



**Built Green™**  
**Renovation Program**  
**Guide for**  
**Single Family &**  
**Row House**

**Developed By Renovators**  
**For Renovators**

May 15, 2010

# Acknowledgments

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The Built Green™ Renovation Program & Guide was tailored for Built Green Canada. This is an evolutionary document, representing the combined efforts of CHBA BC members working as a task force, including renovators, builders, community representatives, and industry experts.

We wish to thank all those CHBA BC members who participated in the *technical meetings* for their time and hard work. In particular, we'd like to thank the following for their contributions:

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# Disclaimer

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Built Green Canada has provided this Guide as part of the Built Green™ Renovation Program. It is intended for use by professional, licensed builders and renovation contractors as an aid to participating in the program. It assumes a certain level of experience and familiarity with building technology and should not be used by untrained builders, do-it yourselfers, or consumers.

The Guide is not intended to eliminate or substitute for the builder/renovator's own judgment or accepted engineering and construction practices. Each home design may have characteristics that could make any one or more of the Action Items suggested in the Guide inappropriate. It is the responsibility of the builder/renovator to choose Action Items that are appropriate in each case.

Furthermore, product information provided in the Guide is not intended to act as or imply a recommendation for using a particular product in a specific application. Where appropriate, products should be tested before installation. All products should be used according to the manufacturers' recommendations.

In addition, local, provincial, and federal regulations must be followed and are not to be superseded by any recommendations made in this Guide. Every effort was made to ensure consistency with the National Building Code standards and the incorporated municipalities within each province at the time of this writing.

Health and safety-related measures described in the Guide are not intended to offer medical advice or to substitute for professional medical consultation.

The Built Green™ Renovation Program is a certification program and as such the renovator/builder must maintain all proof of the selected Checklist Action Items as selected, and be able to provide such proof upon demand by Built Green Canada. Built Green Canada does not warrant whether or not a builder has taken a specific action, this proof must be maintained by the member.

The Checklist is included starting on page 145 at the back for quick reference.

# Program Information

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# Introduction

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This Built Green™ Renovation Program & Guide is the first step for Built Green™ renovations focusing on Single Family and Row House dwellings. Further components (such as for non-Part 9 buildings/units) may be developed based on demand.

The Guide is a reference for Renovator members enrolled in the Built Green™ program. The Renovation Checklist contains more than 290 Action Items to choose from and *functions as a menu* of environmentally friendly Action Items to include in your renovation project. In addition, the Guide describes what is required to score points for each Action Item, and the benefits that result. Additional information about the Built Green™ Renovation Program Checklist Action Items will be provided through technical seminars and other resources.

For further information about Built Green™ Renovation Program or Resources, contact Built Green Canada at: Email [annralph@builtgreencanada.ca](mailto:annralph@builtgreencanada.ca), or visit [www.builtgreencanada.ca](http://www.builtgreencanada.ca).

Built Green is an industry-driven program. Therefore, consumer education and outreach is critical to participating in it successfully. Please contact Built Green Canada to find out more about the marketing tools you can use to promote the program to your clients.

The EnerGuide Rating System (ERS) is an integral part of the Built Green™ program. The ERS was developed by Natural Resources Canada (NRCan) and is used to rate the energy-efficiency of the house's thermal envelope and the heating system. Because Built Green recognizes that to be truly “green” the house must be energy efficient as a whole, the ERS becomes a valuable, and mandatory, part of Built Green™ Renovation Program (the ERS is used in the New House Built Green™ program).

Renovation projects qualify for Built Green status based on:

- the “scale” of the project – i.e. how much of the house will be affected by the renovation
- implementing the mandatory items; these are required for any Built Green™ Renovation- the amount of mandatory items depends on the scale of the project
- how many Built Green™ Checklist points are obtained

## How to use this document

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This Guide includes:

- 1) An outline of the Built Green™ program and how to become a member and how to enroll your projects.
- 2) The Checklist containing more than 290 Action Items.
- 3) A detailed description of what is required to score points for each Action Item on the Checklist, the benefits that result, and a list of relevant resources.

# How to get started

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When considering a renovation project for the Built Green™ Renovation program, first determine the **scale of the project**. The scale refers to the size of the project- how much of the house will be affected:

## **Small Renovation\*:**

- requires no major changes to the mechanical, electrical, and/or water and sewer systems  
*or*
- affects less than 500 square feet area (total of all areas affected)  
*or*
- consists of a kitchen or bathroom renovation, or finishing a basement

## **Renovation:**

- requires major changes to the mechanical, electrical and/or water and sewer systems
- affects more than 500 square feet area (total of all areas affected)

## **Addition:**

- any project that increases the footprint and/or total square footage of the existing home

## **Whole House Renovation:**

- requires major changes to the mechanical, electrical and/or water and sewer systems  
*and one or both of the following:*
- structural and finish changes to more than 70% of the existing structure
- an addition equal to or greater than 50% of the square footage of the existing structure

\*Small Renovations cannot qualify for Platinum status since, by definition, they lack adequate influence on the overall environmental impact of the home.

Then determine what Built Green™ Rating is to be obtained (there are four different ratings: Bronze, Silver, Gold and Platinum). Consult the Rating Levels (see page 9/10) and Program Requirements (see page 8) to see the specific requirements of each Rating level.

# Built Green Membership

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Becoming a Built Green Canada member will improve your business. Consumers are increasingly aware of green building issues and are looking for builders and renovators who can address their needs. Built Green helps to define your business in the marketplace, gives your customers added value in terms of quality and performance of their home, and can improve your bottom line.

As a Built Green Canada member you will have access to a range of useful tools and services to enhance your business, including:

## Resources

- ✓ The Built Green™ Renovation Program Checklist
- ✓ The Built Green™ Renovation Program Guide
- ✓ Training

## Marketing Tools

- ✓ Member Listing on website
- ✓ Consumer Brochures
- ✓ Window Decals
- ✓ Built Green logo for use in marketing materials

Built Green Canada membership is open to qualified builders and renovators. Visit the website, [www.builtgreencanada.ca](http://www.builtgreencanada.ca) and click on 'Apply for Membership' for more information.

In order to become a Certified Built Green™ Renovator the member must successfully complete (by at least one staff person from the company) the Built Green™ Renovator Training Course. In order to enroll renovation projects in the program, a member must successfully complete the training course. Training must be maintained by attending an update course every two years.

# Guide Organization

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## The Guide is organized into two parts

- Program Information (this section),
- Built Green™ Renovation Program Guide includes brief explanations of how to implement each Action Item and the benefits that result.

The *Built Green™ Renovation Program Guide* describes environmentally friendly Action Items arranged in seven categories:

- **Build to “Green” Codes and Regulations**  
As a renovator or builder, you are required to meet energy, air quality, water efficiency, and storm water management standards. The Built Green™ Renovation Program recognizes you for meeting these standards.
- **Built Green Team**  
Participation in the Built Green™ Renovation Program requires a level of knowledge and ongoing education about green building practices. By using Built Green Members on your team, you are tapping into the knowledge and skills of people who have a real commitment to green building.  
**Implementation of Integrated Design Program (IDP) with team members**
- **Site and Water**  
Built Green offers a variety of common-sense site protection, water protection, and development techniques you can use to earn points and be a “fish-friendly” renovator.
- **Energy Efficiency**  
This category promotes energy efficiency and improved comfort with Action Items intended to push your project beyond the National Building Code minimums. Use NRCan’s Energuide Rating System to evaluate the house and educate the Homeowner and Builder.
- **Health and Indoor Air Quality**  
Action Items in this category include selected practices to improve indoor air quality and reduce health risks for occupants and installers.
- **Materials Efficiency**  
Numerous options help you reduce job-site waste, saving both you and your customer money. In addition to using materials efficiently, this section offers recognition for using a variety of “green” building materials that are easier on the environment.
- **Promote Environmentally Friendly Homeowner O&M**  
The only Action Item in this category is required for certification. It is designed to help owners and tenants operate their homes in a more environmentally friendly manner. The Built Green™ Renovation Program recognizes the importance of making certain the Built Green™ home *stays* green. By integrating training and education into your “green” building approach, you earn the respect of customers who appreciate value-added services.

# How to Use the Checklist

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For ease of use, the Built Green™ Renovation Program Certification Checklist coordinates directly with the Guide sections.

The checklist is “key-coded” to help you find information about each measure. The first number indicates what section to look in, and the following numbers indicate the order in which it appears.

Here’s how it works, using an example Action Item from the Checklist:

Item No.	Pts	CREDIT
2-20	5	Amend disturbed soil to a depth of 8 to 10 inches to restore soil environmental functions

In this example, the action *Amend disturbed soil to a depth of 8 to 10 inches to restore soil environmental functions* is assigned 5 points and is described in Section **Two (2)** (*Site and Water*), Action Item **20**.

The checklist is a great planning tool to help you develop your Built Green™ projects.

Review the checklist prior to starting your project, and note Action Items you are interested in investigating. Refer to the general information in the applicable section of the Guide for discussion of these Action Items.

If you’re working with a customer, you may use the checklist as a tool to guide the specifications for their home. This lengthy list can be intimidating for a customer who is unfamiliar with the terms and techniques of green building. We recommend that you narrow down your choices before discussing them with a customer; create standard specifications and upgrade packages to simplify your selling process.

When your project checklist is finalized you can enroll and the home with the program, see details in the next section below.

# How to Enroll Your Project

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As a member of Built Green Canada you can visit the website to enroll your projects by using the Built Green Canada database. The enrolment includes the detailed information about the project (civic address) and a completed checklist (to be uploaded to the database). Once your enrolment has been accepted (after the enrolment fee has been paid) you will have access to your project through the database to view the status. Other project enrolment documentation may be required (such as proof of EcoENERGY Audit and a pdf copy of the house plans – before and after), see the database for details.

Use the checklist prior to construction to determine which features to include in your project. This is a useful tool to engage your client in selecting the quality and performance features of their home; you might decide on achieving a certain rating or focus on the customer's key interest areas, e.g. energy efficiency and indoor air quality. Alternately, you might develop packages of Action Items that you offer as Standard, or Upgrades.

When the renovation is complete, the member will accept the 'sign-off' section on the database, acknowledging that all Action Items selected on the Checklist have been completed to the best of their knowledge and that all back up documents are being maintained in-house to be provided upon demand by Built Green Canada.

Upon 'sign-off' Built Green Canada will review the project file submission and issue the approval and corresponding labels directly to the member.

# Program Requirements

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For ease of use, the Built Green™ Renovation Program Checklist coordinates directly with the Guide sections.

All projects certified by the program must have completed each starred (★) Action Item on the checklist as and if applicable to the scale and scope of renovation. Starred Action Items include code requirements (see Requirements section), and the following additional actions:

- 2-1 Preserve and Protect Wetlands, Shorelines and Bluffs during Construction
- 2-2 Preserve and Protect Critical Areas during Construction
- 2-3 Install Temporary Erosion Control Devices and Optimally Maintain Them
- 2-4 Cover Stockpiled Soil with Mulch or Plastic
- 2-5 Establish and Maintain a Single Stabilized Construction Entrance (Quarry Spall or Crushed Rock)
- 2-6 Install and Maintain Sediment Traps
- 2-7 Prohibit Burying Construction Waste
- 3-1 Install Programmable Thermostats with Nighttime Setback and Switch for Furnace Fan
- 3-4 Conduct Energuide evaluation (via ecoENERGY/LiveSmart BC programs) on house
- 3-14-1 Ventilation Chutes / Insulation Stops – Mandatory
- 3-67 Furnish four Energuide/ENERGY STAR® compact fluorescent light bulbs to owners (req'd if installing screw-in compacts, See Action Item 3-68)
- 4-1 Direct Storm water at Least 5 ft Away from Building Using Grading and Approved Drain System as Appropriate
- 4-2 Seal at Doors, Windows, Plumbing, and Electrical Penetrations against Moisture and Air Leaks
- 4-3 If Slab is Used, Install Poly Barrier Properly; If No Slab, Ensure Bottom of Floor is Sufficient Height above Backfilled Dirt with Vapor Barrier Properly Installed
- 4-4 Ensure Proper Drainage of Crawl Space
- 4-5 Ensure Attic Space is Sealed from Living and Crawl Spaces to Prevent Moisture Build Up
- 4-6 Use Roof Gutters to Drain Out onto Splash Blocks or Approved System to Drain Water Away From Building
- 4-7 Pitch and Flash Roofs Properly
- 4-8 Install Spot Ventilation Equipment in All Appropriate Locations as per Ventilation and Indoor Air Quality Code
- 4-9 Install Spot Ventilation Fans to Same Standard as Whole House Fan (Fan Noise at 1.5 sones or less, etc.)
- 4-10 Ensure Heating and/or Cooling Equipment is Correctly Sized to Meet Design Heating and Cooling Loads of Home (Do Not Oversize). Use Quality First Program – TECA
- 4-47 Install CO detector(s)
- 5-0 Follow Best Practices for detection, removal, and disposal of asbestos-containing materials.

- 5-0-1 Follow Best Practices for detection, removal, and disposal of lead-containing paints and materials.
- 5-1 Provide Waste Reduction Resource Sheet to On-Site Personnel and Subcontractors
- 5-2 Prepare Jobsite Recycling Plan and Post On Site
- 6-1 Provide Owner With Homeowner's Information Kit

# Rating Levels

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Ratings are based on the number of points gained by implementing Action Items. As with the Built Green™ for New Homes program, four different “metal” levels indicate the ratings based on the number of points gained by implementing Action Items. The number of points required for each level depends on the scale of your project.

## Bronze

Complete all Basic Requirements:

- ✓ Comply with all starred (mandatory) Action Items from Section Two through Six;
- ✓ Mandatory EnerGuide for Existing Houses evaluation – for Homeowner education; no requirement to improve the EnerGuide Rating at Bronze Rating Level
- ✓ Earn a total of 50 points from Sections One through Five for a Addition, Renovation or Small Renovation, with a minimum of five (5) points in each section, Two\* through Five, to ensure a balanced approach.

Or

- ✓ Earn a total of 75 points from Sections One through Five for a Whole House Renovation with a minimum of five (5) points in each section, Two\* through Five, to ensure a balanced approach.

## Silver

Complete all Basic Requirements:

- ✓ Comply with all starred (mandatory) Action Items from Section Two\*- Section Six;
- ✓ Mandatory EnerGuide for Existing Houses evaluation – for Homeowner education; no requirement to improve the EnerGuide Rating at Silver Rating Level
- ✓ (IDP) Implementation of Integrated Design Program with team members

Earn:

- ✓ 120 total Checklist points for a Whole House Renovation, or
  - ✓ 85 total Checklist points for an Addition or Renovation, or
  - ✓ 65 total Checklist points for a Small Renovation,
- and*
- ✓ At least 5 points from Section Two\* and at least 8 points from each of Sections Three, Four and Five

\*Section Two does not apply to Small Renovations

## Gold

Complete all Basic Requirements:

- ✓ Comply with all starred (mandatory) Action Items from Section Two\*- Section Six;
- ✓ Mandatory EnerGuide for Existing Houses evaluation – for Homeowner education and requirement to improve the EnerGuide Rating as listed below

- ✓ (IDP) Implementation of Integrated Design Program with team members

Earn:

- ✓ 180 total Checklist points for a Whole House Renovation, or
- ✓ 130 total Checklist points for an Addition or Renovation, or
- ✓ 85 total Checklist points for a Small Renovation,  
*and*
- ✓ At least 5 points from Section Two\* and at least 12 points from each of Sections Three, Four and Five
- ✓ **Improve the EnerGuide rating to at least 77**

\*Section Two does not apply to Small Renovations

## Platinum

Complete all Basic Requirements:

- ✓ Comply with all starred (or flagged) Mandatory Action Items from Section Two- Section Six;
- ✓ Mandatory EnerGuide for Existing Houses evaluation – for Homeowner education and requirement to improve the EnerGuide Rating as listed below
- ✓ (IDP) Implementation of Integrated Design Program with team members

Earn:

- ✓ 220 total Checklist points for a Whole House Renovation, *or*
- ✓ 160 total Checklist points for an Addition or Renovation, *or*
- ✓ n/a for a Small Renovation,  
*and*
- ✓ At least 5 points from Section Two\* and at least 15 points from each of Sections Three, Four and Five
- ✓ **Improve the EnerGuide rating to at least 82**

\*Section Two does not apply to Small Renovations and platinum status does not apply

# Pilot Projects

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As part of developing the Built Green™ Renovation Program, Built Green Canada will spotlight several successful case studies of Built Green™ Renovation projects. These Pilot Projects will be summarized in press releases, and will provide a high profile to participating members.

# Built Green for Today and Tomorrow

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The Built Green™ Renovation Program has been designed *by* renovators, *for* renovators, to set standards of excellence in all the communities. It focuses on actions that can make a significant impact and are readily “do-able” today. When effectively applied to an individual building project, the program is expected to make a positive difference for the environment (and for home owners). To ensure that Built Green™ certification is meaningful, it is important that each participant who enrolls a project accurately completes the checklist. Make sure all required steps have been performed before taking credit for an Action Item and that you are able to provide proof of each item selected.

We recognize that building practices change and new products become available constantly, so the program’s materials will be updated from time to time. Similarly, experience and skill at implementing new practices, and market demand and acceptance of those practices tend to increase in parallel, resulting in greater availability and lower cost of green features. Points thresholds will likely rise over time; the Gold home of today will be a Silver home several years from now.

# Built Green™ Renovation Program –at –a–Glance

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Bronze	Silver	Gold	Platinum
<p>Complete <b>Basic Requirements</b></p> <p>Complete Mandatory Action items from Sections Two through Six</p> <p>Earn <b>50 points</b> by completing Action Items from the Built Green™ Renovation Program Checklist <i>scoring at least five (5) points from each Section, Two through Five.</i></p> <p>Mandatory ERS EnerGuide – no requirement to improve rating</p>	<p>Complete Basic Requirements (See Bronze Rating description) plus mandatory IDP</p> <p>Earn <b>120, 85 or 65 Checklist points (depending on scale of renovation)</b></p> <p>Mandatory ERS EnerGuide – no requirement to improve rating</p>	<p>Complete Basic Requirements (See Bronze Rating description) plus mandatory IDP</p> <p>Earn <b>180, 130, or 85 Checklist points (depending on scale of renovation)</b></p> <p><b>Mandatory EnerGuide Rating increase to at least ERS 77</b></p>	<p>Complete Basic Requirements (See Bronze Rating description) plus mandatory IDP</p> <p>Earn <b>220 or 160 Checklist points (depending on scale of renovation)</b></p> <p><b>Mandatory EnerGuide Rating increase to at least ERS 82</b></p>

# Built Green™ Renovation

## Scope of Work Eligibility

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Rating Level	Small Renovation (kitchen, bathroom, basement)	Addition/Renovation	Whole House Renovation
<b>Bronze</b>	☑	☑	☑
<b>Silver</b>	☑	☑	☑
<b>Gold</b>	☑	☑	☑
<b>Platinum</b>	n/a*	☑	☑

\* Small Renovations cannot qualify at the Platinum Rating Level due to their relatively small impact on the whole house.

## RENOVATION DEFINITIONS

### Small Renovation

These renovations do not affect, in general the major mechanical of a home; meaning that they would not have any impact on the furnace or domestic hot water or whole house ventilation of a home.

A small renovation would have influence on Materials, Indoor Air Quality, Water Management and Energy. The areas here would include:

Area	Example	
	<b>Bathroom</b>	<b>Kitchen</b>
<b>Materials</b>	Drywall post consumer recycled content	Drywall, flooring, etc
<b>Indoor Air Quality</b>	Paints, finishes, caulking, ventilation	Paints, finishes, caulking
<b>Water Management</b>	Low flow, dual flush toilets, faucets	Energystar appliances, low flow faucets
<b>Energy</b>	Lighting, fans, room specific heating	Lighting, fans, appliances,

## Renovation

This would have an impact on the home – and therefore could be platinum. A Renovation is defined as having more impact than just one room; replacement of windows for the entire house and possibly siding of the house. A renovation would impact of more than one room such as kitchen, bathroom, bedrooms and other rooms. To achieve Platinum – this renovation would have to impact major mechanical such as furnace and domestic hot water.

Area	Example
<b>Materials</b>	Drywall post consumer recycled content, siding materials, additional insulation, etc.
<b>Indoor Air Quality</b>	Paints, finishes, caulking, ventilation, installation of heat recovery ventilation, etc.
<b>Water Management</b>	Low flow, dual flush toilets, faucets, irrigation systems, etc.
<b>Energy</b>	Lighting, fans, room specific heating, furnace, space and domestic hot water heating and the addition of renewable energy systems, such as solar thermal and reduced air changes.

## Addition

The Built Green™ Renovation program recognizes that if a dwelling is adding space, it should be done in a way that reduces the overall impact. Additions are a challenge in that they are essentially new builds – therefore can qualify for points such as passive design, alternative building envelopes and other areas that may be more of a New Build vs. Renovation. However, they are still a renovation to the ‘existing’ building. And often the addition will impact the existing buildings mechanical and domestic hot water. In these cases, where the mechanical is affected, this renovation can qualify for Platinum level.

Area	Example
<b>Materials</b>	Drywall post consumer recycled content, siding materials, additional insulation, alternative building envelope, 24” o.c., ICF construction or SIP construction.
<b>Indoor Air Quality</b>	Paints, finishes, caulking, ventilation, installation of heat recovery ventilation, etc.
<b>Water Management</b>	Low flow, dual flush toilets, faucets, irrigation systems, etc.
<b>Energy</b>	Lighting, fans, room specific heating, furnace, space and domestic hot water heating and the addition of renewable energy systems, such as solar thermal and reduced air changes.

## Whole House Renovation

- requires major changes to the mechanical, electrical and/or water and sewer systems *and one or both of the following:*
- structural and finish changes to more than 70% of the existing structure
- an addition equal to or greater than 50% of the square footage of the existing structure

A whole house renovation is a complete gut of a building. This building would come down to stud and ‘may’ go as far as a knock down. The only thing not being renovated at this stage would be the slab. The slab and foot print would stay the same. But the building envelope, walls, windows, roof are all open for new system. It can be debated that this would be a Built Green New Build – however, the issue here is that an ecoEnergy evaluation can be done on this existing building and done on the ‘renovated’ finished product. Therefore, this still fits within the Renovation. In these cases, all of the areas that do affect a New Build could be affected in this renovation except for areas concerned with slab or basement insulation. But areas such as passive solar orientation could be affected as room design may very well be affected, and therefore could be open to passive solar application.

Area	Example
<b>Materials</b>	Drywall post consumer recycled content, siding materials, additional insulation, alternative building envelope, 24” o.c., ICF construction or SIP construction.
<b>Indoor Air Quality</b>	Paints, finishes, caulking, ventilation, installation of heat recovery ventilation, etc.
<b>Water Management</b>	Low flow, dual flush toilets, faucets, irrigation systems, etc.
<b>Energy</b>	Lighting, fans, room specific heating, furnace, space and domestic hot water heating and the addition of renewable energy systems, such as solar thermal and reduced air changes.

# **Built Green™ Renovation Program Guide**

# About the Guide

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**This Built Green™ Renovation Program Guide describes in detail the more than 290 Program Action Items in six sections:**

**Requirements: Codes and Regulations** —These Action Items document that you meet the province’s stringent energy, air quality, water efficiency, and stormwater management standards.

**Section One: Built Green Team —(IDP) Implementation of Integrated Design Program with team members** These Action Items document that you meet the province’s stringent energy, air quality, water efficiency, and stormwater management standards.

**Section Two: Site and Water** —These are practical Action Items for site protection, water protection, development and conservation.

**Section Three: Energy Efficiency** — Energuide for Existing Houses Evaluation (currently ecoENERGY and LiveSmart BC programs). Marked improvement (based on Age of House – Minimum increases). This category promotes energy efficiency and improved comfort with Action Items intended to push your project beyond Energy Code minimums.

**Section Four: Health and Indoor Air Quality** —Action Items in this category include selected practices to improve indoor air quality and reduce health risks for occupants and installers. (*List of all sealants, paints, cleaning agents and adhesives used in construction – listed and added to checklist* )

**Section Five: Materials Efficiency** —Numerous options help you reduce jobsite waste, saving both you and your customer money. In addition to using materials efficiently, this section offers recognition for using a variety of “green” building materials that are easier on the environment.

**Section Six: Promote Environmentally Friendly Homeowner O&M** —The Built Green™ program recognizes the importance of making certain the Built Green™ home *stays* green by providing a Homeowner’s Information Kit that gives new homeowners tips, suggestions, and instructions for maintaining their green home. Provide BG checklist (including IAQ product list) with Reno Manual.

# Requirements: Build to “Green” Codes and Regulations

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This category includes Action Items required by code. This section acknowledges—and lets your clients know—that you routinely follow construction codes and regulations that require environmentally friendly practices and products.

## R-1 Meet Water Use Efficiency Standards or Local Building Codes whichever is more stringent ★

Meet water use efficiency standards. (*Section Two: Site and Water*, has a subsection dedicated to Water Protection that contains additional Action Items to conserve water.)

## R-2 Meet Applicable Stormwater/Site Development Standards ★

Meet applicable provincial and local stormwater controls and site development requirements. (*Section Two: Site and Water* contains additional Action Items that go beyond regulation or represent best management practices.)

## R-3 Meet Energy Code ★

Meet Energy Code requirements. (*Section Three: Energy Efficiency* provides Action Items that go beyond code.)

## R-4 Meet Ventilation and Indoor Air Quality Code ★

Meet ventilation and indoor air quality code. (*Section Four: Health and Indoor Air Quality*, provides Action Items that go beyond code.)

# Section One:

## Built Green Team

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Building green requires a new approach to the design and construction of homes, using existing technologies and new products, equipment and techniques. Making the transition from conventional construction to green building involves learning some new skills and approaches. As a contractor or subcontractor climbs this learning curve, their efficiency at implementing green building strategies improves.

### BUILT GREEN TEAMS

1-1	Use sub-contractors, vendors and service providers who are Built Green Canada Members in good standing	1 - 10 Points
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Participation in the Built Green™ Program requires a level of knowledge and ongoing education about green building practices. By using Built Green Canada Members on your team, you:

Build your team's capacity to implement Built Green Action Items efficiently;

- Help to improve the quality, timeliness and profitability of your projects
- Create market opportunity for businesses who, like you, have made a commitment to Built Green™;
- Each team participant earns 1 point– e.g. 3 design team members = 3 points for checklist.
- Creation and distribution of IDP plan to all design team members and submission to Built Green for review.

Select contractors, vendors and sub-contractors from the Built Green Canada Member listing on Built Green Canada webpage, [www.builtgreencanada.ca](http://www.builtgreencanada.ca) . Score one (1) point for each Built Green Canada Member on your project team – maximum Ten (10) points.

# Section Two:

## Site and Water

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The Action Items in this section will help you manage the natural resources on your construction site. *Site Protection* items address things you can do during the construction phase. This category includes Action Items that help protect natural features, prevent erosion, sedimentation and water pollution due to stormwater runoff, conserve water, and protect water quality.

*Design Alternatives* are actions that need to be implemented during the important design phase of a project. Included in this category are sustainable design alternatives that make better use of the land, promote safety, and optimize use of the building and site as well as the neighborhood.

The Built Green™ program is particularly dedicated to water conservation. The *Water Protection* category includes items for both outdoor and indoor conservation. Outdoor conservation items include landscape design and installation options and awards points for innovative irrigation choices. The Indoor conservation items encourage going beyond code in selecting fixtures and hot water delivery systems. Items that encourage innovative design, equipment, or operating solutions, and those that eliminate water pollutants complete the category.

### SITE PROTECTION, as and if applicable - REQUIREMENTS

#### 2-1 Preserve and Protect Wetlands, Shorelines and Bluffs during Construction ★

Take all necessary steps to fully avoid negative impacts to wetlands, shorelines, and bluffs during construction.

Wetlands provide essential cover, feeding, nesting and breeding habitat for many species of fish and wildlife. They also provide critical hydrological function by acting as a big sponge, buffering the effects of storms on creeks. This buffering effect allows peak velocities to be reduced during storm events and provides base flows during dry times. Wetlands can also act as a natural recharge area for groundwater.

Protect wetlands from sediment using appropriate best management practices such as compost slope mulching and silt retention berms. Leave a vegetated buffer zone, a minimum of 100 feet wide on each side along streams or other water bodies unless approved plans indicate larger buffers are required. (Check with your local jurisdiction for buffer size requirements.)

Coastal slopes are inherently unstable areas. Careful management of site drainage is probably the most cost-effective approach to minimizing bluff hazards. Even when circumstances dictate significant structural stabilization efforts, such as shoreline bulk heading or re-grading slopes, site drainage remains an essential component of proper management.

Approaching shoreline development in a safe and environmentally sound manner, specifically, dealing with drainage wisely, helps to alleviate impact on beaches and shorelines. This alternative also has fewer environmental consequences compared to extensive shoreline bulk heading or major clearing and grading of coastal slopes.

Numerous federal, province, and local laws affect the use and protection of wetlands and other critical areas. Because of the considerable variation in local regulations, contact your local planning department.

## 2-2 Preserve and Protect Critical Areas during Construction ★

Take all necessary steps to fully avoid negative impacts to designated critical areas during construction.

Numerous federal, province, and local laws affect the use and protection of critical areas. Because of the considerable variation in local regulations, contact your local planning department. – Define critical area Hydro / Barriers around trees, and shrubs.

## 2-3 Install Temporary Erosion Control Devices and Optimally Maintain Them ★

Erosion control best management practices (BMPs) are designed to minimize the loss of soil during construction. Often, as construction projects get underway, BMPs are installed, but not maintained on a regular basis. Check and maintain all BMP strategies regularly to avoid BMP failure. Better yet, put in supplemental BMPs as back up, so you won't have to worry or pay for primary BMP failure.

In large development projects, specific measures for stormwater collection, storage, and treatment are required as part of the permitting process. The following are environmentally friendly approaches for any size development (some are now required by code – for examples, refer to local Standards for Stormwater Management, and any Stormwater Special District Standards.

- Use compost barriers or berms, or silt control fencing at appropriate locations (choose filter fabric with proper porosity and ability to trap sediments for type of soil and its location).
- Install stabilized construction entrance (quarry spall or crushed rock). See Action Item 2-5, *Take Extra Care to Establish and Maintain a Single Stabilized Construction Entrance*.
- Protect adjacent and downstream properties from adverse effects of increased runoff.
- Mulch exposed soils or use plastic sheeting. See Action Item 2-4, *Protect Stockpiled*
- *Topsoil with Mulch or Plastic*.
- Install temporary straw bale erosion and sedimentation control check dams in ditches during construction.
- Inspect all erosion and sedimentation control measures immediately if more than ½" of rain falls in a 24 hour period.
- Compost or hydro seed exposed areas as soon as possible.

Using compost for erosion control is a relatively new application (check with your local code enforcers and stormwater management officials first). Slightly coarse to coarse types of compost are well suited for holding surface soil in place even during heavy rainfall. See Action Item 2-15, *Use Compost to Stabilize Disturbed Slopes*, for more information on using compost.

2-3-1 Added point for documenting erosion control measures and submitting documentation with submission.

1 Point

- Point 2-3-1 added on checklist – an added point for documenting this point – include photos or letter from landscape architect indicating this point has been executed.

## 2-4 Cover Stockpiled Soil with Mulch or Plastic



Stockpile topsoil removed during grading for use during final landscaping. The top layer of soil is the most valuable, and should be separated and used again on site as a top layer in grading planting areas. However, bare soil will erode due to wind and water. Protect stockpiled topsoil from erosion by covering with mulch (preferred) or plastic (less preferred because it can cause rapid runoff) until ready for reuse. Surround all stockpiles with a silt fence or compost berm and inspect regularly for proper coverage or sign of erosion, especially after a large storm. Screen soil to remove debris before redistributing for final grading and landscaping.

Native topsoil is best adapted to the site. Limit importing topsoil as much as possible. “New” topsoil is not adapted to your site and thus cannot offer the same nutrient structure, disease resistance, or hydrologic capabilities.

If you do have extra topsoil remaining after final grading and landscaping, consider mixing it with non-organic and inert material to be used as fill (make sure fill materials are clean). Also you can use it in the construction of slopes, or sell it to homeowners, landscapers, or other businesses for reuse.

Absolutely no topsoil should be disposed of in low areas or wetlands.

2-4-1 Added point for documenting erosion control measures and submitting documentation with submission.

1 Point

Include photos or letter from landscape architect indicating this point has been executed.

## 2-5 Establish and Maintain a Single Stabilized Construction Entrance (Quarry Spall Crushed Rock, or Concrete)



Since construction traffic can help contaminate storm and surface water, establish a single stabilized entrance to minimize potential impact. Properly constructed, a single entrance can reduce compaction on site (see Action Item 2-11, *Limit Heavy Equipment Use Zone to Limit Soil Compaction*).

2-5-1 Added point for documenting erosion control measures and submitting documentation with submission.

1 Point

Include photos or letter from landscape architect indicating this point has been executed.

## 2-6 Install and Maintain Sediment Traps



Sediment traps help prevent nonpoint source pollution by allowing sediment to settle out of stormwater before the water leaves the site. Such traps, see figure 2-2, usually consist of a small pond with overflow spilling over a washed gravel outlet. Additional measures, such as compost berms, straw bale check dams, or gravel bag barriers can also help trap sediment (although these are typically used in combination with a sediment trap or other sediment filtration measure).

2-6-1 Added point for documenting erosion control measures and submitting documentation with submission.

1 Point

Include photos or letter from landscape architect indicating this point has been executed.

Pursuant to provincial regulations, all solid waste, including construction waste generated by contractors, must be disposed of at a proper disposal site permitted by the jurisdictional health department. Demolition waste can be disposed of at a permitted inert/demolition landfill or other landfill that accepts this material. The Built Green™ Program promotes waste reduction and recycling, please see *Section Five: Materials Efficiency*, for more information on ways to reduce your disposal costs. **Tailgate meeting – all parties agree to not bury waste onsite – signed declaration. See Appendix for Letter of Understanding**

2-7 Prohibit burying construction waste



2-8 This Item Number is reserved for future additions to Requirements

## SITE PROTECTION - OVERALL

2-9 Build on an Infill Lot to Take Advantage of Existing Infrastructure and Reduce Development of Virgin Sites

n/a

Not applicable.

## 2-10 Build in a Low Impact Development

n/a

Not applicable.

## Protect Site's Natural Features, as and if applicable

### 2-11 Limit Heavy Equipment Use Zone to Limit Soil Compaction

3 Points

Compacted soils are less able to absorb water, resist plant root penetration, and lack the porosity needed for adequate aeration. As a result, they tend to increase stormwater runoff, which disrupts the natural water cycle and stream dynamics.

Limit compaction of site soils by restricting and clearly marking heavy equipment use areas. Use construction fence to mark off “no go” areas.

On the jobsite, limit all vehicle traffic to designated areas, restrict parking vehicles on site, and arrange for particularly heavy vehicles (concrete trucks, cranes, etc.) to avoid the need for large turn-around areas. If porous pavement is planned for the driveway, that area should be left undisturbed during construction so that the subsoil is not compressed. An alternate access road should be used for construction vehicles. To protect exposed soils from excess traffic, locate equipment storage and job shack areas for easy access.

Integrated Design Process – note on site plan for material locations / drop off / parking / site trailers, site logistics etc.

### 2-12 Preserve Existing Native Vegetation as Landscaping

3 Points

Native vegetation is adapted to the Northwest climate of rainy wet winters and dry summers. Retaining native vegetation in a landscape (rather than removing them and then replanting) also provides excellent erosion, sediment, dust, and pollution control. Finally, native plants are more resistant to naturally occurring disease, insects, and low levels of nutrients, thus reducing the need for fertilizer or pesticides.

