

OPTIONAL – 10 Points for adopting additional improvements that extend the simple payback period to at least 14 years.

How

Use the method in **Appendix B** for the simple 10-year payback except extend the payback period to at least 14 years.

- Include the energy improvement report done by the qualified engineer identifying energy efficiency improvements meeting the 14-year simple payback and that provide greater energy efficiency than the prescriptive measures listed in Appendix B.
- Specify those measures in the design and install those improvements.
- Facilitate verification during the construction process.

Intent

All mandatory measures included in **5-2** must be implemented. If new construction standards can be achieved, use the same calculation and documentation methods noted for new construction in **5-7**.

NOTE: If this option is chosen and measures contained in options 5-14, 5-15, or 5-16 are included, double counting of those points will not be allowed.

5-9 Photovoltaic (PV) Panels

OPTIONAL – 5 Points, for the first 1000-Watt PV array for each and every housing unit, 3 points for each additional 500 Watts of installed PV for each and every housing unit, up to a maximum of 3500 Watts or 20 points

How

Install PV panels to provide approximately 10 percent of the project's total estimated electricity demand.

In practice this is approximately equivalent to a 1000-Watt array **per housing unit**. Add additional PV up to 3500 Watts **per housing unit** to optimize return on investment under Washington State's Renewable Energy System Cost Recovery program.

Intent

Use of renewable energy reduces environmental impacts associated with utility energy production and use. These impacts include natural resource destruction, air pollution, greenhouse gas emissions and water pollution. Use of onsite renewable energy technologies, such as PV panels, can also result in energy cost savings. PVs are composite materials that convert sunlight directly into electrical power.

Things to Consider

In May 2005, Washington enacted Senate Bill 5101, establishing production incentives of 15¢ per kilowatt-hour (capped at \$2,000 per year) for individuals, businesses, or local governments that generate electricity from solar power, wind power or anaerobic digesters. The incentive amount paid to the producer is adjusted according to how the electricity was generated by multiplying the incentive by the following factors:

- For electricity produced using solar modules manufactured in Washington state: 2.4
- For electricity produced using a solar or wind generator equipped with an inverter manufactured in Washington state: 1.2
- For electricity produced using an anaerobic digester, by other solar equipment, or using a wind generator equipped with blades manufactured in Washington state: 1.0
- For all other electricity produced by wind: 0.8

Check with your local utility because power companies are not required to participate. Application for cost recovery may be made to the Department of Revenue and the local electric utility. Reference WAC 458-20-274, and see the following document:

http://dor.wa.gov/Docs/Pubs/SpecialNotices/2005/sn_05_solar.pdf

Some Washington utilities provide rebates on installed systems.

5-10 Photovoltaic (PV) Ready

OPTIONAL – 2 Points

How

Site, design, engineer, and install conduit in the development to accommodate installation of PV in the future. Provide the design and engineering analysis that establishes the parameters of the installation and submit photos that demonstrate the following:

- Orient buildings to permit access to sunlight.
- Design and include south facing architectural elements on the roof for PV
- Reserve unobstructed roof areas where panels can be placed
- Run conduit from the prospective PV location to a central panel, as part of the general electrical work.
- Do not install wire inside the conduit until the photovoltaic panels are installed.

Intent

Photovoltaics are composite materials that convert sunlight directly into electrical power and are the easiest renewable energy source to use in affordable housing.

Generating and using renewable energy in a development is a hedge against rising costs for purchased energy. Further, it avoids the environmental impacts associated with conventional power generation: natural resource destruction, air and water pollution, and greenhouse gas production.

Things to Consider

Building “PV Readiness” into a project reserves the opportunity to install a system later when resources become available.

5-11 Domestic Water Heating

MANDATORY

How

- Tank water heaters must meet the following minimum performance factors.

	Tank Size/ Gallons	Energy Factor
Gas Propane	≤60	.61
	>60	.60
Electric	≤60	.92
	>60	.91

Gas commercial tank water heaters may be used if they have standby losses that do not exceed the following (Btu/hr):

	70-74	75-79	80-84	85-89	90-94	95-99	100+	
Gallons								
Max Standby Loss	930	960	980	1010	1030	1060	1080	

Improving the efficiency of the water heating equipment either by improving the combustion efficiency or by reducing standby losses will result in significant energy savings. The equipment selected here is mandatory to comply with the Northwest Energy Star program.

5-12 Domestic Water Heating

OPTIONAL – 3 or 7 Points

How

Water heating equipment meeting the following requirements:

	Type		Points
Gas / Propane / Oil	On Demand	>.80 Energy Factor	3
Gas / Propane / Oil	Condensing Boiler	>.95 AFUE	7
Electric	Heat pump	> 2.0 Energy Factor	7

Equipment that provides superior performance above the mandatory requirements is readily available.

- For individual housing units with gas/propane/oil, the on-demand water heaters are recommended.
- Large central water heating systems should choose condensing boiler equipment.
- For homes with only electric energy, heat pump water heaters are available.
 - **Caution:** heat pump water heaters should not be installed in the conditioned living space or in confined spaces. This type of water heater extracts heat from the surrounding air, cooling the space. They should be installed in spaces that communicate with the outdoor air. As an alternative, they may be integrated with supply and exhaust ventilation systems designed to optimize energy savings.
- Check the following website:
 - <http://gamanet.org/gama/inforesources.nsf/vContentEntries/Product+Directories?OpenDocument>

5-13 Solar Water Heating

OPTIONAL – 10 Points

How

- Provide at least 50% of the domestic water heating requirement using solar collectors. 50% is equivalent to about 2600 kWh of electricity or 125 therms of gas.
- The system must be certified by the Solar Rating and Certification Corporation (SRCC). <http://www.solar-rating.org/>
- Determine annual performance using the SRCC document OG 300 Rated Systems in Seattle Washington.
 - For locations in western Washington, use the Seattle sizing data.
 - For eastern Washington north of I-90, multiply the Seattle rated energy savings by 1.18.
 - For eastern Washington south of I-90, multiply the Seattle rated energy savings by 1.25.
 - Mount the system facing within 25 degrees of south at a 15-45 degree angle.
- If the system cannot be mounted as prescribed, provide engineering documentation that the loads will be met through alternative methods.

Things to Consider

Federal Tax Credits (30% up to \$2000) for the listed equipment are available at least through 2008 for qualifying individuals/businesses that produce 50% of their domestic hot water load. This is about 2400 kWh of electricity or 120 therms of gas.

5-14 Efficient Energy Use – Performance Tested Building Air Sealing

OPTIONAL – 3 or 7 Points

Rehabilitation

How

Performance Tested Building Sealing: In addition to the prescriptive air sealing measures (see Appendix B, page 57), conduct a blower door air sealing protocol that achieves the following performance objectives.

- Use the test method detailed in ENERGY STAR® Homes Northwest Specifications and Technical Reference for Site-Built single family Housing Section 1. Blower Door Air Leakage. See http://www.northwestenergystar.com/files/6498Technical_Spcs_Aug_06.pdf
- For single family homes, the test will be conducted on the entire building.
- For multi-family buildings, the test will be conducted on individual dwelling units. At a minimum a sample of units shall be selected to represent both corner and central dwelling units on each floor. All tested units need to meet the minimum standard.

Through performance testing, document that the unit air tightness level is less than 7 ACH 50. (3 points)

Through performance testing, document that the unit air tightness level is less than 5 ACH 50.
(7 points)

Intent

This section provides credit for the verification of intent. The required prescriptive air sealing and duct sealing should have resulted in an air leakage rate of 7 ACH50 or less.

5 ACH50 is an air leakage rate similar to new construction. Additional points are granted for achieving this level of savings in a rehabilitation project.

Things to Consider

For guidance on air leakage control and possible testing equipment, see the following links:

- A Do-it Yourself Guide to Energy Star® Home Sealing: http://www.energystar.gov/ia/partners/manuf_res/salestraining_res/HS_diy_guide.pdf
- Infiltec Test Equipment: <http://www.infiltec.com/inf-catb.htm>
- The Energy Conservatory Test Equipment: <http://www.energyconservatory.com/>

5-15 Efficient Energy Use – Performance Tested Duct Sealing

OPTIONAL – 10 Points

Rehabilitation

How

Performance Tested Duct Sealing (10 points)

- Test is to be conducted by an Energy Star, Climate Crafters, or equivalent independent third party organization Certified Technician or Inspector.
- Duct leakage shall not to exceed 0.10 CFM50 x floor area (in square feet) served by the system,
- OR -
It shall be reduced by 50% by comparing leakage to the outside before and after sealing.
- Based on the protocol for “Combustion Appliance Zone Pressure Testing” forced air system operation shall not depressurize a combustion appliance zone by more than 3 Pascals.
- When combustion appliances are located within a conditioned space, a UL listed carbon monoxide alarm must be installed unless the appliance has a type IV venting system.

Intent

This section sets performance goals listed for duct sealing beyond the prescriptive requirements.