During building layout, identify existing native plants, including trees and understory plants that you want to save. Precautions during site preparation include:

- Clear only actual areas needed to install driveways, parking areas, and building foundations.
- Clearly mark areas to be graded on plans and field stake or flag on site.
- Identify or flag non-clearing buffers, open spaces, and setbacks from streams, wetlands, and steep slopes as indicated on plat maps.
- Review site areas to be graded with excavation crew to ensure compliance with preservation plan.
- Fence critical areas, such as tree root zones, to prevent crushing or filling. See Action Item 2-13, *Take Extra Precautions to Protect Trees During Construction*, for more information on protecting trees.

- If trees only (not understory) are designated for protection, hand clearing of understory will help protect tree roots. Be careful, however, when exposing some trees by clearing around them—they may become hazards in strong winds or rain. Check with an arborist.
- Check grading operations frequently to prevent accidental damage to marked areas.
- Never park heavy equipment or store heavy materials under trees. See Action Item 2-11, *Limit Heavy Equipment Use Zone to Limit Soil Compaction*.

**2-12-1 Document existing native vegetation as landscaping**

**1 Point**

- Point 2-12-1 added on checklist – an added point for documenting this point – include photos or letter from landscape architect indicating this point has been executed.

**2-13 Take Additional Precautions to Protect Trees During Construction**

**3 Points**

Whenever possible, it is recommended to consult an arborist to select valuable individual trees for preservation.

Keep all excavations, equipment, and debris away from trees by installing tree protection fencing at least at the maximum extent of the canopy (dripline) – and to as much as twice the diameter of the canopy when possible (this protects the root systems). If you must cut roots, cut as few as possible. Cut them cleanly.

If you remove the tree, get the rootball into a moistened burlap sack as soon as possible and re-bury the roots. (The roots begin to dry out almost immediately. Keeping the roots moist, preferably with the soil intact, helps minimize the impact of transplanting.) Preserve most of the important feeder roots. Whenever possible, protect entire stands of trees.

Post signs on trees to be saved, clearly indicating the tree’s monetary value (cost of replacement). Charge subcontractors for tree damage based on this dollar value (optional).

By moderating surface temperatures, trees reduce building heating and cooling requirements. Specifically, trees can increase savings on energy bills by providing shade in summer and wind protection in winter. Trees also reduce stormwater runoff, reducing urban peak runoff, stabilizing soils, and preventing air pollution. All of which have great economic value to cities. Another benefit from trees is that they provide habitat for local wildlife. Trees may also protect some of your site’s critical features like stream buffer zones. Studies show that a single mature tree can provide nearly \$300 annually in energy and resource value in terms of cooling, erosion and pollution control, and wildlife shelter.

In general, homes with mature trees sell for more money and at faster rates. According to 1,350 real estate agents surveyed by Bank America Mortgage, more than 50% believe trees have a positive impact on potential buyers’ impressions of homes and neighborhoods. Additionally, 84% felt that a home with trees would be as much as 20% more salable. A NAHB survey reported that 43% of home buyers paid up to \$3,000 more, and 27% spent over \$5,000 extra for wooded lots. Another study found that the presence of trees increased property values by 3.5% to 6% (Orland, Vining & Ebreo. 1992, *The Effect of Street Trees on Perceived Values of Residential Property, Environment and Behavior*.)

Studies in some regions of the country have found trees add as much as 30% to the selling price of unimproved lots.

**Table 2-1—Potential Problems Associated with a Few Specific Trees**

Tree Type	Potential Problems/Recommended Strategy
Dogwood Douglas Fir Maple Red Alder Western Hemlock Western Red Cedar	They may not adjust to environmental changes as easily as other species. Keep disturbance of these trees to a minimum.
Pacific Silver Fir	If very tall, they can tip over easily. Watch height.
Douglas Fir Western Hemlock	Thinning increases the possibility of tipping over. Keep stands of these trees dense.
Cottonwoods Maples Willows	Water-seeking roots—These trees thrive well in high moisture areas but keep away from sewer lines and filter fields.
Grand Fir Noble Fir Pacific Dogwood Pacific Silver Fir Red Alder Sitka Spruce Western Hemlock Western Red Cedar	Keep stands of these trees dense, whether one type or mixed varieties. These trees are very prone to disease caused by thinning or damage to any part of the trees.

**2-14 Set Aside a Percentage of Site to be Left Undisturbed**

**3-6 Points**

This Action Item requires that you set aside a percentage of the site that will not be cleared or graded, as follows (3 points for achieving the percentage appropriate for your size lots):

- For lots less than 0.25 acre—10%
- For lots up to 1 acre—20%
- For lots between 1 and 5 acres—35%
- Not applicable for lots larger than 5 acres
  - **Double Points:** if you double the set-aside percentages on the lot you can double your points (6 points total):
- For lots less than 0.25 acre—20%
- For lots up to 1 acre—40%
- For lots between 1 and 5 acres—70%

- Not applicable for lots larger than 5 acres

Setting aside undisturbed areas helps preserve soil, water, and vegetation. Undisturbed areas stabilize soils and filter sediments from stormwater runoff before they enter waterways. They also allow rainwater to stay on site and soak into the ground, recharging groundwater, instead of running off site. In addition, they provide a cost-effective head start on landscaping.

Coordinate with the grading designer and equipment operators to let them know about this goal and to help you come up with creative solutions. Preserving natural features can add landscape beauty, enhance fish and wildlife habitat, and reduce noise. To ensure the benefit of this measure, set aside areas should be protected by covenant.

Review the set aside plans with subs, especially grading and excavation crews and make sure they are clearly marked off.

## Protect Natural Processes On-Site

### 2-15 Use Compost to Stabilize Disturbed Slopes

1 Point

Soil left exposed on slopes will erode. Research has shown that compost can often outperform conventional slope stabilization methods.

Grade the slope to a ratio no steeper than 2 horizontal to 1 vertical, or terrace steeper slopes with retaining walls. Apply compost to cover the entire exposed soil surface, extending approximately 3 feet over the top of the slope or meshing into existing vegetation. The compost application rate will vary depending upon degree of slope, soil type, and compost characteristics. As a rule of thumb, however, a 3-to 4-inch layer of compost will effectively control erosion on a slope of up to 45% for between one and three years.

Composts containing particles that range in size ( $\frac{1}{2}$ " or greater) will produce a more stable mat. Stable, relatively dry yard trimmings compost will also filter and bind pollutants from stormwater, reintroduce organic material, and enhance water retention/infiltration. Avoid very coarse composts if the slope is to be landscaped or seeded. In environmentally sensitive areas or where water quality is concern, use only compost made from yard trimmings, uncontaminated wood by-product based materials, or well-stabilized biosolids.

#### 2-15-1 Document compost on disturbed slopes

1 Point

- Point 2-15-1 added on checklist – an added point for documenting this point – include photos or letter from landscape architect indicating this point has been executed.

### 2-16 Balance Cut and Fill, while Maintaining Original Topography

3 Points

Minimizing or balancing cut and fill avoids expensive exporting or importing of topsoil. If you need to import fill to the site, use only approved materials for filling and grading. It is important to avoid radically altering the basic topography of the site so that you don't get into a situation where the changes alter existing water functions.

**2-17 Limit Grading to Within 20 ft Outside Building Footprint****3 Points**

Soil that is compacted or contaminated by construction activity may become lifeless (see Action Item 2-11, *Limit Heavy Equipment Use Zone to Limit Soil Compaction* and Action Item 2-5, *Take Extra Care to Establish and Maintain a Single Stabilized Construction Entrance*). Designing for minimal grading helps retain healthy soil and natural water infiltration processes. Where grading is unavoidable, carefully remove and stockpile existing topsoil (see Action Item 2-4, *Protect Stockpiled Topsoil with Mulch or Plastic*), replacing it after rough grading.

Where possible, protect “no go” areas with construction fencing. Avoid disrupting existing drainage patterns and in general minimize grade changes where possible. Grading for stormwater control should direct water to planted areas to minimize irrigation needs. Steep slopes may benefit from terracing and retaining walls.

**2-18 Preserve Topsoil in Place****3 Points**

Preserving topsoil in place, without compaction, grading, or excavation and replacement will maintain and preserve soil health and stormwater infiltration of the site both during construction and after completion of the project (see Action Item 2-11, *Limit Heavy Equipment Use Zone to Limit Soil Compaction*).

Where grading is unavoidable, carefully remove and stockpile existing topsoil (see Action Item 2-4, *Protect Stockpiled Topsoil with Mulch or Plastic*), replacing it after rough grading.

**2-19 Grind Landclearing Wood and Stumps for Reuse On-site****3 Points**

For builders working on multiple sites or large developments, grinding landclearing wood waste can be a cost-effective way to reduce jobsite waste and provide opportunities to reuse the material as mulch (on site or at other locations). Mulch can renew the soil by improving water and nutrient retention and can also be used to protect stockpiled topsoil. See Action Item 2-4, *Protect Stockpiled Topsoil with Mulch or Plastic*.

**2-20 Amend Disturbed Soil to a Depth of 8 to 10 Inches to Restore Soil Environmental Functions****5 Points**

Preferably, have the soil tested by a reputable soil lab to get data about the site soil’s chemical and physical condition, as well as its biological health. These labs will provide specific recommendations for optimum soil amendment. Amendments may include sand or gravel for improved drainage, lime or other pH modifiers, or organic manure or compost to improve nutrient availability. Compost amendments reduce summer irrigation demand, reduce stormwater runoff and erosion, improve soil quality, and improve turf aesthetics.

Compost should be mature and stable. Ask your supplier for “Grade A” compost. Mature composts settle less, provide stable nutrient sources, and also provide higher levels of beneficial organisms.

As a rule of thumb, a 2 to 1 ratio of existing soil to compost, by loose volume, will achieve the desired organics level of 8 to 13% by soil weight. The final depth of the amended soil will be between eight and ten inches, depending upon the equipment you use.

For typical subsoil, this means approximately 13 cubic yards per 1,000 square feet. If instead you start with four inches of healthy native topsoil, you will need only about 7-3/4 cubic yards per 1,000 square feet. You will achieve best results using 7/16-inch well-degraded compost. (It is very important to thoroughly mix the compost into the native soil in the turf areas.)

## 2-21 Replant or Donate Removed Vegetation for Immediate Reuse

3 Points

Plants and trees to be removed for construction can often be reused for landscaping on site. Replant as soon as possible and make sure you follow appropriate procedures so plants survive. If you can't replant immediately, protect the root ball while waiting to replant (See Action Item 2-12, *Preserve Existing Native Vegetation as Landscaping*, and 2-13 *Take Additional Precautions to Protect Trees During Construction*.)

Local Conservation offices may also be able to use native vegetation that you cannot. Some nurseries participate with local organizations involved in restoration projects.

## 2-22 Use a Water Management System That Allows Groundwater to Recharge

5 Points

Groundwater is a resource that may have only minimal direct impact on a particular site, but its purity is an important issue downslope where it seeps to the surface or is pumped out of the ground as potable water. Groundwater is "recharged" from surface waters infiltrating into natural recharge areas. It is important to understand the hydrology of your site so as not to interfere with these areas.

In addition to preserving groundwater recharge zones, there are techniques that can reestablish proper water functions that may have been disrupted during site development. Landform engineering is the term used for techniques that use the natural movement of water while manipulating and enhancing existing topographic conditions to improve a site's ability to catch, hold, and absorb water, mimicking natural drainage features. Water storage and nutrient collection processes contribute to forming a healthier ecological community within the landscape. This process allows water to infiltrate into the ground and enrich the life of the soil ecology. Examples of landform engineering that can contribute to a water management system include: mulching, contour trenches, swales and terraces, check dams, dry wells and sand traps, retention basins, and diversion ponds.

Other alternative strategies include roof infiltration systems, level spreaders, and rainwater storage vaults or dispersion systems. These systems can be used alone or in combination to put runoff back in the ground through infiltration or dispersion through natural vegetation. Avoid directing runoff directly to a natural or constructed drainage system and keep your runoff and sediment on site.

## 2-23 Design to Minimize Stormwater Impacts. Achieve Effective Impervious Area. Less than 5 Acres = 10%, 5 Acres and Above = 0% - square feet of property.

5 Points

The goal of this strategy is to *reduce* the total stormwater runoff due to impervious surfaces on the site.

**EFFECTIVE IMPERVIOUS AREA:** It is critical to distinguish between *total* impervious area and *effective* impervious area:

- Total impervious area comprises surfaces that do not allow infiltration of stormwater runoff into the ground. Such surfaces include conventional roofs and conventional paved driveways, sidewalks, and streets.
- An impervious surface is only *effective* if the rain running off the surface has no chance to infiltrate into the ground before it reaches a pipe, ditch, or other conveyance system. Once the water enters a conveyance system it is usually headed straight to the nearest stream, lake, or other water body. It may be temporarily detained in a pond or vault along the way, but this only changes the timing of the extra runoff. The extra stormwater still reaches and impacts the aquatic system.

Impervious surfaces can be made *ineffective* by allowing (or encouraging) infiltration of the runoff from these surfaces into the ground before the runoff reaches a conveyance system. Strategies to *reduce* the total stormwater runoff due to impervious surfaces include:

- Building “up” rather than “out.” For example, adding a bonus room over an existing garage. Adding structures above existing ones, rather than at ground level, results in zero net increase to the total impervious surface.
- Change the landscape/site design so that runoff is effectively spread over large vegetated areas.
- Reducing total impervious surfaces overall. You can do this by avoiding paved walkways, drives, or other impervious surfaces and replacing them with pervious surfaces (See Action Item 2-24, *Use Pervious Materials for at Least One Third of Total Area for Driveways, Walkways, and Patios*) or by replacing a conventional roof with a vegetated roof. (See Action Item 2-26, *Install Vegetated Roof System (e.g. Eco-Roof) to Reduce Impervious Surface.*)

<b>2-24 Use Pervious Materials for at Least One Third of Total Area for Driveways, Walkways And Patios</b>	<b>5 Points</b>
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Pervious paving materials may initially cost more than conventional paving materials (such as asphalt), but pavement replacement is simplified, and expensive measures such as asphalt cutting for underground repairs are eliminated. More importantly, pervious paving materials help to maintain the water hydrology of the site. Examples of permeable options include:

- Porous or “No Fines” concrete or asphalt (properly specified)
- Uncompacted gravel (Note 1)
- Crushed stone (Note 1)
- Open or porous paving blocks
- A “Hollywood” driveway design (Note 2)

Notes:

1. Gravel or crushed stone is not considered pervious for driveways or parking areas, as these materials will generally compact under vehicle traffic, unless it is reinforced with a plastic, cellular containment product. Use gravel and crushed stone for walkways and other light traffic areas.

2. A “Hollywood” driveway consists of only two long strips of pavement where the car wheels need support. The area between should be vegetated (preferably with a low-grow turf, like a fescue) or filled with gravel. Vegetated strips provide some infiltration of runoff, sediment filtering, and pollutant removal.

Disconnecting impervious surfaces on site is as important as the materials you select. Avoid situations in which one impervious surface drains onto another impervious surface, which magnifies stormwater runoff problems. A paved driveway, for example, should not drain onto a paved street. Try to separate impervious surfaces with areas of turf, other vegetation, or gravel. Curbs should be avoided, and the paved surfaces should be even with the vegetated filter strip. Filter strips should slope (no more than 5%) downhill away from the paved surfaces. Grass should be planted if these strips are to be used as part of the stormwater conveyance system, if not, any ground cover can be used (groundcover should be dense enough to discourage channelizing and erosion).

<b>2-25 Use an Alternative Foundation System to Minimize Disturbance to Soil and/or to Water Flow</b>	<b>5 Points</b>
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Excavation and movement of heavy equipment during construction can compact and degrade the ability of soil to infiltrate and store stormwater. Alternative foundation systems minimize soil disturbance both around and beneath a building footprint. This allows stormwater to infiltrate and follow natural, shallow subsurface flow paths. Applicability and installation requirements for the site should be determined by a qualified engineer.

<b>2-26 Install Vegetated Roof System (e.g. Eco-Roof) to Reduce Impervious Surface</b>	<b>5 Points</b>
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Eco-roofs or green-roof systems are best suited for low-slope roofs. They are designed to protect the roof and permit the use of rooftop plantings. More commonly used in Europe, green-roofs can detain over 50% of rainwater from a typical storm. Stormwater detention reduces the often-high loads placed on sewer systems after a rainfall.

Multi-layered green-roof systems are thicker than conventional roofs. Space must be allocated for the unusual insulation and roofing membranes. A green-roof includes a synthetic waterproof membrane, a drainage layer, a thin soil layer (2 to 4 inches), and a cover with specific plant species adapted to the extremes of a rooftop environment. A thick sod of native grasses interspersed with wildflowers can be a wonderful architectural element.

The green-roof can be very low maintenance, and is self-sustaining without need of irrigation, fertilizers, or pesticides. The first cost may be about 50% more than a good quality conventional roof, but they last about twice as long so they have a relatively low life cycle cost. They also help to reduce building heat gain and urban heat islands (temperature differences between developed and undeveloped areas that can affect the microclimate and human and wildlife habitat.). Additionally, the plantings absorb carbon dioxide.

**Table 2-2— Comparisons of Eco-roofs and Conventional Roofs** (Source: Tom Lipton, *Spawning Great Ideas Proceedings*).

Characteristic	Eco-roof	Conventional Roof
Stormwater		
Retention	15 to 35% in wet season, 65 to 100% in warm season	None
Peak flow mitigation	All storms	None
Temperature mitigation	All storms	None
Improves water quality	Yes, retains atmospheric deposition and retards roof material degradation	No
Air Quality	Filters air, prevents temperature increases, stores carbon	None
Energy Conservation	Approaches predevelopment air/surface energy relationship; insulates structures	None
Vegetation	Allows seasonal evapo-transpiration; provides photosynthesis, oxygen-carbon-water balance	None
Greenspace	Can replace 100% of greenspace lost to building footprint, although some greenspace quality may be lost	None
Habitat	For some insects and birds	None
Livability	Buffers noise, eliminates glare, alternative aesthetic, offers passive recreation	None
Costs	About 30 to 60% more expensive for construction including retrofits	Highly variable from \$2 to \$10/ft <sup>2</sup> for new construction and \$4 to \$5/ft <sup>2</sup> for retrofits
Cost off-sets	Energy savings, potential for higher rental value, sewer fee reductions, reduced need for insulation materials, reduces waste to landfills	None
Durability	Waterproof membrane protected from solar and temperature exposure, lasts more than 36 years, membrane protected from O&M staff damage	Little protection, exposure to elements, lasts less than 20 years
Maintenance	Once or twice a year to tend plants, once a year to assure drains are not clogged and check for damage from O&M	Once a year to assure drains are not clogged and check for damage from O&M

**2-27 Construct No Additional Impervious Surfaces Outside House Footprint**

**10 Points**

Use pervious materials for all surfaces outside the house footprint. See Action Item 2-24, *Use Pervious Materials for at Least One Third of Total Area for Driveways, Walkways, and Patios*, for examples of materials that can be used for typically paved areas.

## Eliminate Water Pollutants

### 2-28 Take Extra Precautions to Not Dispose of Topsoil in Lowlands or Wetlands

2 Point

**Preserve and protect all topsoil. See Action Item 2-4, *Protect Stockpiled Topsoil with Mulch or Plastic*.** Disposing of topsoil in lowlands or wetlands threatens water quality and quantity and endangers wildlife habitat.

### 2-29 Wash Out Concrete Trucks in Slab or Pavement Subbase Areas

2 Point

Wash out concrete trucks and pumps in slab or pavement subbase areas, such as driveways, where you are not using pervious materials, so slurry can be contained and will be useful.

Alternately, use a vendor-provided wash-out tray, enabling the recycling of surplus concrete. Over the life of a project one to three yards of concrete slurry and lime can be generated from washing out concrete trucks. Cementitious runoff can contaminate the site, harm local waterways and fish, reduce conveyance capacity of surrounding stormwater systems, plug infiltration facilities, and contaminate treatment facilities.

### 2-30 When Construction is Complete, Leave No Part of the Disturbed Site Uncovered or Un-stabilized

1 Point

All disturbed areas should be treated in some way with landscaping, site features, or erosion control devices.

Bare soil will erode due to wind and water. Seed, replant, or cover exposed soils with compost, mulch, vegetation, and/or matting as soon as practical. Use wildflower seeds appropriate for this region for color and interest, such as along driveways. .

### 2-31 Recycle Antifreeze, Oil, and Oil Filters at Appropriate Outlets

1 Point

Used antifreeze, oil, and oil filters are readily recycled by a number of companies. Recycling is always preferable to disposal in a dumpster. Definitely DO NOT pour any of these materials into a drain (especially if connected to a septic system), onto the ground or in water – *it's illegal*. Remember it's also against the law to reuse oil as a dust or weed suppressant.

Keep these wastes separate: mixing them with other wastes or products will render them non-recyclable.

## 2-32 Dispose of Non-Recyclable Hazardous Waste at Legally Permitted Facilities

1 Point

In addition to using private companies providing legal waste management services, SQGs can self-transport their wastes to a permitted facility (other generators must contract to have their wastes picked up), and they don't need to fill out as much paperwork as larger generators. Contractors who qualify as SQGs may be eligible to dispose of their hazardous wastes at collection sites operated by local governments. This option can be less expensive. Information about local programs can be obtained from local governments.

## 2-33 Establish and Post Cleanup Procedures for Spills to Prevent Illegal Discharges

1 Point

Requirements for cleaning spills or releases vary with the material. Become familiar with cleanup procedures for the materials you use regularly. Included in your Clean-up Procedures should be components of a safety program, which considers the range of potential spills and establishes appropriate emergency actions.

Make sure everyone, especially subcontractors, is aware of your procedures by posting them prominently in a central location and referring to them regularly during safety meetings.

## 2-34 Reduce Hazardous Waste Through Good Jobsite Housekeeping

2 Points

Eliminating sources of hazardous waste by using good housekeeping and non-hazardous alternatives is the best way to curb your hazardous waste generation, reduce costs associated with disposal, and avoid potential liability. If you cannot find a less toxic or non-toxic substitute and still need to purchase a hazardous product, use care in purchasing and managing the product. Here are some ideas:

- Avoid overstocking hazardous materials. Dated materials become hazardous waste.
- Adopt a "last in / first out" policy to prevent raw materials from becoming obsolete.
- Label hazardous waste containers properly to avoid mixing incompatible wastes or contaminating clean materials.
- Keep excess material in original containers. Any leftover excess not able to be reused – donate. Receive documentation – provide for proof of credit
  - Control access to storage areas and routinely inspect containers.
  - Inspect containers upon receiving. Reject leaking or damaged containers. These can lead to a hazardous materials spill.
  - Promptly respond to spills and know response procedures ahead of time.
  - Maintain vehicles and equipment at a central location, preferably in a garage or maintenance facility. Keep vehicles tuned and leak-free. Fluids removed from vehicles should be recycled or disposed of at an approved facility.

### **2-35 Provide an Infiltration Trench and/or Raingarden for Rooftop Runoff 3 Points**

If not already required by code, provide an individual downspout infiltration system, which is designed to receive only stormwater from roof downspout drains (not from paved areas).

Trench length should not exceed 100 feet from the inlet sump. Be sure to provide an overflow device, and it is recommended you include an observation well to allow the owner to monitor the performance of the system.

Infiltration systems are only as good as the soils they are built in. In tight soils a larger “raingarden” might be required. A raingarden (or Bio-retention cell) is a shallow landscape depression with a designed soil mix and plants adapted to the local climate and soil moisture conditions that will receive stormwater from a contributing area. This approach uses healthy soil structure and vegetation to promote infiltration, storage and slow release of stormwater flows.

Ask your architect or engineer about the applicability of infiltrating roofwater in your soil type.

### **2-36 Establish and Post Clean-Up Protocol for Tire Wash and Construct Wash Facility On-site if Necessary 2 Points**

- Post tire wash protocol for all trades or field labor using vehicles on site. If you need to construct a tirewash, a pressure hose wash down area minimizes water consumption and runoff, and results in better cleaning. Drive-through troughs, while more convenient, tend to be less effective and consume more water. Designate and mark the wash area well.
- Provide hose or pressure washer with no lock on trigger to prevent water from being left running.
- Restrict the size of the wash area to no larger than the largest vehicle.
- Where needed, require biodegradable detergents. Detergents or cleaners containing phosphate are prohibited. Minimize quantity of soap, detergents, or other chemicals used.

In addition, pave and drain the area to an oil-water separator if it is connected to the sanitary sewer, or direct tire wash water to other sediment trap or pond. Provide temporary gravel base on site to keep vehicles clean.

### **2-37 Use Slow-Release Organic Fertilizers to Establish Vegetation 2 Points**

Studies have shown that a majority of the phosphorus entering local waterways is coming from single-home residential areas. The primary source for this contaminant is fertilizers and soil wash-off. Excess nutrients promote algae blooms, which in turn threatens fish and aquatic life. Moderate fertilization with natural or natural/synthetic slow-release combination fertilizers will help build soil nutrient reserves and biodiversity without contaminating waterways.

### **2-38 Use Less Toxic Form Releasers 4 Points**

Forms are commonly coated with fuel oil to prevent the concrete from sticking to the form. Runoff, incidental drips, and spills contaminate soils and may enter storm drains thereby contaminating

surface water. Use less toxic form releasers or strategies, such as “kick-hard,” vegetable oil spray, or waxing or painting the forms prior to use.

**2-39 Use Non-Toxic or Low-Toxic Outdoor Lumber for Landscaping (e.g. Plastic Lumber or Low Toxic Treated Wood) 2 Points**

Using non- or low-toxic materials in the landscape helps preserve soil and water quality. Examples include low-toxic wood preservatives (such as borate), naturally rot-resistant woods, and plastic lumber (preferably with recycled content). Alkaline Copper Quaternary (ACQ) treatment does not qualify for this Action Item. Railway ties / creosote treated are not applicable for use.

*See Section Five: Materials Efficiency Action Items 5-77, Use Reclaimed or Salvaged Material for Landscaping Walls, decks and patios, 5-78, Use Recycled-Content Plastic or Wood Polymer Lumber for Decks and Porches, and 5-79, Use Non-Toxic or Low-Toxic Pressure-Treated Wood.*

**2-40 When using shake roofing, Avoid the use of CCA-treated wood shake roofing 2 Points**

Lumber treated with chromated copper arsenate (CCA), an inorganic, waterborne preservative, has been phased out of production due to health concerns associated with chemicals leaching out of the wood. However, CCA-treated roofing shakes are still available. They are to be avoided, due to concerns that chemicals leached from these shakes will be carried in roof runoff, possibly leading to contamination of surface and groundwater.

**2-40-1 Absolutely no use of CCA-treated wood shake roofing in entire renovation 3 Points**

Lumber treated with chromated copper arsenate (CCA), an inorganic, waterborne preservative, has been phased out of production due to health concerns associated with chemicals leaching out of the wood. However, CCA-treated roofing shakes are still available. They are to be avoided, due to concerns that chemicals leached from these shakes will be carried in roof runoff, possibly leading to contamination of surface and groundwater.

**2-41 Follow Seasonal Landclearing Worksheet prescription for seasonal land clearing between October 1 and April 30 3 Points**

The Seasonal Landclearing Worksheet is designed to assess the potential for land clearing on your site to have a negative impact on water quality through the off-site transport of sediments and other pollutants from your site. Even if your site lies outside designated protected watersheds, any landclearing activities will have an impact on water quality downstream of your site. By completing a Seasonal Landclearing Worksheet prior to planning your project, you can determine if it is

appropriate to do land clearing on your site in the “off season” and what water quality protection measures you should take.

Based on your score, follow the prescribed requirements for your site, which may include developing and submitting a Erosion and Sediment Control Plan, and implementing a range of best management practices to prevent erosion and protect water quality.

A copy of the Worksheet can be found in the Appendix of this User Guide.

<b>2-42 No Zinc Galvanized Ridge Caps, Copper Flashing, Copper Wires, or Copper/Zinc Impregnated Shingles/Shakes For Algae/Moss Prevention (Action Item 2-73 also required)</b>	<b>2 Points</b>
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Zinc galvanized ridge caps, copper flashing, copper wires, and shingles impregnated with copper or zinc granules are sometimes installed on roofs to discourage moss and other growth. However, they are of environmental concern because the zinc and copper will leach from these products into stormwater. Once a part of the water cycle, they can accumulate to toxic levels in the food chain. See Action Item 2-73, *Educate Homeowners about Fish-Friendly Algae/ Moss Control*.

Moss and Algae can most effectively be removed using a stiff corn broom on a hot summer day. Avoid the use of pressure washers to remove moss and algae, since these can damage shakes and shingles, reducing their effectiveness and service life.

## Design Alternatives

*Section Under Development – Action Items 43 thru 53 – still under development as of this update for Built Green™ Renovation Guide*

# WATER PROTECTION

## Outdoor Conservation

Although outdoor water use varies widely from site to site, on average it accounts for about 50% of residential water use. However, proper selection of plants and turf, landscape arrangement, irrigation equipment, use of soil amendments, and irrigation scheduling can dramatically reduce outdoor water use. Along with indoor conservation measures, outdoor water conserving features can help reduce daily water use from an average of 80 gallons per day (gpd) to 50 gpd.

### 2-54 Mulch Landscape Beds with 2 Inches of Organic Mulch 1 Point

If the new landscape isn't already densely planted, mulching is the next best solution to reduce the number of weeds and make weed removal easier, which in turn, helps to minimize herbicide use. In addition, mulching provides additional soil nutrients, increases the capacity of the soil to retain moisture, moderates soil temperature, and limits soil erosion.

Non-woody mulches, compost, cut grass clippings, or leaves are best for annuals. Woody mulches, such as wood chips or bark, work best with perennials. However, limit the use of bark mulch as much as possible, and never use in areas that drain directly into storm sewers or open water. Bark produces a toxic leachate that can end up in water supplies.

### 2-55 Use only Bark-free Mulches 2 Points

Use no bark mulch products in landscaping. Bark produces a toxic leachate that can end up in water supplies.

### 2-56 Use Grass Type Requiring Less Irrigation and Minimal Maintenance 1 Point

When planting a new lawn, select a grass mix that is suitable for the sun conditions and the lawn's intended use, and grows slowly, requiring less frequent mowing. Use locally adapted rye-fescue seed blends. Be aware that tall and other fescue grasses can be drought-tolerant if given a deep soil culture for their long roots – they need more water if planted in shallow soil. Mixes containing clover, bentgrass, yarrow, chamomile, and English daisies are another option where an informal-looking lawn fits the landscape. These mixes are extremely drought-tolerant and offer a delightful variation from traditional lawns.

Regardless of the type of grass you choose, always plant densely. Thick, dense, and thatchy well-established lawns absorb and infiltrate rainwater better than thinly planted plots. (Soil conditions can significantly affect lawn establishment. See also Action Item 2-57, *Use Compost Soil Amendments to Establish Turf and Other Vegetation with Less Irrigation.*)

**2-57 Use Compost Soil Amendments to Establish Turf and Other Vegetation with Less Irrigation** **3 Points**

Whether you seed or sod, all turf installations perform better when at least 2 inches of compost is tilled into the upper six inches of soil. Twelve inches is better for deep rooted, drought-tolerant grasses. (See *Section Two: Site and Water*, Action Item 2-20, *Amend Disturbed Soil to a Depth of 8 to 10 Inches to Restore Soil Environmental Functions*.)

**2-58 Limit Use of Turf Grass to 25% of Landscaped Area** **3 Points**

Design turf areas where they will be functional and well adapted to the site. Specifically, place turf in areas expected to be used for walking or playing. Lawns work well in sun to light shade, with well-drained soils and on level to slightly sloped areas. Don't plant lawns in heavy shade or in areas with saturated soils or heavy slopes. Always keep turf away from the water's edge because of the increased likelihood of chemical contamination, because it reduces habitat and shading for wildlife, and because of the possible increase in erosion potential. Finally, design the lawn in a shape that can be efficiently watered, in other words, it matches the design of available irrigation systems. For instance, an oval shape can accommodate sprinkler sprays or pop-up irrigation sprays.

**2-59 No Turf Grass** **10 Points**

Although turf grass is a traditional component of residential landscaping, it is not necessary for a beautiful and luxurious landscape. In fact, a landscape that uses existing vegetation along with well-constructed new plantings can offer a beautiful, low-maintenance alternative to the "traditional" fare.

As an alternative to turf, consider constructed landscapes that mimic ecological habitat models that can decrease life cycle maintenance costs, enhance wildlife survival, and blend edges of adjoining existing vegetation. To mimic ecological habitat models, emulate natural succession by planting larger deciduous trees with smaller conifers to gradually develop canopy. Deciduous trees generally perform better in south-facing areas, while conifers are better suited near streams or on the north side of the plot. See the Resource Section for Action Item 2-50, *Landscape with NATIVE Plants*, for suggestions on working with native alternatives.

Other turf alternatives include a variety of groundcovers, hardscape materials, including, nut shell casings or other natural materials, or stone gardens (see Picture 2.1).

**2-60 Landscape with Plants Appropriate for Site Topography and Soil Types, Emphasizing Use of Plants with Low Watering Requirements** **5 Point**

In the summer, up to 50% of the water used by municipal systems is for outdoor irrigation. The increased demand in summer comes at the same time reservoir and stream levels drop and precipitation dramatically decreases, putting tremendous pressure on local water supplies. Examples of landscaping techniques you can use that will result in low water use include:

- Use established vegetation (see Action Item 2-12, *Preserve Existing Native Vegetation as Landscaping*, for more information)

- Limit turf areas, choose appropriate turf types and plant in suitable areas (see Action Item 2-58, *Limit Use of Turf Grass to 25% of Landscaped Area*)
- Cluster plants with similar water needs (“water-use” zones)
- Plant native species that will adapt well to the site
- Plant species from other geographic areas with similar climates
- Plant certain species from Mediterranean climates (check with your local nursery for ideas).

The Northwest has hundreds of beautiful plants that require very little water once they are established. Ask your local nursery or landscaping contractor for information about the water efficient trees, shrubs, perennials, and ground covers they supply. Keep in mind that some low water use plants may have certain needs, such as shade, which when not met can lead to increased water use.

### 2-61 Landscape with NATIVE Plants Appropriate for Site Topography and Soil Types, Emphasizing Use of Plants with Low Watering Requirements 2 Points

Constructed landscapes that mimic ecological habitat models can decrease life cycle maintenance costs, enhance wildlife survival, and blend edges of adjoining existing vegetation. To mimic ecological habitat models, emulate natural succession by planting larger deciduous trees with smaller conifers to gradually develop canopy. Deciduous trees generally perform better in south-facing areas, while conifers are better suited near streams or on the north side of the plot. Use native plants in the constructed landscape that are:

- Diverse in color, form, and texture offering a wide variety to fit any design
- Adapted to our climate – rainy wet winters and dry summers. After initial one to two seasons of irrigation, many native plant species become established and require little to no irrigation
- Adapted to our naturally occurring low levels of nutrients
- Resistant to local insects and diseases, which allow for minimizing fertilizer and pesticide use
- Native to provide habitat for local wildlife.

### 2-62 Landscape fire buffer around buildings using native species that are fire resistant 2 Points

If your site is located in a area of lower-density development with large amounts of natural vegetation, create an effective defensible space around the home, using appropriate landscaping materials and layouts.

Contact your local Fire Department for guidance.

**2-63 Work with Master Gardener Volunteer to develop landscape design and implementation plan for 2-60, 2-61 and/or 2-62**

**1 Point**

The Master Gardener Program is a public service program that provides training to volunteers for the purpose of enabling them to serve their communities through horticulture.

Master Gardeners are trained volunteers who serve as educators in their communities. The Master Gardener program is located at regional botanical gardens to better serve the public—specifically home gardeners

Master Gardener Volunteers can provide valuable assistance with the selection, layout and installation of plants to ensure good survivability, low maintenance and minimal watering requirements.

For more information, contact the Master Gardener Program, <http://www.mastergardeners.org>.

**2-64 Rough-in Plumbing to Capture Graywater for Reuse/Irrigation**

**4 Points**

Graywater is all water generated in the house, except from toilet flushing. Sometimes referred to as “reclaimed” or “recycled” water, this includes water from laundries, showers, and sinks. Graywater can be collected and stored for reuse as a nutrient-rich irrigation source, which conserves water. To use graywater, a dual plumbing system must be installed to separate it from blackwater, which is wastewater generated from toilet flushing.

Graywater systems are currently treated as an “exception” to the code. Systems are approved, on a case-by-case basis as “experimental” systems, requiring compliance with stringent local and provincial regulations. If approved, graywater irrigation systems are generally required to be subsurface, although some local jurisdictions permit aboveground irrigation. Factors affecting the approval and use of graywater irrigation systems include soil depth and characteristics as well as drainage and flooding patterns. Other guidelines include setbacks for graywater irrigation lines from property or potable water line.

Note: If you choose to plumb for gray water irrigation, you should also consider providing plumbing to use graywater for toilet flushing (see Action Item 2-75, *Include Innovative Design, Equipment, and Operation Solutions to Conserve Water and Reduce Impact on Water Resources*).

**2-65 Install Rainbarrels to Store Rainwater for Reuse**

**2 Points**

Rainwater collected from the roof is a free source of landscape irrigation water. Rainbarrels should be located under downspouts that serve the largest areas of roof. Rainwater should be screened before it enters the barrel to prevent build up of leaves and other matter. Barrels should have an overflow piped to a raingarden or infiltration trench (See Action Item 2-35: *Provide an infiltration trench and/or raingarden for rooftop runoff*).

Rainbarrels may be used for manual watering, or connected to a drip or trickle irrigation system.

## 2-66 Install Rainwater Collection System (Cistern) for Reuse

10 Points

Rainwater collected from the roof is a free source of landscape irrigation water. Rainwater can also be harvested from soil surfaces and outdoor paved surfaces. While rainwater collection is allowed in some jurisdictions, this measure covers only systems used for irrigation. Let the homeowner know the rainwater supply is *not* intended for potable use (in other words, is *not* for drinking). (Rainwater collection for *potable* water use requires case-by-case approval and compliance with stringent local and provincial health regulations.)

A rooftop rainwater collection system consists of a suitable roof and guttering system, a storage tank(s), and a simple filtration system. The irrigation system can be supplied using the tank(s) and a small-scale pressurized pump system (see Action Item 2-67, *Install Irrigation System Using Recycled Water*).

*For collecting rainwater from roof areas:*

- Use appropriate roofing materials such as metal, tile, or fiber cement. Lead-containing materials, such as flashing, should not be used in catchment roofs. Likewise, ensure that no zinc galvanized ridge caps, copper flashing, or copper wires for moss prevention are used. Asphalt composition roofs should not be used for collecting water for watering any food producing plants.
- Construct cistern or tank storage sized for the rainfall amount and roof size, with appropriate overflow devices. Cisterns can be made of concrete, ferro-cement, stone, or prefabricated metal, plastic, or fiberglass. Use only watertight, opaque materials and provide a cover.
- Provide an overflow route to direct excess flows away from building and in such a manner as to avoid impact to downstream properties.
- Install gutters and downspouts sized for the roof and rainfall intensity.
- Install screening devices or roof washers to filter out leaves, debris, and sediment that can clog the system.

*For collecting and harvesting water from the soil surface and outdoor paved surfaces:*

- Use open conveyances such as grass or gravel swales to direct and deliver harvested water to storage areas, such as small ponds, for reuse as irrigation water.
- Allow continuous trickle irrigation from rainwater storage systems during wet seasons, to continuously open up storage capacity to buffer new rainfall events. Provide a pressurization system to deliver irrigation water if needed.
- Incorporate aquatic plants to maintain storage pond's ecological balance.

For irrigation with recycled water see Action Item 2-67, *Install Irrigation System Using Recycled Water*, below.

## 2-67 Install Irrigation System Using Recycled Water

5 Points

Recycled water includes both rainwater and graywater.

See Action Item 2-75, *Include Innovative Design, Equipment, and Operation Solutions to Conserve Water and Reduce Impact on Water Resources* for discussion of graywater and related requirements.

In cases where graywater for irrigation is acceptable, plumbing for graywater would be hooked up to the irrigation system. The irrigation system can be supplied using the tank(s) and a small-scale pressurized pump system.

In cases where you would be using collected rainwater (on a per site basis, a more cost-effective approach), hook up the irrigation system to the rooftop cistern (see Action Item 2-66, *Install Rainwater Collection System (Cistern) for Reuse*). These systems can provide significant quantities of irrigation water. Whether a rooftop cistern will be sufficient to meet all of the irrigation demands during the dry season will be dependent upon the irrigation requirements of the landscape and the system's storage capacity.

## Indoor Conservation

### Eliminate Water Pollutants

2-68	Educate Homeowners about Fish-Friendly Moss Control	1 Point
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Moss is a natural part of the natural environment. It thrives in lawns, on roofs, and in crevices in sidewalks and drives. There are various chemical treatments available on the market for control of moss and other growth. However, several have adverse environmental impacts. For this reason, homeowners (and builders) should avoid all zinc and copper products including zinc sulfate, monohydrate, copper sulfate (also called blue stone), galvanized ridge caps, copper flashing, and copper wires. In addition, homeowners should avoid the use of table salt to kill moss and algae. It is corrosive to metal and is not very effective.

Instead, homeowners should remove moss from roofs and other areas using a stiff brush, broom, or power washer for hard-to-reach areas. As a last resort, remove moss by spraying it with hot water (use a utility or other sink with hot water supply and connect a hose).

Provide information about environmentally friendly moss control to the homeowner as part of the Homeowners Kits (see Action Item 6-1, *Provide Owner With a Homeowner's Information Kit*).

2-69	Provide Food Waste Chutes and Compost or Worm Bins Instead of a Food Garbage Disposal	4 Points
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Composting is an old technique that has made a comeback in recent years. The process turns organic wastes (such as grass clippings and food waste) into humus, which is vital to soil fertility. About thirty percent of household waste is compostable. Worm bins are another alternative that is growing in popularity. They are appropriate for treating primarily vegetative food waste and small amounts of grass clipping. By providing homeowners with a compost or worm bin, you promote this form of waste reduction. In addition, you provide the homeowner with an organic alternative to chemical fertilizers typically used to boost soil fertility. Finally, this organic stream is not added to the sewer system.

You may want to build-in a convenient method of collecting food waste in the kitchen. A covered "waste box" can be installed next to the sink. Food waste can then be dropped through a chute into

the bin underneath. Additionally, new ready-made food chutes are now available that can be inserted into the kitchen cabinetry.

## Innovation

<b>2-70 Include Innovative Design, Equipment, and Operation Solutions to Protect the Site's Natural Features, Conserve Water, and Reduce Impact on Water Resources</b>	<b>4 - 10 Points</b>
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This Action Item recognizes builders for using innovation and emerging technologies, practices, and products that fulfill on the intentions of the Water Protection section, but are not called out in the checklist.

Members can earn up to 10 points by submitting a short written justification for the extra credit points to the Built Green™ Standards Committee for review, approval, and award of points. Members are encouraged to recommend point values (up to 10) for their submittals in line with the Built Green™ Program. The Standards Committee will evaluate the submittal and recommended points and will determine final point awards.

Several innovative suggestions are included below that include suggested point values. You may select from these suggestions, or provide your own alternative innovation. For instance, an innovative educational element that brings in the community may be valued at 2 points, while creating a full-scale low-watering, low-maintenance demonstration landscape may be valued at 10 points.

**Innovation Example 1: Stub-In Plumbing to Use Graywater for Toilet Flushing (4 points).** The use of potable (drinking) water to flush toilets is not the best use of this limited resource. There are other alternatives: Graywater, defined as the wastewater produced from baths and showers, clothes washers, and hand basins, (not blackwater, the wastewater generated by toilets, kitchen sinks, and dishwashers), is being used for toilet flushing in a number of areas. Although its use for toilet flushing is not generally allowed by code, this is expected to change in the near future as potable water resources in our region become more and more limited. These systems are now permitted with a variance on a case-by-case basis.

Graywater collection requires dual plumbing distribution lines and a storage tank. You can receive points under this Innovation Action Item if you provide the additional plumbing required to allow for future connection to graywater for toilet flushing (see Action Item 2-64, *Rough-in plumbing to capture graywater for reuse/irrigation*).

**Innovation Example 2: Use Graywater for Toilet Flushing (8 points)**

Using recycled water (normally graywater) for toilet flushing conserves our valuable potable water resources. Currently considered an “exception” allowed by code, the use of graywater for toilet flushing may be approved on a case-by-case basis. This “experimental” system will require compliance with stringent local and provincial regulations.

**Innovation Example 3: Install Composting Toilets (10 points)**

Composting toilets convert human waste into nutrient-rich fertilizer for non-food plants rather than mixing the waste with potable water and flushing it down the drain. The advantages of these toilets

include dramatic reductions in water use, reduced groundwater pollution or sewage treatment impacts, and a recycling of nutrients. One toilet can accommodate up to five persons.

Some composting chambers can be used with microflush toilets; however, most are non-flush units. If composting toilets are used, graywater treatment and disposal must be addressed. Systems must meet local health department regulations for alternative on-site sewage systems.

# Section Three:

## Energy Efficiency

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In addition to environmental benefits, energy efficiency can significantly improve comfort levels in the home and save on energy bills—both a proven selling point. NRCan energy guidelines serve as a minimum standard. This section defines achievable goals that go beyond the code’s minimums.

For Example, in BC a contractor must adhere to minimum to Part 10 of the BC Building Code (the minimum as outlined in 10.2.1.1.A.) Should there be a higher standard in the jurisdiction, the local code prevails.

The energy efficiency actions in this section accomplish one or more of the following objectives:

- Reduce heating/cooling load overall.
- Use energy required to meet the load more efficiently.
- Site homes to take advantage of natural resources and site features, such as orientation to increase solar gain or to provide wind shielding.

### REQUIREMENTS

<b>3-1</b>	<b>Install Programmable Thermostats with Nighttime Setback and Switch for Furnace Fan</b>	<b>1 Point</b>
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Programmable thermostats reduce energy use by providing heat only when and where required. Most of the latest generation programmable thermostats perform one or more of the following energy control functions: 1) store and repeat multiple daily settings, which can be manually overridden without affecting the rest of the daily or weekly program; 2) store four or more temperature settings a day; and/or 3) adjust heating or air conditioning turn-on times as the outside temperatures change. EPA estimates that ENERGY STAR®-labeled programmable thermostats, when used properly, can save consumers 20-30% on heating and cooling bills.

Better control – use blower fan (ECM) improve comfort –

- 1) Control of blower fan on / off
- 2) Speed of blower fan must be manually adjusted can not be done by thermostat
- 3) Control of blower fan – time and duration (extra timer required)

## OVERALL

### 3-2 Provide third-party verification of energy performance of design 5 Points

Employ the services of an outside consultant to model and verify the energy performance of your design. This will quantify the impacts of the energy saving design features you have incorporated, compared to the base case. An ecoENERGY evaluation will satisfy these requirements. A qualified consultant may also identify opportunities for improvement in design performance.

Create more detailed HOT 2000 model of house than ecoENERGY provides (i.e. document exact size of windows)

### 3-3 Orient Home on Site to Make Best Use of Solar Energy 5 Points

The long walls of a home (and windows in those walls) absorb the most heat from solar radiation. Orient buildings so that longer walls face north and south, so that they can be protected from the high angle sun using roof overhangs. The east and west walls are exposed to lower angle sun, which can be blocked with vertical shading, fences and deciduous plantings that will shade in summer, but let sun through in winter.

Homes are generally located on a site to maximize views and access roads. When planning for solar orientation, there may be trade-offs to address these and other considerations. Narrow lots usually limit the size and location of windows, with much of the glass and sun exposure on the front and back (typically short ends) of the building. Create a plan that will encourage Passive Heating / Cooling Plan – for Design considerations.

#### 3-3-1 Tune Windows for Passive Heating / Cooling 3 Points

Tune windows to increase or reduce solar heat gain to increase overall performance for heating and or cooling loads – provide documentation to demonstrate performance. Specify low emissivity glazing's that encourage high and low solar heat gain applications for passive heating and cooling.

### 3-4 Conduct Energuide for Existing Houses Evaluation (currently ecoENERGY/LiveSmart BC programs) on house ★

Homeowners can take advantage of the ecoENERGY/LiveSmart BC grant programs to become educated as to the energy-efficiency of their home as well as qualify for grant money based on certain upgrades being done. Through the EnerGuide for Existing Houses program, the Built Green™ Renovation program can promote smart consumer choices for products, building upgrades, and homes that go beyond our already stringent local codes to save money while preventing pollution.

Baseline existing home with EnerGuide for Existing Houses Evaluation (currently ecoENERGY/LiveSmart BC programs) – pre retrofit – then finish with Post Retrofit ecoENERGY.

EneGuide for Existing Houses evaluation mandatory for all scales of renovation. Bonus points if it is a small renovation. Based on overall improvement ½ point for every full improvement point. i.e. ecoENERGY base 60 – improves to ecoENERGY 70 – 10 point improvement = 5 point for checklist.

Mandatory minimum final EnerGuide rating if it is an addition or whole house renovation.

- 1 Electric baseboard, fan-forced, or other zonal controlled, ductless, electric resistance systems. Forced air electric furnaces are not allowed.
- 2 Under-floor insulation requirements. Perimeter crawlspace insulation is not allowed under this requirement.
- 3 To qualify as a slab below grade, the average depth of the perimeter must be two feet or greater below site grade.
- 4 All forced air heating and cooling system ducts and equipment must meet PTCS specifications for duct leakage, equipment sizing, and installation.
- 5 Efficiency requirements apply to heat pumps and air-conditioning equipment if installed. Air conditioning is NOT required in all homes.
- 6 For gas and heat pump homes, no additional tightening measures beyond code are required. Envelope tightness will be tested on a random sample basis to measure “fleet-average” tightness for these homes. Electric zonal houses shall be tested individually and must not exceed the air leakage specification listed.

## ENVELOPE

Building envelope Action Items consider the building as a whole and look for ways to implement and document improvements in energy efficiency:

- Reduce heat loss—Install insulation, windows, and doors that exceed code requirements.
- Air sealing—Use techniques to reduce thermal losses that occur due to air leakage.
- Thermal bridges—Use techniques to reduce/eliminate thermal bridges, the heat flow “shortcuts” that can significantly degrade thermal performance.
- Solar design—Design and build to take advantage of the home’s orientation to utilize the sun’s energy for heat.

## Thermal Performance

<b>3-5 Document Envelope Improvements Beyond Code (Component Performance Approach)</b>
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**1 pt/%**

Use the EnerGuide for Existing Houses Evaluation (currently ecoENERGY/LiveSmart BC programs) program implemented by Natural Resources Canada to document improved performance. The number of points awarded relates to documented improvement as follows:

**Examples:**

- a) 70% efficient home to 80% efficient = 10% improvement = 10 pts
- b) 66% efficient home to 84% efficient = 18% improvement = 18 pts

Document upgrades and resulting improvement on Chart 3-A in the Appendix, and provide a copy to the homeowner as part of their Homeowner's Information Kit (Action Item 6-1, *Provide Owner With a Homeowner's Information Kit*).

**3-6 Install weatherstripping**

**2 Points**

Use the prescriptive approach and Chart 3-B, provided in the Appendix, to note the actions you will take to improve efficiencies above and beyond NRCan. Note the efficiencies you expect to achieve. See Chart 3-B for point assignments, which are based on measures taken (range is 1 to 31 points).

## **Air Sealing**

Proper air sealing can have a major impact on energy savings. Department of Energy estimates that up to 30% of a home's energy can be lost through air leaks. Typical areas for sealing include under sill plates, around windows, doors, framing members, and electric, plumbing and mechanical penetrations. Sealing materials, which include caulking, sealant, foam, and tape, are easy to find and inexpensive.

**Please note that "tightening" the home to save energy requires careful attention to indoor air quality.** Providing an adequate, controlled supply of fresh air to the home is addressed in *Section Four: Health and Indoor Air Quality*.

**3-7 Use Airtight Drywall Approach for Framed Structures**

**3 Points**

The airtight drywall approach (ADA) for framed structures is an advanced sealing package that goes beyond basic practice. Specifically, it includes caulk or gasket drywall installed on exterior walls at the top and bottom plates, windows and doorframes; caulk or gasket drywall installed on interior walls at intersections with exterior ceilings; and caulk or gasket electrical, plumbing, or mechanical penetrations in the drywall.

Make sure you use good quality, durable materials for sealing and use the proper type of sealing material for the size of gap. Install quality, self-closing dampers on vents to prevent backdrafts on windy days.

**3-8 Use Airtight Building Method, such as Structural Insulated Panels or Insulated Concrete Forms, for Building Envelope**

**3 Points**

An airtight building method uses airtight structural elements such as structural insulated panels (SIPs), insulating concrete forms (ICF), and concrete masonry units to replace some or all of

conventional stick framing elements. (Note: The use of an airtight wall system as such does not automatically eliminate leakage through or around windows. Systematic air sealing of the entire house is the most effective way to reduce infiltration. See Action Item 3-7, *Airtight Drywall Approach for Framed Structures*.

*SIPs*—SIPs create a continuous air barrier. All field connections, windows, electrical, plumbing, and mechanical penetrations still require careful caulking or gaskets. Taking into account both the thermal benefits of SIPs and substantial reductions in air leakage, this measure can be cost effective. Note: Some SIPs are manufactured with CFC-containing materials, which cause ozone depletion. You will want to check with the manufacture to avoid using them.

*ICF*—Insulating concrete forms (ICFs) are rigid plastic foam forms that hold concrete in place during curing and remain in place afterwards to serve as thermal insulation for concrete walls. The foam blocks, panels, or planks are lightweight and result in energy-efficient, durable construction. ICFs are used to make structural concrete walls, and can be used to make either foundation or above-grade walls. ICF walls provide R-values between R-14 and R-24 and lower air infiltration rates when compared to typical wood frame construction. Consider the thermal bridging of different cross-tie designs when considering different ICF systems.

In addition to higher R-values, advantages over conventional construction include a reduction in the number of trade contractors required, strength, reduction in through-the-wall sound transmission, and ease of construction. See Action Item 5-37, *Use Insulated Concrete Form (ICF) Walls with Flyash and or blast furnace slag cement in concrete*, for information about the material efficiencies associated with this technique.

<p><b>3-8-1 Use an Exterior Air Barrier on the exterior wall assembly Installed per Manufactures guidelines. <span style="float: right;">3 Points</span></b></p>
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*Exterior Air Barrier* – An air barrier material is any House Wrap, sprayed applied fluid or other building material with air permeance less the or equal to 0.02 L/(s·m<sup>2</sup>) @ 75Pa (0.004 cfm/ft<sup>2</sup> @ 1.57 psf) as measured in accordance to ASTM E2178 Standard Test Method for Air Permeance of Building Materials. Material should be installed continuously on building walls according to manufactures guidelines regarding detailing, taping of seams and fastening method.

Adding an External Air Barrier has many long term performance characteristics to a building envelope.

- **Improved Comfort:** A tighter building envelope reduces the drafts and can maintain a more consistent level of comfort throughout the house.
- **Improved Indoor Air Quality:** A tighter building envelope reduces the infiltration of moisture and outdoor air pollutants.
- **Lower Energy Bills:** Air leakage accounts for 25% to 40% of the energy used for heating and cooling. Installing the air barrier on the exterior of a wall surface also reduces the “wind washing” effect which helps to protect the designed R-Values of the insulation products used in the wall system.
- **Reduced Condensation Issues:** A tighter building envelope can reduce the amount of air transported moisture which can condense on cold surfaces within the envelope.

Reduced Obsolescence: Tighter building envelopes are expected to become standard practice for the building industry

### 3-9 Use interim Blower Door Test to Identify and Correct Air Infiltration Problems 6 Points

The blower door test is a proven, objective means to identify air leaks in a home. It removes the guesswork of weatherizing and improves a building's efficiency and comfort. Blower door tests are used to identify air leakage paths in a home and to quantify air leakage. Blower doors can also be used to locate duct leaks (commonly known as duct blaster tests).

A blower door consists of a variable speed fan sealed into an exterior doorway and used to blow air into or out of a house. When air is blown out of the house, the house develops a slight negative pressure (or vacuum) relative to outside. The pressure differential drives outside air into the house (infiltration) through any available openings in the exterior shell. These leaks can be located by touch or with smoke, then sealed.

In addition, the pressure induced by the blower door can be used to yield a quantitative estimate of the "leakiness" of the home (in square inches). Additional calculations yield the approximate natural air change rate (ACH).

Blower door tests of homes built to code average 0.34 ACH. Reducing to 0.30 ACH through improved air sealing will reduce annual energy use by about 8% and is very achievable. (Homes with forced air systems will have a slightly higher ACH.)

It's best to do a blower door test once just before sheet rock and once after sheet rock, but before attic insulation is blown in.

An air sealing package that results in a blower door test documented improvement in from 0.40 ACH to 0.30 ACH will yield approximately 9% savings in energy consumption.

- Performed as early as possible – and if poly is used – performed after drywall installed – does not have to be completed – but boarding complete to ensure poly not affected by blower door test.
- On foam and exterior air barrier – blower door test completed as soon as feasible.
- Air tight drywall – test completed as soon as feasible
- Follow Canadian Standard CAN/CGSB-149.10-M86 (Determination of the Airtightness of Building Envelopes by the Fan Depressurization Method)

## Reduce Thermal Bridging

Where framing members make full connection between the interior drywall and exterior sheathing, a cold spot forms. These areas increase heat loss, reduce comfort, and increase condensation on interior surfaces. In addition, cold spots attract dirt and will soil faster.

Limiting the number of framing members that fully bridge the interior and exterior surfaces can save energy and produce a more comfortable home. The thermal bridges that allow heat to escape include solid headers over doors and windows and other paths for conductive heat loss.

### 3-9-1 Thermal By Pass Inspection Completed before Drywall Installed

4 Points

A Thermal By Pass inspection checks for approximately 20 different areas that need to be checked to ensure that the building is meeting its key points including proper insulation installation, HVAC installation, and other areas to ensure quality construction. Checklist in Appendix.

### 3-10 Use Blown-In Insulation (cellulose and/or foam) in exterior walls and ceiling 1 Point

Blown-in insulation products, including cellulose, fiberglass blown in batts (BIBS) and urethane/soy-based foams, have an advantage over conventional fiberglass batts in that they provide better penetration and filling of cavities. The insulation can be dry-blown or poured loose-fill into enclosed cavities, but is most commonly wet-sprayed. When sprayed, the product leaves few voids, reducing problems with air infiltration. If installed properly.

Blown insulation must be carefully installed to prevent “overblowing,” which reduces the R-value for a given, installed thickness. Careful installation of blown insulation in attics requires even coverage, avoiding high and low areas with varying R-values, and avoids blocking ventilation paths. Ask how the insulation contractor controls for the proper amount of insulation material and depth.

Cellulose can also be dry-packed into wall cavities. Cellulose insulation is made from 100% post-consumer recycled newspapers or telephone books and is usually combined with boric acid or sodium borate as a fire retardant. An additional benefit of boric acid is that it kills carpenter ants and termites. (See also Action Items 5-75, *Use Recycled-Content Insulation*, and 5-76, *Use Environmentally Friendly Foam Building Products (Formaldehyde-Free, CFC-Free, HCFC-Free)*.)

### 3-10-1 Blown In Cellulose Insulation – Recycled Content

1 Point

Points awarded based on majority of envelope – over 75% of all possible or potential areas use either type of insulation program

### 3-11 Use Insulated Headers

1 Point

As much as 4% of the area of the typical building envelope consists of window and door headers. Insulated headers reduce thermal transfer (bridging) found in standard construction using solid wood headers for exterior window and door openings (see Figure 3-1). Although they can be purchased pre-assembled, they are often built on-site by sandwiching rigid insulation between the lumber. Using insulated headers achieve higher R-values without sacrificing structural integrity.

Typically, 4x and 6x have been used for header stock, but they should only be used when structurally necessary. Doors in non-load bearing walls do not require structural headers. Building codes allow these practices and recognize this proven performance.

If you use a King Stud and insulated header or a let-in header with framing clips instead of cripple studs, you save lumber and there will be more room in your walls for insulation.

#### 3-11-1 Replace uninsulated exterior doors with insulated doors 2 Points

#### Figure 3-1—Insulated Headers

(Source: CHBA- Builders Manual)

### 3-12 Fully Insulate Corners (Requires Two-Stud Corners Instead of Three-Stud Corners)

1 Point

Corner construction using two instead of three studs leaves space for additional insulation (see Figure 3-2). Drywall clips spaced two feet apart can provide back-up for interior finish materials. Place the clips where one wall abuts another, or where two walls intersect at corners.

#### Figure 3-2—Corner Construction ?

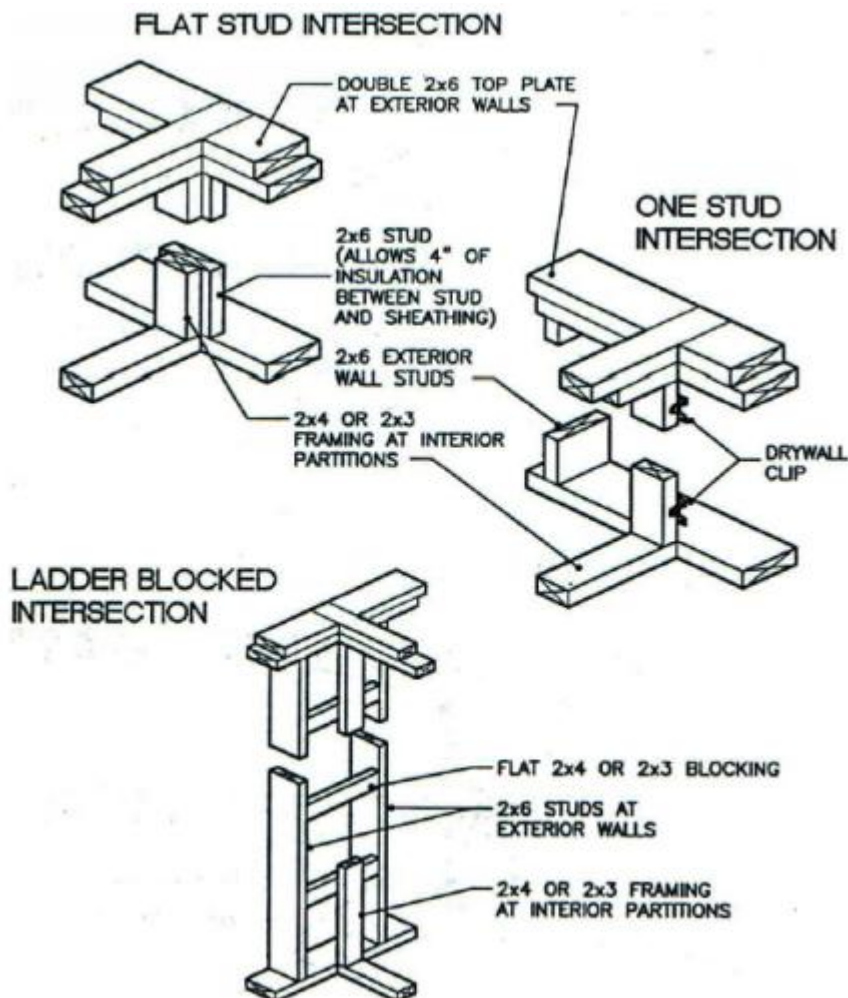
(Source: Canadian Home Builder's Association Builder's Manual, Advanced Framing Techniques – Canadian Home Builders Association)

Note: Points are awarded *only* for improvements that are above and beyond NRCan's energy efficiency requirements.

Optional framing details provide for easy placement of insulation (see Figure 3-3). (Note: Points are awarded *only* for improvements that are above and beyond NR Can requirements.)

### Figure 3-3—Construction Details for Easy Insulation

(Source: *Canadian Home Builder's Association Builder's Manual, Advanced Framing Techniques – Canadian Home Builders Association*)



3-14 Specify and Use High (Energy Heels) of 8 In. or More on Trusses to Allow Added Insulation Over Top Plate

1 Point

If you specify energy heels in the original truss order, it should not add costs. Figure 3-4 provides options to maintain full heel insulation (advanced frame ceiling).

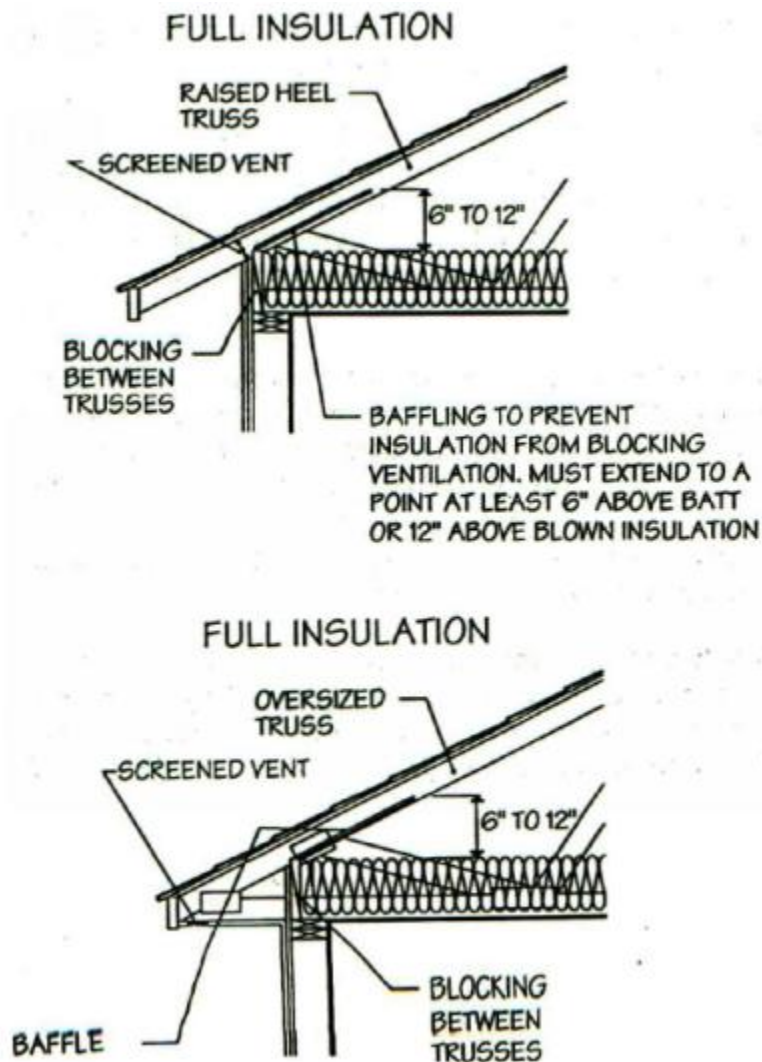
Figure 3-4—Construction Details, Full Heel Insulation

(Source: [Canadian Home Builder's Association Builder's Manual](#))

3-14-1 Ventilation Chutes / Insulation Stops



Figure 3-5 – Insulation Stops



Between trusses – ensuring that insulation stops or ventilation chutes are installed on every truss bay to prevent vortex currents from pushing blown insulation around and creating bare cold spots in attic. As well, these stops direct air over attic insulation reducing wind effects that reduce insulation value.

### 3-15 Use Insulated Exterior Sheathing

2 Points

The use of insulated exterior sheathing eliminates all of the thermal bridging created by framing. In many cases the use of exterior sheathing may allow the builder to use 2X4 instead of 2X6 framing, or to improve the thermal performance of an existing 2X4 wall rather than reframing with 2x6, thus reducing lumber use and cost. Insulated exterior sheathing can reduce condensation in walls because the wall stays warmer. Exterior insulated sheathing when properly detailed can provide a superior exterior water management system.

### 3-16 Add Wall, Ceiling, and/or Floor Insulation Beyond Code Requirements 3 Points

Consider adding insulation to the walls, ceiling, attic, or floors beyond code requirements. Blown-in insulation products, including cellulose or Icynene, have an advantage over fiberglass in that they seal out drafts, provide similar R-values, and are made from non-toxic materials. See Action Item 3-10, *Use Blown-In Insulation in exterior walls and ceilings*. Cellulose can also be dry-packed into wall cavities.

Try to use an insulation product with recycled content, or one that is less polluting in its manufacturing process as well as in the home. See also Action Items 5-75, *Use Recycled-Content Insulation*, and 5-76, *Use Environmentally Friendly Foam Building Products (Formaldehyde-Free, CFC-Free, HCFC-Free)*.

Recommend: R-21 for walls, R-38 for ceilings and vaults, R-30 floors, R-19 for basement walls and R-10 for slab perimeter.

Note: Points are awarded *only* for improvements that are above and beyond NRCan's energy efficiency requirements.

### 3-17 Use Structural Insulated Panels (SIP) or Insulated Concrete Forms (ICF) with insulation over cross-ties for Building Envelope

7 Points

Because SIPs and ICFs contain few framing members, they have fewer thermal bridges than conventional wood frame construction. Only ICFs that have insulated cross-ties, effectively limiting the thermal bridging of the tie, qualify for this credit.

Do not select SIPs or ICFs made with CFCs. See Action Item 3-8, *Use Airtight Building Method, such as SIP or ICF, for Building Envelope* for more information.

### 3-18 Use Advanced Wall Framing—24-in OC, w/Double Top Plate

3 Points

Sometimes referred to as Advanced Wall Framing, this technique is a code-recognized process that incorporates 24-inch on-center framing with increased insulation. Other features include two-stud

corners and intersections (see Action Item 3-12, *Fully Insulate Corners*), insulated headers (see Action Item 3-11, *Use Insulated Headers*), oversized or raised heel trusses to allow full depth of attic insulation (see Action Item 3-14, *Specify and Use Energy Heels of 6 In. or More on Trusses to Allow Added Insulation Over Top Plate*), and full insulation where interior partition walls meet exterior walls (see Action Item 3-13, *Fully Insulate at Interior/Exterior Wall Intersection*).

To help increase the efficiency of exterior walls, use ladder partitions. The usual practice of adding extra studs in the exterior wall to provide nailing for drywall creates an inaccessible pocket that can't be insulated after exterior sheathing is installed. In ladder partition, the horizontal blocking across the front of the wall cavity allows for plenty of insulation behind. This alternative saves lumber and improves R-value.

On average, advanced framing uses 30% less lumber, takes less time to construct and costs less to build because the reduced use of lumber more than offsets the additional cost of header insulation. Construction cost savings is estimated at \$0.29 per square foot of wall area. Total savings for this measure alone are 2 to 4% of total energy use.

You'll need to use sheathing, siding and drywall rated for 24-inch stud spacing. Fewer studs mean fewer plumbing and electrical penetrations and fewer nail or screw holes to seal and sand. Although more insulation is required, wider stud spacing results in fewer pieces of insulation and therefore faster installation.

Tip: To eliminate concerns about "wavy walls," install exterior sheathing horizontally rather than vertically.

<b>3-19 Use Advanced Wall Framing—24-in OC, w/SINGLE Top Plate</b>	<b>4 Points</b>
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As an alternative to 3-18, using Advanced Framing with a single top plate, further reducing thermal bridging and materials usage.