Things to Consider

For guidance on duct sealing and possible testing equipment, see the following links:

- Thermal Energy Distribution: <http://ducts.lbl.gov/>
- Infiltec Test Equipment: <http://www.infiltec.com/inf-catb.htm>
- The Energy Conservatory Test Equipment: <http://www.energyconservatory.com/>

5-16 Efficient Energy Use – Space Heating and Cooling Equipment Replacement

OPTIONAL – 2, 5, or 7 Points

Rehabilitation

How

In order to claim these points, all ducts must be mechanically fastened, sealed with mastic, and insulated.

Space Heating and Cooling Equipment Replacement:

Electric Resistance Heating in a Forced Air Furnace (7 points)

- Upgrade electric resistance forced air furnace to Energy Star compliant furnace or heat pump.

Other Central Heating Equipment: (5 points)

- During equipment replacement, choose Energy Star central heating equipment, including boilers, furnace or heat pumps.

Heat Pump Performance Testing: (2 points)

- The air distribution system design and installation shall be such that air flow across the indoor coil is as specified in the heat pump manufacturer's literature, or is between 350 and 425 cubic feet per minute (CFM) per 12000 BTU/hr output at ARI rating conditions.
- Use the test specifications from ENERGY STAR® Homes Northwest Specifications and Technical Reference for Site-Built Single Family Housing, Section 2., Air Handler Flow Measurement.

Intent

Improving equipment efficiency at time of equipment replacement is very cost effective for all but a few applications. This section provides points for increasing the energy efficiency in existing housing using equipment upgrades.

Things to Consider

- Always size the equipment as to meet the design heating and cooling loads as noted in the **7-8 HVAC Equipment and Duct Sizing** criteria.
- For combustion appliances, examine combustion venting needs before selecting equipment.
- For heat pumps, make sure the existing duct work has enough cross sectional area for the equipment.

5-17 Efficient Energy Use – Document Space Conditioning Savings of 50 percent or More Compared to National Standards

OPTIONAL – 17 Points

New Construction

How

In addition to meeting the mandatory requirements for energy efficient new construction as specified in **5-1**, demonstrate that space conditioning energy use is reduced by 50 percent when compared to the 2004 International Energy Conservation Code Supplement.

Documentation is provided by Home Energy Raters certified in the region to provide the Northwest Energy Star support or by a qualified architect or engineer.

Intent

The Federal Government has implemented an efficiency program that provides a \$2000 per unit tax credit for the construction of energy efficient homes. This criterion encourages developers and builders to participate in this program and achieve the target energy savings.

Things to Consider

As of the writing of this Criterion, qualification is typically provided using energy simulation software designed to provide the required documentation. Prescriptive options are being developed and will be provided when they are finished.

In addition to meeting the Energy Star Northwest requirements, or the requirements for multi-family construction outlined in **5-1** and **Appendix A**, the following measures will likely be included:

- Glazing area limited to 13-15 percent of floor area
- U-0.30 glazing standard
- All of the heating and cooling system components are installed inside the heated space
- Air leakage of the building is limited to 3.7 ACH 50
- Furnace Efficiency of 94 percent AFUE

Contact WSU Extension Energy Program for more information at 360-956-2042.

SECTION 6: MATERIALS BENEFICIAL TO THE ENVIRONMENT **(ALL ITEMS ARE OPTIONAL)**

6-1 Construction Waste Management

OPTIONAL – up to 5 Points

How

Reduce the amount of construction waste and demolition debris sent to the landfill.

Choose one of the following methods.

Method #1

- Provide a job site waste plan that diverts 50% of the construction waste from the landfill. (2 Points)
- Provide a job site waste plan that diverts 75% of the construction waste from the landfill. (5 Points)

Method #2 – Material Specific (1 Point each up to a maximum of 5 Points)

- Recycle all cardboard
- Recycle all wood
- Recycle all drywall
- Recycle all metals
- Recycle all concrete, brick, and asphalt
- Develop and implement a comprehensive efficient framing plan that minimizes all waste by design

Note: A construction waste management plan is required that specifies how reusable or recyclable materials are redirected from the landfill and where each material will go.

Intent

The amount of job-site waste resulting from construction of the average U.S. home is 4 pounds per square foot of conditioned space, totaling about 8,000 pounds and taking up 50 cubic yards of landfill space. To the extent possible, waste should be avoided because 1) landfill space is rapidly diminishing, 2) incineration produces pollutants, and 3) waste of materials is in itself a negative environmental impact. Source: National Association of Home Builders Research Center, 2001,

<http://www.toolbase.org/ToolbaseResources/level3.aspx?BucketID=5&CategoryID=26>

See the following for more information on advanced framing:

<http://www.eere.energy.gov/buildings/info/documents/pdfs/26449.pdf>

6-2 Recycled Content Material

OPTIONAL – 2 Points for the first 5 percent, plus 2 points for each additional 5 percent increment, not to exceed 14 points.

How

Use materials with recycled content. The percentage of recycled content material is based on cost or value and does not include mechanical and electrical equipment. Provide calculations for recycled content percentage as follows:

- For a given material or furnishing, multiply the recycled content percentage by weight (post-consumer or post-industrial) by the value of the product to find the value of the recycled content for that item.
- Add up the values of the recycled content of all the materials and furnishings.
- Divide this sum by the total value of the materials for the project.

Intent

Recycled materials have been recovered or otherwise diverted from the solid waste stream either during the manufacturing process or after consumer use. Use of recycled content materials reduces the negative impact resulting from extraction and processing of virgin materials. Many recycled content materials have additional benefits, which yield better results and a stronger final product.

Things to Consider

- Consider the incorporation of recycled content building materials from the early stages of project design.
- Many commonly used products, such as metals, concrete, masonry, acoustic tile, drywall, carpet, ceramic tile and insulation, are now available with recycled content. For guidance, see the Federal Trade Commission document, *Guides for the Use of Environmental Marketing Claims*, 16 CFR 260.7(e).

6-3 Certified, Salvaged and Engineered Wood

OPTIONAL – 10 Points

How

Use at least 50 percent (by cost) wood products and materials that are certified in accordance with the Forest Stewardship Council, salvaged wood, or engineered framing materials. The percentage of certified, salvaged and engineered wood products is based on cost or value. The project architect must complete and submit the following calculation: divide the sum of the value of all certified, salvaged or engineered wood products by the value of all wood products.

Intent

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

6-4 Water-Permeable Walkways**OPTIONAL – 5 Points**

How

Use water-permeable materials in 50 percent or more of walkways.

- Include a site map showing all walkways to be constructed and identifying the area that will be water-permeable.

Intent

Water-permeable materials reduce storm-water runoff by allowing water to soak into the ground. Storm-water runoff pollutes receiving waterways by carrying sediment and other pollutants and by raising water temperature. Storm-water runoff also causes downstream flooding and erosion, and hampers aquifer recharge and transmission of moisture for vegetation.

Things to Consider

Use water-permeable materials such as pervious interlocking concrete paving blocks, concrete grid pavers, perforated brick pavers, or compacted gravel.

6-5 Water-Permeable Parking Areas**OPTIONAL – 10 Points**

How

Use water-permeable materials in 50 percent or more of the parking and driveway area.

- Include site map showing the parking areas and vehicle access areas and the areas of those that will be water-permeable.

Intent

Water-permeable materials reduce storm-water runoff by allowing water to soak into the ground. Storm-water runoff pollutes receiving waterways by carrying sediment and other pollutants and by raising water temperature. Storm-water runoff also causes downstream flooding and erosion and hampers aquifer recharge and transmission of moisture for vegetation.

Things to Consider

Water-permeable materials include pervious interlocking concrete paving blocks, concrete grid pavers, perforated brick pavers, or compacted gravel.

6-6 Roofing

OPTIONAL – 5 Points

How

Choose, specify, and use Energy Star-compliant (reflectivity of greater than .65) and high-emissive roofing (with an emissivity of at least 0.8 when tested in accordance with ASTM 408).

Or, install a “green” (vegetated) roof for at least 50 percent of the roof area.

Combinations of high-albedo and vegetated roof can be used, providing they collectively cover 75 percent of the roof area.

Energy Star Roof Products:

http://www.energystar.gov/index.cfm?c=roof_prods.pr_roof_products

Design green vegetated roofing in accordance with the following ASTM standards:

E2396-05 Standard Test Method for Saturated Water Permeability of Granular Drainage Media [Falling-Head Method] for Green Roof Systems

E2397-05 Standard Practice for Determination of Dead Loads and Live Loads associated with Green Roof Systems

E2398-05 Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Green Roof Systems

E2399-05 Standard Test Method for Maximum Media Density for Dead Load Analysis of Green Roof Systems

E2400-06 Standard Guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems

Include map of roof(s) showing the area and the type of roofing that will be used.

Intent

Urban heat islands disturb the atmosphere and cause energy waste by increasing loads on cooling systems. Heat islands create thermal gradient differences between developed and undeveloped areas. Using roof surfaces that do not retain heat reduces the heat island.