This approach requires stacked framing so that rafters, trusses, joists and studs are vertically aligned to properly transfer loads through the frame to the foundation.

<b>3-20 Use ENERGYSTAR Windows rated one climate zone higher than project location</b>	<b>3 Points</b>
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Energide/ENERGY STAR® qualifying windows in the northern climate region must have a U factor rating of 0.35 or below. Skylights must have a U-factor rating of 0.45 or below.

<b>3-20-1 Use Energide/ENERGYSTAR rated two climate zones higher than project location</b>	<b>2 Points</b>
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rating of for Zone C – will provide added insulation value and provide added points for specifying better rated windows.

## Solar Design Features

Good solar design can reduce heating bills and eliminate the need for mechanical cooling. Solar features also provide consumers with attractive natural lighting and reduce interior temperature swings. However, solar design is a comprehensive practice. If you approach it piecemeal, you may end up overheating the home, causing discomfort and increasing the demand for cooling.

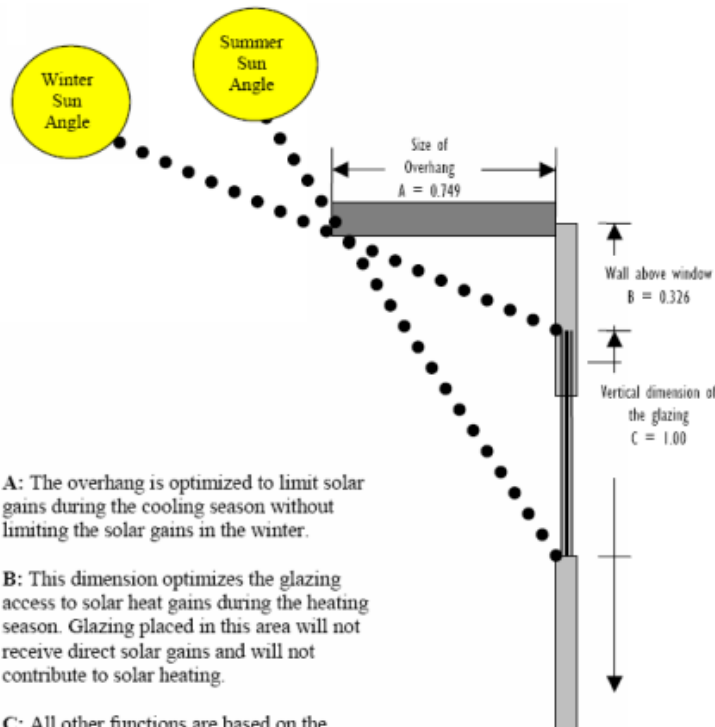
To be effective, solar strategies must be considered during the design phase of a project. By placing approximately 50% of the glazing on the south side of the structure and including thermal mass features in the living space of the home, you can achieve 20% savings in energy. (There may be additional cost in construction for these features.) Simple, easy-to-use software is available to help the designer optimize the solar design.

### 3-21 Install Properly Sized Overhangs on South Facing Glazing

2 Points

Properly sized overhangs will prevent excessive solar gains in the summer while allowing the sun to enter the home during the heating season. Optimized south-facing overhangs are illustrated in Figure 3-5.

**Figure 3-5**



**A:** The overhang is optimized to limit solar gains during the cooling season without limiting the solar gains in the winter.

**B:** This dimension optimizes the glazing access to solar heat gains during the heating season. Glazing placed in this area will not receive direct solar gains and will not contribute to solar heating.

**C:** All other functions are based on the vertical dimension of the glazing.

**B + C:** Glazing placed below this dimension will not be shaded in the summer. This will result in solar gains during the summer months.

Effectiveness of the shading diminishes if the building orientation changes. Within 30 degrees of due south, this formula will provide relatively good results. East and West facing glazing require shading by other means such as exterior blinds, or landscaping.

### 3-22 Orient Windows to Make the Best Use of Passive Solar

2 Points

To make the best use of passive solar, orient the majority of the building's glazing within 22 degrees of due South. Due South can be located with a simple compass. Remember to make the correction for magnetic North. Obviously, this assumes there will be windows on the south side; for solar heating benefit, these should not be obstructed in winter. To prevent overheating, window glass on the south side of the building should not exceed 8% of the floor area. However, window area can be increased significantly (and solar performance enhanced) if there is accessible thermal mass in the space to absorb excess heat. Building components that can add mass to the home include concrete floors, tile, extra drywall, and to some extent, wood flooring. Consider the installation of skylights in a south-facing roof. Install with blinds to control the heat.

**3-23 On West-Facing Windows, Use Glazing with Solar Heat Gain Coefficient Less Than 0.35**

**2 Points**

East and west shading strategies help protect against overheating the home. The most shading is provided by means of exterior shading devices, especially trees and other natural landscaping. They block the heat before it gets to the window. In addition, windows made using specially coated or tinted glazing reduce the window's solar heat gain coefficient (SHGC). They block the heat gain without rejecting too much visible light. For comparison, standard clear glass has a SHGC of 0.85. Special coatings/tinting can produce windows with SHGC below 0.35, depending upon the treatment. These can be especially useful if the home has an attractive view to the West.

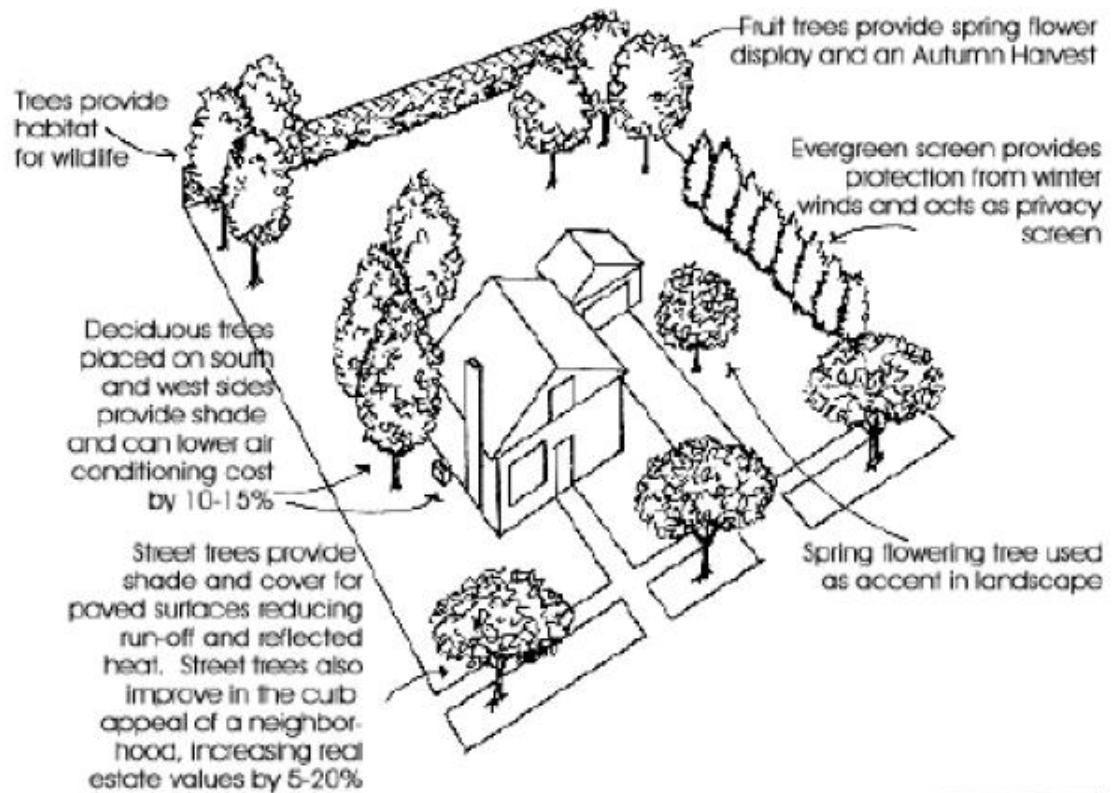
**3-24 Use Building and Landscaping Plans that Reduce Heating/Cooling Loads Naturally**

**2 Points**

Energy-conscious landscaping and building design can result in reduced operational costs for the homeowner, greater comfort, and less energy use. Trees properly placed around buildings (see Figure 3-6) can reduce air conditioning needs by 30 % and can save 20-50 % in energy used for heating. Well-placed windbreaks of evergreens can reduce a building's heating bill by up to 20%. (Natural vegetation can also provide visual pleasure, effective erosion and stormwater control, shelter for wildlife, and sound absorption. See *Section Two: Site and Water*, Action Items 2-12, *Preserve Existing Native Vegetation as Landscaping*, and 2-13, *Take Extra Precautions to Protect Trees During Construction*.)

Examples of energy-saving design include:

- Compact building design. A 1,500 square-foot house with quite low energy performance standards (R-13 walls and R-19 ceilings) will still use a lot less energy for heating and cooling than a 3,000 square-foot house of comparable geometry with much better energy detailing (R-19 walls and R-30 ceilings). (Source: Environmental Building News, January 1999). (See Action Item 5-3, *Create Functional Multi-Purpose Spaces While Limiting Additional Square Footage*, for information about small home design.)
- Maximum southern exposure with most windows facing south.
- Plantings on the east and northeast to filter the sun without blocking the light.
- Plantings on the south to create shade and channel breezes in summer without obstructing sun in winter.
- Mid-range colored materials for driveways, walkways, and parking spaces to reflect sun in summer and to absorb and re-radiate heat in winter.
- Paved areas located away from south windows and shaded with plantings.



**Figure 3-6—Tree Placement to Reduce Heating/Cooling Loads Naturally**

(Source: Cool Communities, [www.coolcommunities.org](http://www.coolcommunities.org))

**3-25 Demonstrate using Approved Energy Modeling Software an Overall Reduction in Space Conditioning via Passive Solar Renovation 1-5 Points**

For solar designs, demonstrate a reduction in space conditioning energy (heating plus cooling) as modeled using one of the software methods listed below. (Base case is: building shell and heating system in the proposed design, lightweight construction, all windows evenly distributed N.S.E.W.)

Documented Improvement	Points Awarded
• Model the home, learn from the experience	1
• 10% improvement in energy use	2
• 20% improvement in energy use	3
• 30% improvement in energy use	4
• 40% improvement in energy use	5

*Recommended Modeling Software:*

- HOT 2000 -
- Possible MURB over 5 storeys – EE4

- RETScreen
- Utilize HOT 2000 eco-ENERGY to evaluate improvements

### 3-26 Install infrastructure for future photovoltaic installation

3 Points

Provide an appropriate area of south-facing roof (or ground-based location) for future PV panel installation. Ensure the area is “shadow-free” (e.g. avoid adjacent tree or building shade, locate vent stacks, chimneys, etc. to north of location. Install an approved safety anchor on the north side of the ridge, above the location for installers and maintenance use.

Provide an area in the attic adjacent to the location for mounting equipment, junction boxes, etc. Run appropriately sized metal conduit from this location to an appropriate location (in garage, utility room, or exterior wall) for an inverter and provide supports for mounting the inverter. Conduit should use large radius bends and no 90 degree bends if possible, to facilitate the future pulling of large gauge copper wire for DC electricity transmission.

### 3-27 Install a Photovoltaic System of at least 1.0kW capacity

5 Points

Photovoltaic (PV) modules convert sunlight directly into electricity. They do not produce pollution or carbon dioxide emissions and unlike generators, they operate silently and require little maintenance. Once installed, PV produces free electricity from sunlight that can power certain home functions or supply the entire electrical needs of a home and eliminate the need to rely on the utility grid.

Newer PV systems are integrated into roofing materials replacing traditional PV modules that are mounted on rooftop racks. They are more attractive than accessory solar systems, and because they are part of the building, the added cost for PV is easier to justify. Consumer interest in the product is high.

Currently estimated cost of electricity produced from a PV system is equal to about 25 to 50 cents per kilowatt-hour (kWh) when considering initial cost spread over the lifetime of the system, plus maintenance costs. (However, the cost for PV installations is dropping.) For buildings that are not near electric power lines, PV systems are often less costly than extending power lines to the building.

# HEATING/COOLING SYSTEM

## Distribution

Heat loss from the average ducted air distribution system can reduce the overall system efficiency by 30%. Reducing duct air leakage and improving duct insulation has potential to significantly reduce utility bills and prevent or eliminate associated comfort and health problems. Specifically:

- Heating and cooling costs can be reduced by as much as 20-30%
- Comfort can be improved by ensuring adequate delivery and return of conditioned air
- Downsizing of heating and cooling equipment is possible, reducing first costs
- Entry of mold, radon, dust, and moisture into the house can be reduced.

At the beginning of a project, give consideration to:

- Location of the duct work
- Duct type and size
- Sealing method
- Insulation method, R-value
- Providing equal cross-sectional area for supply and return duct openings, and eliminating non-communicating ducts. (Each supply duct needs to “see” a return duct, and vice-versa. If there is a door between them, a transfer duct is required.)
- Reducing or elimination electric resistance heat in favour of electric heat pump or natural gas heat.

As discussed below, it is preferable to locate ducts within the building envelope. However, this option is not always possible, even with new construction. In this case, ducts should be sealed with mastic and preferably insulated (see Action Item 3-36, *Seal Ducts Using Low Toxic Mastic or Aerosolized Sealing System*).

### 3-28 Centrally Locate Heating/Cooling System to Reduce the Size of the Distribution System

1 Point

Locating the furnace in a central, well-insulated mechanical closet can save energy by reducing delivery distance and heat loss. (It can also conserve material use by requiring less ducting.) Make sure you provide sufficient make-up air.

### 3-29 Install Two or More Properly Supported Ceiling Fan Pre-Wires

1 Point

Provide wiring and switching needed for one or more ceiling fans in the electrical plan. If installed, a ceiling fan can be used as a low-energy option to provide cooling on hot summer days.

### 3-30 Install Energuide/ENERGY STAR® Heating Equipment

3-30-1 Ground Source Heat Pump	3 Points
3-30-2 Air-Air Heat Pump	2 Points
3-30-3 Air-to-Water Heat Pump	2 Points

By selecting Energuide/ENERGY STAR® rated heating equipment you are assured of significant energy savings. The Energuide/ENERGY STAR® standard for heating equipment includes 90% AFUE furnaces.

### 3-31 Install Energuide/ENERGY STAR® Cooling Equipment 2 Points

By selecting Energuide/ENERGY STAR® rated cooling equipment you are assured of significant energy savings.

### 3-32 Insulate any Ducts Located in Unconditioned Space to R-11 2 Points

Uninsulated ducts in the crawl space can actually *increase energy* use in the home, lead to increases in crawl space moisture, and cause frozen water pipes. To avoid these problems insulate all ducts to at least R-11. See Action Item 3-38, *Locate HVAC Distribution System Inside the Conditioned Space*.

### 3-33 Use Direct Vent Gas or Propane Hearth Product (AFUE Rating) 2 Points

Combustion appliances in general can be troublesome if not completely sealed. They can inadvertently admit noxious gases such as carbon monoxide into the air. Even if a fuel-burning device is connected to a chimney, pollutants can enter the house through spillage, backdrafting (whenever there is even a slightly negative air pressure in the house), or due to lack of maintenance or damage to the chimney.

***Mandatory – ONLY spark ignition fireplaces to be installed in renovations.***

### 3-34 No Fireplaces or Only High Efficiency Units (Rumsford or Russian Fireplace, Masonry Heater) 2 Points

Wood or coal-burning stoves and fireplaces can be troublesome if not completely sealed. Even if a fuel-burning device is connected to a chimney, pollutants can enter the home through spillage, backdrafting (whenever there is even a slightly negative air pressure in the house), or due to lack of maintenance or damage to the chimney.

**3-35 No separate Air Conditioner installed with new system****3 Points**

The best option is to initially design the home to make the best use of natural ventilation and passive cooling techniques. See Action Items 3-21, *Install Properly Sized Overhangs on South Facing Glazing*, 3-22, *Orient Windows to Make the Best Use of Passive Solar*, 3-23, *Use Glazing with Solar Heat Gain Coefficient less than 0.35*, and 3-29, *Install One or More Properly Supported Ceiling Fan Pre-Wires*.

However, if you install an exhaust air heat pump system for the water heater, some systems offer an option to provide supplemental space heating and cooling. This actually increases their heat recovery efficiency. The systems require additional ductwork to and from the space(s) being cooled or heated and a heating / cooling thermostat in each space. Generally, they provide space conditioning at about 7,000 Btu/hour. This is adequate for supplemental conditioning of a fairly large zone in a home, such as a family room, living room, or great room.

**3-36 Seal Ducts Using Low Toxic Mastic or Aerosolized Sealing System****5 Points**

Efficiency of the heating distribution system can be improved by 15% if the ducts located in the crawlspace or attic are sealed better than standard practice. Using mastic to seal commonly used fittings or using improved duct fittings with gaskets reduce the air leakage rate of the heating system and the structure as a whole. Additional benefits may include improved comfort by reducing drafts, improved occupant control of the distribution of heat to individual rooms, and a reduction of dirt introduced into the home.

Aeroseal is a patented duct-sealing system that seals ducts from the inside using a sealant which is introduced into the ducts as an aerosol and then fills and seals all leaks. Cost effectiveness criteria would be similar to manual sealing, above.

Note: The home needs to be pressure balanced with the goal of reducing backdrafts. If the furnace return is adjacent to a combustion appliance it will backdraft even with a perfectly airtight duct system.

**3-37 Performance Test Duct for Air Leakage Meets Third-Party Review and Certification****5 Points**

Duct performance tests prove the airtight integrity of the ducting and provide third-party certification that you can show your customers. Performance tests can be obtained by the same contractor who performs blower door tests (See Action Item 3-9, *Blower Door Test*). Use accepted criteria such as EcoENERGY criteria.

**3-38 Locate HVAC Distribution System Inside the Heated Space****3 Points**

An HVAC system's efficiency can be improved by if the entire distribution system is located within the heated space. In many cases this will be a no-cost measure. For forced air heating systems, moving the ducts inside usually increases the cost of framing and drywall. But the HVAC bid may be lower, off-setting these costs. Even if the total cost increases some, the energy savings will more

than pay for the change in construction details. Carefully planned hydronic systems or in-space heating systems will also provide these benefits.

An HVAC system's efficiency can be improved by 30% or better if the entire system is located within the heated space. In many cases this will be a no-cost measure. For forced air heating systems, moving the ducts inside usually increases the cost of framing and drywall. But the HVAC bid will be lower, off-setting these costs. Even if the total cost increases some, the energy savings will more than pay for the change in construction details. Carefully planned hydronic systems or in-space heating systems will also provide these benefits.

HVAC / Mechanical Room should not be accessible through the garage - there should be no direct connection between garage and HVAC space.

**3-39 Size Duct and Appliance Selection according to TECA Quality First program**  
**2 Points**

**3-40 Where appropriate, install furnace with an electrically commutated (variable speed) fan motor**  
**3 Points**

An ECM motor will reduce motor energy use by about 331 kWh per year. However, because the motor gives off waste energy as heat to the home, the energy it is not truly lost during the heating season, and financial savings are about half what might otherwise be expected. If used with an air conditioner, however, the electrical energy savings could double. For these reasons, consider an ECM motor when installing heating or cooling equipment.

Note: The most appropriate use of a ECM is on equipment specifically designed to take advantage of the motors part load capability. This is most commonly found on high quality heat pump systems with variable speed fan controls and some variable speed gas furnaces.

**3-41 Use a ductless heat distribution system**  
**8 Points**

A ductless heating system, such as hydronic radiant floor, base board, or in-space air handler system avoids the significant distribution heat losses associated with ducted systems. Air has a low thermal capacity (it gains and loses heat rapidly). Forced air systems move large volumes of air over considerable distances, through ducts that have large surface areas that can be difficult to insulate. Consequently, significant amounts of heat are lost between the furnace and the supply registers. The greater thermal capacity of water and the small surface area of the distribution system result in smaller distribution losses. The same is true for electric distribution (e.g. electric base board, electric radiant panel) where the distribution heat losses are almost insignificant.

However, electric space heating systems may be less attractive from the operating cost perspective, when compared to oil or gas (on-site combustion) due to the efficiency losses during generation and distribution.

**3-41-1 Perform Comprehensive crawl space improvement**  
**5 Points**

## Controls

### 3-42 Install 60-Minute Timers or Humidistat for Bathroom and Laundry Room Fans

1 Point

Countdown or electronic delay timers allow effective use of bathroom fans without wasting energy. The fan will run for a predetermined period after the light is switched off, to dry the room out. A humidistat is slightly more costly, but adds a further level of efficiency, switching on and off automatically, according to the humidity level in the room.

## Heat Recovery

### 3-43 Install a Heat Recovery Ventilator and ensure compliance to CSA F326

5Points

A heat recovery ventilator (HRV), also known as an air-to-air heat exchanger (AAHX), provides an energy efficient and effective ventilation system that cannot be matched by exhaust-only ventilation systems commonly used in houses. With these units, waste heat in the exhaust air stream is transferred by a heat exchanger into the incoming air stream, significantly reducing the energy required to heat cold outdoor air to interior comfort levels. These units are able to recover 50% to 80% of the heat energy that would otherwise be lost through ventilation. Even in Southwest BC's mild climate, these energy savings pay for the HRV long before the equipment reaches its rated service life.

The system is typically designed to exhaust each bathroom, laundry room, and kitchen, and supply each bedroom and living space (office, living room, and den) using 4-inch or 6-inch diameter ductwork. This installation meets all the requirements of the code, and no other fans or timers are necessary (except perhaps kitchen range hood exhaust). The design provides effective ventilation for the entire house without relying on passive vents, window slot vents, or centrally ducted make-up air. Finally, the HRV is effective at controlling indoor moisture levels and accommodates various filters, which may be incorporated to address other indoor air quality issues.

High efficient filters are not very effective on hrv due to the low cfm of air movement

Another advantage of an HRV system is that it provides high quality ventilation to the house for maintaining indoor air quality (see Action Item 4-57, *Provide Balanced Indoor Pressure Using Controlled Ventilation*).

If you install an HRV, be sure to verify air sealing with a blower door air test. See Action Item 3-9, *Use Blower Door Test to identify and correct air infiltration problems*. If the building is not tight, there are no benefits. teca etc

## WATER HEATING

Water heating typically accounts for 15 to 25% of the energy used in a home. Consequently, improvements in water heating efficiency offer good opportunities to save resources *and* money. Fuels with greater heating value include natural gas, propane, and fuel oil.

The water heating improvements listed below are based on the water heater being located inside the conditioned space of the home. Water heaters located in the garage or other exterior spaces are likely to save more. These upgrades are commonly available in 40-gallon and 50-gallon units.

### Heating and Distribution

#### 3-44 Use a heat pump or indirect water heater for Domestic Hot Water 2 Points

Heat pump water heaters are more efficient than electric resistance models because the electricity is used for moving heat from one place to another rather than for generating the heat directly. The heat source is the outside air or air in the basement where the unit is located, or in the ground underneath or adjacent to the house. Refrigerant fluid and compressors are used to transfer heat into an insulated storage tank. Heat pump water heaters are available with built-in water tanks called integral units, or as add-ons to existing hot water tanks. A heat pump water heater uses one-third to one-half as much electricity as a conventional electric resistance water heater. In warm climates they may do even better.

Indirect water heaters use the home's boiler or furnace as the heat source. In boiler systems, hot water from the boiler is circulated through a heat exchanger in a separate insulated tank. In the less common furnace-based systems, water in a heat exchanger coil circulates through the furnace to be heated, then through the water storage tank. Since hot water is stored in an insulated storage tank, the boiler or furnace does not have to turn on and off as frequently, improving its fuel economy. Indirect water heaters, when used in combination with new, high-efficiency boilers or furnaces, are usually the least expensive way to provide hot water. These systems can be purchased in an integrated form, incorporating the boiler or furnace and water heater with controls, or as separate components. Gas, oil, and propane-fired systems are available.

#### 3-45 Locate Water Heater within 20 Pipe Feet of Highest Use 1 Point

Locating the hot water heater near the point of highest use will minimize pipeline energy loss. Typically, the point of highest demand is the shower.

#### 3-46 Insulate Hot and Cold Water Pipes within 3 Feet of the Hot Water Heater 1 Point

This measure reduces standby heat loss from the water tank. The tank continuously heats the piping and the water in it even when no water is being used. They act as "cooling rods." Insulating them reduces the rate of heat loss.

### 3-47 Install “Home Run” Hot Plumbing at Farthest Location from Water Heater

2 Point

The goal is to eliminate the loss of energy from hot water left standing in long pipe runs from water heater to point of use.

On-Demand, Tankless or Instant On systems are located at the point of use and heat the water as it passes through, producing hot water on demand. The heating is switched on (or ignited, if gas) when water begins to flow through the unit. This saves water at the tap and can save energy that would otherwise be used to store hot water until needed. Since a limited amount of water can be drawn off at any one time, this option should be considered for intermittent and low volume demand needs. See also Action Item 2-72, *Install Instant Hot Water Systems (Where Appropriate)*. Alternately, a small, well-insulated tank-type water heater can be installed at a remote point of use.

“Home Run” hot plumbing uses a small diameter pipe to deliver hot water direct from water heater to remote location, rather than carrying water to that location via the large diameter hot water system that serves the rest of a house. Plumbing systems that use PEX piping and an accessible, central distribution manifold rather than a plumbed loop system, provide this facility on all plumbing runs.

### 3-48 Install On-Demand or Small, Local Hot Water Delivery System at Farthest Location from Water Heater

3 Points

The goal is to eliminate the loss of energy from hot water left standing in long pipe runs from water heater to point of use.

On-Demand, Tankless or Instant On systems are located at the point of use and heat the water as it passes through, producing hot water on demand. The heating is switched on (or ignited, if gas) when water begins to flow through the unit. This saves water at the tap and can save energy that would otherwise be used to store hot water until needed. Since a limited amount of water can be drawn off at any one time, this option should be considered for intermittent and low volume demand needs. See also Action Item 2-72, *Install Instant Hot Water Systems (Where Appropriate)*. Alternately, a small, well-insulated tank-type water heater can be installed at a remote point of use.

### 3-49 Install Electric Water Heater Efficiency to EF of .93 or Higher (or Use 3-52 Below)

2 Points

Current code requires domestic hot water systems meet the NRCan requirements. Installing electric water heater efficiency from an Energy Factor (EF) of .88 to .93 will save 225 kWh per year. Household operational savings will support an additional cost of about \$50. Be careful to avoid heat loss (through heat traps) when you have a hot water tank on lower floors feeding upper stories.

**3-50 Install Gas or Propane Water Heater Efficiency to EF of .57 (or Use 3-53 Below)**  
**2 Points**

Installing gas water heater efficiency from an EF of .55 to .60 will save 18 therms per year. Household operational savings will support an additional cost of about \$38. Upgrading a propane water heater from an EF of .55 to .60 will save 16 gallons of propane per year. Household operational savings will support an additional cost of about \$50. Be careful to avoid heat loss (through heat traps) when you have a hot water tank on lower floors feeding upper stories.

**3-51 Install the Water Heater Inside the Conditioned Space (Electric, Direct Vent, or Sealed Venting Only)**  
**2 Points**

By installing the water heater inside the heated space, you minimize heat loss to the outside.

Combustion water heaters located inside the living area must be sealed combustion type. They will have outside combustion air ducted to the firebox. They also must be directly vented to the outside with no possibility of combustion products mixing with indoor air.

Direct vent hot water heaters help protect indoor air quality by venting combustion by-products outside. They also draw combustion air from outside instead of using treated indoor air.

**3-52 Install Exhaust Air Heat Pump Water Heater or De-Superheater: EF 1.9 (Alternate to 3-49 Above)**  
**4 Points**

The exhaust air heat pump is a good option for families who require lots of hot water. A unit with an EF of 1.9 will yield 50% savings in energy use compared to a conventional system.

**3-53 Install Gas or Propane Water Heater to EF of .90 (Alternate to 3-50 Above)**  
**3 Points**

A condensing water heater works for either gas or propane. A unit with an EF of .83 will yield 30% savings. This is cost effective when used in a combination space and water heating application.

**3-53-1 No DHW Storage – all on demand – no tank and no indirect tank**  
**1 Point**

**3-54 Rough in plumbing and provide a suitable, south-facing roof area for a Solar Water Heat collector**  
**3 Points**

Solar energy can meet part or all of a home's domestic hot water needs. Geographic location, system design, collector orientation, and collector size will determine how much energy can be provided for domestic hot water heating. A solar water heating system may result in immediate positive cash flow if the monthly cost of financing the system is less than the net savings.

Limitations include the need for regular maintenance, a relatively high initial cost, and a long payback period. Solar panels may be aesthetically unacceptable to some. Systems are becoming more efficient and cost competitive all the time. The cost of retrofitting the required plumbing and engineering a suitable space if not provided in an existing house can be preclusively expensive. However, there is little cost to do this during construction, and by doing so, you provide your customer with the capacity to install solar water heating more cost-effectively in the future.

Provide an area of at least 80 sq.ft. on area of roof that faces within 15 degrees of true (not magnetic) South. Run cold water supply and hot water return plumbing from the hot water storage tank to this location.

### 3-55 Install a Solar Water Heating System

10 Points

Solar energy can meet part or all of a home's domestic hot water needs. Geographic location, system design, collector orientation, and collector size will determine how much energy can be provided for domestic hot water heating. A solar water heating system may result in immediate positive cash flow if the monthly cost of financing the system is less than the net savings.

Limitations include the need for regular maintenance, a relatively high initial cost, and a long payback period. Solar panels may be aesthetically unacceptable to some. Lastly there is potential for freezing with passive systems. Vacuum tube collector systems have addressed maintenance, freezing and aesthetic problems, and are significantly more efficient than older systems.

Check local building codes to determine codes related to the installation of solar water heaters. The Solar Ratings and Certification Corporation runs a certification program for solar water heating systems.

#### 3-55-1 Install a Solar Water Heating System for Space Heat $\geq$ 25%

5 Points

Encourage the implementation of implementing solar hot water for space heating – not just domestic hot water. However, this should be calculated and designed to meet 25% or greater for space heating requirements.

#### 3-55-2 Install a Solar Water Heating System for Existing Pool 5 Points

Encourage the implementation of implementing solar hot water for existing pools. Rather than use homes existing heating system or other non-renewable heating sources. This point is designed to reduce energy consumption for existing pools by implanting solar hot water. These points are only for existing and not – new pool installations.

# Drainwater Heat Recovery

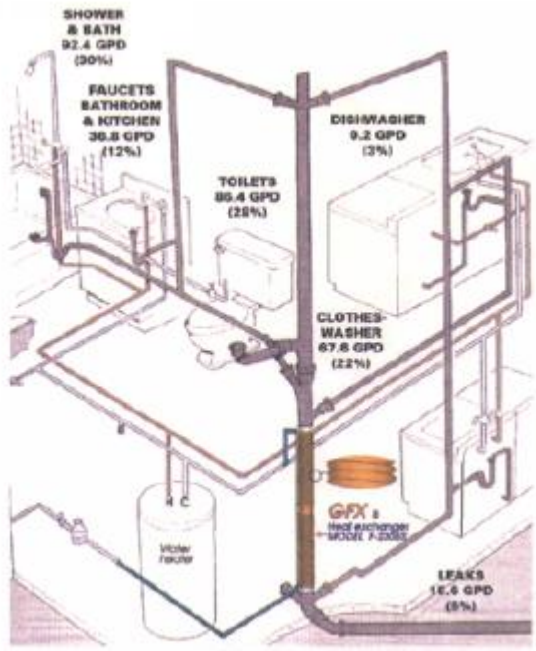
3-56 Install Drainwater Heat Recovery System (DHR) 3 Points

A significant amount of energy is lost when draining warm wastewater. Drainwater heat recovery (DHR) devices fit into existing drain lines to capture some of that exiting energy. DHR systems use drainwater to preheat cold water going to a shower or to a water heater. DHR systems reduce the energy needed to heat water and can increase the capacity of water heaters. DHR systems cost between \$400 and \$800 not including installation or about \$1000 installed.

- 2 points for short (3' long) system
- 3 points for long (4+' long) system

**Figure 3-6—Drainwater Heat Recover System**

(Source: [Canadian Home Builder's Association Builder's Manual](#))



## Appliances

All appliances installed in the home should be as energy efficient as possible. The reduced electrical costs for operating energy efficient appliances rapidly offset slightly higher initial costs, if any.

The “Energy Guide” or ENERGY STAR® labels found on many appliances identifies them as energy efficient. Also, look for the following energy-saving characteristics:

- Refrigerator/Freezer—Energy-efficient characteristics include freezer-on-top arrangement (rather than side-by-side), manual defrost, and absence of through-the-door dispensers and automatic icemakers. In general, the larger the refrigerator, the more energy it takes to run. However, newer models with some of these features compensate for the energy penalty with advanced insulation systems.
- Dishwasher—The primary cost of running a dishwasher is the cost of heating the water. Energy saving features includes light load options and air circulation for drying. Also, the smaller the machine the less energy required to run a load. If you are building a home for a large family, though, it will be better to install a larger machine that can be run fewer times a day.
- Washing Machine—Similar to the dishwasher, the primary energy cost is in heating the water. Energy saving features include options for cold water wash and small loads. In general, front-loading washing machines use one-third less water than top-loading machines, and research shows they do a better job of cleaning the clothes.
- Dryer—The primary energy saving feature is automatic shut-off when the clothes are dry.

### 3-57 Provide an Outdoor Clothesline

1 Point

A permanent clothesline can save energy and help reduce air pollution by reducing use of the clothes dryer (frequency and/or load volume). An outdoor location avoids moisture problems in the home. Using only a clothesline, instead of electric or gas dryer, saves an average of 1,000 kWh of electricity a year.

### 3-58 Install Gas Clothes Dryer

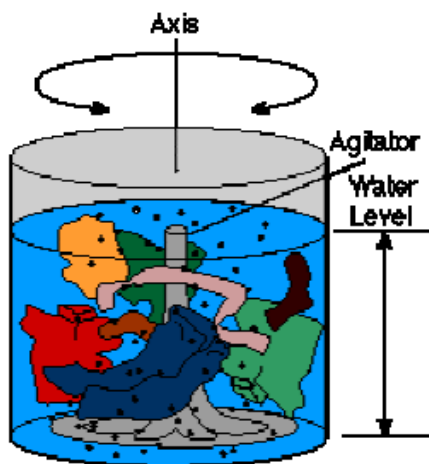
1 Point

In new construction, installation of a gas clothes dryer in lieu of an electric one will result in cost savings to the homeowner, even considering installation of the additional gas piping. Cost for fuel piping when installed during construction is minimal—\$40 to \$75. Gas clothes dryers generally cost about \$40 more than electric clothes dryers.

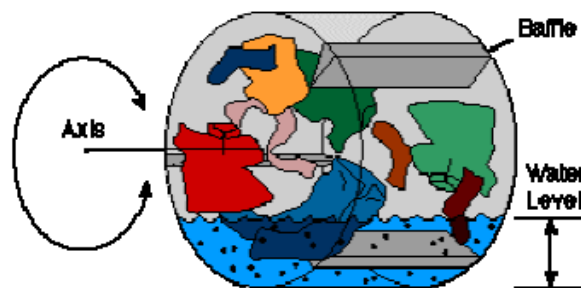
Energide/ENERGY STAR® certified clothes washers offer significant water and energy efficiencies (up to 30% less) compared to non-certified machines. Additionally, because they use higher spin speeds, clothes at the end of the wash cycle contain less water compared to conventional washers. This reduces *dryer* energy use as well. Finally, Horizontal-axis (H-axis) washers generally use less water per wash, and are gentler on clothes so they last longer (see Figures below). All these benefits are features you can “sell” to your clients.