Energy Star Reflective Roofing may reduce energy use in the warmer regions of Washington State. Green Vegetated Roofing may also reduce energy use and provide desirable storm water retention. Resources and information on green roofs can be found at:

1. www.earthpledge.org/GreenRoof.html;
2. [Greenroofs 101](#);
3. [Scandinavian Green Roof Institute](#)

Things to Consider

Energy Star Reflective Roofing may or may not provide energy saving benefits in Washington. A reflective roof will reduce cooling cost, but may slightly increase heating cost in ceilings or attics with lower levels of insulation. To demonstrate that the application of an Energy Star roof provides energy savings and financial benefit, use the Energy Star Roofing Calculator listed below.

Energy Star Roofing Calculator: <http://roofcalc.cadmusdev.com/>

Note: This calculation is not required to claim and achieve these points.

6-7 Reducing Heat-Island Effect – Paving**OPTIONAL – 5 Points**

How

Use light-colored/high-albedo materials and/or an open-grid pavement, with a minimum Solar Reflective Index of 60 over at least 30 percent of the site's hardscaped area.

- Include a map of all paved areas showing the portion that will reduce the heat-island effect and the type of material.

Intent

Urban heat islands have increased local air temperatures due to the absorption of solar energy by the built environment. They increase energy consumption by increasing loads on cooling systems. Heat islands create thermal gradient differences between developed and undeveloped areas. Use paving surfaces that do not retain heat and that reduce the heat island effect.

SECTION 7: HEALTHY LIVING ENVIRONMENT

7-1 Low / No VOC Paints and Primers

MANDATORY

How

Specify that all interior paints and primers must be listed as Green Seal certified under the current Green Seal standards limiting hazardous air pollutants, ozone-depleting compounds, carcinogens, mutagens, reproductive toxins, and VOCs (volatile organic compounds).

Intent

VOCs are chemicals containing carbon molecules that are volatile enough to evaporate from material surfaces into indoor air at normal temperatures. Interior paints and primers that release VOCs may pose health hazards to residents and workers. Outdoors, VOCs react with sunlight and nitrogen in the atmosphere to form ground level ozone, a chemical that has a detrimental effect on human health and ecosystems. Ozone damages lung tissue, reduces lung function and sensitizes the lungs to other irritants. Use of low-VOC paints and primers will reduce the concentration of such airborne chemicals.

Things to Consider

- The website <http://greenseal.org/> lists hazardous substance and VOC limits for paints.

7-2 Low / No VOC Adhesives and Sealants

MANDATORY

How

Specify that all adhesives must comply with the most recent version of Rule 1168 of the South Coast Air Quality Management District.

Specify that all caulks and sealants must comply with Regulation 8 Rule 51 of the Bay Area Air Quality Management District.

Intent

Interior caulks, sealants and adhesives that release VOCs may pose health hazards to residents and workers. (See 7-1.) Use of low-VOC adhesives and sealants will reduce the concentration of such airborne chemicals.

Things to Consider

- Pontolilo, Brian. "Making Sense of Caulks and Sealants." *Fine Homebuilding Magazine* 62 (April/May 2004): 97-101.
- NREL. *Weatherize Your Home – Caulk and Weatherstrip*. U.S. Department of Energy,

National Renewable Energy Laboratory, p. 4.

- Here is a link to Rule 1168 of the South Coast Air Quality Management District: <http://www.aqmd.gov/rules/reg/reg11/r1168.pdf>
- Here is a link to Regulation 8 Rule 51 of the Bay Area Air Quality Management District: <http://www.baaqmd.gov/dst/regulations/rg0851.pdf>

7-3 Formaldehyde-Free Composite Wood

OPTIONAL – 5 Points

How

Only use composite wood products exposed to the interior with no added urea formaldehyde unless all of the exposed areas including edges are sealed to prevent off-gassing with a Green Seal certified sealer.

Intent

Particleboard, interior grade plywood, MDF, and other composite wood products typically contain formaldehyde based glues. Formaldehyde is a volatile organic compound. Symptoms of exposure vary widely and can include watery eyes, nausea, coughing, chest tightness, wheezing, skin rashes, allergic reactions and burning sensations in the eyes, nose and throat. In a recent report, the World Health Organization (WHO) International Agency for Research on Cancer upgraded its evaluation of formaldehyde from a probable carcinogen to a known human carcinogen based on new evidence that formaldehyde causes nasopharyngeal cancer in humans. Avoiding products with added urea formaldehyde will reduce the quantity of harmful indoor air contaminants.

Things to Consider

- Specify wood products with no added urea formaldehyde for interior applications inside of the weatherproofing system. This includes particleboard, plywood, medium density fiberboard, and any other applicable wood products.
- ANSI standards A208.1 and A208.2 apply to formaldehyde emission limits of particleboard and medium density fiberboard. They do not regulate the content of urea formaldehyde resins, and therefore cannot be used as an indicator for this criterion.
- Structural panel products bearing the trademark of the APA use phenol formaldehyde resins. These glues are highly durable, waterproof, and do not release significant amounts of formaldehyde. These products meet the specs of this criterion.

7-4 Green Label Certified Floor Coverings

MANDATORY

If Providing Floor Coverings

How

- Do not install carpets in basements, entryways, laundry rooms, bathrooms, kitchens, or in

other wet areas.

- If using carpet, use the Carpet and Rug Institute’s Green Label Plus certified carpet (and adhesive, if needed) and Green Label certified carpet pad.

Intent

New carpets, padding, and adhesives release VOCs that may pose health hazards to residents and workers. Carpets also attract allergens such as dirt, pollen, mold spores, dust mites and other microbes that may pose health hazards to individuals allergic to these substances. The Carpet and Rug Institute’s program certifies that labeled carpets are low VOC.

Things to Consider

- More information on the Carpet and Rug Institute’s Green Label program can be found on their website at www.carpet-rug.org.
- The EPA Energy Star with Indoor Air Package Specifications require Green Label Plus carpet. The plus label is more stringent. The California Rug Institute maintains a list of manufacturers and products meeting the Green Label Plus standard. To view the list go to: www.carpet-rug.org/drill_down_2.cfm?page=8&sub=17&requesttimeout=350.
- Make Green Label Plus part of the specifications for sub-contractor submittals when using carpet.
- In wet areas, use smooth and resilient flooring that can tolerate moisture (e.g., ceramic tile, linoleum, etc.).

7-5 Exhaust Fans – Bathroom: New Construction

MANDATORY

How

Install Energy Star-labeled bathroom fans that exhaust to the outdoors and are equipped with a timer, humidistat sensor, or that operate continuously.

Intent

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 percent 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.

Things to Consider

- Washington State Ventilation and Indoor Air Quality Code, Chapter 3, requires a bath fan that provides 50 cubic feet per minute (CFM) intermittently or 20 CFM if operating continuously. This standard upgrades the fan requirement to an Energy Star labeled fan.
- For more information on bathroom fans, go to the Products section of the Energy Star homepage: www.energystar.gov.

7-6 Exhaust Fans – Kitchen: New Construction

OPTIONAL – 3 Points

How

Install Energy Star labeled power vented fans or range hoods that exhaust to the exterior.

Intent

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 byproducts of cooking. Energy Star-qualified fans use 65 percent less energy on average than standard models and move more air per unit of energy used with less noise.

Things to Consider

- Washington State Ventilation and Indoor Air Quality Code, Chapter 3, requires kitchen exhaust that provides 100 CFM on an intermittent basis, or 25 CFM if operated continuously. This standard upgrades the fan requirement to an Energy Star labeled product.
- For more information on kitchen fans or range hoods, go to the Products section of the Energy Star homepage, www.energystar.gov.

7-7 Ventilation

MANDATORY

How

Install a ventilation system for the dwelling unit that provides a minimum of 15 cfm (cubic feet per minute) of fresh air per occupant. This is a requirement of the Washington State Ventilation and Indoor Air Quality Code (WAC 51-13). As an alternative, use 2004 ASHRAE standard 62.2.

Intent

Optimal ventilation improves indoor air quality by providing fresh air to the living space on a regular basis. Since air sealing is part of the energy efficiency measures, adequate ventilation becomes essential to the health of the occupants.

Things to Consider

Specify a mechanical whole-house ventilation system per Washington State Ventilation and Indoor Air Quality Code or the 2004 ASHRAE 62.2. In smaller units, a bathroom exhaust fan can double as the whole house fan if the fan is set to properly cycle on and off.

7-8 HVAC Equipment and Duct Sizing

MANDATORY

How

Size heating and cooling equipment in accordance with the Air Conditioning Contractors of America Manual, Parts J and S, to prevent short-cycling of heating or air conditioning and to ensure adequate dehumidification. Use Air Conditioning Contractors of America Manual D to determine the correct duct size when new ductwork is being installed.

Intent

Appropriately sized equipment and ducts will improve the heating, cooling, and dehumidification performance.

Things to Consider

- 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 rating. The contractor can utilize one of the HVAC-industry adopted software programs, based upon Manual J, which assists with these designs.
- Manual D provides duct sizing instruction that assures that the system does not restrict air flow across the equipment heat exchanger. Manual D design also assures all rooms are provided with the design air flow needed to heat or cool the space.
- Consult www.acca.org for a list of software programs to perform Manual J and D calculations.