Energide/ENERGY STAR Front Loader –3 Points

**Figure 6-1— Top Load:  
Vertical Axis Configuration**



**Figure 6-2— Front Load:  
Horizontal Axis Configuration**



**3-60 Install an Energuide/ENERGY STAR® Dishwasher****1 Point**

As with other home appliances, national energy standards have spurred the development of more efficient dishwashers. Energy- and water-efficiency are closely related in dishwashers except for booster heating and drying cycles. The most water-efficient dishwashers use as little as 3.9 gallons per cycle at the economy setting. Energy savings range from 80 kWh per year to 364 kWh per year. Some of the most efficient dishwashers also operate significantly more quietly than conventional dishwashers.

You can market your selection of an extra-efficient dishwasher to the homeowner from several perspectives—performance, water and energy efficiency, ease of use, total features, quiet operation, and reliability.

**3-61 Install an Energuide/ENERGY STAR® Refrigerator****1 Point**

Energide/ENERGY STAR® refrigerators are at least 20% more efficient than the current federal minimum standard. Energy savings range from 125 kWh per year to 320 kWh per year, depending on size, style, and features. A cost effective consumer investment ranges from \$25 to \$125.

**3-62 Demonstrate that the Energuide/ENERGY STAR® appliance suite selected uses 15% less energy than minimum Energide/ENERGY STAR® requirements****5 Points**

Offer your customer a selection of appliance packages that feature all ENERGY STAR® appliances.

You can market your selection of extra-efficient clothes washers, dishwashers, and refrigerators to the homeowner from several perspectives—performance, water and energy efficiency – reducing operating costs, ease of use, total features, quiet operation, and reliability.

Refer to the certified product lists at the Energide and ENERGY STAR websites, or arrange special package options with your appliance supplier, and provide them with materials on the benefits of ENERGUIDE/ENERGY STAR® appliances (see Action Items above).

## LIGHTING

Lighting accounts for 5 to 10% of total energy use in homes, costing \$50 to \$150 directly per year. While this amount is relatively small, lighting choices can also affect the amount of energy used to heat and cool the home. More efficient lighting can also mean better lighting, such as when daylighting and task lighting is specifically considered as part of the design.

## Natural Light

### 3-63 Use Light-Colored Interior Finishes

1 Point

Light colored interior finishes naturally reflect both natural and artificial light, reducing the demand for additional artificial lighting.

### 3-64 Use Clerestory or Roof Monitor for Natural Lighting

2 Points

Careful design and specification of windows is a cost-effective way to save energy. Further savings are achieved by shading techniques and north-facing clerestory windows (any window with sill above eye level) that admit natural light without direct solar gain.

### 3-65 Use Light Tubes for Natural Lighting and to Reduce Electric Lighting

2 Points

Well-placed windows, small skylights, and light-colored surfaces can make for a sunny, cheerful, inviting interior while saving energy. Light tubes are a new type of “skylight” on the market. These devices are tested to be very effective at transmitting light, generally do not suffer condensation problems, and when compared to conventional skylights, allow less heat loss during winter and less solar heat gain in summer. They also provide significant location flexibility and are fairly easy to install. Basic components include a clear plastic dome on the roof that admits sunlight; a reflective tube that carries light down into the home; and a ceiling-mounted light diffuser that distributes light into the target room. Also available are light tube options with a vent (for bath) or recessed can (for illumination at night).

## Solar Powered Lighting

### 3-66 Use Solar-Powered Walkway or Outdoor Area Lighting

1 Point

Solar powered outdoor lighting uses a photovoltaic (PV) panel to generate electricity during the daytime, which is then stored in a battery. At night, stored electricity is used to power the light. Some models are manual, while others are turned on automatically by light-sensing controls or activated by motion-sensing devices. Most of these walkway or security lights require no wiring or installation other than pushing the stake into the ground, or screwing the fixture to a garage wall.

Most of the widely marketed solar walkway lights do not put out a lot of light, but they are useful for lighting the path to the door so guests can find their way. Also available are larger solar lights that *do* provide a lot of light, but these can be expensive.

Solar-powered outdoor lights can be found in many hardware or department stores, or purchased through catalog retailers of alternative energy and stand-alone power equipment.

## Efficient Lighting

<b>3-67 Furnish Four ENERGUIDE/ENERGY STAR® Compact Fluorescent Light Bulbs to Owners</b>	<b>★ and/or 1 Point</b>
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This Action Item is required for credit in the program if you are installing screw-in compacts for conventional fixtures. See Action Item 3-71, *Use ENERGUIDE/ENERGY STAR® Compact Fluorescent Bulbs in Three High-Use Locations.*) If you don't provide additional bulbs, the homeowner may go back to incandescent bulbs when replacements are needed.

If you provide dedicated fixtures AND replacement bulbs, you receive 1 point.

Compact fluorescent lights (CFL) have a higher first cost (up to \$10 to \$12 more), but advanced technology enables CFLs to use 75% less energy than a standard incandescent bulb and last up to 10 times longer. This means that over the life of one CFL, a consumer can avoid replacing up to 13 incandescent bulbs! The super efficient performance of CFLs also means a consumer can save at least \$25.00 in energy costs over the life of each CFL that replaces an incandescent bulb. Modular compact fluorescent lights can save the customer even more, because as lamps fail, only the lamp itself, and not the ballast, has to be replaced.

Furthermore, earlier objections to the quality of fluorescent lights no longer holds merit because newer bulbs produce a warm light with good color rendering similar to incandescent, while electronic ballasts eliminate the hum, flicker, and delayed illumination time, which were common with older models.

Fluorescent bulbs that meet ISO 9000 standards are low-mercury or mercury-free.

<b>3-67-1 Use Any Fixture that Uses Less Energy than Incandescent Light 80% of Lighting</b>	<b>1 Point</b>
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<b>3-67-2 Exceed performance of Incandescent light by 50% - 80% of Lighting in House</b>	<b>2 Points</b>
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**3-68 Substitute Halogen Lighting for Incandescent Down-Lights****1 Point**

Halogen lamps are “turbo-charged” incandescents that screw into standard sockets and are about 10% more efficient than standard incandescents. Often called “punchy,” they emit a whiter light than standard incandescents, making them a good choice for illuminating work requiring high visual acuity or where color rendition is important, such as lighting works of art. They are available in reflector, flood, spotlight, and standard styles, and are dimmable. Halogens lose less than 10% of their brightness over their lifetimes, compared to 25% for standard incandescents.

Halogen-IR bulbs are even more efficient, using about half the electricity of standard incandescents, cost \$5 to \$6 each, and last longer than normal incandescents.

Let the homeowner know that halogen torchieres are a fire hazard.

**3-68-1 Reduce Halogen Lights in House to Less than 50% of all house lights****1 Point**

Reduce Halogen Lights in house to less than 50% of all house lights

**3-68-2 Reduce Halogen Lights in House to Less than 25% of all house lights****1 Point**

Reduce Halogen Lights in house to less than 25% of all house lights

**3-69 Install Motion Detectors and Photocell Controls on All Exterior Lights****1 Point**

Light-sensing controls are increasingly being used to control outdoor lights along driveways and walkways. Consider motion detectors and photosensors for energy efficiency. Consult with your lighting supplier for optimal placement.

**3-70 Install Lighting Dimmer, Timers, and/or Motion Detectors on Interior Lights****2 Points**

Dimmers allow you to use one light for many purposes, and can save energy and extend the life of most bulbs when used at lower levels. Look for full-range dimmers that vary the light continuously from off to full brightness. Dimmers can be used with incandescent lights, including low voltage systems, and with compact fluorescents. There are several choices of wall-mounted dimmers: toggle, rotary, sliding, solid-state touch, and new integrated systems with remote controls that can recall previous lighting levels. If several high-wattage incandescent lamps are to be controlled at one point, add a hard-wired dimmer.

Timers can be located at a light switch, a plug, or in a socket, and are available as both mechanical and solid-state. Some offer the option of a manual override. Some screw-base compact fluorescent bulbs cannot be used with timers; check manufacturer's recommendations.

Motion detectors or occupancy sensors can result in significant energy savings, especially in bathrooms and bedrooms where lights are frequently left on. Sensors can have manual on/off switches or can operate entirely automatically. Motion detectors should not be used with some compact fluorescents, or with high intensity discharge lights because of their inability to re-light quickly. Some models feature dimmers that reduce light to a preset level rather than turn completely off; others come with photosensors that turn lights on only when the light level is below a preset point and motion is detected.

**3-70-1 Motion Detectors used in conjunction with LED lighting 1 Point**

**3-71 Use Energuide/ENERGY STAR® Compact Fluorescent Bulbs or LED in Three High-Use Locations (Kitchen, Porch/Outdoors, and One other Location) Nothing but above rated lighting. 2 Points**

Fluorescent lighting uses about 1/3 of the electrical energy as incandescent lighting. To be cost-effective, fluorescent fixtures should be installed in the fixtures that get the greatest use. A recent study performed by a local Public Utility identified the fixtures that are most likely to be on more than three hours per day in the winter months. The most used fixtures were in the kitchen, followed by the porch, living room, and other outdoor lighting. Lamps that are on three hours per day can provide a simple payback to the homeowner in less than 3 years if the upgrade cost is less than \$15. Fluorescent lamps can be expected to last 10,000 hours. (See Action Item 3-67, *Furnish Four ENERGUIDE/ENERGY STAR® Compact Fluorescent Light Bulbs to Owners.*)

**3-71-1 Use Non-Screw In Type Fixture to Ensure Impossible Replacement to Incandescent 1 Point**

**3-72 Install ENERGUIDE/ENERGY STAR® Fixtures (Including one Original and One Back-up Lamp) in Three High-Use Locations (Kitchen, Porch/Outdoors, and One other Location) 5 Point**

Fluorescent lighting uses about 1/3 of the electrical energy as incandescent lighting. Using ENERGUIDE/ENERGY STAR® fluorescent light fixtures is preferable to using screw-in CFL bulbs, because the ballast is located in the fixture not the bulb. This makes replacement bulbs less expensive and reduces material consumption and waste production.

To be cost-effective, fluorescent fixtures should be installed in the locations that get the greatest use. A recent study performed by City of Tacoma Public Utilities identified the fixtures that are most likely to be on more than three hours per day in the winter months. The most used fixtures were in the kitchen, followed by the porch, living room, and other outdoor lighting. Lamps that are on three hours per day can provide a simple payback to the homeowner in less than 3 years if the upgrade cost

is less than \$15. Fluorescent lamps can be expected to last 10,000 hours. (See Action Item 3-60, Furnish Four ENERGY STAR® Compact Fluorescent Light Bulbs to Owners.)

## Innovation

<b>3-73 Include Innovative Design, Equipment, and Operation Solutions to Enhance the Energy Efficiency of the Home</b>	<b>4-10 Points</b>
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This Action Item recognizes renovators and builders for using innovation and emerging technologies, practices, and products that fulfill on the intentions of the Energy Efficiency section, but are not called out in the checklist.

Members can earn up to 10 points by submitting a short written justification for the extra credit points to the Built Green™ Standards Committee for review, approval, and award of points. This justification should include a description of the innovative action, an explanation of why it is beneficial, and a recommended point value (up to 10) based on its impactfulness, in line with the Built Green™ Program. The Committee will evaluate the submittal and recommended points and will determine final point awards.

Points for:

Energy Reduction	1-5
Water Reduction	1-3
Material Resource	2
Indoor Air Quality	1-3

## Section Four:

# Health and Indoor Air Quality

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The Action Items in this section are intended to promote good indoor air quality as well as reduce health risks from toxins and allergens for occupants and installers. Please note that the practices described in this section are not intended to represent the comprehensive approach required for an occupant with unusual chemical sensitivities or allergies. A product labeled as non-toxic may be harmless for most individuals, but may cause problems for particularly sensitive individuals. Such a client should be encouraged to consult a qualified health professional for assistance.

## REQUIREMENTS

4-1	Direct Stormwater at Least 5 ft Away from Building Using Grading and Approved Drain System as Appropriate	★ or 1
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Stormwater that stands or seeps around crawlspace, slab, foundation, or basement can lead to moisture damage, dampness, and mold growth. Backfilled dirt around the footprint of a building should slope down and away for a distance of at least 5 feet to ensure surface runoff away from structure. Down spouts should feed into infiltration trenches or other drainage systems that convey water away from footings. Garage floor and driveway are sloped to drain out.

4-2	Seal at Doors, Windows, Plumbing, and Electrical Penetrations Against Moisture and Air Leaks	★ or 1
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Sealing these penetrations is required by code, but often difficult to enforce. As part of quality control, make sure your crew seals *all* penetrations at doors, windows, plumbing, and electrical penetrations.

Pay special attention to plumbing stacks that run from the crawlspace to the attic, adjacent to baths and kitchen. Leaky pathways in these locations can act as chimneys, continuously drawing cool air from the crawlspace to the attic. During winter months especially, the cold air drawn through rooms with high relative humidity cools interior surfaces and promotes condensation and mold growth.

Even better is to use the Airtight Drywall Approach (ADA), an advanced sealing package that goes beyond basic practice. (See Action Item 3-7, *Airtight Drywall Approach for Framed Structures.*)

**4-3 If Slab is Used, Install Poly Barrier Properly; If No Slab, Ensure Bottom of Floor is Sufficient Height Above Backfilled Dirt with Vapor Barrier Properly Installed**

★ or 1

If a slab is installed, use gravel fill beneath the foundation slab with a poly membrane (min. thickness of 6 mm) or vapor retarder, sealed over the gravel prior to pouring the basement floor. Seal the poly at the edges and seams to prevent moisture from migrating into the home. (Note: The poly barrier also protects against radon and other soil gases.)

If you do not use a slab, the bottom of floor structure should be at least 12 inches (1 foot) above backfilled dirt.

**4-4 Ensure Proper Drainage of Crawl Space**

★ or 1

Avoid over-excavation and provide appropriate grading in crawl space and drainage pathways through footings/foundations.

The damming effect of concrete footings may lead to incomplete drainage of a crawl space. Moisture barrier will not prevent standing water from impacting moisture content in crawl space with potential mold growth and structural damage as a consequence. (See Action Item 2-25, *Use an Alternative Foundation System to Minimize Disturbance to Soil and/or to Water Flow.*)

**4-5 Ensure Attic Space is Sealed from Living and Crawl Spaces to Prevent Moisture Build Up**

★ or 1

Air seal living areas from attic space, including air-tight access hatch. All plumbing, wiring, and HVAC chases from the crawl space should also be air sealed from the living space.

**4-6 Use Roof Gutters to Drain Out onto Splash Blocks or Approved System to Drain Water Away From Building**

★ or 1

Some municipalities require drainage to the stormwater system. The best alternate way to divert water away from home is to put in a dedicated drain field. Roof gutters direct the flow onto splash blocks or approved drain system so water drains away from building.

**4-7 Pitch and Flash Roofs Properly**

★ or 1

Roofs are pitched at least 3-in-12, and all roof penetrations are properly flashed. Eaves extend out far enough to keep water off windows.

#### 4-8 Install Spot Ventilation Equipment in All Appropriate Locations as per Ventilation and Indoor Air Quality Codes

★ or 1

Cooking produces odors, water vapor, and particulates such as grease and smoke. Bathrooms, laundry rooms, and pool and hot tub rooms generate lots of moisture. Exhaust fans capture and remove these pollutants from the interior of the house to prevent airborne contamination.

With respect to kitchen exhaust range hoods, bigger is not always better. Range hoods should be carefully sized and installed. If combustion appliances are present or the fan flows are high, provide make-up air to assure safe operation. In these situations, test to assure that pressure imbalance caused by the exhaust fans do not exceed minus 3 PA indoors to outdoors, or equivalently, the test meets Performance Tested Comfort Systems (PTCS) performance criteria for controlling de-pressurization (see Note below).

Look for “low-sones” fans to encourage use; the quietest fans can hardly be heard when you’re in the same room. See Action Item 4-8, *Install Spot Ventilation Fans to Same Standard as Whole House Fan* that specifies sone ratings.

Note: The Performance Tested Comfort Systems program provides training to HVAC contractors for this testing (see Action Item 3-37, *Performance Test Duct for Air Leakage Meets Third-Party Review and Certification*).

#### 4-9 Install Spot Ventilation Fans to Same Standard as Whole House Fan (Fan Noise at 1.5 sones or less, etc.)

★ or 2

Standard requirements for this category include:

- Fan Rating – Based on application. Fan exhaust rates should be at 0.25 inches water gauge, which is shown on the manufacturer's fan curve. However, the rating marked on packaging is often at the lower 0.1 inches water gauge, which does not meet the VIAQ requirement
- Fan Noise – Fans must be rated at 1.5 sones or less if the fan is located within 4 feet of the interior pick-up grille
- Ducts – Must be sized and installed appropriately with respect to number of elbows, length of run, have a back draft damper, be insulated to R-4 outside heated space and terminate to the outside
- Outdoor Air Inlets – Must be provided into each space with an exhaust fan.

#### 4-10 Ensure Heating and/or Cooling Equipment is Correctly Sized to Meet Design Heating and Cooling Loads of Home (Do Not Oversize)

★ or 2

New heating and cooling equipment should be specified to meet the requirements of the space, not significantly oversized. By limiting the size of space conditioning equipment, you avoid excessive equipment cycling, which reduces energy efficiency and service life and increases maintenance requirements. It also insures that the run cycle is long enough to condition air, remove moisture, and filter air. This should also result in downsizing equipment, which will generally reduce cost or allow more efficient equipment within budget.

## OVERALL

### 4-11 Certify Renovator/Builder to Have Taken Indoor Air Quality Course 5 Points

Topics covered include indoor air quality and health, design and energy issues, material selection, dust and moisture control, ventilation and filtration methods, and pesticide and chemical usage. The course is open to the public, but is targeted to building professionals, including architects, builders, industrial hygienists, engineers, interior designers, and others.

For further information, see <http://www.healthhouse.org/build/training.asp> or visit CMHC's website. Course: Let's Clear the Air (LCTA), one day; or approved equivalent. [http://www.cmhc-schl.gc.ca/en/ab/noho/noho\\_020.cfm](http://www.cmhc-schl.gc.ca/en/ab/noho/noho_020.cfm)

## Jobsite Operations

### 4-12 Use Less-Toxic Cleaners 1 Point

Cleaners and solvents can be sources of hundreds of potentially harmful chemicals. Review manufacturer's Material Safety Data Sheets (MSDS) before you buy. Avoid products that are given a health hazards rating higher than "1." In addition, avoid as much as possible products with ingredients that the MSDS classifies as *toxic* (poisonous), *flammable*, *caustic* (causes burns), or chemically *reactive*. Leftovers of these products will be hazardous waste. (For proper hazardous waste handling and disposal procedures, see Action Items 2-32, *Dispose of Non-Recyclable Hazardous Waste at Legally Permitted Facilities*, 2-36, *Establish and Post Cleanup Procedures for Spills to Prevent Illegal Discharges*, and 2-35, *Reduce Hazardous Waste Through Good Jobsite Housekeeping*.)

Use environmentally friendly alternatives, including biodegradable products and those that are zero-VOC or low-VOC (no- to low-volatile organic compounds).

### 4-13 Require Workers to Use VOC-Safe Masks 1 Point

For small projects with short exposures to VOCs, a gray carbon-impregnated dust mask manufactured by 3M or equivalent should suffice. These masks are readily available at most lumberyards and run about \$4 to \$5 each.

Whenever workers are exposed to off-gassing or fine particulates (for example, from paints, solvents, adhesives, molds, or finishes), a flexible half-mask equipped with two or three straps to ensure a tight fit should be worn. Filter cartridges are used to complete the mask. They are color-coded to identify the kind of contaminant they are designed to capture. Cartridges designed to capture VOCs are black and filled with activated charcoal. When the charcoal becomes saturated (end of life), the operator will begin to smell the vapor, signifying that it is time to change the filter. To extend the life of the filter, store in a plastic bag between uses. The mask usually costs under \$30; a set of filters can run from \$30 to \$50.

Note: Filtration through a mask is actually the *least* effective method of reducing worker exposure to volatile organic compounds (VOCs) resulting from applying paints, thinners, and solvents. The best method is to eliminate or reduce the problem in the first place by choosing low- or non-toxic alternatives and keeping the work area thoroughly ventilated (see Action Items 4-34, *Use Low-VOC, Low-Toxic, Water-Based, Solvent-Free Sealers, Grouts, Mortars, Caulks and Adhesives Inside the House*, and 4-40, *Use Low-VOC /Low-Toxic Interior Paints and Finishes for Large Surface Areas*).

**4-14 Take Measures During Construction Operations to Avoid Moisture Problems Later** **½ point for each max 2 points**

Moisture problems in today’s “tight” buildings are always a concern. Measures to take during construction operations to avoid moisture problems down the road include:

**Durability Plan**

Pump or drain standing water out of the structure after major rainstorms	½ pt
Hook up installed rain gutters to temporary pipes to draw water away from foundation	½ pt
Keep stored materials dry with tarps or in a protected place, or use just-in-time delivery to avoid problems with stored materials	½ pt
Protect woodwork from moisture damage during transit, delivery, storage, and handling	½ pt
Install footing drains, tight lines, downspout systems	½ pt
Use flashing instead of caulking to seal above doors, windows, and other openings	½ pt
Properly counter flash chimneys and build a cricket above chimney to divert water	½ pt
Properly flash all roof-to-wall intersections	½ pt
Avoid flat roofs	½ pt
Use quiet fans (1.5 sones or less) bathrooms with a 60 minute timer. Noisy fans will not get used.	½ pt
During construction, remove unwanted moisture with a dehumidifier, not combustion heaters, which only bring more moisture into the home.	½ pt
Temporary Roofs Tarpred to Prevent Interior Framing from getting wet while under construction	½ pt

**4-15 Take Measures to Avoid Problems due to Construction Dust** **2 Points**

Preventive measures to avoid subsequent problems resulting from construction dust include:

- Cleaning/vacuuming up dirt, dust, and wood shavings as you go
- Vacuuming stud bays before dry-walling

- Vacuuming the floors before final flooring installation
- Mask floor registers or use temporary screens or protective boxes to prevent debris from accumulating during construction
- Install construction filters—Change them after construction is done, then flush and change them again (mechanical contractor can do this).

#### 4-15-1 Isolate Construction Area

1 or 2 Points

Isolate construction area from non-construction area with physical barrier, 1 point. Add pressure separation, take one additional point.

#### 4-16 Protect Exterior Building Components from Water or Moisture Damage

2 Points

Properly protect exterior components from future moisture damage. Measures to take include the following:

- Flash around all openings.
- Tape housewrap to flashing.
- Take steps to keep vegetation more than a foot away from the house.
- Caulk all exposed joints.

#### 4-17 Use Moisture Meter to Ensure Moisture Levels are below 15% in Walls and below 10% in Floors before Closing Up, Installing Dry Wall, and Finish Floors

2 Points

Moisture problems in today’s “tight” buildings are always a concern.

Use a moisture meter to make sure moisture content of sheathing and framing materials does not exceed 15%. Sub-floors should be below 10% moisture content before finish floors are installed. If readings exceed these levels, dehumidify before installing insulation and drywall (See Action Item 4-19: *Use Dehumidifiers or Electric Heaters During Construction (No Unvented Combustion Heaters)*)

#### 4-18 Ventilate with Fans After Each New Finish is Applied

3 Points

Each new finish (for example, paints, stains, and floor finishes) will off-gas for a time after it is applied. Emissions are highest immediately after the finish is applied. It is important to ventilate the house with fans (several box fans in windows work best) so that gases will be exhausted outside. Venting out should continue for at least two and up to seven days after each application, depending on the amount of surface covered and the toxicity of the finish. (For toxic finishes applied over large areas, vent for seven days.) Use construction filters and change them out before occupancy. If the

house is not properly ventilated during this phase, the emitted gases will adhere to surfaces in the house and later re-released into the indoor environment.

<b>4-19 Use Dehumidifiers or Electric Heaters During Construction (No Unvented Combustion Heaters)</b>	<b>3 Points</b>
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The use of unvented combustion heaters produces excess moisture that can become trapped inside framing members during construction, leading to subsequent moisture damage. In addition, they produce fumes that can be hazardous to workers. Instead use a vented heater or portable electric heater.

Also, do not use the home's heating system during construction. Instead, start up the heating system for testing and balancing just before the owners move in.

Note: Often heaters are used to "dry out" the building following a rainstorm. Rent a dehumidifier instead.

<b>4-20 Clean Ducts and Furnace Thoroughly at Job Completion</b>	<b>3 Points</b>
------------------------------------------------------------------	-----------------

During construction, debris often enters through the registers to collect in the ducting. Unless removed, fine particles from the debris, which can be respiratory irritants, can circulate within the ducts and re-enter the spaces through the registers.

In the final stages of construction and before owners move in, thoroughly clean and vacuum ducts to remove any particles that may have entered during construction.

<b>4-21 Prepare an Indoor Environmental Quality Protection Plan for the Project</b>	<b>3 Points</b>
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Planning ahead, and ensuring that your construction team is familiar with the plan can minimize the risk of IEQ problems that can be caused during construction. Your IEQ plan should include:

- Plan to protect all building materials from unnecessary exposure to moisture, and how to respond if materials do get wet. How will you dry the building out before closing up? What moisture content should be achieved in wall structures and floors before applying finish materials?
- HVAC Protection - How will you protect your HVAC system from contamination by dust, chemicals, etc. during construction and pre-occupancy;
- Source Control – Use of non-toxic materials where possible (including caulks, adhesives, sealants, paints, etc.)
- Isolation and/or ventilation of "wet" or dusty work areas to prevent contamination of finished spaces.
- Housekeeping – schedule and requirements for cleaning/removal of contaminants – e.g. removal of dust in stud bays prior to sheet-rocking.

- Scheduling – construction sequencing to reduce absorption of VOCs – e.g. completing all painting, sealing, and caulking prior to installing “soft” materials such as ceiling tiles, carpets, fabric furnishings, etc.

All of these items are covered elsewhere in the IAQ section of the checklist. This plan formalizes your selected Action Items enable effective communication and construction site management.

## 4-22 Involve Subs in Implementing the IEQ Plan for the Project

4 Points

To implement healthy building jobsite plan, it is important to enlist the support and cooperation of your subcontractors, especially painters, floor finishers, cabinet maker, as well as any others that will be applying adhesives and caulks indoors (for example, flooring installers, countertop installers, finish carpenters, framers, plumbers, and HVAC contractors). Before the job begins and during on-site work, coordinate with them about:

- Using low toxic materials (see Action Items 4-34, *Use Low-VOC, Low-Toxic, Water-Based, Solvent-Free Sealers, Grouts, Mortars, Caulks and Adhesives Inside the House* and 4-40, *Use Low-VOC /Low-Toxic Interior Paints and Finishes for Large Surface Areas*).
- Venting out the building during and after each finish is applied (see Action Item 4-18, *Ventilate with Fans after Each New Finish is Applied*).
- Preventing moisture accumulation and entrapment in the structure during construction that could cause mold growth or other damage during the life of the structure (see Action Item 4-14, *Take Measures During Construction Operations to Avoid Moisture Problems Later*).
- Using only electric or vented heaters during construction (see Action Item 4-19, *Use Dehumidifiers or Electric Heaters During Construction {No Unvented Combustion Heaters}*). Use dehumidifiers, if needed, to dry out the building during construction.
- Prohibiting smoking in the structure enclosure.
- Coordinating closely with HVAC and electrical contractors for installation of whole house ventilation and quiet spot ventilation in wet areas.
- Making sure any toxic materials such as asbestos, lead, or CCA pressure treated lumber are handled properly. (See Action Items 2-32, *Dispose of Non-Recyclable Hazardous Waste at Legally Permitted Facilities*, 2-33, *Establish and Post Cleanup Procedures for Spills to Prevent Illegal Discharge*, 2-34, *Reduce Hazardous Waste through Good Jobsite Housekeeping*. See Action Item 5-8, *Contractually Require Subcontractors to Participate in Waste Reduction Efforts*, for tips on ways to involve subs.

## LAYOUT AND MATERIAL SELECTION

How we finish and furnish our homes can impact the quality of the home's indoor environment. This means selecting products that are environmentally friendly, healthy, and low in formaldehyde and volatile organic compounds. It also means using less carpet and other textiles and installing more flooring and other surfaces that are smooth and easy to clean.

### 4-23 If Using Carpet, Specify Low VOC Carpets with Indoor Air Quality (IAQ) Label

1 Point

New carpet can emit volatile organic compounds (VOCs) when first installed. Labeling programs aid in the selection of low-emitting carpet, adhesives, and cushion materials.

Carpet bearing the IAQ label indicates that:

- The manufacturer voluntarily participates in these programs and is identified by an assigned number in the label.
- The manufacturer is committed to developing ways to minimize any adverse effects on indoor air quality.
- A representative sample of the product type has been tested by an independent laboratory and meets the established requirements for each program.

### 4-24 Install Low Pile or Less Allergen-Attracting Carpet and Pad

1 Point

Carpet off-gases when it is new. In addition, carpeting acts as a highly effective reservoir for allergens such as dirt, pollen, mold spores, dust mites, and other toxins carried into the house by shoes. Moreover, as carpet wears out, the surface yarn breaks down and becomes house dust. For that reason, this program encourages limiting or eliminating carpet (see Action Item 4-41, *No Carpet*).

However, if you do select carpet for the home, protect air quality by choosing a low pile type and installing it with urethane padding. Preferably, select a carpet made from natural fibers (see Action Item 4-39, *Install Natural Fiber Carpet*) or an all-nylon carpet, which is less attractive to dust mites and mold. Also look for recycled-content carpets (see Action Item 5-52, *If Installing Carpet, Use Recycled-Content or Renewed Carpet*); the processed materials used in them tend to be less toxic than virgin synthetics. Finally, avoid dark colors; these carpets contain more toxins than light carpets because more dye is needed to create the dark color.

Also, carpet should never be applied to a concrete slab unless provisions for a moisture/vapor retarder or insulation have been incorporated in the slab that will allow the carpet to remain warm and dry. If not, moisture can migrate through the floor and cause mold growth under the carpet.

### 4-25 Provide Cleanable Doormat and/or Shoe Racks at Entry(ies) to Home

1 Point

Some studies indicate that up to 80% of indoor pollutants are tracked into the home on shoes. Track-off mats reduce particulate pollutants carried in on shoes. Installing a shoe rack, and perhaps a

convenient seat encourages shoe removal, which effectively eliminates this source of indoor pollution.

**4-26 Build a Lockable Storage Unit for Hazardous Cleaning and Maintenance Products, Detached From Occupied Space 1 Point**

A lockable storage closet in the garage (vented to the outside away from fresh air intakes such as windows) prevents fumes from getting into the living area, as well as toxic or otherwise dangerous chemicals from getting into the hands of curious children. Keep the storage closet small, to discourage homeowner from accumulating too many hazardous products, and locate it away from any source of ignition, such as a water heater. Provide a note in the Homeowner's Information Kit advising that all hazardous materials should be stored in original containers.

**4-27 If Installing Water Filtration, Select Biodegradable Carbon Filters 1 Point**

As a result of growing concern about the quality of drinking water, the popularity of domestic water filters has increased dramatically. In fact, one third of consumers surveyed in a 1997 Water Quality Association study reported they currently use a home water-treatment device other than bottled water.

There are many kinds of filters available, some expensive, some inexpensive. Whichever you install, make sure it uses biodegradable carbon filters.

**4-28 Limit Carpet to One-Third of Home's Square Footage 3 Points**

The healthiest floor choices are smooth surfaces, such as tile, linoleum, and wood, which do not harbor dust and other allergy-causing particles. Solid surfaces are easier to clean than carpet and they keep vacuuming to a minimum. (Vacuuming stirs up dust, even under ideal conditions.) Wood and tile floors are also more durable than carpet, so they cost less per year of use. (See *Section Five: Materials Efficiency, Finish Floor, Action Items 5-50, 5-53, 5-54, and 5-55*).

**4-29 Optimize Air Quality in Family Bedrooms 3 Points**

The most important area of the house to optimize the indoor air quality is in the bedrooms, by eliminating toxic finishes, dust, and/or moisture-prone surfaces in these rooms. This is because we spend the most time there. For example, make sure that the paints, varnishes, and wall coverings used to finish the family bedrooms are low-VOC and easily maintained without the use of harsh chemical cleaners or waxes. In addition, it is especially important to avoid use of carpets, heavy draperies, or other dust-catching furnishings in the sleeping areas.

Optimizing air quality in sleeping areas is one example of "air quality zoning," a strategy that recognizes that different rooms have different functions and air quality control requirements. Another example is isolating air distribution systems serving hobby rooms and office areas, which produce odors, from the rest of the home.

**4-29-1 Cross ventilation****3 Points**

Provide for cross ventilation using operable windows in addition/renovation.

**4-29-2 Re-work existing windows****1 Point**

Re-work existing windows that have been painted shut to make them operable.

**4-30 If Using Carpet, Install by Tacking (No Glue)****1 Point**

Adhesives used to install the carpet to the floor are a significant source of odor and air pollution. Tack strips eliminate this problem. As a last resort, choose a low-odor, water-based adhesive. Never use solvent-based carpet adhesive.

**4-31 If Garage is Attached, Air-Seal it from House****\***

Studies show that carbon monoxide, sometimes produced in significant levels when automobiles are started, can enter the home from the attached garage. This Action Item eliminates this potential source of indoor air pollution by air sealing it from the house.

Air sealing the garage from the house involves:

- Using caulk or foam to seal all holes in walls and the ceiling between the house and garage.
- Using the Airtight Drywall Approach (ADA) in the walls and ceiling shared by house and garage. ADA is an advanced sealing package that goes beyond basic practice (see Action Item 3-7, *Airtight Drywall Approach for Framed Structures*).
- Making sure that the door between the house and garage is weather-stripped and is fitted with a threshold that creates a tight seal with the door.
- It is mandatory that the Mechanical Room not be in the garage.

**4-32 Use Low-VOC, Low-Toxic, Water-Based, Solvent-Free Sealers, Grouts, Mortars, Caulks, and Adhesives Inside the House****\***

Conventional construction adhesives, grouts, and mortars used to bond structural components may off-gas large amounts of toxic VOCs (including solvents and aromatic hydrocarbons). Choose healthier low-VOC options. This will reduce potential harmful impacts on the health of the occupants as well as installers.

**Table 4-1— Recommended Limits for VOCs in Adhesives (in grams per liter, less water and example compounds)**

(Source: <http://www.ecologo.org/en/criteria/search/>)

Application	VOC Limits
Non-vinyl backed indoor carpet installation Carpet pad installation Wood flooring installation VCT and asphalt tile installation	150
Ceramic tile installation	130
Subfloor installation	200
All other	250

**4-33 Use Plywood and Composites of Exterior Grade or Formaldehyde-Free (for Interior Use) 3 Points**

Particleboard, interior grade medium density fiberboard (MDF), and other interior use, glue-containing products use urea-formaldehyde glue as a binder. With an off-gassing half-life of about 10 years, urea-formaldehyde continues to off-gas formaldehyde for a long time after application. Formaldehyde in the indoor environment can cause a several health problems for the occupants, including headaches and flu like symptoms, and can be a cause of sick building syndrome.

Instead, use materials containing no formaldehyde, such as Medex grade MDF, whenever possible. Or use products with exterior grade glue, which use phenoformaldehyde glue. Phenoformaldehyde glue off-gases quickly, and most formaldehyde is gone before the product reaches the jobsite. Exterior grade products include most plywood and OSB currently available.

**4-34 Use Cabinets Made with Formaldehyde-Free Board or Exterior Grade Plywood and Low-Toxic Finish 3 Points**

Cabinets are often built from particleboard, which off-gasses formaldehyde for a long time (see Action Item 4-35, *Use Plywood and Composites of Exterior Grade or Formaldehyde-Free.*) Instead, purchase cabinets made from a formaldehyde free material, such as Medex grade MDF, solid wood, or plywood, which adds very little additional cost to the overall cabinet budget. Cabinets should be finished with a low toxic finish.

**4-35 Use Glass, Ceramic, or Porcelain Tile for Flooring in Bathrooms, Laundry and Kitchen 1-5 Points**

Score 1 point for each room using these finish floors: Maximum 5 Points

Glass, ceramic, and porcelain tile floors usually pose very little health risk on a day-to-day basis. Because they are more durable than carpet, they also cost less per year of use. During installation,

make sure you use low-toxic grout (Action Item 4-34, *Use Low-VOC, Low-Toxic, Water-Based, Solvent-Free Sealers, Grouts, Mortars, Caulks and Adhesives Inside the House*) and keep the workspace well-ventilated.

All three types of tile are available with recycled content.

Note: Avoid the use of imported tile. The glazing used on imported tiles can contain lead.

**4-36 Use Polyethylene Piping for Plumbing (No PVC)**

**3 Points**

Some studies indicate that use of PVC plastics in the home is related to increased incidence of bronchial obstruction (asthma) in children (source: *American Journal of Public Health*. 1999;89:188&SHY;192). Also, in the event of a fire, PVC can release toxic smoke. If the water is slightly acidic or alkaline, copper plumbing can release copper ions into drinking water, which is potentially harmful to health. Instead, use polyethylene piping for plumbing.

**4-37 Install Natural Fiber Carpet (e.g. Jute, Sisal, Wool)**

**3 Points**

Today, 97% of all manufactured carpets consist of synthetic fibers. These synthetic components off-gas and the glues that bind the fibers to the backing may contain chemical compounds, a number of which are known to be toxic. Several companies make carpets with natural fibers, such as wool or cotton. However, these natural fiber alternatives tend to cost more than synthetics. (Note: Even natural carpets can be a source of noxious gases if treated with chemicals. For example, wool carpet is often moth-proofed.) Even natural fiber carpets may cause allergic reactions in a very small percentage of the population.

An acceptable, cost-effective alternative is a low-pile, all nylon carpet (see Action Item 4-24, *Install Low Pile or Less Allergen-Attracting Carpet and Pad*).

**4-38 Use Low-VOC /Low-Toxic Interior Paints and Finishes for Large Surface Areas**

**5 Points**

Paint should be compliant with the VOC limits set by provincial body. See below for recommendations:

**Interior Coatings:**

<u>Coating Type</u>	<u>VOC weight in grams/liter of product minus water</u>
Non-flat <sup>3</sup>	150
Flat	50

**Exterior Coatings:**

<u>Coating</u>	<u>VOC weight in grams/liter of product minus water</u>
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## **Type**

Non-flat <sup>4</sup>	200
Flat	100

Solvent-based paints are traditionally considered the most durable, but they produce toxic emissions when curing and require the use of hazardous solvents for cleanup. In addition, they off-gas trace amounts of volatiles (gases) for months following application, which can cause upper respiratory irritation to the occupants.

“Zero-VOC” or low-VOC water based paints are generally safer to handle, can be cleaned up with water, and produce little or no off-gassing. For most indoor applications, there is almost no difference in performance between solvent-based and water-based paints. Many low-VOC paints are comparable in price to conventional paint.

Low-VOC, water-based paints may still contain toxic ingredients, however. Although these toxic ingredients are not generally an air quality problem for *occupants*, they may be hazardous to painters and those involved in manufacture of the paint. In addition, hazardous ingredients can degrade the natural environment during production and after disposal. Fortunately, several locally available, water-based paints perform well *and* are low-toxic. These paints tend to cost 10% to 30% more than most conventional paints.

Low-toxic, clear sealers are also available to use as finishes for woodwork. Water-based varnishes, polyurethane, and other finishes for hardwood floors are very durable and much safer to handle than traditional products. Low-toxic solvents, water-based strippers, and all-natural thinners are also locally available.

### **4-39 No Carpet in Home**

**3 Points**

Carpet off-gases when it is new. In addition, carpeting acts as a highly effective reservoir for allergens such as dirt, pollen, mold spores, dust mites, and other microbes. Moreover, as carpet wears out, the surface yarn breaks down and becomes house dust. For that reason, this program encourages eliminating carpet (see Action Items 4-23, *If Using Carpet, Specify Low VOC Carpets with the CRI IAQ Label* and 4-24, *Install Low Pile or Less Allergen-Attracting Carpet and Pad*).

## **MOISTURE CONTROL**

Moisture that enters the home through the foundation walls and floor can lead to problems such as mold growth and can contribute to a variety of health problems for the homeowner. Specific construction techniques and materials can eliminate moisture.

### **4-40 Fully Insulate Garage to Minimize Condensation-Based Mold Growth 2 Points**

Insulate to R-9 (R-19 if space is heated) and install insulated garage doors.

Garages are typically not insulated because, unless the space is heated, the cost and materials use will offset any energy and comfort benefits.

However, sources of heat and moist air (refrigerators, freezers, washer and dryer, automobiles, etc.) are often found in garages. During cool seasons, the temperature differential across an uninsulated envelope may be sufficient to produce condensation. This might lead to mold growth, potentially resulting in degraded air quality in the garage and, if attached to the house without proper air sealing, in the home.

#### **4-41 Vent Attic Over Code Requirements to Prevent Moisture Build-up 2 Points**

Venting of attic spaces beyond code requirements is an effective way to reduce moisture buildup in the home.

Ensure that attic space is effectively sealed from living spaces. Take care to make sure the venting “communicates” with “dead” spaces in the attic.

Ensure that Code Requirement of 1:300 square foot ratio is at least met and calculations provided.

#### **4-42 Use an unvented or mechanically-exhausted, conditioned crawl space 3 Points**

Unvented, conditioned crawl spaces perform better than vented crawl spaces in terms of safety, health, comfort, durability and energy consumption. Conditioned crawl spaces also do not cost more to construct than vented crawl spaces. (Unvented crawl spaces are not appropriate for flood zones, where flood venting is required).

The International Residential Code allows for the construction of “conditioned” crawl spaces. For further information on crawl space design and code requirements, review the technical article at: [http://www.buildingscience.com/resources/foundations/conditioned\\_crawl.pdf](http://www.buildingscience.com/resources/foundations/conditioned_crawl.pdf)

Unvented, conditioned crawl spaces with insulation on the perimeter perform better in terms of safety and health (pest control), comfort (warm floors, uniform temperatures), durability (moisture) and energy consumption than passively vented crawl spaces with sub floor insulation.

Perimeter insulation, rather than floor insulation, performs better in all climates from an energy conservation perspective. The crawl space temperatures, dew points and relative humidity track that of the house. Crawl spaces insulated on the perimeter are warmer and drier than crawl spaces insulated between the crawl space and the house.

Crawl spaces should be designed and constructed as mini-basements, part of the house – within the conditioned space. They should be insulated on their perimeters and should have a continuous sealed ground cover such as taped polyethylene. They should have perimeter drainage just like a basement when the crawl space ground level is below the ground level of the surrounding grade.

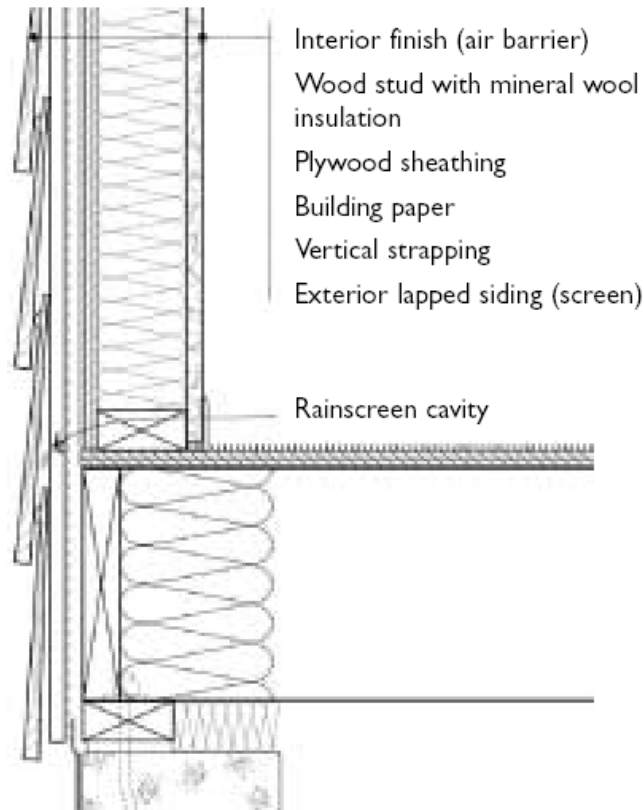
**4-43 Design Wall System to Allow Water to Drain Out in the Event of Possible Water Penetration (Rain Screen Wall System) If not code required**

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Rain penetration management is the single most important factor in assuring durability of the structure. Leading building scientists recommend that walls include rain screens, vented cladding, or vented drainage spaces in locations with 40 to 66 inches of rain per year. A pressure equalized rain screen is recommended if average rainfall exceeds 60 inches per year. In all climates, properly flashed window details are recommended.

A simple and effective rainscreen wall can be achieved by attaching furring strips

**Figure 4-2: Simple Rain Screen wall system** (From Canadian Mortgage and Housing Corporation)



**4-43-1 Install a Drainable House Wrap or Double Layer Building Paper under exterior siding to promote wall drainage – if Rain Screen Not Used** **1 Point**

*Drainable House Wrap:* A Drainable House Wrap is defined as any properly installed house wrap that is engineered to have a minimum drainage efficiency of 90% measured in accordance to ASTM E2273 – Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies. Because this is the criteria used to establish drainage by ICC-ES (International Code Counsel – Evaluation Service) Acceptance Criteria AC-24 – Interim Criteria for Exterior Insulation and Finish Systems, house wraps with a code report showing this evaluation are acceptable.

A Drainable House Wrap should not be confused with a “Rain Screen” system. A properly installed “Rain Screen” system, will fir your exterior cladding a minimum of 3/8” away from the exterior sheathing. The benefits of a “Rain Screen” System are: Drainage, Depressurization of the wall and Ventilation of the wall cavity. A Drainable Housewrap does not ventilate or depressurize a wall, but it will provide Drainage. Drainage is particularly important when working in High Wind Pressure areas or when installing Cedar, Manufactured Stone, EIFS or Stucco claddings. In order to achieve drainage with manufactured stone and stucco claddings a secondary, sacrificial water resistive barrier must be installed.

Points cannot be combined for having a Drainable House Wrap and a Rain Screen system. See section 4-45 of the Built Green™ Checklist for more information on Rain Screens.

4-43-2 Design exterior wall system to allow water to drain out in the event of possible water penetration (e.g. vented rainscreen wall) 5 Points

## AIR DISTRIBUTION AND FILTRATION

4-44 Install Return-Air Ducts in Bedroom(s) or Undercuts and Continuously Operating Blower Fan 1 Point

The installation of return air ducts to every bedroom ensures an adequate supply of fresh air to sleeping areas. (Also see Action Item 4-30, *Optimize Air Quality in Family Bedrooms through source reduction and ventilation.*)

4-45 Install Carbon Dioxide (CO) Detector(s) ★

A detector should be installed wherever there is a fuel-burning device and near the bedrooms.

Carbon monoxide (CO) is produced by incomplete combustion of materials such as natural gas, wood, coal, oil, kerosene, gasoline, and even tobacco. Sources include wood or gas burning stoves and fireplaces, automobile exhaust from attached garages, and contamination from furnace flue leaks and backdrafting. At low levels, CO causes fatigue in healthy people and chest pains in those with heart disease. At higher levels, symptoms range from impaired vision and coordination, to headaches, dizziness, nausea, and death.

Home detectors warn occupants of unsafe CO levels and are relatively inexpensive and easy to install. Check consumer-testing results before buying.

4-46 Install an Operable Skylight (Manual or Automated) High Up in the Structure to Aid Natural Ventilation. energy star – up one climate zone 2 Points

An operable skylight can be used to create controlled natural ventilation, allowing warm air that has risen to the top of the house to escape, and drawing up cool air from below. However, skylights can be a source of unwanted solar heat gain and/or thermal loss, so location should be carefully selected, and the benefits weighed against the disadvantages.

Operable clerestory windows in an upper wall or a roof monitor could also qualify.

**4-47 Verify Performance of Ventilation Systems; Measuring Supply and Exhaust Airflow, Checking Control Activation and Damper Operation 3 Points**

This Action Item verifies proper operation of ventilation systems by measuring the air flow of all supply and exhaust systems using a flow hood. Also check controls for proper activation. Check mechanical damper operation, if applicable.

**4-47-1 Inspect, repair and upgrade air distribution systems. 3 Points**

**4-48 Install Medium-Efficiency Pleated Filter or Better 3 Points**

Use a furnace filter with a MERV rating of 10 or above.

Medium efficiency pleated filters filter air through an extended surface area (pleating) to remove between 40% and 50% of all particulate matter. They are relatively inexpensive and sufficient for most home applications.

More efficient filters, such as HEPA (high efficiency particulate air) filters, remove 99% or more of all particulate matter in the air. They are expensive, have high flow resistance, and may require custom design for home applications. For these reasons, they are not commonly used in residential filtration but may be desirable for highly sensitive/allergic homeowners.

Make sure you include information about the air filter system you choose (including filter size, type, quality, and the ideal replacement schedule) in the Homeowner's Kit so homeowner can properly maintain it (see Action Item 6-1, *Provide Owner With Homeowner's Information Kit*).

**4-49 Install Furnace and/or Duct-Mounted Air Cleaner or High Efficiency Air Filter 3 Points**

Filtering the air is key to removing airborne contaminants and to keeping the air handling system clean. The higher the efficiency, the better the filtration system is at capturing and removing small particles from the air. A MERV 12 filter or equivalent is required for this point.

A HEPA (High Efficiency Particle Air) Filtration System is 99.97% efficient at removing particles 0.03 microns in size. Because of its high efficiency at filtering out tiny particulates, HEPA filtration is recommended for those individuals who suffer from allergies, asthma, or other respiratory problems. The filtration system connects in-line with the furnace ductwork and offers three-stage filtration. An anti-microbial polyester pre-filter with a five pound, activated carbon filter is attached to the filtration system. Filtration media that are not maintained at appropriate intervals will reduce the efficiency of the HVAC system and may increase fan motor wear.

Electronic filters remove particulates from the air by charging them so that they are attracted by and adhere to a filter screen, to room surfaces or to each other (forming larger clumps that fall to the ground). These types of filters may require more frequent maintenance than media filters to maintain performance. They can produce ozone (which can be a respiratory irritant) and will become less effective over time if not adequately cleaned and properly maintained.

Make sure you include information about the air filter system you choose (including filter size, type, quality, and the ideal replacement schedule) in the Homeowner's Kit so homeowner can properly maintain it.

**4-50 Plumb for or Install Central Vacuum, Exhausted to Outside 2 or 3 Points**

Install plumbing and wiring for a central vacuum system – 2 Points

Install complete system, including plumbing, wiring and vacuum unit – 3 Points

Central vacuum systems provide cleaner indoor air by efficiently removing particles without stirring up microscopic dust particles and re-emitting them into the home's interior.

If plumbing for or installing a central vacuum, locate it in the garage and exhaust it to outside (but not near a fresh air inlet). Make sure the garage is air sealed from the living spaces (see Action Item 4-32, *If Garage is Attached, Air-Seal from House*).

## **HVAC EQUIPMENT**

**4-51 Install Exhaust Fans in Rooms Where Office Equipment is Used 2 Points**

More and more residences include home offices or dens where computers, faxes, photocopiers, and other business machines are used. This office equipment and the supplies associated with it can emit VOCs and gases, including ozone, which is carcinogenic in high concentrations. A spot fan, installed in a home or commercial office, is an effective means of reducing health risks by dealing with the pollution at its source. Make sure you allow for fresh air intake elsewhere in the building to balance the system and ensure adequate ventilation. Look for "low-sones" fans to avoid distracting occupants; the quietest fans can hardly be heard when you're in the same room.

**4-52 Install Sealed Combustion Heating and Hot Water Equipment 2 Points**

Sealed combustion equipment draws combustion air from outside the living space and exhausts combustion by-products to the outside, allowing no spillage or backdrafting into the living space. Maximize the distance between exhaust vents and fresh air intakes.

**4-53 Install 100% Rigid Insulated Sheet Metal Ducts for HVAC Distribution System 3 Points**

Sealed combustion equipment draws combustion air from outside the living space and exhausts combustion by-products to the outside, allowing no spillage or backdrafting into the living space. Maximize the distance between exhaust vents and fresh air intakes.

#### 4-54 Provide Balanced Indoor Pressure Using Controlled Ventilation

5 Points

Greater air tightness creates a need for mechanical ventilation to avoid potential indoor air quality problems. Balanced ventilation keeps outdoor pollutants from being drawn into the house, prevents backdrafting or spillage from combustion appliances (due to under-pressurization), and prevents moisture migration into structural cavities (due to over-pressurization).

It is a good idea to operate the home at a natural pressure (+ 1 Pascal pressure difference with respect to outdoors). If you accomplish this using supply ventilation only, you may be ignoring other critical factors involved in making the home energy efficient and healthy. These items need to accompany any attempts to balance a system.

The primary causes of negative pressure in the home are:

- Wind, natural convection or the stack effect
- Supply duct leaks
- Supply ducts isolated from return ducts by a closed door
- Excessive exhaust ventilation: Usually a large range hood or the clothes dryer.

The best way to bring a home into natural pressure, under normal operating conditions is:

- Caulk and seal the home (see Action Items 3-4 through 3-9)
- Seal the heating system ducts with mastic (see Action Item 3-34)
- Provide return air to isolated rooms with ductwork or bypass grille.

Once these items are addressed, the supply ventilation system may be used to balance exhaust ventilation de-pressurization or provide a slight positive pressure with a modest volume of fresh air. Ventilation can be provided by quiet fans with automatic controls or by heat recovery ventilators (HRVs) (see Action Item 3-43, *Install a Heat Recovery Ventilator*). The volume of air supplied should be provided as specified by the province's Ventilation and Indoor Air Quality Code if one exists or as specified by the CAN/CSA-F326-M91 Residential Mechanical Ventilations Systems standard.

4-54-1 For pre-1981 homes, upgrade to a whole-house balanced ventilation system.

10 Points

#### 4-55 Install a Ductless Heating System (e.g. Radiant Floor or Radiant Baseboard)

n/a

Faucets typically use 11.4 gallons per person per day. Selecting low flow faucets (less than 2.5 gpm) can help reduce overall water usage.

Faucet aerators with flow rates of 0.5 or 1.0 gpm are available and should be used in bathroom and cloakroom sinks. Ask your supplier for details.

Consumer performance complaints with reduced flow rates are most often associated with the “feel” of the water coming from the faucet and clogging associated with equipment that reduces flow rate with small hole screening. Faucets with flow rates less than 2.5 gpm that have the “feel” of higher flow and that are guaranteed against clogging are now available. Remember that not all brands are created equal, so talk to your supplier. The added cost of higher-performance, low-flow heads is minimal.

*Please reference the Energy Efficiency Tables in PART 10 BC Building Code.*

4-56	For Bathroom Faucets, Select Fixtures with GPM Less than Code	1 Point
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4-57	For Kitchen Faucets, Select Fixtures with GPM Less than Code	1 Point
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See Action Item 2-68, *For Bathroom Faucets, Select Fixtures with GPM Less than Code*, above.

Faucets typically use 11.4 gallons per person per day. Selecting low flow faucets (less than 2.5 gpm) can help reduce overall water usage.

For kitchen and utility room faucets where rapid filling of sinks, pots and other containers is valuable, use 1.5 or 2.0gpm aerators to ensure customer satisfaction.

*Conversion: 1.5 gallons = 5.67 litres/minute 2.0 gallons = 7.57 litres/minute*

4-58	Select Toilet Fixtures that Meet Code, and Work with the First Flush	1 Point
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Toilet flushing is the largest single use of water (up to 40% of residential water use), and water savings from the new standard is significant compared to the older models that used 3 to 5 gpf. However, early problems with operation of the new designs often resulted in double flushing, which reduced water savings (although not entirely) and caused customer complaints. Many of those problems have been resolved and a number of brands consistently rate well in performance surveys.

BC Building Code 2006 – Part 10 now requires that all residential Part 9 Buildings meet the requirement laid out in Table 10.3.1.1. Federal law mandates all new toilets use no more than 1.6 gallons per flush (gpf). Toilet flushing is the largest single use of water (up to 40% of residential water use), and water savings from the new standard is significant compared to the older models that used 3 to 5 gpf. However, early problems with operation of the new designs often resulted in double flushing, which reduced water savings (although not entirely) and caused customer complaints. Many of those problems have been resolved and a number of brands consistently rate well in performance surveys.

#### 4-59 Install Dual Flush or Ultra Low Flow Toilets

2 Points

Toilets are one of the largest users of water in an average home. Dual flush toilets are designed to use the standard 1.6 gallon flush to flush “solids” and also offer a reduced 1.0 or 0.8 gallon flush for “liquid only” flushes. Several imported products have been available for several years and are tried and tested in the market place. Numerous domestic manufacturers are now offering reliable dual flush products.

Pressure-assisted ultra low flow toilets are also available. These toilets use the pressure of your cold water supply to pressurize a reservoir of water concealed within a standard toilet tank. When flushed, this water is released at high pressure into the toilet bowl, delivering a clean flush with an average 1.1 gallon flush.

A family of four, using dual-flush or ultra-low flush toilets can save as much as 6,000 gallons of water per year, compared to conventional 1.6 gallon per flush models.

**4-60 Install Instant (Tankless) Hot Water Systems (Where Appropriate) 2 Points**

See Action Item 3-47, *Install On-Demand or Small, Local Hot Water Delivery System at farthest location from water*, for additional information.

With instant or demand or “tankless” water heaters, you only heat the water you use. Instead of storing hot water in an insulated tank, the water is heated, on demand, at the point of use. These systems can save as much as 3 to 4 gallons per use, considering that this is the amount of cooled water that must be drained before hot water arrives at the faucet in traditional systems. In addition, standby energy losses represent 10% to 20% of a household’s annual water heating costs.

In the past, instant hot water systems were either electric (converting only a third of the primary energy into usable thermal energy), or if they were gas fired, they were equipped with continuously burning pilot lights that wasted energy. Newer, gas-fired models without continuously burning pilot lights are available. Such systems save water and energy, providing even more bang for the buck.

**4-60-1 Install water metering system in place to manage water consumption 2 Points**

**4-61 Provide Basic Whole House Water Filtration System 1 Point**

As a result of growing concern about the quality of drinking water (whether utility-supplied or well water), the popularity of domestic water filters has increased dramatically. In fact, one third of consumers surveyed in a 1997 Water Quality Association study reported they currently use a home water-treatment device other than bottled water.

There are many kinds of filters available, some expensive, some inexpensive. Whichever you choose, ensure filtration media are reusable or recyclable (See *Action Item 4-27: If installing water filters, select one with reusable or biodegradable filters.*)

**4-62 Separate Outdoor Water Supply Prior to Filtration 1 Point**

By excluding water for exterior use from the filtration system, you will significantly reduce wear and tear, and the rate of cleaning and replacement of filtration media. This will reduce cost and maintenance time for the homeowner, and improve resource efficiency.

#### **4-63 Provide High Performance Spot Water Filtration in Kitchens and Bathrooms**

**1 to 3 Points**

Providing high-performance filtration, using reverse osmosis or comparable media filtration at the point of use provides the best overall approach to water quality, since you filter only the water that is used for human consumption and/or human hygiene.

Score one (1) point for each fixture served by spot filtration (bathroom sink faucet, showerhead, kitchen faucet, etc.) to a maximum of three points.

## **Innovation**

#### **4-64 Include Innovative Design, Equipment, and Operation Solutions to Protect Human Health and Enhance Indoor Air Quality During Construction and/or Occupation**

**4-10 Points**

This Action Item recognizes members for using innovation and emerging technologies, practices, and products that fulfill on the intentions of the Health and Indoor Air Quality section, but are not called out in the checklist.

Members can earn up to 10 points by submitting a short written justification for the extra credit points to the Built Green™ Standards Committee for review, approval, and award of points. This justification should include a description of the innovative action, an explanation of why it is beneficial, and a recommended point value (up to 10) based on its impactfulness, in line with the Built Green™ Program. The Committee will evaluate the submittal and recommended points and will determine final point awards.

# Section Five:

## Materials Efficiency

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The Action Items in this Section will help you increase the efficiency of your jobsite operations through use of the “Three R’s—Reduce, Reuse, Recycle—as well as make your design and material selection more resource efficient.

### REQUIREMENTS

#### 5-1 Provide Waste Reduction Resource Sheet to On-Site Personnel and Subcontractors ★

This Action Item is required for credit in the program. See Appendix.

An effective Waste Reduction program requires the participation of everyone on the jobsite. To achieve this, you must clearly communicate your intentions to reduce waste and provide the basic information needed to enable people to contribute to your goals. This Waste Reduction Resource Sheet provides useful strategies, tips, and resources. Other helpful things to do are to:

- Communicate your waste reduction goals at a jobsite kick-off meeting and during safety meetings.
- Give examples of types of materials that can be reused.
- Clearly indicate materials you will be targeting for recycling on this job and explain how you will be collecting recyclable materials.
- Highlight special considerations and answer waste management questions.
- Provide incentives to encourage subs to participate.

See Action Item 5-8, *Contractually Require Subcontractors to Participate in Waste Reduction Efforts*, 5-2, *Prepare Jobsite Recycling Plan and Post On Site* and 5-18, *Contractually Require Subcontractors to Participate in Recycling Efforts*.

#### 5-2 Prepare Jobsite Recycling Plan and Post On Site ★

This Action Item is required for credit in the program.

Each construction project presents a unique set of circumstances. Therefore, it’s best to develop a job-specific recycling plan. Some key points to keep in mind when developing your plan include:

- Make a jobsite recycling plan that “fits” your site. For your convenience, a form you can use to develop the plan is provided in the Appendix.
- Target only high-potential materials for recycling and reuse. Phase recycling based on construction activities.

- Decide if you will co-mingle or source-separate materials, and if you will need to have a hazardous materials survey performed prior to delivering materials to your receiver.
- Decide how and where you are going to collect materials you are targeting. For example, you may want to stockpile cardboard in a garage, use a roped-off area for metal, and use containers for wood and drywall.
- Make recycling on the jobsite as convenient as disposal. For example, place wood collection container near to the central cutting area.
- Rely on good quality, easily accessible recycling and salvage service providers and facilities.
- “Sell” program benefits — savings, safety, marketing benefit — to jobsite crews (including subs). Provide key field personnel the information they need to participate. This could include:
  - A copy of the Jobsite Recycling Plan (see above).
  - A copy of relevant contract language to subcontractor.
  - Regular updates on recycling results at safety or project meetings.
  - Give recognition to everyone participating in the program.

## OVERALL

### 5-3 Create Functional, Multi-Purpose Spaces While Limiting Overall Square Footage

5-25 Points

Less than or equal to:

- 300 sq.ft. + 300 sq.ft. per bedroom: 25 points
- 300 sq.ft. + 400 sq.ft. per bedroom: 15 points
- 300 sq.ft. + 500 sq.ft. per bedroom: 5 points

The goal of this Action Item is to reward houses that are smaller than average for the marketplace, based on the number of bedrooms they contain.

Large spaces are more expensive to condition, maintain and furnish but do not necessarily increase the comfort and usability of a home. Through careful layout and design, you can create functional, multi-purpose spaces, which reduce materials usage and direct more of the budget to comfort, detail and/or energy efficiency features. Smaller houses inherently reduce the embodied energy of a home (the total amount of energy used to extract, refine, produce, and distribute materials from their point of origin to installation and then ultimately to disposal).

In 1949, the average residence (not including the garage) was less than 900 square feet and housed 4.2 people. In 1991, the typical 2,000 square-foot residence housed only 2.6 people.

Small houses can be made space-efficient, functional, and livable through careful layout and design. Fortunately, there are a number of excellent resources available on compact house design.

Besides the size of a house, the shape of a house is one of the main factors in construction expenses. Complicated angles and shapes significantly increase the cost of the building. Also keep in mind it may cost less to build up than to build out, depending on local land and labor costs. Starting out with

the most appropriate size and shape for your house reduces the costs of almost all aspects of construction, including waste disposal.

## JOBSITE OPERATIONS

### Reduce

“Reduce” means preventing waste *before* it happens. The following practices can help you realize significant reductions in waste and cost of materials on a construction project. Many of the Action Items in this section require only slight modifications to standard procedures.

- *Avoid damage.* Train site crews to handle and store materials properly.
- *Use materials efficiently.* Encourage site crews to use scraps and use less materials overall.
- *Estimate as accurately as possible.* The more accurate, the less waste. Suppliers can often provide tips on estimating specific materials.
- Purchase precut and prefab components.
- *Choose strong materials* and exploit structural advantages.
- *Purchase high-grade materials.* These will get more usage and generate less waste in the long run.
- Limit framing waste to 3%. Use efficient framing.

#### 5-4 Use Suppliers Who Offer and Take Back Reusable or Recyclable Packaging

1 Point

Cardboard, plastic shrink wrap, kraft paper, wood pallets or frames, and metal bands are just some of the packaging materials that show up on your jobsite along with the materials you order. In the end, they comprise a significant portion of the typical construction waste stream and in this way add to your project costs.

A few manufacturers are beginning to take their own packaging back and reuse it to package new materials. Items that can be reused cost-effectively include:

- Pallets
- Some corrugated cardboard packaging
- Plastic buckets.

In addition, you can encourage manufacturers to accept and *recycle* their own packaging and product waste. Some ways to encourage suppliers and manufacturers to take responsibility for their packaging is to:

- Request minimal packaging when placing a materials order.
- Select brands of building products that are delivered with minimal packaging.
- Select products with reusable packaging.
- Select products with recyclable packaging.
- Purchase materials like fasteners, paints, caulking, and drywall mud in bulk containers.

- Request suppliers take back their packaging.

Some packaging will always be necessary to prevent materials damage, but the trick is to find the balance between necessary and excessive packaging. Let your suppliers know you care for economic and environmental reasons.

#### 5-5 Provide Weather Protection for Stored Materials

1 Point

Prevent damage to materials from weather (and accidents or vandalism) by storing materials in a secure, protected place, or by covering them with tarps. Used shipping pallets and other used packaging can be put to temporary use storing materials off the ground and protecting them from the weather. Be sure to follow manufacturer's recommendations for proper storage to prevent structural or finish damage. For example, panelized materials should be kept dry and flat. Siding and other finish materials should be stored back-to-back and face-to-face, taking measures to protect the faces from marring one another.

Storing materials in a dry, protected place on a construction site can be a challenge. Rather than trying to store materials safely on site until needed, many renovators opt for "just-in-time" delivery.

#### 5-6 Create Detailed Take-Off and Provide as Cut List to Framers

2 Points

Having a list identifying the intended location of each piece of lumber reduces the overall volume of lumber needed to construct the house as well as the volume of leftover scraps because it reduces the risk of large pieces being unintentionally cut for alternative uses. Create a board-by-board take-off that can be used as a cut list for framers and an order list for your supplier. This list increases accountability of framers and suppliers and can result in significant savings.

#### 5-7 Use Central Cutting Area or Cut Packs

2 Points

Designating a centralized cutting area reduces wood waste, reduces the total amount of wood that must be supplied to the site, and saves time by making it convenient for carpenters to reuse cutoffs and scrap. It also makes the cutting process itself more efficient. Studies of construction sites with a centralized cutting area showed total waste reduction of as much as 15%. See Action Item 5-9, *Reuse Scrap Dimensional Lumber*, for reuse suggestions.

A central cutting area also creates an ideal location for the wood scraps bin or pile, convenient for subcontractors so they'll reuse the wood. (See Action Item 5-8, *Contractually Require Subcontractors to Participate in Waste Reduction Efforts*, below.)

Cut packs greatly reduce on-site waste since they are pre-measured and cut at the lumberyard.

#### 5-8 Contractually Require Subcontractors to Participate in Waste Reduction Efforts

2 Points

The most effective way to ensure that subcontractors participate in waste reduction efforts is to require them to do so in a written agreement or contract.

Sample contract language:

*“Subcontractor will be required to reduce the amount of waste generated on the site and recycle materials per the Contractor’s jobsite recycling plan. Subcontractor will follow source-separation recycling requirements for each waste type targeted in the plan and use the appropriate on-site containers for each waste type. Subcontractors are required to participate in jobsite meetings during the course of the project as part of the waste reduction program. In addition, subcontractors are to use recycled-content products whenever feasible.”*

See Action Items, 5-1, *Provide Waste Reduction Resource Sheet to On-site Personnel and Subcontractors*, 5-2, *Prepare Jobsite Recycling Plan and Post On Site* and 5-18, *Contractually Require Subcontractors to Participate in Recycling Efforts*.

## Reuse

“Reuse” means reusing materials removed during demolition and scraps generated during construction.

Salvage or reuse prevents building materials from becoming waste, and transforms the materials from a renovator liability and expense to an asset. In addition, for salvage in particular, it often preserves unique materials not currently manufactured.

Reusable items may be sold through classified ads or a yard/garage sale. Items can also be given away curbside or donated to a charitable organization, which may be tax deductible. Both for-profit and nonprofit reuse centers are emerging which specifically handle used building materials and sell to either the general public or the low-income community. By donating reusable items, you add to the cost effectiveness of your projects through reduced disposal fees and tax advantages, while also contributing to your community.

### 5-9 Use Scrap Dimensional Lumber; Must Be Regraded for Structural Use 1 Point

Over 90% of the houses built each year are wood-framed. Even when renovators order carefully, and store and handle materials to keep from damaging them, there will still be some good scrap generated from cutoffs and possibly from warped or knotty boards. Most estimates place wood waste at 25-35% of the total waste generated from new construction and demolition. Finding applications for the wood on site can prevent a significant part of this waste.

Blocking, bracing, shims, back framing, and forming stakes can be fabricated from small pieces of dimensional lumber that would otherwise be wasted. Some renovators use warped pieces of wood in blocking. Make this extra wood available in a central area so everyone on site knows it can be reused (see Action Item 5-7, *Use Central Cutting Area or Cut Packs*).

When reusing large pieces of dimensional lumber, you should be aware that grading will be required if you’re using it for structural purposes. Check with your local building inspector.

5-9-1 Reuse other building materials where appropriate. 1 Point

5-9-2 Reuse, sell, or give away non-code windows for use in unheated spaces. 1 Point

## 5-10 Use Reusable Supplies for Operations, such as Construction Fences, Tarps, Refillable Propane Tanks

1 Point

You'll save money, reduce waste, and extend the natural resources used to produce building supplies when you use reusable supplies. Construction fences and tarps can be reused at the next jobsite, and refillable propane tanks can be reused again and again.

Other materials commonly reused include:

- Concrete forms (may involve modifying the way you remove forms from concrete. See *Section Two: Site and Water*, Action Item 2-38, *Use Less Toxic Form Releasers*)
- Concrete, brick, and masonry (for small jobs like building steps or hearth trim on another site)
- Finishes such as tile, carpet, millwork, and cabinets
- Dimensional lumber, scraps, shingles, siding, and other wood
- Broken concrete from demolition (as inexpensive fill buried more than 6" deep)
- Windows, doors, and associated hardware
- Sinks, bathtubs, and accessories
- Electrical fixtures and lamps as well as some electrical conduits, boxes, and switch gear
- Drywall scraps (for patches around doors or windows)
- Drywall mud pails (for storing loose items such as tools or fasteners)
- Paints and stains
- Insulation
- Appliances (including ranges, furnaces, dishwashers, and hot water tanks).