Sizing:

2006 International Residential Code: M1401.3 Sizing. Heating and cooling equipment shall be sized based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.

2006 Washington State Energy Code: 503.2.2 Space Heating and Space Cooling System Sizing Limits: Building mechanical systems for all buildings which provide space heating and/or space cooling shall be sized no greater than 150% of the heating and cooling design loads as calculated above.

2006 International Residential Code: M1601.1 Duct design. Duct systems serving heating, cooling and ventilation equipment shall be fabricated in accordance with the provisions of this section and ACCA Manual D or other approved methods.

7-9 Water Heaters, Condensing Boilers, Furnaces, and Air Conditioning – Mold Prevention

MANDATORY for New Construction

How

If storage water heaters are installed in interior spaces provide an auxiliary drain or catch pan that drains to the exterior of the building. For HVAC equipment, provide auxiliary drain pans when required by code. Insure that any catch pans or drip pans minimize standing water.

Intent

The use of heaters with drains and catch pans prevents moisture problems caused by leakage or overflow. Capturing water overflow from hot water heaters and allowing for proper drainage will prevent water from sitting idle, creating excess moisture and allowing mold to propagate. Cooling coils, as part of the HVAC equipment for air conditioning, can generate significant amounts of water through condensation on the surface of the coils. If this water is not constantly drained from the “drip pan” under the coil, mold and other organisms can grow in the standing water. HVAC-system air blowing across this area can distribute this mold and other material throughout the home.

Things to Consider

- ASHRAE. User's Manual of Standard 62.1-2004, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., 2004. (Fig 4.9a and 4.9b). See www.ashrae.org.
- International Residential Code IRC SECTION M1411 notes when requirements for auxiliary condensate drain pans are required for air conditioners and condensing equipment. See International Code Council website for background: www.iccsafe.org.

7-10 Water Heaters – Minimizing Carbon Monoxide (CO) in the Living Space

MANDATORY

How

If using fossil fuel fired water heaters, specify direct power vented or combustion sealed appliances when the heater is located in a conditioned space.

Intent

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 out an approved chimney or vent system to the outdoors.

For all new construction in Washington since 1990, homes have been constructed to the air sealing level defined by the International Residential Code as unusually tight construction. In

addition, projects complying with the energy efficiency requirements of this standard will achieve unusually tight construction.

International Residential Code:

UNUSUALLY TIGHT CONSTRUCTION: *Construction in which:*

1. *Walls and ceilings comprising the building thermal envelope have a continuous water vapor retarder with a rating of 1 perm (5.7·10⁻¹¹ kg/Pa · s · m²) or less with openings therein gasketed or sealed.*
2. *Storm windows or weatherstripping is applied around the threshold and jambs of opaque doors and openable windows.*
3. *Caulking or sealants are applied to areas such as joints around window and door frames between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, and at other openings.*

Chapter 17 Combustion Air:

M1701.1.1 Buildings of unusually tight construction. In buildings of unusually tight construction, combustion air shall be obtained from outside the sealed thermal envelope. In buildings of ordinary tightness, insofar as infiltration is concerned, all or a portion of the combustion air for fuel-burning appliances may be obtained from infiltration when the room or space has a volume of 50 cubic feet per 1,000 Btu/h (4.83 L/W) input.

7-11 Cold Water and Hot Water Pipe Insulation

MANDATORY

How

Insulate all hot water pipes from the hot water heater. Insulate exposed cold water pipes in climates and building conditions susceptible to moisture condensation. Insulate all cold water pipes in locations where freezing is a possibility including exterior walls and unheated attics or crawl spaces.

At a minimum, the following building codes apply:

Insulate Cold Water Pipes in accordance with the Uniform Plumbing Code, as amended by Washington State, (*Chapters 51-56 and 51-77 WAC*), *Section 313.6*.

- All hot and cold water pipes installed outside the conditioned space shall be insulated to a minimum R-3.

Insulate Hot Water Pipes in accordance with the *Washington State Energy Code (2006) Section 503.11 and Table 5-12* based on pipe size and operating temperature.

- 1 inch (R-3.6) for non circulating domestic water pipe less than 2 inches in diameter.
- Refer to WSEC Table 5-12 for all other applications

Intent

- Insulation of hot water pipes minimizes heat loss and may allow the lowering of water heater temperature.
- Insulation of cold water pipes prevents condensation that can lead to mold growth. Wherever there is a high differential between indoor air temperatures and the temperature of water supplies – especially in locations with moderate to high humidity – condensation on uninsulated cold water pipes is likely to occur.
- Plumbing in exterior walls and in unconditioned attics or crawl spaces may be exposed to substantial variations in temperature making it more vulnerable to damage and leakage.

7-12 Materials in Wet Areas – Surfaces**MANDATORY**

How

In wet areas, use materials that have smooth, durable, cleanable surfaces. Do not use mold-propagating materials such as vinyl wallpaper and unsealed grout.

Intent

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

7-13 Materials in Wet Areas – Tub and Shower Enclosures**MANDATORY**

How

Use one-piece fiberglass or similar enclosure or, if using any form of grouted material, use backing materials such as cement board, fiber cement board, fiberglass-reinforced board or cement plaster.

Intent

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

7-14 Basements and Concrete Slabs – Vapor Barrier

MANDATORY

How

Provide vapor barriers under interior slabs. For concrete floors either in basements or the on-grade slab, install a capillary break of 4 inches of clean or washed gravel (0.5 inch or greater) placed over soil. Cover all gravel with a 6 millimeter polyethylene sheeting moisture barrier, with joints lapped 1 foot or more to prevent moisture from migrating from the soil through the slab to a living or storage area. On interior below grade walls, avoid using separate vapor barrier (such as polyethylene sheeting, vinyl wallpaper), or a below grade vertical insulation (foil-faced) that can trap moisture inside wall systems.

Intent

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.

Things to Consider

Ensure that the vapor barrier is protected and that trades people working after the vapor barrier is laid do not puncture it.

7-15 Radon: New Construction

MANDATORY

How

In high risk radon counties, provide radon mitigation as required by code. Radon Mitigation Systems are required for new construction in EPA Zone 1 counties. High risk EPA Zone 1 counties in Washington State are: Clark, Ferry, Okanogan, Pend Oreille, Skamania, Spokane, and Stevens Counties.

- Washington State has adopted the International Residential Code *APPENDIX F RADON CONTROL METHODS* for single family and duplex construction.
- For other residential construction, refer to the *Washington State Ventilation and Indoor Air Quality Code Chapter 5* for radon requirements in new construction.

Intent

Installation of radon-resistant features will reduce concentrations of radon, a cancer-causing soil gas that can leak into homes from the crawl space, cracks in the slab, or basement walls. EPA estimates that 21,000 individuals die of cancer every year due to excessive exposure to radon.

Things to Consider

- Consult <http://www.epa.gov/radon/index.html> for information on the health effects, testing and mitigation strategies.

7-16 Radon Testing: Existing Buildings

MANDATORY

How

In EPA Radon Zone 1 counties (See **7-15** above for the list), conduct radon testing using the protocols described in the EPA publication: “*Protocols for Radon and Radon Decay Product Measurements in Homes.*” See http://www.epa.gov/radon/pdfs/homes_protocols.pdf.

Intent

Determine if radon mitigation measures are necessary to lower the risk of cancer.

Things to Consider

- The most commonly used test methods are: Activated Charcoal Adsorption for short-term monitoring (2-5 days) and Alpha Track Detection for long-term monitoring (3-12 months). Long term monitoring provides the most reliable results.
- Tests are best conducted during the winter months under closed house conditions. This is when the building is most likely to have higher radon levels.

7-17 Radon Mitigation: Rehabilitation of Existing Buildings

MANDATORY

Rehabilitation

How

When testing concludes that indoor radon levels in the home are 4 picocuries per liter (pCi/L) or higher, provide radon mitigation measures.

Intent

As part of a building rehabilitation project, reduce the health risks of radon exposure. Install one of the radon mitigation systems recommended by U.S. EPA.

Things to Consider

Radon mitigation strategies are provided in the EPA publication Radon Reduction Techniques for Existing Detached Houses: Technical Guidance (Third Edition) for Active Soil Depressurization Systems.

7-18 Water Drainage

MANDATORY

How

Provide drainage of water away from windows, walls, and the entire perimeter of foundations. In new construction, foundation walls should be carefully waterproofed on the exterior to avoid

moisture migration and should not leach chemicals into the soil. If poured concrete walls are used, release agents used to free forms from concrete walls should not be comprised of used motor oil or some other toxic material. Install a coating on footers to keep moisture from wicking up through them.

Divert water drainage away from the building by directing gutters and downspouts to flow onto splash blocks or a proper drainage system. If possible, water should be diverted at least 12 feet from any building foundation and then allowed to infiltrate on site. Slope new and rebuilt walkways, stairs, patios and thresholds away from the buildings. Properly flash all roof penetrations. Where feasible, extend eaves 18 inches to 2 feet to keep water off walls and windows. Install pan flashing on windows and exterior doors. Apply window pan flashing over building paper at sill and corner patches.

Intent

Diverting water from the building prevents bulk water entry through foundations and into 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. Careful architectural detailing of the drainage system and diligent construction supervision ensure proper water drainage.

Things to Consider

Best practices include a grade of 0.5 inch per foot, or approximately a 4 percent pitch. EPA recommends a 2 percent pitch (0.25 inch per foot) for hard surfaces such as patio slabs, walks and driveways.

Code References:

Storm Drainage:

Provide storm drainage in compliance with the Uniform Plumbing Code Chapter 11, the International Residential Code Chapter 4, and local storm water regulations. This includes but is not limited to:

- *All roofs, paved areas, yards, courts and courtyards shall be drained to a separate storm system, or to other place of disposal satisfactory to the Authority Having Jurisdiction.*
- *Subsoil drains shall be provided around the perimeter of buildings having basements, cellars, crawl spaces or floors below grade.*
- *Lots shall be graded to drain surface water away from foundation walls. The grade shall fall a minimum of 6 inches (152 mm) within the first 10 feet (3048 mm).*

Foundations:

Provide foundation water proofing in compliance with IRC SECTION R406. Select environmentally friendly release agents and coating materials. This includes but is not limited to:

- *Foundation walls that retain earth and enclose interior spaces and floors below grade shall be damp proofed from the top of the footing to the finished grade.*
- *If poured concrete walls are used, release agents used to free forms from concrete walls should not be comprised of used motor oil or some other toxic material.*

Water Resistive Barriers and Flashing:

Provide Water Resistive Barriers and Flashing in compliance with the International Residential Code, Chapter 7 for wall covering and Chapter 9 for roof covering.

7-19 Garage Isolation

MANDATORY

How

Provide a continuous air barrier between the conditioned (living) space and any unconditioned garage space to prevent the migration of any contaminants into the living space. If the HVAC air handler is located in the garage, provide air sealing to prevent air leakage from the garage to the living space. In single-family houses with attached garages, install a CO (carbon monoxide) alarm inside the house. If a bedroom shares a common wall with an attached garage, put a CO alarm in that bedroom. Other bedrooms should also be protected by having a CO alarm in a common living area between the attached garage and the bedrooms.

If the HVAC system is tested for air leakage, and meets the requirements for Energy Star Northwest, a CO alarm is not required.

Intent

The air barrier will help prevent the migration of carbon monoxide from the garage to the living space. The CO alarm will help ensure that residents are alerted in the case of accidental accumulation of carbon monoxide.

Things to Consider

ASHRAE 62.2 requires that the building envelope between the garage and occupied spaces be sealed to prevent air leakage. In addition, if the air handler is located inside the garage, the duct system must be tested to demonstrate an air leakage rate < 6% of the fan flow when tested at .1 inch wc (25PA). Refer to ASHRAE 62.2 for more information and to specify garage contaminant isolation measures. Homes meeting the Energy Star Northwest certification will meet the duct leakage test standard.

7-20 Clothes-Dryer Exhaust

MANDATORY

How

Clothes dryers must be exhausted to the exterior.

Intent

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

Things to Consider

It is important to minimize the duct run to avoid build up 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 to reduce the buildup of particles and moisture.

International Residential Code

SECTION M1502

CLOTHES DRYER EXHAUST

M1502.1 General. Dryer exhaust systems shall be independent of all other systems, and shall convey the moisture to the outdoors.

Exception: This section shall not apply to listed and labeled condensing (ductless) clothes dryers.

Refer to subsections for details on duct termination, duct type, duct diameter, duct length limits.

7-21 Integrated Pest Management

MANDATORY

How

Seal all wall, floor and joint penetrations to prevent pest entry. Provide rodent and corrosion proof screens (e.g., copper or stainless steel mesh) for large openings.

Intent

Sealing of cracks and penetrations will minimize entry points for pests such as rodents and cockroaches.

7-22 Lead-Safe Work Practices: Rehabilitation

MANDATORY

Rehabilitation

How

For properties built before 1978, use lead-safe work practices during renovation, remodeling, painting and demolition.

Intent

Any activity that disturbs painted surfaces or building 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.

Things to Consider

Get a lead-based paint inspection or risk assessment if it is likely that the surfaces to be disturbed contain lead-based paint. Information about lead-safe work practices can be found at www.epa.gov/lead/pubs/traincert.htm and www.hud.gov/offices/lead/training/index.cfm.

7-23 Healthy Flooring Materials – Alternative Sources**OPTIONAL – 5 Points**

How

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

Intent

While certain health hazards are linked with the production of vinyl products, some alternative flooring materials that are natural and renewable have demonstrated low-VOC emissions and an environmentally friendly production. Avoid the use of carpet, which can serve as a sink for dust, allergens and other substances that may pose health hazards to susceptible residents.

Things to Consider

- Use alternative flooring materials such as linoleum, laminate, ceramic tile, bamboo, cork, wood (especially salvaged wood) or rubber.
- For concrete floors and basements, leave the slab exposed and stained with low-VOC material rather than providing any floor treatments.

7-24 Whole House Vacuum – Reducing Dust**OPTIONAL – 2 Points**

How

Install a whole-house vacuum system with high-efficiency particulate air filtration.

Intent

Frequent vacuuming reduces the amount of dust burden in the home. HEPA (High-Efficiency Particulate Air Filter) filtration prevents the airborne distribution of irritating or allergenic particulate matter during vacuuming.

SECTION 8: OPERATIONS AND MAINTENANCE

8-1 Owner's Manual

MANDATORY

How

Provide a manual that includes the following: a routine maintenance plan; instructions for all appliances, HVAC operation, water-system turnoffs, lighting equipment and other systems that are part of each occupancy unit; an occupancy turnover plan that describes in detail the process of educating the tenant about proper use and maintenance of all building systems; and information on how to maintain the green features of the site, including all ventilation fans, paving materials and landscaping.

Intent

A regularly maintained building and site will provide optimum health benefits and ensure environmental and economic performance.

Things to Consider

NCHH. "Healthy Homes Maintenance Checklist." National Center for Healthy Housing, 2005. See www.centerforhealthyhousing.org.

Ventilation instruction manuals have been developed for the most common systems. They can be downloaded from the WSU Extension Energy Program Web Site.

<http://www.energy.wsu.edu/code/>

*Washington State Ventilation and Indoor Air Quality Code, 2006 edition
101.4 Operating Instructions: Installers shall provide the manufacturer's installation, operating instructions, and a whole house ventilation system operation description.*

8-2 Occupant's Manual

MANDATORY

How

Provide a guide for homeowners and renters that explains the intent, benefits, use and maintenance of green building features, and encourages additional green activities such as recycling, gardening and use of healthy cleaning materials.

Intent

Homeowners and renters may be unfamiliar with green systems or features installed in their houses or buildings. Assistance with understanding, operating and maintaining them will allow both homeowners and renters to fully realize the environmental, health and economic benefits that Evergreen offer.

8-3 Homeowner and New Resident Orientation

MANDATORY

How

Provide a walk-through and orientation for each homeowner or new resident that reviews the building's green features, operations and maintenance.

Intent

A walk-through and orientation will help ensure that the Green Development Plan achieves its intended environmental and economic benefits.

Appendix A

Washington State Housing Trust Fund

Evergreen Sustainable Development Criteria

Energy Efficiency for New Multi-family Construction

The following methodology has been developed to demonstrate a 15 percent reduction in space heating energy compared to the 2006 Washington State Energy Code (WSEC). This approach allows the applicant to use the identical methodology used for energy code compliance. It simply changes the target values selected for the building envelope.

The energy code allows three methods of demonstrating code compliance: prescriptive, component performance, or systems analysis. The following outlines the modifications that need to be made to demonstrate a 15 percent reduction in energy use compared to the 2006 WSEC.

Prescriptive

When using the prescriptive method, substitute the prescriptive WSEC table with the prescriptive Evergreen Criteria table. For buildings located in climate zone 1, substitute WSEC Table 6-1 with Evergreen Criteria Table 6-1. For buildings located in climate zone 2, substitute WSEC Table 6-2 with Evergreen Criteria Table 6-2.

Component

When using the component performance method, substitute the prescriptive WSEC Table 5-1 with the prescriptive Evergreen Criteria Table 5-1. This method is also supported by the Component Performance Worksheets available through the WSU Extension Energy Program Code Support web site. The Component Performance Worksheets are Excel worksheets developed to assure the calculations needed to meet code are accurate. Download the 2006 WSEC Component Performance Worksheets and look for the tab labeled Evergreen Criteria: Zone 1 or Evergreen Criteria: Zone 2. This worksheet is available at the following web address:

<http://www.energy.wsu.edu/code/code2006.cfm>

Systems Analysis

The code criteria for the WSEC Systems Analysis Approach is also based on WSEC Table 5-1. To provide a 15 percent reduction in energy use, substitute this table with Evergreen Criteria: Table 5-1. Once again we are recommending that the first step in the process be completing the Component Performance Worksheet available from WSU. This will provide the corrected take off information needed for the target building. This information can then be entered into the simulation software. It is recommended that the software used to perform simulation be a version of DOE II. One version that is available at no cost over the internet is EQuest.