## 5-11 Move Leftover Materials to Next Job or Provide to Owner

1 Point

Many materials can be moved to the next job or left on site for the new owner at their request to use for repairs or expansions. Paint, for example, can be left with owners for touch-ups and repainting, or can be used as a primer on your next job. Decking material can be reused by the owner as part of a future expansion or for other landscaping applications.

## 5-12 Reuse Spent Solvent for Cleaning

1 Point

Spent petroleum-based solvents must be managed as hazardous waste. If you must use a solvent, consider one that's citrus-based. Regardless which solvent type you use, allow solids to settle out of spent solvents in a closed container. After settling, pour off the clear top layer and reuse. Solids can also be strained from spent solvent using many different types of paper or cloth filters. Although this technique significantly reduces the volume of material, settled and strained solids often need to be managed as hazardous waste.

**5-13 Sell or Give Away Wood Scraps****1 Point**

Sell or give away logs not used as timber, or wood scraps that are less than one foot long since they are unlikely to be reused on the job.

**5-14 Sell or Donate Reusable Items (e.g. pallets)****1 Point**

Rising raw materials costs and landfill tipping fees are making it more economical for renovators to salvage materials for reuse than to pay for new materials and/or disposal costs. If some demolition of existing structures is required at your site, the renovator, designer, and owner should schedule a walk-through prior to demolition to identify materials that might be salvaged. If you intend to sell salvaged materials, a representative from the salvage business should be included in the initial walk-through to help identify salvageable materials that are in demand.

Products with consistent demand include:

- Hardwood flooring
- Windows that are in good condition (matching sets preferable)
- Kitchen cabinets and solid wood doors
- Architectural detailing and window and door hardware.

Check with salvaged building materials dealers, and online used building materials exchanges.

You can also consult your local telephone book, under “Second Hand Stores.”

**5-15 Purchase Salvaged Building Materials for Your Job****2 Points**

For best results, the use of salvaged materials should be considered during the design phase. While purchasing materials from a reused materials store may not reduce waste materials on the site, it will help ease natural resource demand, reduce construction waste from other sites, and extend the life of building materials. It also strengthens the market for reused building materials, which benefits you when you need an outlet for such materials. As a rule, most used building materials can be installed as long as they are not acting as a structural component or might potentially compromise safety (for example, outdated electrical wiring). Materials purchased at salvage yards are usually priced at 10% to 50% of the going price for new materials.

Check with local salvaged building materials dealers, and online used building materials exchanges.

You can also consult your local telephone book, under “Second Hand Stores.”

**5-16 Save and Reuse Site Topsoil****2Points**

See Action Item 2-4, *Protect Stockpiled Soil with Mulch or Plastic.*

## Recycle

To “Recycle” means to separate recyclable materials from non-recyclable materials and supply them to a hauler or business so they can be processed and used to make new products. By choosing to recycle on your jobsite you will:

- Reduce disposal fees and overall construction costs
- Provide “stock” for new materials to be manufactured
- Keep valuable material from entering landfills.

Generally, the following construction and demolition materials can be recycled, though these may vary by location:

- Clean and demolition wood, land clearing, pallets and yard waste
- Cardboard
- Scrap metal
- Concrete, asphalt, rock, and brick
- Drywall and plasterboard
- Non-asbestos roofing materials
- Packaging
- Plastics.

To prepare a job-site recycling plan, evaluate your waste stream and target materials that have significant market value, that have local cost-effective recycling options for your project, and can be conveniently collected given your project particulars. Typically this includes wood, cardboard, metal, drywall, concrete, and masonry.

Cardboard, metal scrap, wood scrap and broken pallets, packaging, plastics, drywall, concrete/asphalt rubble, rock and brick can be co-mingled in some regions for collection. Other vendors, require materials be source-separated. To assist in source separation, identify locations on site to collect these materials and use signs to clearly identify materials being collected in that location. (You may want to limit the number of bins by setting them up on a phased basis to correspond to the phases of construction and the typical waste streams generated during each phase.)

Contractors Waste Reduction Resource (See Appendix) includes specific information on recycling vendors.

Some companies, such as scrap metal dealers, will pay for recyclable material. Others charge to accept or pick up recyclables. Even if a fee is charged, however, it is generally less than fees paid for disposal. Recyclers have specifications for the quality, types, and grades of materials they can accept. For example, Sanitary Services Corporation will accept co-mingled construction debris if it complies with their preparation specifications. To achieve the most benefit from your efforts, find out what these specifications are.

You can transport your recyclable materials to these facilities in a variety of ways. Consider the following methods:

- *Full-service recycling contractors.* They provide all bins, on-site sorting, and pick-up.
- *Garbage hauler.* Your hauler may provide bins and pick-up for certain materials.
- *In-house recycling.* Working with individual recyclers, you arrange bins, pick-up, and/or self-haul.
- *Subcontractors recycling.* Subs work with individual recyclers to arrange bins, pick-up,
- Contractor should keep Hauling Way Bills and Recycling Way Bills to confirm Recycling.

## 5-17 Contractually Require Subcontractors to Participate in Recycling Efforts

2 Points

Subcontractors need to be aware and committed to the program you've established. This starts with the bid and contract negotiation process. Action Item 5-8, *Contractually Require Subcontractors to Participate in Waste Reduction Efforts*, has some suggestions to follow, including template contract language. Here are some other tips to consider:

- Require compliance to your Jobsite Recycling Plan (see Action Item 5-2, *Prepare Jobsite Recycling Plan and Post On Site*). Language in the subcontractor agreement should commit them to comply with your jobsite recycling plan. Make sure each subcontractor has a copy of the plan and that they clearly are aware of the materials being collected on site.
- Require full participation in training and assessment. Additional language could require the subcontractor to attend orientation and mid-course assessment meetings as part of fulfilling their waste management requirements.
- Require subcontractors to adhere to recycled-content purchasing practices. Specify in the contract that the subcontractor will purchase recycled-content building products and packaging whenever feasible.
- Engage subcontractors in developing the jobsite recycling plan by soliciting input from them.

Ask them about container location and phasing so that their recycling coincides with the overall program.

- Recognize subcontractor participation. Whether recycling is required or not, it always a good idea to recognize a job well done, through jobsite signage or other incentives. This positive feedback will help your site produce clean, uncontaminated recyclables, adding to the efficiency of the program and therefore, your bottom line.

## 5-18 Recycle Cardboard

1 Point

Cardboard is generated throughout most homebuilding projects, but the largest volume occurs during the finish phase of the project, when electrical and mechanical fixtures are being installed. Cardboard can often be recycled for free, either at drop-off sites or picked up by a hauler who may provide a bin. Wax, moisture, and metal banding can be considered contaminants. Check with cardboard recycler to identify any restrictions on the cardboard they accept.

## 5-19 Recycle Metal Scraps

1 Point

Copper scraps have been recycled for years because the metal has a high market value. As other metals (steel, iron, and aluminum) have increased in value, it has become more beneficial to recycle them as well. Metal can be collected or accepted for free, with higher value metals providing revenues. Rebates available for recycled metals vary with market value.

Separated metals have a higher value than mixed metals. Some recyclers will pay for sorted metals. Check with recycler for their specifications.

**5-20 Recycle Wood Scrap and Broken Pallets****1 Point**

On average, about 25% of discarded construction material is dimensional lumber and another 10% is waste from manufactured wood products. Wood scrap you can't reuse should be targeted for recycling.

Wood processing technology has improved significantly, and more and more of the construction wood waste stream can be recycled. Check with wood recycler to identify any restrictions on the wood they accept. Depending on the final use of the material, the following *may* be considered unacceptable contaminants: paint, stain, pressure treatment, lamination, adhesives, and nails or other fasteners.

Many of the region's wood recyclers also accept pallets as part of their wood waste stream. Consult the directories of services or contact your wood recycler first.

**5-21 Recycle Packaging****1 Point**

Material packaging makes up a substantial percentage of construction material waste. Keeping material out of the waste stream helps preserve landfill space. Recycle packaging or have subcontractors make arrangements to take the packaging back to the supplier.

**5-22 Recycle Drywall****1 Point**

Drywall generally makes up 11% by volume and 26% by weight of a residential home's waste stream or roughly 1-1.2 lbs. per square foot. Drywall is most often recycled as feedstock for more drywall. If your drywall subcontractor handles his or her own waste, work with the subcontractor to develop a recycling program. See Action Item 5-18, *Contractually Require Subcontractors to Participate in Recycling Efforts*, for more information.

**5-23 Recycle Concrete/Asphalt Rubble, Rock, and Brick****1 Point**

Concrete, brick, and asphalt rubble can be collected on site and recycled for less money than it costs to be landfilled. On large demolition projects, where a significant amount of asphalt or concrete is being demolished as part of site preparation, the material can be ground to meet base or fill specifications and reused on site.

**5-24 Recycle Paint****3 Points**

Options for recycling paint currently exist. Optimally, paint for recycling should be newer, clean of debris, and stored above freezing.

**5-25 Recycle Asphalt Roofing****4 Points**

Asphalt roofing is being collected in some regions for use as road base.

Many companies collect and process landclearing debris and yardwaste. In addition there are companies that offer mobile grinding services in which they will process landclearing debris at the jobsite. This reduces transportation costs and provides you with a material to use on your site for site protection activities.

## Hazardous Waste

- See Action Items 2-31, *Recycle Antifreeze, Oil, and Oil Filters at Appropriate Outlets* and 2-32, *Dispose of Non-recyclable Hazardous Waste at Legally Permitted Facilities*.

## DESIGN AND MATERIAL SELECTION

This category includes Action Items intended to help you make design and material selection choices that benefit the environment while still providing the quality and performance you demand for your projects. In addition to promoting the purchase of materials that include recycled or “reworked” content, these Action Items also suggest methods to reduce the use of limited resources.

Many standard construction materials that you are accustomed to using contain recycled-content and have for years. Furthermore, technology advancements have allowed the introduction of many new building products made with recycled-content that are also cost-effective and perform well.

By buying building products with recycled-content you reduce the use of “virgin” materials to produce construction products. Also, by specifying engineered products and waste-limiting framing options, you conserve materials which otherwise would have contributed to your site waste. All of these efforts conserve limited landfill capacity. In addition, you help encourage the market for recycled and engineered products. The end benefit will be competitive pricing for the finished products as well as better value for the recycled material used to make those products, including materials you recycle from your jobsite.

Recycled-content products can include two kinds of recycled material—*post-industrial* and *post-consumer*. *Post-industrial* recycled-content means the product includes waste material created as a by-product of an industrial process, such as sawdust produced in the milling process, or plastic “grinds” produced during the manufacture of a plastic product. *Post-consumer* recycled-content means the product includes waste material created as a result of actual use by the consumer (such as carpet or wood waste).

The higher the post-consumer content in a product the better. However, any recycled-content is better than none at all, when compared to using products with virgin materials that can require a lot of energy or other resources to produce.

When ordering building products from suppliers, it’s important to let them know your preference for recycled-content alternatives. Manufacturers producing recycled-content building products typically produce an equivalent without recycled-content (often with no price differential), and if you don’t specify recycled-content, you may not get it.

Another way to be a Built Green™ renovator is to use products manufactured in the area (1000 km radius), thus reducing the amount of energy used to get them to your site. The energy used to transport finished building products to their distribution site or directly to your site is one form of “embodied energy.” Embodied energy is energy “contained” in materials that has been used in resource extraction, manufacture, transport, installation, and, after useful life is over, removal and disposal. Besides reducing energy use, using locally manufactured products reduces air pollution associated with that energy use and supports the local business community.

In this section, information is provided about resource-efficient products available as of this writing. The products are readily available materials that are, for the most part, cost-competitive.

## Overall

**5-27 Use Standard Dimensions in Design of Structure**

**1 Point**

Incorporating standard sizes in the design will result in less wasted lumber, drywall, and other materials. It also requires less cutting—which ends up saving you time and labor. For example:

- Use increments in floor and wall layout to correspond with the standard two- and four-foot increments of most materials.
- Pay close attention to door and window placement to avoid the need for extra studs or cutting materials to special sizes.
- Incorporate standard finish dimensions in design. For example, keep standard carpet sizes in mind when creating floor dimensions.

### 5-28 Install Materials with Longer Life Cycles

1 Point

Whenever possible, choose materials that offer durability over lower first cost. Durable products naturally have longer life cycles. When making your materials selections, consider:

- Life Cycle Assessment (LCA) - Simply put, LCA evaluates a material to determine the overall environmental impact based on its “cradle-to-grave,” or “life” cycle: including raw materials extraction and processing, intermediate materials manufacture, material manufacture, installation, operation and maintenance, and ultimately recycling and waste management following the end of a product’s useful life. The National Institute of Standards and Technology and the USEPA sponsor a Windows-based decision support software, BEES (Building for Environmental and Economic Stability), that includes actual environmental and economic performance data for nearly 200 building products. Some manufactures are also providing life-cycle assessments.
- Life cycle costs - pro-rate the cost over the life of the product. Your supplier or manufacturer should be able to supply life cycle costing for materials they provide.
- Manufacturer warranties - provide some indication of how long the product is expected to last. Look for 30- to 50-year warranty products, in other words, 50-year roofing, cement siding, appliances, interiors, or clad windows.

### 5-29 Install Locally Produced Materials from within the Municipal Radius – 800 Km Radius

1-3 Points

“Locally produced” materials are generally considered to be extracted and produced within an 800 km radius.

### 5-30 Use Re-Milled Salvaged Lumber

3 Points

The most common commercially salvaged and reused building component is wood salvaged from beams in turn-of-the-century buildings or abandoned railroad trestles. Consequently, reclaimed wood is often available in species, coloration, and wood quality not found in today’s new material markets. Some companies offer original hand-hewn beams for reuse in their present form. Others provide salvaged wood re-milled into flooring, millwork, or paneling. Most companies grade the wood depending on its grain, the number and type of knots, and the number of nail holes left from its prior use.

**5-31 Use Wood Products Certified as “Sustainably Produced” by a Recognized Third Party** **1-3 Points**

Forest certification is a voluntary, market-based approach to help conserve, protect, and restore the world's forests. There are currently four Forest certification systems in operation and certifying wood products for sale – Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), CSA International, and American Tree Farm System.

According to Metafore ([www.metafore.org](http://www.metafore.org)) (formerly the Certified Forest Products Council), “an effective system should lead to continued improvement in forest management standards and integrate environmental, social, and economic interests.”

Metafore uses the following key concepts as a basis for evaluating the effectiveness of certification systems:

- The openness and transparency of its standards development and governance
- The objectives of its standards for evaluating forest management
- The rigor of its operating procedures.

Of the four systems, in terms of transparency, objectivity and rigor, FSC is currently considered the most effective system. CSA International, run by the Canadian Standards Association, is somewhat less rigorous and transparent. While SFI and the American Tree Farm System have many strengths they do not demonstrate the key concepts outlined above to the same extent as the other programs.

Use of wood certified under these systems will score points as follows:

- Forest Stewardship Council (FSC) 3 Points
- CSA International 2 Points
- Sustainable Forestry Initiative (SFI) 1 Point
- American Tree Farms System 1 Point

For further information and comparison of certification systems, visit

[www.certifiedwood.org/search-modules/CompareCertSystems.asp](http://www.certifiedwood.org/search-modules/CompareCertSystems.asp).

See also Action Item 5-39: *Use at least 50% of dimensional lumber certified as “sustainably produced” by a recognized third party*; 5-40: *Use at least 90% of dimensional lumber and 50% of sheathing certified as “sustainably produced” by a recognized third party*

## Framing

**5-32 Use Stacked Floor Plans** **1 Point**

Reduce the building size by stacking floor plans. Wet spaces can be located over mechanical areas, minimizing piping, vents, and chases. By building up versus out, efficiency of land use preserves open space, and tight floor plans reduce material consumption. Stacked plans also reduce construction costs for site and foundation work.

## 5-33 Use Engineered Structural Products

1 Point

There is a large family of engineered structural products, including laminated veneer lumber (LVL), wood I-beams and I-joists, and wood roof and floor trusses. These products combine efficient raw material use with improved strength and performance capabilities to produce a superior option to traditional materials. Engineered lumber manufacturers use fast-growing, small-diameter trees efficiently.

Combining wood veneer and fiber with adhesives produces laminated veneer lumber. The LVL manufacturing process allows more of the log (up to 80%) to end up as product. LVL lumber is very consistent and stable. Wood I-beams and I-joists also combine veneer and adhesives.

LVL headers and I-beams are accepted by all major building codes. They provide more load-bearing capacity than solid sawn lumber, and resist shrinking, twisting, splitting, warping, and crowning. They are capable of long spans, thereby increasing design flexibility. They can cost more than dimensional lumber, but in general are considered better products.

Wood roof and floor trusses are commonly used instead of cut rafters because they save both time and materials. They can also reduce wood waste because, ideally, you order only what you need, and because of efficiencies in the production process.

Prevent waste by making sure you and your truss supplier are “on the same page.” Supply a detailed building plan (calling out any unusual requirements due to an oddly shaped cathedral ceiling or an opening planned through the roof framing). Also, make sure trusses are stored flat to prevent warping.

Be aware of the indoor air quality issues associated with formaldehyde binders. Look for products that do not contain this type of binder or at a minimum used phenol formaldehyde in place of urea formaldehyde binders. Ask your supplier for more information. Also ask them about manufacturers who use certified wood in their engineered wood products.

## 5-34 Use Structural Insulated Panels

2 Points

Using structural insulated panel (SIP) systems for wall, roof, and flooring applications instead of traditional stick framing can be an effective way to reduce the amount of wood used in a building. Panel systems have been in use for over 30 years and a variety of systems are available. The most common system includes a foam core sandwiched between oriented strand board (OSB) skins. Avoid structural insulated panels produced with ozone-depleting HCFCs. EPS (expanded polystyrene) does not contain HCFCs or other ozone-depleting chemicals. Non-ozone-depleting polyurethane is now available.

In order to get optimum performance and waste reduction out of a panel system, first carefully evaluate your building plans to see if panels are appropriate. A complex shell design with lots of window or door openings can make it more difficult to use panels resourcefully. If you decide to use panels, make sure your framer understands how to work with them. Improper installation can negate the benefits. (The manufacturer should be able to provide some assistance when you start using these products.) See Energy Efficiency section Action Item 3-8, *Use Airtight Building Method, such as SIP or ICF, for building envelope*; for more information on the energy aspect of this building method.

**5-35 Use Advanced Framing****7 Points**

Use Advanced Framing Techniques to reduce wood waste and to increase insulation values in some cases.

Technique	Points
24" o.c. stud framing	1
Single top plates	1
2 stud corners	1
Open web trusses	1
Engineered I-joist floor system	1
In Line Framing	1
Coordinated Window Openings	1

(Source: Advanced Framing Techniques – Canadian Home Builders Association, Greater Vancouver Regional District, Prepared by Warren Jones)

With Intermediate Framing, studs are placed at 16-inch on-center as in conventional framing. However, it differs from conventional framing in that it includes insulated headers, corners, and intersections. While aspects of this approach are considered an energy efficiency strategy (see *Section Three: Energy Efficiency*, Action Items 3-11 through 3-14), this method also contributes significantly to minimizing material use.

Some renovators/builders continue to use densely framed walls, but as costs of framing lumber rise and the availability of straight tight lumber decreases, intermediate and advanced framing can add to savings to the bottom line. Because an advanced or intermediate frame house uses 20-30% less lumber, it should also take less time to construct and be less expensive to build. Recent studies by building scientists also show that this system generates less movement in the wall system resulting in less nail pops. Finally, fewer plumbing and electrical penetrations, result in fewer nail or screw holes to seal and sand.

Using two-stud rather than 3-stud corner construction reduces material use (See Action Item 3-12, *Fully Insulate Corners*). The extra studs are non-structural nailers for interior finishing. With two-stud corners, drywall clips spaced two feet apart can provide back up for interior finish materials, eliminating the need for extra studs. Place the clips where one wall abuts another, or where two walls intersect at corners.

To help increase the efficiency of exterior walls, use ladder partitions. The usual practice of adding extra studs in the exterior wall to provide nailing for drywall creates an inaccessible pocket that can't be insulated after exterior sheathing is installed. In ladder partition, the horizontal blocking across the front of the wall cavity allows for plenty of insulation behind. This alternative saves lumber and improves R-value.

**5-36 Use Insulated Concrete Form (ICF) Walls with Flyash and/or Blast Furnace Slag Cement in Concrete. (See also Item 5-42) 3 Points**

See Energy Efficiency section Action Item 3-8, *Use Airtight Building Method, such as SIP or ICF*, for more information on the energy aspect of this building method. In addition to energy savings, this method represents an opportunity to use waste products, flyash or blast furnace slag, in standard building material, which coincidentally offers superior performance. Flyash waste from coal burning has been shown to improve the strength of concrete when used to replace up to 30% of the Portland Cement content. Blast furnace slag from steel smelting can also be used in place of Portland cement, and in combination with flyash. (see Action Item 5-42, *Use Flyash or Blast Furnace Slag cement in Concrete*). Flyash content typically improves the workability and finish quality of concrete, but will slow the curing time – with possible impacts on construction schedules if you don’t plan for it.

In addition, some ICF systems are made with waste wood. The system offers significant savings in labor by combining framing, insulating, and sheathing. Less waste is produced because of the system’s flexibility (the forms can be cut to any shape). Additionally, many systems have “studs” built in so there’s something to nail or screw to, and sheetrock may be attached directly to the foam’s interior surface. Exterior siding material, such as wood, vinyl, brick, or stucco, can be easily attached.

**5-37 Use Finger-Jointed Framing Material (e.g. Risers and Studs); Longitudinal Compression Loads Only 3 Points**

Finger-jointing (gluing short lengths of wood together) makes use of wood that traditionally would have been disposed of as waste. Finger-jointed products are generally straighter and stronger than solid wood; you won’t have to reject and waste warped or split boards. Commonly used finger-jointed products include studs and painted trim. For structural use, they are acceptable for longitudinal compression loads only.

**5-38 Use at Least 50% of Dimensional Lumber Certified as “Sustainably Produced” by a Recognized Third Party 3-6 Points**

Percentage calculations are based on materials cost, excluding delivery costs.

Use of wood certified under these systems will score points as follows:

- Forest Stewardship Council (FSC) 6 Points
- CSA International 4 Points
- Sustainable Forestry Initiative (SFI) 3 Points
- American Tree Farms System 3 Points

For further information and comparison of certification systems and visit [www.certifiedwood.org/search-modules/CompareCertSystems.asp](http://www.certifiedwood.org/search-modules/CompareCertSystems.asp).

See Action Item 5-32, *Use Wood Products Certified as “Sustainably Produced” by a Recognized Third Party* for more information on forest certification.

**5-39 Use at Least 90% of Dimensional Lumber and 50% of Sheathing Certified as “Sustainably Produced” by a Recognized Third Party 5-10 Points**

Percentage calculations are based on materials cost, excluding delivery costs.

Points allotted for this strategy are dependent upon the house section where the strategy is applied, as follows:

	Floor	Roof	Walls
• Forest Stewardship Council (FSC)	4 Pts	3 Pts	3 Pts
• CSA International	3 Pts	2 Pts	2 Pts
• Sustainable Forestry Initiative (SFI)	2 Pts	1 Pt	1 Pt
• American Tree Farms System	2 Pts	1 Pt	1 Pt

For further information and comparison of certification systems, and visit [www.certifiedwood.org/search-modules/CompareCertSystems.asp](http://www.certifiedwood.org/search-modules/CompareCertSystems.asp).

See Action Item 5-32, *Use Wood Products Certified as “Sustainably Produced” by a Recognized Third Party* for more information on forest certification.

## Foundation

**5-40 Use Regionally Produced Block for Foundation 1 Point**

Points are awarded for using locally produced block in recognition that this strategy reduces the amount of fuel used to transport material to the site.

**5-41 Use Flyash or Slag in Concrete 1 Point**

Flyash is a by-product of burning coal for electricity production. It can be added to concrete slabs and foundation mixes as a substitute for typically 20 – 30% of the Portland cement mixture. It has been shown to improve the strength of concrete as well as increase its workability. Be advised that concrete with flyash content sets up somewhat more slowly, but it is easy to work with and has a slightly smoother finish. It is readily available and involves no added cost.

Slag cement is made from the slag material produced inside blast furnaces used for iron production. It can be used as a substitute for up to 50% of the Portland cement in concrete. Slag cement tends to improve workability, finish quality and strength of concrete, but typically does not increase the curing time. It is becoming more available, and it is becoming cost competitive with flyash and Portland cement.

#### 5-42 Use Recycled Concrete, Asphalt, or Glass Cullet For Base or Fill for Foundation

2 Points

If you choose to do this, make sure concrete, asphalt, or glass cullet is ground properly to meet base or fill specification. When ground to specs, the materials compact nicely to form a stable base. Get a sample from the supplier for your excavator crew to approve.

#### 5-43 Use Insulated Concrete Forms (ICFs) for Foundation

2 Points

See Energy Efficiency section Action Item 3-8, *Use Airtight Building Method, such as SIP or ICF*, for more information on the energy aspect of this building method. In addition to energy savings, this method also represents an opportunity to use a waste product, flyash, in standard building material, which coincidentally offers superior performance. Flyash waste from coal burning has been shown to improve the strength of concrete (see Action Item 5-42, *Use Flyash or Slag Cement in Concrete*).

In addition, some ICF systems are made with waste wood. The system offers significant savings in labor by combining framing, insulating, and sheathing. Less waste is produced because of the system's flexibility (the forms can be cut to any shape). Additionally, many systems have "studs" built in so there's something to nail or screw to, and sheetrock may be attached directly to the foam's interior surface. Exterior siding material, such as wood, vinyl, brick, or stucco, can be easily attached.

#### 5-44 Use an Alternative Foundation System that Minimizes Volume of Foundation Material

2 Points

Conventional foundations that involve the excavation and pouring of footings and/or slabs below grade use large quantities of concrete and other materials. The extraction, production, and transportation of these materials have significant financial and environmental costs.

By using alternative foundation systems, such as systems that employ surface-poured foundations and recycled steel pins to anchor them into the ground, you can significantly reduce the amount of materials used in a home.

Applicability and installation requirements for the site should be determined by a qualified engineer.

## Sub-Floor

#### 5-45 Use Recycled-Content Underlayment for Sub-Floor

1 Point

Using underlayment products below wood, tile, resilient flooring, or carpet and carpet cushion provides a level surface, covers cracks, and helps insulate floors from sound transmission and some heat loss. Standard particleboards are traditionally used for the purpose of underlayment, even though they are known to be the primary source of formaldehyde gas in new homes.

Exterior grade plywood or formaldehyde-free wood fiberboard with recycled-content is a superior choice for underlayment. Other environmentally preferable materials for flooring underlayment

include natural cork and options made with recycled rubber, paper, jute hemp, and/or agricultural fiber. (See *Section Four: Health and Indoor Air Quality*, Action Item 4-35, *Use Plywood and Composites of Exterior Grade or Formaldehyde-Free (for Interior Use)*).

## Doors

<b>5-46 If Using Wood Interior Doors, Select Products from Wood Grown in North America</b>	<b>2 Points</b>
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North American wood interior doors offer the same performance as doors made from tropical woods without compromising limited and endangered hardwood species stock. They also represent an opportunity to reduce embodied energy through minimizing the transportation impact, and support domestic economic development.

<b>5-47 Use Recycled Content Interior Door Package</b>	<b>2 Points</b>
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Many molded and engineered wood product doors contain a percentage of recycled content, generally wood fiber. Specify interior door package with recycled content.

<b>5-48 Use Salvaged Door Package</b>	<b>3 Points</b>
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High quality, solid wood interior doors are commonly salvaged from building demolitions. The cost, quality and feel of such doors make them an attractive option for some home buyers. Finding matching sets can be challenging, but some homebuyers are flexible on this issue. It may pay to source salvaged doors before finalizing your plans to ensure you have access to sufficient doors of the correct dimensions. Contact your local building materials salvage yard for more details.

## Finish Floor

<b>5-49 If Installing Vinyl Flooring, Use Product with Recycled-Content</b>	<b>1 Point</b>
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Vinyl flooring is a commonly used material and often preferred for economy and durability. It is not environmentally preferred, however, due to the manufacturing process that creates air pollution problems, impacts from VOCs off-gassing during construction and occupancy, and the fairly limited potential for recycling the material after it has been used as flooring.

Vinyl Composition Tile (VCT), on the other hand, contains recycled-content and is preferred over sheet vinyl because VCT contains fewer VOCs and other chemicals and damaged tiles can be replaced individually.

**5-50 If Installing Carpet, Use Recycled-Content Carpet Pad****1 Point**

A variety of cost-competitive resource-efficient carpet padding options are available. In general, these products have been found to be very resilient and possess good performance characteristics.

Carpet padding may be made from several recycled-content materials including nylon and polypropylene waste from carpet manufacturing and recycled tire rubber and rebound urethane, reprocessed from virgin prime urethane products.

**5-51 If Installing Carpet, Use Recycled-Content or Renewed Carpet****3 Points**

A variety of cost-competitive resource-efficient carpet options are available. In general, these products have been found to be very resilient and possess good performance characteristics.

Recycled-content carpets may include plastic yarns produced from recycled pop bottles or recovered fibers from recycled textiles. Wool carpet is another resource-efficient option that is renewable, biodegradable, naturally fire- and stain-resistant, and colorfast.

Renewed carpet is used carpet that has been cleaned and restamped. A variety of attractive renewed styles are available. Ask your supplier.

**5-52-1 Re-use existing wood flooring****3 Points****5-52-2 Use wood flooring that is certified as “sustainably produced” by a recognized third party****3 Points**

Points allotted for this strategy are dependent upon the house section where the strategy is applied, as follows:

- Forest Stewardship Council (FSC) 3 Pts
- CSA International 2 Pts
- Sustainable Forestry Initiative (SFI) 1 Pt
- American Tree Farms System 1 Pt

For further information and comparison of certification systems and visit [www.certifiedwood.org/search-modules/CompareCertSystems.asp](http://www.certifiedwood.org/search-modules/CompareCertSystems.asp).

See Action Item 5-32, *Use Wood Products Certified as “Sustainably Produced” by a Recognized Third Party* for more information on forest certification.

**5-53 Use Recycled-Content Glass, Ceramic, or Porcelain Tile****5 Points**

Several manufacturers make glass, ceramic, and porcelain tiles with recycled-content. These tend to be pricey, but are durable and offer an attractive opportunity to highlight (and market) the use of an environmentally friendly material to your client or market.

**5-54 Use Linoleum, Cork, Salvaged Wood, or Bamboo Flooring****5 Points**

Linoleum is made from all-natural materials and is a durable, low-maintenance flooring made of linseed oil, pine resin, sawdust, cork dust, limestone, natural pigments, and a jute backing. Linoleum does not contain significant petroleum-based products or chlorinated chemicals, as does vinyl sheet flooring, which is often mistakenly referred to as linoleum.

Cork and bamboo are renewable resources as well as natural materials. Cork flooring is durable, sound absorbing, and naturally moisture-, mold-, and rot-resistant. Bamboo flooring is also a very durable and dimensionally stable material. Despite the long-distance transport of the products to Canada, the durability, hardness, and short regeneration time of bamboo provide justification for specifying bamboo flooring instead of wood. There is also an indoor air quality advantage to using natural materials – less off-gassing due to fewer or no chemicals used in the manufacturing process.

See Action Item 5-31, *Use Re-Milled Salvaged Lumber*, for a discussion of salvaged wood.

## Interior Walls

**5-55 Specify and Use Drywall with Recycled-Content Gypsum****1 Point**

Drywall manufactured with recycled gypsum is commonly available at most building material suppliers and is cost-competitive with conventional drywall. However, it must be specified if you want to use it (in other words, it is not automatic).

**5-56 Specify and Use Recycled or “Reworked” Paint and Finishes****1 Point**

Companies are marketing recycled paint on a regional basis. Recycled paint was formerly offered only in limited colors and styles, but the selection is expanding, and recycled paint is usually cheaper than its virgin counterpart. Keep in mind that you will not want to use these paints in frequently occupied living spaces, such as bedrooms, children’s playrooms, or in home for individuals with chemical sensitivities. (See Action Items 4-30, *Optimize Air Quality in Family Bedrooms Through Source Reduction and Ventilation*, and 4-40, *Use Low VOC/Low-Toxic Interior Paints and Finishes for Large Surface Areas*.)

## Other Interior - Recycling

### 5-57 Provide Garage Sorting Bins for Recyclable Materials

2 Points

Communities offer town- or city-sponsored recycling collection programs. Some the programs provide two or more collection bins for pre-sorted recyclables, and some programs provide one or two bins for mixed recyclables. Check with your municipality first to see whether the bins offered by the program are suitable to meet the daily collection needs of the family in the home. As an added service to your clients who pre-sort, you can offer additional bins for the garage to make the daily collection of recyclable materials more convenient, allowing municipal containers to remain outside for weekly or bi-weekly collection.

### 5-58 Provide Built-In Kitchen or Utility Room Recycling Center

4 Points

One way to encourage recycling is to build a space for recycling containers in or near the kitchen, where 80% of a home's waste is generated.

Most millwork manufacturers include recycling centers within their cabinetry line. The cost of including such an area within the kitchen depends upon the style desired. Installing bins in existing base cabinets or closets can be done fairly inexpensively. For new cabinetry that includes factory installed pull-out bins, the estimated cost range is \$30 to \$40 per linear foot. There may be additional costs associated with extra floor space, if required.

## Exterior Walls

### 5-59 Use Recycled-Content Sheathing

1 Point

Sheathing can comprise a significant portion of the material used in a project. Therefore, choosing a sheathing product made with a minimum of 50% pre- or post consumer recycled-content can have a significant impact on resource conservation. Many options are available including products made from certified sustainable wood.

### 5-60 Use Siding with Reclaimed or Recycled Material

1 Point

Two types of siding currently include recycled-content: metal and to a small degree, vinyl. These products also offer durable and low-maintenance alternatives to wood siding. Metal offers the greatest opportunity to use post-consumer recycled-content in your project. Aluminum or steel siding products contain high percentages of recycled metal—up to 100%. The scrap is also recyclable.

Vinyl siding can include a small percentage of post-industrial scrap in the manufacturing process. However, PVC is difficult to recycle, and there are no vinyl siding products with post-consumer vinyl at this time.

Fiber-cement composites are also resource-efficient, and in addition to durability and low maintenance, offer a very good fire rating when compared to wood or metal siding. The wood fiber in these products is reclaimed from wood processing waste. It can also be harvested from small diameter fast-growing tree species.

#### 5-61 Use 50-year Siding Product

2 Points

Minimizing the need to replace any siding product offers a maximum consumer benefit to the homeowner, in addition to the obvious environmental impact. Many of the fiber-cement composites offer a 50-year warranty. Ask your local supplier for this and other options.

#### 5-62 Use Salvaged Masonry Brick or Block for Exterior

2 Points

The Contractors Waste Reduction Resource lists a number of reusable building material companies. Check with these vendors or consider establishing a reuse policy for the masonry brick or block you generate during construction.

#### 5-63 Use Locally-Produced Stone or Brick for Exterior

2 Points

“Locally produced” materials are generally considered to be materials produced within the region, ideally within a 500 km radius. Use locally quarried, indigenous stone that is cut and polished locally. Use of regional materials helps keep material transport costs down, reinforce a regional aesthetic, and support the local economy.