EQuest can be downloaded from the following web address: <http://doe2.com/equest/>

For other DOE II software, go to: <http://gundog.lbl.gov/>

	2006 Energy Code	15 % Savings
Prescriptive: Climate Zone 1	WSEC Table 6-1	Evergreen Criteria: Table 6-1
Prescriptive: Climate Zone 2	WSEC Table 6-2	Evergreen Criteria: Table 6-2
Component Performance Zone 1 & Zone 2	WSEC Table 5-1	Evergreen Criteria: Table 5-1
Systems Analysis Zone 1 & Zone 2	WSEC Table 5-1	Evergreen Criteria: Table 5-1

**Evergreen Criteria: Table 5-1
TARGET COMPONENT VALUES FOR GROUP R-1 & R-2 OCCUPANCY Only**

Component	Climate Zone	
	1	2
Glazing % Floor Area	15%	15%
Vertical Glazing U-Factor Group R-1 and R-2	U = 0.300	U = 0.300
Overhead Glazing U-Factor	U = 0.58	U = 0.58
Doors	U = 0.200 (R-5)	U = 0.200 (R-5)
Ceilings		
Attic	U = 0.031 (R-38)	U = 0.031 (R-38)
Single Rafter/Joist Vaulted ³	U = 0.034 (R-30)	U = 0.034 (R-30)
Walls ^{1,2}	U = 0.057 (R-21)	U = 0.044 (R-19A+R-5)
Floors	U = 0.029 (R-30)	U = 0.029 (R-30)
Slab on Grade Slab R-Value	F = 0.54 (R-10)	F = 0.54 (R-10)
Below Grade Interior		
Wall R-Value	R-19	R-19
2' Depth: Walls Slab	U = 0.043 F = 0.69	U = 0.043 F = 0.69
3.5' Depth: Walls Slab	U = 0.041 F = 0.64	U = 0.041 F = 0.64
7' Depth: Walls Slab	U = 0.037 F = 0.57	U = 0.037 F = 0.57
Below Grade Exterior		
Wall R-Value	R-10	R-12
2' Depth: Walls Slab	U = 0.070 F = 0.60	U = 0.061 F = 0.60
3.5' Depth: Walls Slab	U = 0.064 F = 0.57	U = 0.057 F = 0.57
7' Depth: Walls Slab	U = 0.056 F = 0.42	U = 0.050 F = 0.42

1. Log and solid timber walls that have a minimum average thickness of 3.5" are exempt from wall target UA and proposed UA calculations.
2. "A" means advanced framing. For more information, see Section 1005.2.
3. Requirement applicable only to single rafter or joist vaulted ceilings where both (a) the distance between the top of the ceiling and the underside of the roof sheathing is less than 12 inches and (b) there is a minimum 1-inch vented airspace above the insulation. Other single rafter or joist vaulted ceilings shall comply with the "ceiling" requirements. This option is limited to 500 square feet of ceiling area for any one dwelling unit.

**EVERGREEN CRITERIA TABLE 6-1
PRESCRIPTIVE REQUIREMENTS^{0,1} FOR GROUP R-1 & R-2 OCCUPANCY ONLY: CLIMATE ZONE 1**

Option	Glazing Area ¹⁰ : % of Floor	Glazing U-Factor		Door ⁹ U-Factor	Ceiling ²	Vaulted Ceiling ³	Wall ¹² Above Grade	Wall [•] int ⁴ Below Grade	Wall [•] ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
		Vertical	Overhead ¹								
A.	15%	0.30	0.58	0.20	R-38 / U=0.031	R-30 / U=0.034	R-21 U=0.057	R-21	R-10	R-30	R-10
B.	13%	0.33	0.58	0.20	R-38 / U=0.031	R-30 / U=0.034	R-21 U=0.057	R-21	R-12	R-30	R-10
C.	12%	0.36	0.58	0.20	R-38 / U=0.031	R-30 / U=0.034	R-21 U=0.057	R-21	R-12	R-30	R-10
D.	15%	0.33	0.58	0.20	R-38 adv /U=0.026	R-30 / U=0.034	R-21 adv U=0.051	R-21	R-10	R-30	R-10
E.	13%	0.37	0.58	0.20	R-38 adv /U=0.026	R-30 / U=0.034	R-21 adv U=0.051	R-21	R-12	R-30	R-10
F.	12%	0.4	0.58	0.20	R-38 adv /U=0.026	R-30 / U=0.034	R-21 adv U=0.051	R-21	R-12	R-30	R-10

* Reference Case

0. Nominal R-values are for wood frame assemblies only or assemblies built in accordance with Section 601.1.

1. Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor area of 13%, it shall comply with all of the requirements of the 15% glazing option (or higher). Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.

2. Requirement applies to all ceilings except single rafter or joist vaulted ceilings complying with note 3. 'Adv' denotes Advanced Framed Ceiling.

3. Requirement applicable only to single rafter or joist vaulted ceilings where both (a) the distance between the top of the ceiling and the underside of the roof sheathing is less than 12 inches and (b) there is a minimum 1-inch vented airspace above the insulation. Other single rafter or joist vaulted ceilings shall comply with the "ceiling" requirements. This option is limited to 500 square feet of ceiling area for any one dwelling unit.

4. Below grade walls shall be insulated either on the exterior to a minimum level of R-10, or on the interior to the same level as walls above grade. Exterior insulation installed on below grade walls shall be a water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See Section 602.2.

5. Floors over crawl spaces or exposed to ambient air conditions.

6. Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See Section 602.4.

7. Int. denotes standard framing 16 inches on center with headers insulated with a minimum of R-10 insulation.

8. This wall insulation requirement denotes R-19 wall cavity insulation plus R-5 foam sheathing.

9. Doors, including all fire doors, shall be assigned default U-factors from Table 10-6C.

10. Where a maximum glazing area is listed, the total glazing area (combined vertical plus overhead) as a percent of gross conditioned floor area shall be less than or equal to that value. Overhead glazing with U-factor of $U=0.40$ or less is not included in glazing area limitations.
11. Overhead glazing shall have U-factors determined in accordance with NFRC 100 or as specified in Section 502.1.5.
12. Log and solid timber walls with a minimum average thickness of 3.5" are exempt from this insulation requirement.

EVERGREEN CRITERIA TABLE 6-2
PRESCRIPTIVE REQUIREMENT S^{0,1} FOR GROUP R-1 & R-2 OCCUPANCY ONLY:CLIMATE ZONE 2
 To provide a 15% reduction in space heating energy compared to the 2006 WSEC

Option	Glazing Area ¹⁰ : % of Floor	Glazing U-Factor		Door ⁹ U-Factor	Ceiling ²	Vaulted Ceiling ³	Wall ¹² Above Grade	Wall• int ⁴ Below Grade	Wall• ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
		Vertical	Overhead ¹								
A.	15%	0.30	0.58	0.20	R-38 / U=0.031	R-30 / U=0.034	R-19+ R-5 ⁸ U=0.044	R-21	R-12	R-30	R-10
B.	12%	0.30	0.58	0.20	R-38 / U=0.031	R-30 / U=0.034	R-21 int ⁷ / U=0.054	R-21	R-12	R-30	R-10
C.	11%	0.33	0.58	0.20	R-38 / U=0.031	R-30 / U=0.034	R-21 int ⁷ / U=0.054	R-21	R-12	R-30	R-10
D.	14%	0.30	0.58	0.20	R-38 adv ¹³ /U=0.026	R-30 / U=0.034	R-21 adv ¹³ U=0.051	R-21	R-12	R-30	R-10
E.	13%	0.32	0.58	0.20	R-38 adv ¹³ /U=0.026	R-30 / U=0.034	R-21 adv ¹³ U=0.051	R-21	R-12	R-30	R-10

* Reference Case

0. Nominal R-values are for wood frame assemblies only or assemblies built in accordance with Section 601.1.
1. Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor area of 13%, it shall comply with all of the requirements of the 15% glazing option (or higher). Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.
2. Requirement applies to all ceilings except single rafter or joist vaulted ceilings complying with note 3. 'Adv' denotes Advanced Framed Ceiling.
3. Requirement applicable only to single rafter or joist vaulted ceilings where both (a) the distance between the top of the ceiling and the underside of the roof sheathing is less than 12 inches and (b) there is a minimum 1-inch vented airspace above the insulation. Other single rafter or joist vaulted ceilings shall comply with the "ceiling" requirements. This option is limited to 500 square feet of ceiling area for any one dwelling unit.
4. Below grade walls shall be insulated either on the exterior to a minimum level of R-12, or on the interior to the same level as walls above grade. Exterior insulation installed on below grade walls shall be a water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See Section 602.2.
5. Floors over crawl spaces or exposed to ambient air conditions.
6. Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See Section 602.4.
7. Int. denotes standard framing 16 inches on center with headers insulated with a minimum of R-10 insulation.
8. This wall insulation requirement denotes R-19 wall cavity insulation plus R-5 foam sheathing.
9. Doors, including all fire doors, shall be assigned default U-factors from Table 10-6C.
10. Where a maximum glazing area is listed, the total glazing area (combined vertical plus overhead) as a percent of gross conditioned floor area shall be less than or equal to that value. Overhead glazing with U-factor of U=0.40 or less is not included in glazing area limitations.
11. Overhead glazing shall have U-factors determined in accordance with NFRC 100 or as specified in Section 502.1.5.

12. Log and solid timber walls with a minimum average thickness of 3.5" are exempt from this insulation requirement.
13. adv indicates advanced framing techniques. For a description of advanced framing see WSEC Section 1005.2 and 1007.2.

Notes on the Development of the Evergreen Criteria Tables:

The tables used in this document were developed by Chuck Murray, Energy Policy Specialist, Department of Commerce, 360.725.3113, Chuck.Murray@commerce.wa.gov.

A simple shoe box prototype of a 12 unit multi-family building was used to develop the criteria. This is the same prototype used for analysis by the Northwest Power Planning Council. This prototype has also been used for WSEC code development for many years. The glazing area was adjusted from the Power Plans value of 12 percent of floor area to 15 percent of floor area to be consistent with the WSEC. This is a wood frame building.

Prototype Characteristics

Stories		3
Units		12
Unit Size		836
Cond Floor Area		10032
Volume @ 9'		90288
Floor Area		3344
Roof Area		3344
Gross Wall		6480
Window area	15% of floor	1504
Door area		288
Net Wall Area		4663

First, Evergreen Criteria: Table 5-1 was developed. Energy modeling software was used to determine what change in whole building heat loss would result in a 15 percent energy savings. The analysis was conducted using the criteria from the WSEC, Chapter 4: Systems Analysis.

The whole building heat loss was changed by adjusting only the glazing U-factor. It was determined that the change in building heat loss needed to provide an energy savings in excess of 15 percent could be achieved by glazing alone. When a simulation was conducted changing the windows from the code required U-0.40 to U-0.30 in climate zone 1, it resulted in a savings of 17.1 percent. For climate zone 2, changing from U-0.40 to U-0.30 resulted in a savings of 15.3 percent.

Because most modest income multi-family projects actually have much less glazing than the prototype building, the analysis was also conducted with 12 percent glazing to floor area ratio. When a simulation was conducted changing the windows from the code required U-0.40 to U-0.30 in climate zone 1, it resulted in a savings of 15.1 percent. For climate zone 2, changing from U-0.40 to U-0.30 resulted in a savings of 13.5 percent.

To simplify the results, and provide some balance between actual glazing areas and code target glazing areas, a decision was made to use U-.30 glazing as the new target for Table 5-1 in both climate zones.

Simulation Results

	Savings: Climate Zone 1	Savings: Climate Zone 2
U-0.40 to U-0.31 @ 15%	15.5 %	13.5 %
U-0.40 to U-0.30 @ 15%	17.3 %	15.3 %
U-0.40 to U-0.31 @ 12%	13.6 %	12.0 %
U-0.40 to U-0.30 @ 12%	15.1 %	13.5 %

The Evergreen Criteria: Table 5-1 was then used to develop the new prescriptive tables. Each option in the prescriptive tables represents equivalent heat loss to the target heat loss in Table 5-1.

Note: The prescriptive tables meet both the WSEC and the requirements of this standard.

Appendix B

Washington State Housing Trust Fund

Evergreen Sustainable Development Criteria

Energy Efficiency for Rehabilitation of Existing Housing

A list of prescriptive weatherization methods has been adopted as the primary method for meeting the Evergreen Sustainable Development Criteria for energy efficiency during building rehabilitation. Two analysis methods are also available as an alternative to the prescriptive method. This includes a simple 10 year payback calculation, or a savings to investment ratio.

The prescriptive options have been adopted principally from the Regional Technical Forum, Site Built Housing Weatherization Specifications, October 1, 2003. This is the list of measures developed by the Northwest Power Planning Council and Bonneville Power Administration. The list of measures has been developed over 20 years with input from weatherization agencies and sponsor utilities. The list of measures has remained fairly consistent over time. In most cases, when the opportunity presents itself, it is cost effective to provide air sealing and insulation measures to housing in the Pacific NW Region.

There are special conditions in some buildings that make it more difficult than usual to install the prescriptive options detailed here. For these cases, the applicant may wish to propose an alternative to the prescriptive requirements. To propose an alternative list of measures, the applicant may provide either a simple payback analysis or a savings to investment ratio, as detailed below.

In all cases minimum code requirements must be met. Specific to energy efficiency, the requirements of Washington State Energy Code Section 101.3 apply to existing buildings.

1. Prescriptive Option - Mandatory Measures

For each project, complete the following mandatory weatherization measures.

Existing Building Air Sealing and Ventilation:

Mechanical Ventilation: (Mandatory)

Provide a whole house mechanical ventilation system in compliance with the Washington State Ventilation and Indoor Air Quality Code or ASHRAE Standard 62.2 - 2004.

Prescriptive Air Sealing: (Mandatory)

All accessible exterior joints around windows and door frames, openings between walls and foundation, between walls and roof and wall panels; openings at penetrations of utility services through walls, floors and roofs; and all other openings in the building envelope for all occupancies and all other openings in between units in R-1 and R-2 occupancies shall be sealed, caulked, gasketed or weatherstripped to prevent air leakage. All exterior doors or doors serving as access to an enclosed unheated area shall be weatherstripped to prevent leakage around their perimeter when in a closed position.

Attic Spaces: (Mandatory)

- All penetrations in the ceiling shall be sealed to prevent air leakage from the interior space to the attic space.
- Attic ceilings with less than R-20 existing insulation shall be insulated to a minimum of R-38 or the highest R-value approaching R-38 which is practical.

- Uninsulated knee walls shall be insulated to R-21, or the highest R-value approaching R-21 which is practical.
- Attic access doors which are adjacent to Conditioned Spaces shall be insulated to at least R-30 for horizontal openings and to at least R-13 for vertical openings and weatherstripped.
- If water pipes are located in the attic space, water pipe insulation shall be included with ceiling insulation.

Single Rafter Vaults: (Mandatory)

- When vaulted roof cavities are exposed during renovation, the cavity shall be insulated to R-38 or highest R-value approaching R-38 which is practical. Code required roof cavity ventilation shall be taken into account when determining the maximum depth of insulation installed in the rafter space.

Floors over vented crawl space, or other unconditioned spaces. (Mandatory)

- All penetrations in the floor system shall be sealed to prevent air leakage from the crawl space to the interior space.
- Underfloors shall be insulated to a minimum of R-30, or to the maximum level needed to fill the joist cavities.
- Any crawlspace access door adjacent to a Conditioned Space shall be insulated to at least R-30 for horizontal openings and to at least R-13 for vertical openings and shall be weatherstripped with appropriate materials.
- Uninsulated walls separating the crawlspace from Conditioned Space shall be insulated to a minimum of R-21 or the highest R-value which fills the cavity.
- If water pipes are located in the crawlspace, water pipe insulation shall be included with underfloor insulation.

Above and Below Grade Walls (Mandatory)

- Insulation shall be installed in wall cavities that have less than 1" of existing insulation.
 - Walls shall be insulated to minimum R-13 in 2x4 walls and R-21 in 2x6 walls or the highest R-value practical for the wall cavity space.
- When exterior wall cladding is replaced or installed over existing siding and windows are replaced, R-5 minimum exterior foam sheathing shall be installed.

Window Replacement: (Mandatory)

- When windows are replaced, all replacement windows must meet a minimum thermal heat transmission of U-0.30. An area weighted U-factor calculation may be used to demonstrate compliance.
- For homes with exhaust only ventilation systems, outdoor air inlets meeting the requirements of the Washington Ventilation and Indoor Air Quality Code shall be installed in new window frames.

Skylight Replacement: (Mandatory)

- When skylights are replaced, all skylights must meet a minimum thermal heat transmission of U-0.40.

Ductwork located in unconditioned and semi-conditioned spaces, including crawl spaces, attics and garage.

All existing ductwork shall be inspected. Damaged ducts are to be repaired or replaced with new ductwork. All joints are to be inspected to assure they are mechanically fastened as required by the mechanical code. All duct joints and seams shall be sealed with mastic. All existing ducts shall be insulated to R-8 (2 ½ ") if the existing insulation is less than R-4 (1/1/2") insulation.

2. Simple Payback Method Option – (Mandatory)

As an alternative to the prescriptive building envelope measures, implement all building envelope measures that are demonstrated to provide a 10 year simple payback or less.