## Windows

#### 5-64 Use Wood/Composite Windows

1 Point

Manufacturers have developed new window frame materials from a composite of recycled polyvinyl chloride (PVC) or high-density polyethylene (HPDE) plastics and waste wood fiber. Combining the two materials creates a product that has important advantages over both wood and vinyl windows: the dimensional stability and thermal performance of wood, and the uniformity and decay resistance of plastics. The cost of wood/plastic composite windows is often less than that of wood or vinyl.

Wood/plastic composites consist primarily of waste sawdust and scrap PVC generated in the production of wood and vinyl windows, or with PVC, from post-consumer bottle waste. Wood content ranges from 40 to 70%, depending on the manufacturer. According to recent tests, the frames have roughly the same energy performance as solid wood, but perform slightly better than vinyl window frames.

Wood fiber increases the dimensional stability of the composite material. Dimensional stability is commonly a problem with PVC plastic frame materials. The composite coefficient of expansion more closely matches glass than vinyl and helps keep the seal between the frame and glass intact for long-term performance. Further, the composite does not absorb moisture and will not swell like wood.

Some window manufacturers offer a line that can qualify under the ENERGY STAR® program.

**5-65 Use Finger-Jointed Wood Windows**

**1 Point**

Traditionally, the finest clear-grained wood has been used for doors and window frames. However, the availability of stable, clear, mature wood has declined. As a result, the industry has responded by developing finger-jointed wood products—taking smaller scraps of lower value wood and edge-gluing them together, covered by top-quality wood veneers on the finish surface.

## **Cabinetry and Trim**

**5-66 If Using Hardwood Trim, Use North American Products for Cabinetry and Trim**

**2 Points**

Locally-sourced products minimize transportation impacts.

**5-67 Use Finger-Jointed Trim for Cabinetry and Trim**

**2 Points**

Since the availability of stable, clear, mature wood has declined, any application, which requires straight, knot-free wood is affected. As a result, the industry has responded by developing finger-jointed wood products—taking smaller scraps of lower value wood and edge-gluing them together, covered by top-quality wood veneers on the finish surface. Interior trim is an excellent application for this new product; it offers improved product consistency and durability, while at the same time uses harvested wood fiber more efficiently.

**5-68 For Cabinetry/Trim, Use North American Hardwood that is Certified as “Sustainably Produced” by a Recognized Third Party**

**2 Points**

Use of wood certified under these systems will score points as follows:

- Forest Stewardship Council (FSC) 3 Points
- CSA International 2 Points
- Sustainable Forestry Initiative (SFI) 1 Point
- American Tree Farms System 1 Point

For further information and comparison of certification systems, visit

[www.certifiedwood.org/search-modules/CompareCertSystems.asp](http://www.certifiedwood.org/search-modules/CompareCertSystems.asp).

When domestic hardwood trim can be substituted in the design, look for trim from certified or sustainable sources. (See Action Item 5-32, *Use Wood Products Certified as “Sustainably Produced” by a Recognized Third Party* for information on forest certification.)

**5-69 For Cabinetry/Trim, Use Tropical Hardwood Trim or Cabinets ONLY if Certified as “Sustainably Produced” by a Recognized Third Party 3-5 Points**

Use of wood certified under the Forest Stewardship Council (FSC) certification system will qualify for 5 points under this Action Item.

For further information and comparison of certification systems, visit [www.certifiedwood.org/search-modules/CompareCertSystems.asp](http://www.certifiedwood.org/search-modules/CompareCertSystems.asp).

Some designs specify a particular hardwood to achieve a certain “look.” When local options are not substitutable, then at a minimum select trim or cabinets from certified or sustainable sources. (See Action Item 5-32, *Use Wood Products Certified as “Sustainably Produced” by a Recognized Third Party* for information on forest certification.) Although there may be a slight cost premium associated with this choice, it allows you to contribute to a sustainable enterprise and ensures protection of endangered hardwood forests.

## Roof

**5-70 Use Recycled-Content Roofing Material 2 Points**

Traditional cedar shakes, although appealing for their textural qualities, only offer a 10-15 year life span in most climates. Several new composite options are available that provide lower maintenance along with durability. Many of these options include recycled-content or reclaimed materials: fiber-cement composites, asphalt shingles, plastic shakes, ridged sheet material made with fiber and asphalt, and metal shingles.

Fiber-cement composite slates are lightweight, long lasting, and fire proof. They offer an efficient use of wood fiber and can be used on standard roof structures. Asphalt shingles contain recycled “mixed” waste paper or reclaimed mineral slag resulting in 20% to 25% recycled-content. Roof panels made from recycled plastic resins provide a lightweight roofing alternative, in addition to recycled aluminum shingles that may contain up to 100% recycled-content.

**5-71 Use 40-year Roofing Material 2 Points**

Varieties of organic felt-based shingles are available with up to 40-year warranties. Talk to your local supplier about other options that provide a 40-year warranty.

**5-72 Use 50-year Roofing Material 3 Points**

Using durable materials with long-lasting value helps prevent the need for replacement – an asset to the homeowner – which add to the value of any home.

Some brands of aluminum or steel shingles have a 50-year limited warranty and in addition, come with a coating approved by HUD, which allows the roof to be used for collecting rainwater.

**5-73 Use a Lifetime Warranty Roofing Material****4 Points**

Several roofing manufacturers are now offering products that carry a lifetime warranty. While warranty periods only offer an approximation of actual service life, these products should prove more durable than comparable products with shorter warranty periods.

**Insulation****5-74 Use Recycled-Content Insulation****1 Point**

There are three commonly available types of recycled content insulation:

- *Cellulose insulation* is made from 100% post-consumer recycled newspapers or telephone books. The insulation can be dry-blown or poured loose-fill into enclosed cavities, but is most commonly wet-sprayed.
- Several brands of *fiberglass insulation batts* and *BIBS* are manufactured using recycled glass, including post-consumer glass collected in curbside recycling programs.
- *Mineral wool insulation* is another option and is available in loose-fill or batts. It has, on average, 75% post-industrial recycled-content.

Insulation	Recycled Content*	Points
Batt / Loose Fill / Spray Foam	< 25% <35%	1
Batt / Loose Fill / Spray Foam	≤35% <50%	2
Batt / Loose Fill / Spray Foam	≤ 50% <75%	3
Batt / Loose Fill / Spray Foam	≤ 75%	4

- \* Recycled Content comprised content is post consumer and post industrial waste content.

**5-75 Use Environmentally Friendly Foam Building Products (Formaldehyde-free, CFC-free, HCFC-free)****3 Points**

Building an environmentally friendly home means eliminating the use of foam building materials that are manufactured using chlorofluorocarbons (CFCs) or hydro chlorofluorocarbons (HCFCs).

CFCs are known to contribute significantly to ozone depletion and global warming, two of our most serious environmental concerns. HCFCs are considerably less damaging than CFCs, but should also be avoided if at all possible. In addition, avoid products that include formaldehyde, because indoor formaldehyde is gaining recognition as a severe health hazard causing reactions ranging from flu-like symptoms to death in individuals that become sensitized through exposure.

Options to consider include:

- Beadboard or EPS (expanded polystyrene) rigid foam insulation has an insulating value of (R-3.6 to R-4.4 per inch) and can be used for interior or below grade uses. It is less damaging to the environment because pentane is used in its production rather than HCFC.
- Polyurethane insulation (e.g. polyisocyanurate) made with pentane instead of HCFCs as the blowing agent is now available. Unlike, EPS, however, there are few outlets for polyurethane foam as a recycled product.
- Blown-in cellulose (100% recycled newspaper content) or formaldehyde-free fiberglass.

## Other Exterior

### 5-76 Use Reclaimed or Salvaged Material for Landscaping Walls and decks/patios

2 Points

Using discarded stone, brick, masonry, or wood materials to construct the landscaping walls not only saves resources, but also can provide a unique appearance to match the style of the home.

### 5-77 Use Recycled-Content Plastic or Wood Polymer Lumber for Decks and Porches

3 Points

There are many manufacturers of plastic lumber nationwide. Recycled plastic lumber or plastic/wood composite lumber provide durable alternatives to solid wood for exterior applications such as fences, benches, decking, docks, retaining walls, picnic tables, and landscape borders. Due to its weather- and insect-resistant nature, plastic lumber can readily substitute for treated wood in non-structural applications. Plastic lumber is also rot and corrosion-proof, and will not crack, splinter, or chip. It has a long life expectancy in exposed, sub-grade or marine applications, and does not leach chemicals into ground or surface water or soil as treated wood can.

Plastic lumber resists vandalism and does not require painting. It is available in a variety of colors, including white, although many companies have a standard color of either brown or black.

These products can be nailed, screwed, sanded, glued, or turned on a lathe with standard woodworking tools. One challenging aspect of working with plastic lumber is its high expansion coefficient, which must be considered during installation. Expansion issue is not a problem for wood polymers lumber product. Check with the manufacturer regarding structural support specifications.

### 5-78 Use Non-Toxic or Low-Toxic Pressure-Treated Wood

3 Points

There are several types of pressure treated wood products available, which, while providing the same quality characteristics, represent minimized health risks or disposal dilemmas because of the different chemicals used in their manufacture. When treated wood must be used, select one of the newer, copper-based products, such as ACQ (Ammoniacal Copper Quaternary), CBA (Copper Boron Azole), or a Borate based preservative.

ACQ preservative may be preferred where long-term weather resistance is required in addition to protection from termites and other pests. (PLEASE NOTE: ACQ treatment is corrosive to some fixing materials. Ensure that appropriate nails, screws and other hardware are used with ACQ treated lumber; stainless steel screws are recommended).

CBA is sold under the trade name Wolmanized Natural Select. Provides long-term resistance to termites and fungal decay in ground contact and aboveground applications. Also can be used in fresh-, but not saltwater applications.

Borate preservatives (such as Hi-Bor) are much less toxic than CCA, but will leach out of wood in wet conditions. They are effective for treatment against termites when wood will not be exposed to weather.

As the industry transitions to alternatives, there may be price fluctuations. Initially, alternative products may cost more than CCA-treated products, but some suppliers, in anticipation of the phase-out, are offering ACQ and CBA products at competitive prices.

Naturally rot-resistant species, such as cedar and redwood, are an option, especially if any are available from certified, well-managed forests. Recycled Plastic lumber and wood polymer lumber are other alternatives that are cost-effective, durable, and can be used in low-load structural applications, including decks and docks, playground equipment, benches, and tables.

What happened to CCA? In the past, the majority was treated using chromated copper arsenate (CCA), an inorganic, waterborne preservative. Some of the chemicals used in this treatment process, however, pose a certain health risk. There are health risk concerns about prolonged exposure after installation due to splinters or wet wood creating a route for skin absorption. Another major concern is the resulting disposal problem it creates. CCA treated wood is not recommended for burn facilities, so therefore, it becomes a landfill waste problem.

Since January 2004, the Environmental Protection Agency has banned the use of CCA treated dimensional lumber in any residential applications. CCA-treated lumber is still available for nonresidential applications. To obtain points for this Action Item, you must select a product that does not contain CCA.

## Innovation

### 5-79 Include Innovative Design, Equipment, and Operation Solutions to Conserve Natural Resources and Minimize Waste Produced on the Project 4-10 Points

This Action Item recognizes renovators for using innovation and emerging technologies, practices, and products that fulfill on the intentions of the Materials Efficiency section, but are not called out in the checklist.

Members can earn up to 10 points by submitting a short written justification for the extra credit points to the Built Green™ Standards Committee for review, approval, and award of points. This justification should include a description of the innovative action, an explanation of why it is beneficial, and a recommended point value (up to 10) based on its impactfulness, in line with the Built Green™ Program. The Committee will evaluate the submittal and recommended points and will determine final point awards.

## Section Six:

# Promote Environmentally-Friendly Homeowner Operations & Maintenance

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The purpose of this section is to promote responsible homeowner operation and maintenance throughout the life of the home, by equipping your clients to continue the good work you have begun. Whether your client initiated using green features, or it is part of your standard business practices, it is important to educate your clients in using and maintaining the products, equipment, or other features installed as part of the project. Studies show that most individuals care about the environment and are willing to take certain actions to protect it, as long as those actions are not expensive, time-consuming, or inconvenient. You can take steps to provide useful information and practical products to help your clients maintain their new green home.

## HOMEOWNER'S KIT

6-1	Provide Owner With Homeowner's Information Kit	★
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This Action Item is required for credit in the program. The minimum requirements are called out in the Information Box below.

Your Homeowner's Kit may simply include the required information or it may also include environmentally friendly "gifts." We encourage you to be creative with this Action Item. In addition to the Kit's educational value, you'll benefit from showing your client that you care. It will reinforce your reputation as a Built Green™ Renovator serving the community. Personalize the Homeowner's Kit by labeling it with the owner's name and address and be sure to include any specific information requested by owner. Obtain owner's signature on a "sign-off" sheet indicating information in the kit has been received. Let owner know the information should be read carefully in order to optimize the environmentally friendly features you have taken extra effort to incorporate.

See the next page for additional suggestions.

**The following are examples of additional materials you may also want to include as a service to your customer.**

**Information on:**

- Local mass transit opportunities
- Environmentally friendly landscaping operations and maintenance practices
- Pervious surfacing products for outdoor projects/surfaces (to avoid increasing stormwater runoff)
- Pest-resistant and disease-resistant plants, including native plants, provide a list
- Optimally operating and maintaining irrigation equipment
- Site critical areas, such as buffer zones, that should be protected (if applicable)
- Protecting and caring for valuable site features, including mature trees if applicable
- (Encourage protection and retention of existing arboreal overstorey where possible)
- Integrated pest management as an alternative to chemical landscape pest treatments
- Operating and maintaining water-using fixtures and equipment to avoid long-term leaks and optimize use
- Energy efficient appliances, including fact sheets, or a list of options (if appliances are not included)
- Energy-efficient lighting fixtures
- Operating and maintaining the home for good indoor air quality
- Non- or low-toxic cleaning supplies, such as environmentally friendly laundry or dish detergent, or paper products with recycled-content
- Environmentally friendly furnace filter(s)
- Native species flower seeds
- Environmentally friendly gardening supplies.

**Minimally, the Homeowner's Information Kit should contain:**

- A "Starter Kit" of brochures and fact sheets that relate to operating and maintaining an environmentally friendly home (from MBA)
- A copy of the completed Self-Certification Checklist, and appropriate energy efficiency worksheet
- Warranties and operating instructions for equipment or landscaping you have installed
- Underground maintenance information – as-built drawings of utilities and drain lines, and operation and maintenance (O&M) procedures for on-site drainage systems (include details such as how and when to clean screens, catch basins, drain lines, and clean-outs), and sewage/septic systems (include details such as how and when to inspect the system, pump the tank, and check settings) if applicable
- Information on operating and maintaining a whole house fan system, if applicable
- Completed copy of Chart 3-1A or 3-1B (If you are claiming Action Item 3-5 or 3-6)
- Information about installed air filter systems (Action Items 4-50, 4-51)
- Information on non-toxic and low-toxic moss removal Action Item 2-73, Educate Homeowners About Fish-Friendly Moss Control.

# APPENDIX

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## SEASONAL LANDCLEARING WORKSHEET

Use this Checklist to evaluate the Erosion and Sediment Control measures needed for wet season landclearing (October 1- April 30)

Date of Evaluation: \_\_\_\_\_ Proposed Start Month for Project: \_\_\_\_\_

Site/Lot#: \_\_\_\_\_ Address: \_\_\_\_\_

**Total Points By Month (see thresholds below to determine which month to legally begin project)**

**TIME OF YEAR** – Weighted by average monthly rainfall:

October	POINTS 5	_____
November	POINTS 20	_____
December, January, February, March	POINTS 25	_____
April	POINTS 10	_____

**HYDROLOGIC SOIL GROUPS -**

Group A: High Infiltration Rate	POINTS 5	_____
Group B: Moderate Infiltration Rate	POINTS 10	_____
Group C: Slow Infiltration Rate	POINTS 15	_____
Group D: Very Slow Infiltration Rate	POINTS 20	_____

**SLOPE** - Steepest portion of the footprint of the area proposed for clearing activity, prior to land disturbance:

0% to 2% slope	POINTS 0	_____
3% to 8% slope	POINTS 5	_____
9% to 14% slope _____%	POINTS 10	_____
15% to 34% slope	POINTS 20	_____
Over 35% slope	POINTS 30	_____

**CLEARING ACTIVITY SIZE -**

500 to 5,000 square ft.	POINTS 5	_____
5,001 square ft. to .99 acre	POINTS 10	_____
1 to 5 acres	POINTS 30	_____
Over 5 acres	POINTS 50	_____

**PROXIMITY TO WETLAND OR WATER BODY**- Cumulative (20' wide driveway across drainage ditch =0):

Less than 10 feet from drainage ditch or storm drain, other than a driveway crossing.	POINTS 20	_____
Less than 100 feet from a wetland or stream (subject to the Critical Area Ordinance)	POINTS 20	_____
Less than 200 feet from a lake or marine shoreline	POINTS 20	_____

Evaluator Name/Contact \_\_\_\_\_ Subtotal:

**ACTION:**

- ◆ **40 OR LESS:** Standard Erosion and Sediment Control BMPs
- ◆ **GREATER THAN 40 AND LESS THAN 75:** Winter Clearing Plan developed, applied and monitored by a certified ESC installer. Current certification and contact information must be included with BuiltGreen submittal.
- ◆ **75 OR GREATER:** Do not clear site during wet season start (October 1- April 30).



## Chart 3-A. Component Performance Method

Heat Loss Reduction	Points
<input type="checkbox"/> 10% improvement	10
<input type="checkbox"/> 20% improvement	20
<input type="checkbox"/> 30% improvement	30
<input type="checkbox"/> 40% improvement	40

Total heat loss reduction for home. \_\_\_\_\_ (BTU)









To document what you have done for the client,  
please record U values below.

Building Component	Upgrade
Window	Upgrade U-Value to _____
Skylight / Vault	Upgrade U-Value to _____
Floor Over Crawl	Upgrade R-Value to _____
Wall	Upgrade R-Value to _____
Attic	Upgrade R-Value to _____
Vault	Upgrade R-Value to _____
Slab on Grade	Upgrade R-Value to _____
Below Grade Slab	Upgrade R-Value to _____
Below Grade Wall	Upgrade R-Value to _____
Other _____	Upgrade U/R-Value to _____
Improve heating (AFUE or HSPF)	_____



## Chart 3-B. BUILT GREEN™ Prescriptive Scoring Method - Upgrades for all Fuel Types (See Note 1)


Envelope Component	Envelope Improvement	U-value (Note 2)	Heat Loss Reduction (Note 3)	Point Assignment (Note 4)	Score (Note 5)
<b>Windows</b>					
	Code baseline (Note 6): U = 0.40	0.400	0%	0	
	U = 0.32	0.320	6%	6	
<b>Skylight</b>					
	Code baseline (Note 6): Area weighted U value = 0.68	0.680	0%		
	U = 0.58	0.580	1%	1	
	U = 0.48	0.480	2%	2	
<b>Floor</b>					
	Code Baseline (Note 6): R-30 Standard	0.029	0%	0	
	R-38 2X12 I-Joist	0.022	3%	3	
<b>Above Grade Wall</b>					
	Code Baseline R-21 Standard 2X6 Framing	0.057	0%	0	
	R-21 Intermediate 2X6 Framing	0.054	1%	1	

Envelope Component	Envelope Improvement	U-value (Note 2)	Heat Loss Reduction (Note 3)	Point Assignment (Note 4)	Score (Note 5)
	R-21 Advanced 2X6 Framing 	0.051	3%	3	
	R-21 Standard 2X6 Framing + R-5 Foam Sheathing	0.043	6%	6	
	R-21 Advanced 2X6 Framing + R-5 Foam Sheathing 	0.040	7%	7	
	6" Foam Panel 	0.042	7%	7	
	8" Foam Panel 	0.034	10%	10	
<b>Attic</b>	Code Baseline (Note 6): R-38 Standard Framing	0.036	0%		
	R-38 Raised Heel Truss	0.032	1%	1	
<b>Vault</b>	Code Baseline (Note 6): R-30 Standard 2X12 Framing	0.034	0%		
	R-30 High Density Batts, 2X10 Framing 	0.034	0%	0	
	R-38 High Density Batts, 2X12 Framing 	0.027	1%	1	
	8" Foam Panel 	0.034	0%	0	
	10" Foam Panel 	0.026	1%	1	
<b>Slab on grade</b>	Code Baseline (Note 6): R-10 Foam 2'	0.540	0%		
	R-15 Foam 2'	0.520	1%	1	
	R-10 Foam 4'	0.480	2%	2	
	R-10 Full Slab, Not Heated	0.360	6%	6	

Envelope Component	Envelope Improvement	U-value (Note 2)	Heat Loss Reduction (Note 3)	Point Assignment (Note 4)	Score (Note 5)
<b>Below Grade Wall</b>	Code Baseline (Note 6): R-19 Interior Insulation	0.037	0%		
	R-21 Interior Insulation	0.034	1%	1	
	Foam Block	0.032	1%	1	
<b>Below Grade Slab</b>	Code Baseline (Note 6): No Thermal Break	0.540	0%		
	R-5 Thermal Break	0.500	1%	1	
<b>TOTAL SCORE</b>					

**Chart 3-1B Notes:**


1. The prescriptive path is the simplest, but also the least flexible, method for estimating heat loss reduction. It does not provide credit for reductions in glazing areas. You may (or may not) have a higher score if you use the component performance method (Chart 3-1A).
2. **U-Value:** Calculated U-value for the described building component. If you select a component that is not described in the text, use the Reference U-value of the product to score it.
3. **Heat Loss Reduction:** Estimated reduction in total UA of the structure. Based on two prototypical structures. Note: This is NOT equivalent to energy savings. NRCAN can provide you with estimated fuel savings.
4. **Assigned Point Value:** based on 1 point for each percentage point in heat loss reduction.
5. **Score:** Record your score based on assigned point values for the measures you implement. For example, if you use windows with U equal to 0.50, the estimated heat loss reduction is 10%, so your score for this item is 10 points. If you use more than one component type per category (wall, attic, etc.), average the scores for all components. Your total score is the sum of all scores for individual items. Max. score is 32 points.
6. **Code Baseline:** NRCAN Target Prescriptive Path for “other fuels.” Minimum requirements must be met for all components.

 Identifies those products that provide wood savings as well as energy savings.



## Chart 3-C. BUILT GREEN™ Thermal Bypass Checklist

(Source: ENERGY STAR Qualified Homes Thermal Bypass Inspection Checklist)

Home Address: _____		City: _____	Province: _____		
Thermal Bypass	Inspection Guidelines	Rater Verified	Builder Verified	N/A	
1. Air Barrier and Thermal Barrier Alignment	Insulation is installed in full contact with the air barrier to provide continuous alignment of the insulation with the air barrier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Shower / Tub at Exterior Wall	Exterior walls have been enclosed on all six sides	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Exterior walls have been fully insulated	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Insulated Floor Above	Air barrier is installed at any exposed edges of insulation garage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Insulation is installed to maintain permanent contact with the underside of the subfloor decking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. Attic Knee Walls	Continuous top and bottom plates are installed with an air barrier on the attic side of insulated walls, including exposed edges of insulation at joists and rafters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Insulation is in complete alignment with interior wall finish and the attic side air barrier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. Attic Access Panel / Drop Down Stair	Attic access panel or stair is fully gasketed for an air-tight fit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Attic access panel or stair is covered with insulation that is attached and fits snugly in the framed opening	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Cantilevered Floor	Air barrier spans cantilever and any exposed edges of insulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Floor framing is completely filled with insulation or insulation is installed to maintain permanent contact with the sub-floor decking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
7. Duct Shaft / Piping Shaft and Penetrations	Openings to unconditioned space are sealed with solid blocking and any remaining gaps are sealed with caulk or foam	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

8. Flue Shaft	Combustion clearance between flue and combustible materials (e.g., OSB) are properly closed with UL- approved metal collars	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Attic Eaves	Solid baffles are provided at framing bays to avoid wind washing of attic insulation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Dropped Ceiling / Soffit	Air barrier is fully aligned with insulated framing and any gaps are fully sealed with caulk, foam, or tape	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Fireplace Wall	Air barrier is fully aligned with insulated framing in framed shaft behind fireplace and any gaps are fully sealed with caulk, foam, or tape	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Staircase Framing at Exterior Wall / Attic	Air barrier is fully aligned with insulated framing and any gaps are fully sealed with caulk or foam	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Recessed Lighting	Airtight IC-rated recessed light fixtures are sealed to drywall with gasket, caulk, or Foam	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. Porch Roof	Air barrier is installed at the intersection of the porch roof and exterior wall	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Whole-House Fan Penetration at Attic	An insulated cover is provided that is gasketed or sealed to the opening from either the attic side or ceiling side of the fan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Common Walls Between Dwelling Units	Air barrier is installed to seal the gap between a gypsum shaft wall (i.e., common wall) and the structural framing between units in duplex and townhouse construction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Home Energy Rating Provider: _____  Home Energy Rater Company: _____  Home Inspector Signature: _____  Inspection Date: _____		Builder Company: _____  Builder Employee Signature: _____  Inspection Date: _____  Re-Inspection Date: _____		





## - Letter of Understanding - RE: Materials Efficiency & Job-Site Waste

This document is to have agreement that all parties involved in the Built Green Renovation program will work to reduce the damage to the surrounding site.

Pursuant to provincial regulations, all solid waste, including construction waste generated by contractors, must be disposed of at a proper disposal site permitted by the jurisdictional health department. Demolition waste can be disposed of at a permitted inert/demolition landfill or other landfill that accepts this material. The Built Green™ Program promotes waste reduction and recycling, please see *Section Five: Materials Efficiency*, for more information on ways to reduce your disposal costs

By signing this document the parties agree to manage waste in a responsible and environmentally sensitive method.

Team Member	Signatory Name	Company	Telephone #	E-mail Address	Signature
Client / Owner / Developer					
Built Green Consultant					
Architect					
Contractor					
Sub Trades					
- Electrical					
- Plumbing					
- Siding					
- Carpets					
- Painters					
- Insulators					
- Other					

# Jobsite Recycling Plan



## Recyclable Materials

What material will you target?	Condition of material*	How will it be handled on site?	Who will haul it?	Where will it be taken?
<input type="checkbox"/> Wood				
<input type="checkbox"/> Cardboard				
<input type="checkbox"/> Ferrous metal				
<input type="checkbox"/> Non-ferrous metal				
<input type="checkbox"/> Drywall				
<input type="checkbox"/> Asphalt Roofing				
<input type="checkbox"/> Concrete / Asphalt Rubble				
<input type="checkbox"/> Other				

\*Check with your recycler or hauler to see if any specifications or conditions exist regarding the material being recycled. Examples include size restrictions and non-acceptable materials (for example, treatments, finishes, or fasteners).

### Action Items

- Complete this Jobsite Recycling Plan and post on site.
- Commit subcontractors to recycle in Subcontractor Agreement.
- Keep subcontractors and workers aware and informed of Recycling Program.
- Require individuals to properly sort recyclables and hold them responsible for mis-sorted loads.
- Track and promote recycling results.

# Contractors' Waste Reduction Resource Sheet

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## Introduction

This short guide contains information condensed from the “Contractor’s Guide to Waste Prevention and Recycling.” The guide provides recycling and waste prevention how-to’s for all members, from handyman/renovators to large commercial contractors, who want to save money. Municipalities and the province can provide assistance on reducing, reusing and recycling construction wastes. Other resources are listed in this guide under “*Where to Get More Information.*”

## Preventing Waste in the First Place

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Waste prevention is even more beneficial than recycling. Why? Activities that prevent the production of waste, such as reusing building materials not only cuts garbage and recycling collection costs but also reduces materials expenses. Small changes to building practices and extra attention to detail can add up to significant savings for the renovator and the environment.

### Design to Prevent Waste

- Design with standard sizes for all building materials
- Specify materials and assemblies that can be easily disassembled at the end of their useful life
- Choose durable interior finishes or materials that can be easily removed and recycled when worn or damaged
- Consider reusing materials (on-site) or installing salvaged materials from off-site sources.

### Prevent Waste On-Site

- Set up central cutting areas for wood and other materials. Make sure the crew uses all the reusable pieces before cutting a new piece.
- Reuse concrete forms on the job and on other jobs. Wood forms can frequently be used up to 15 times. Alternatively, use reusable metal or fiberglass forms.

## Construction Methods that Prevent Waste

- Consider the purchase of good-quality, previously used items such as cabinets, doors, and equipment.
- For wood construction, use advanced framing techniques (e.g. 24" on center, and insulated headers), trusses for roof or floor framing, finger jointed studs and trim, and engineered wood products.
- Consider using wood frame wall panels prefabricated off site
- For concrete construction, use precast concrete members.
- Practice material storage and handling procedures that prevent loss from weather and other damage.

## Purchase to Prevent Waste

- Consider the purchase of good-quality, previously used items such as cabinets, doors, and equipment.
- Re-evaluate estimating procedures to make sure the correct amount of each material is delivered to the site.
- Choose products that come with minimal or no packaging.
- Replace toxic materials with less toxic or non-toxic alternatives to reduce hazardous waste disposal fees.
- Ask suppliers to deliver supplies using sturdy, returnable pallets and containers. Have them pick up the empty containers when delivering new supplies. Also, require suppliers to take back or buy-back substandard, rejected, or unused items.

## Salvage and Reuse of Building Materials

By reusing items on-site, donating and/or selling salvageable items, you can cut waste and reduce supply costs. If you are using a demolition contractor, specify reuse and salvage in the contract.

- Before demolition/deconstruction, identify potentially reusable or salvageable items.
- Determine the savings and cost of reusing, donating, and/or selling the salvageable items.
- Inform the demolition crew of the salvage procedures and expectations. Careful removal of these items is the key to their marketability.

### Other Reuse Options

Many companies have had success with less formal reuse options. Consider the following ideas:

- Advertise reusable items in the newspaper.
- Conduct a "yard sale" on the job-site to sell reusable items.
- Allow workers to remove wood or other salvageable items for their own use.
- Set out "free wood" signs. Ask some subcontractors to reuse or recycle their own materials. Consider asking for or requiring documentation to verify reuse or recycling.

The following are just a few of the materials that can be salvaged, and donated or sold locally:

Appliances	Bathroom Fixtures
Bricks	Cabinets
Carpeting	Dimensional Lumber
Doors	Ductwork
Flooring	Insulation
Lighting Fixtures	Marble
Metal Framing	Paneling
Pipes	OSB & Plywood
Shelving	Siding
Tile	Trim
Windows	Wood Beams

# Setting Up a Job-Site Recycling Program

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Recycling construction materials helps save money by cutting disposal costs. It also reduces waste going to the landfill and attracts clients who value environmental responsibility. Other benefits include a cleaner, safer site and improved community relations. Follow these steps to set up a successful, cost-effective recycling program for your job-site.

## Start Early

Incorporating recycling up front will ensure that opportunities are not missed and that the program is successful.

## Analyze Project Waste

- Estimate the types and quantities (tons or cubic yards) of waste the project will generate. Include demolition phase volumes
- Determine when the project will generate each waste.

## Identify Recyclables and Research Recycling Options

- Landclearing debris, wood, drywall, concrete, rock, asphalt, brick, carpet and asphalt roofing and other construction wastes may be recyclable. Remember that chipping land clearing debris to use for mulch or erosion control, and grinding concrete and asphalt for fill are inexpensive, on-site recycling options.
- Decide whether to self-haul recyclables to the recycling facility or to contract with a recycling hauler.
- For recycling haulers, determine whether you will co-mingle recyclables or source separate them for collection.

## Select the Recyclers

- Contact your local Built Green office for referral to recycler(s) of the materials you will be generating on your site.

## Determine the Savings

- Compare the cost of normal construction waste disposal practices with the cost of recycling to determine if recycling is feasible.
- Use the economics worksheets in the Appendix to determine potential costs and savings for recycling.

## Develop a Waste Management Plan

A Waste Management Plan identifies materials to be recycled on a project; including materials subcontractors will be responsible for recycling.

The plan outlines recycling procedures, expectations, and results.

- Filling out the Recycling Checklist will give you a good start on the basics of a Waste Management Plan.

## Set Up the Site

Work with your recycler and crew to determine the most effective way to set up the site for maximum recycling. Some suggestions include the following:

- Clearly designate the recycling bins. Post lists of what is and what is not recyclable.
- Place garbage and recycling bins near each other, and close to the point of waste generation but out of the traffic pattern.

## Communicate the Plan

It is important to educate everyone on the job-site about the waste management program.

- Discuss waste handling requirements with crew and subcontractors prior to beginning a project.
- Post easy to read signs and provide written information about the recycling program.

## Monitor the Program

An effective recycling program includes occasional monitoring.

- Check bins regularly for contamination.
- Periodically check the wastes in the garbage dumpsters to see if recyclables are being thrown away or if there are additional materials that could be recycled.
- Call the recycler before bins are full to arrange for pick up.

## Making Your Program Work

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The small effort needed to prevent waste and recycle on a job-site usually pays off in disposal and supply cost savings. Here are solutions to some of the challenges faced when developing and implementing a waste management plan.

- Designate a person to manage the details of creating and implementing the program. On residential projects, this might be the contractor, site supervisor, or crew chief.
- Require subs to use the recycling and disposal bins on-site. This allows the most control of recycling activities. Be sure to provide recycling for the variety of wastes the subs generate.
- Alternatively, ask the subs to recycle their own waste, but require written reports. Since many subs wastes are homogeneous, it is easy to separate the wastes for recycling.

### Space Constrained Sites

- Choose smaller bins and more frequent collection. There are a variety of container sizes and service options available through recycling service providers.
- Use scrap lumber to divide one dumpster into separate compartments for storing recyclables and trash on-site instead of having multiple dumpsters.
- Use smaller containers that are collected at the end of the day and dumped into a larger container for pick up.

## Track Your Success

Tracking the quantities and cost savings of diverted materials is important for future estimating. It is also required for Built Green™ certification.

- Once construction has started, keep the receipts from recycling and garbage disposal. Furnish receipts to your company's estimating department for planning future waste management budgets.

- If self-hauling, build custom containers to fit the space requirements using scrap or damaged plywood, concrete forms, or barrier fencing.

## Promotion and Education

- Include waste handling requirements in all project documents. This makes it clear from the beginning that waste prevention and recycling is expected from all crew members and subs.
- Treat waste management like a safety program. Integrate recycling training into the safety education, or design a separate recycling education program.
- Share the success. Let subcontractors and crew know how well they are doing by regularly posting volumes of materials reused/recycled.
- Dump out contaminated loads and have the subcontractors and/or crew pull out the contaminants themselves. It takes some time, but contamination probably won't happen again.
- Place small recycling bins on the work floor and use the crane or laborers to empty the bin on a regular basis.

# Using Recycled-Content Building Materials

Many common building products like drywall and blown-in cellulose insulation have contained recycled materials for years. New products utilizing recycled materials, such as carpet, concrete, and plastic lumber, are being developed every day.

## How to Buy Recycled

- Obtain information on recycled products. Consistently communicate your interest in recycled-content building materials in your specifications, policies and in your job-site meetings.
- Contact manufacturers for product specifications and samples. Look for products with the highest post consumer content that meets your strength and durability specifications.
- Look for recycled content products for your office or job shack. Copy paper, toner cartridges, and desk supplies are readily available with recycled content.

## Examples of Recycled-Content Building Products

BUILDING MATERIALS	SITE WORK
Bathroom Partitions Benches Bike Racks Carpet/Carpet Pad Ceiling Tiles Cellulose Insulation Copper Shingles Counter Tops Ductwork Exterior Sheathing Fences/Posts Fiberboard Fiberglass Insulation Floor Joists Flooring Lumber Pilings Roof Structural Steel Wallboard	Asphalt Base Course Building Blocks Building Panels Compost Concrete Concrete Masonry Units Fill Material Glassphalt Parking Stops Recycling Containers