- Identify an engineer or energy auditor to conduct an energy analysis of the existing building condition and identify cost-effective energy improvements by preparing an energy improvement report.
- The report analyzes the current and projected energy performance of the building using energy simulation software.
- Analyze all of the mandatory prescriptive measures listed above.
- First costs are determined using actual bids for the project, or information from a similar project. First costs include only the contractor bid price. First costs do not include financing, overhead or profit.
- Cost of energy is calculated using local utility rates. If the local utility uses a block rate structure, the lowest block rate should not be used to calculate space conditioning energy cost. Use the second and third block rates.
- Simple payback is calculated as: first cost of the measure / first year energy cost savings.

3. Savings to Investment Ratio Option – (Mandatory)

Using TREAT Weatherization Evaluation Software, analyze all of the mandatory prescriptive measures listed above. Implement all measures that are demonstrated to provide a savings to investment ratio greater than 1.

- Follow the weatherization analysis procedures developed for the Washington State Department of Community, Trade & Economic Development (CTED) Weatherization Program.

http://www.cted.wa.gov/portal/alias_cted/lang_en/tabID_513/DesktopDefault.aspx

Simple Payback Method – Additional Points (10 points)

Specify and install measures that provide greater energy efficiency than the prescriptive measures listed above as demonstrated by a 14-year simple payback calculation described above.

Notes:

This Appendix was developed by Chuck Murray, Energy Policy Specialist, Department of Commerce, 360.725.3113, Chuck.Murray@commerce.wa.gov.

The prescriptive standards included here were adopted from the 5th Northwest Power Plan, with some modification. Since the 1980's, the Northwest Power Planning Council has developed a set of weatherization measures for regional adoption. They are analyzed for three regional climate zones. Zones 1 and 2 are in Washington State. The standards were developed using a detailed cost effectiveness calculation. They evaluate the life cycle cost to the building occupant, as well as impacts of savings on the regional rate payers.

Prior to making this recommendation, several additional sources were checked to confirm that measures, measure savings and cost figures were reasonable.

To confirm that the list of measures was not out of the ordinary:

- The weatherization specifications developed by Oak Ridge National Laboratory was consulted. This document was in agreement with the list of the applications. The R-values varied to some degree. ORNL staff contacted noted they are currently updating the R-values to reflect recent changes in fuel cost.
- The weatherization specifications developed by the CTED weatherization program was consulted. Table 5.1 Draft Matrix of Weatherization Measures. This document also includes a similar set of measures, with somewhat different R-values. CTED staff noted this table has not been updated to reflect the recent changes in fuel price.

To confirm that the cost in the Power Plan were not out of the ordinary, 2006 RS Means was consulted. There is some variation in the cost. Some cost are higher, some lower. But there were no cases where the cost differences were substantial.

For insulation, the changes have been small. The level of insulation recommended for rehabilitation work has remained fairly constant since the early 1990's. The opportunities to make changes in existing structures have not changed over time. The physical limitations on access and space in attic crawl or wall systems have not changed. This document has included two variations from the Power Plan.

- All references to R-11 insulation have been changed to R-13.
- All references to R-19 for walls have been changed to R-21.
- In response to changes in fuel cost, the insulation measures are the same for all equipment and fuel types.

There are several mandatory measures that are only required as part of other work. This is because they are only cost effective when incorporated with the work noted. This includes:

- Window Replacement – U-factor: Window replacement is very expensive. It is not cost effective to replace windows simply for energy savings. But when windows are replaced, it is cost effective to purchase the most energy efficiency products available. The state energy code would require a U-35 window. The mandatory requirement for window replacement for this document is U-.30.
- Window Replacement – ventilation ports: The Washington State Ventilation and Indoor Air Quality Code requires outdoor air inlets as part of code compliance. For exhaust only ventilation systems, this is typically accomplished by providing small ports in the frame. This is a reasonable requirement for projects using this ventilation strategy when the windows are replaced.
- Foam Sheathing- Adding foam sheathing is cost effective when exterior cladding is being replaced or installed over existing siding. In addition, it is important to integrate the foam sheathing with the flashing details, especially with the windows. As a result, foam sheathing is only required when both the windows are being replaced and the cladding is replaced or new cladding is installed over existing siding.

Prescriptive air sealing measures have been included. This is simply a “find the hole, seal the hole” approach. For additional points, performance testing has been included.

In all cases, when air sealing work is conducted, a minimum standard for whole house ventilation needs to be included. Because there are very few people that can accurately assess the need for mechanical ventilation, it is mandatory in all cases. Also, it is likely that it will cost less to simply implement a ventilation strategy, than to analyze it.

Duct sealing and improved duct insulation was introduced during the early 1990’s. The Power Plan would require the performance testing as noted in the optional measures. The prescriptive section was written to simply bring the existing ducts up to current energy code requirements. Use the Performance Tested Comfort Systems methodology, or an equivalent to take additional credit for air sealing. This method is required on all new Energy Star homes with duct systems.

Additional credit is assigned to performance testing for heat pump systems. Heat pumps need to have adequate air flow across the heating/cooling coil to achieve the rated performance. Performance Tested Comfort Systems methodology has been developed to meet this challenge. It is required on all new Energy Star homes with heat pumps.

Equipment upgrades during time of replacement are only included in the optional criteria. For most rehabilitation projects providing the most efficient replacement equipment would be cost effective. It is highly recommended. There are conditions where the cost of replacing existing venting systems or ductwork to accommodate contemporary systems is too costly to provide reasonable recovery.

The Simple Payback method was tested against the Northwest Power Plan list of measures weatherization measures. All of the measures recommended meet the simple payback criteria of a 10 year or less payback, if the electric price was greater than \$.055. As the cost of fuel is decreased, some measures fall off the list. The average price of all fuels (adjusted for system efficiency) typically exceed \$.055. But there are some locations in the state with very low public power rates. In these areas, the list will not provide cost effective savings to the consumer. But, the Northwest Power Plan still recommends implementation of these measures because of the benefits they provide to the regional power supply. Most of the PUD’s with low rates agree. Many provide financial support for the list of measures.

The SIR method was included to provide synchronization with the CTED weatherization program.

List of weatherization measures from the 5th Northwest Power Plan.

Measure Name	Savings (kwh/yr)	Phys Life (yrs)	Capital Cost (\$2000)	Deemed
		45.0		
Single Family R0 to R19 Attic Insulation - Heating Zone 1	1.83	0	0.86	X
		45.0		
Single Family R0 to R19 Attic Insulation - Heating Zone 2	2.41	0	0.86	X
		45.0		
Single Family R19 to R38 Attic Insulation - Heating Zone 1	0.66	0	0.33	X
		45.0		
Single Family R19 to R38 Attic Insulation - Heating Zone 2	0.87	0	0.33	X
		45.0		
Single Family R0 to R19 Floor Insulation - Heating Zone 1	2.04	0	0.80	X
Single Family R0 to R19 Floor Insulation - Heating Zone 2	2.68	45.0	0.80	X

		0		
		45.0		
Single Family	R19 to R30 Floor Insulation - Heating Zone 1	0.38	0	0.15 X
			45.0	
Single Family	R19 to R30 Floor Insulation - Heating Zone 2	0.50	0	0.15 X
			45.0	
Single Family	R0 to R11 Wall Insulation - Heating Zone 1	1.90	0	0.81 X
			45.0	
Single Family	R0 to R11 Wall Insulation - Heating Zone 2	2.49	0	0.81 X
			20.0	
Single Family	Infiltration Control - Heating Zone 1	0.24	0	0.16 X
			20.0	
Single Family	Infiltration Control - Heating Zone 2	0.32	0	0.16 X
Single Family	Energy Star Prime Window Replacement - Heating Zone 1	10.04	0	16.01
Single Family	Energy Star Prime Window Replacement - Heating Zone 2	13.17	0	16.01
		2.49		1.19

Measure Name	Savings (kwh/yr)	Phys Life (yrs)	Capital Cost (\$2000)	Deemed
		45.0		
Multifamily - R0 - R19 Attic insulation - Heating Zone 1	2.23	0	0.86	X
		45.0		
Multifamily - R0 - R19 Attic insulation - Heating Zone 2	3.26	0	0.86	X
		45.0		
Multifamily - R19 - R38 Attic insulation - Heating Zone 1	0.46	0	0.33	X
		45.0		
Multifamily - R19 - R38 Attic insulation - Heating Zone 2	0.66	0	0.33	X
		45.0		
Multifamily - Wall Insulation - Heating Zone 1	1.31	0	0.81	X
		45.0		
Multifamily - Wall Insulation - Heating Zone 2	1.91	0	0.81	X
		45.0		
Multifamily - R0 - R19 Floor insulation - Heating Zone 1	1.41	0	0.80	X
		45.0		
Multifamily - R0 - R19 Floor insulation - Heating Zone 2	2.05	0	0.80	X
		45.0		
Multifamily - R19 - R30 Floor insulation - Heating Zone 1	0.26	0	0.15	X
		45.0		
Multifamily - R19 - R30 Floor insulation - Heating Zone 2	0.38	0	0.15	X
Multifamily - Energy Star Prime Window Replacement - Heating Zone 1	9.58	0	16.01	
Multifamily - Energy Star Prime Window Replacement - Heating Zone 2	13.97	0	16.01	