Hawaii
BuiltGreen™

User Guide

for

Home Builder Checklist

Produced by
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DISCLAIMER

The Building Industry Association of Hawaii (BIA-Hawaii) has provided this User Guide as part of the Hawaii BuiltGreen™ Program. It is intended for use by licensed building industry professionals 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 User Guide is not intended to eliminate or substitute for the builder's own judgment or accepted engineering and construction practices. Each project may have characteristics that could make any one or more of the Action Items suggested in the User Guide inappropriate. It is the responsibility of the building professional to choose Action Items that are appropriate in each case. Furthermore, any product information provided in the User 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 manufacturer's recommendations.

In addition, local, state, and federal regulations must be followed and are not to be superseded by any recommendations made in this User Guide. Every effort was made to ensure consistency with the standards of the State of Hawaii at the time of this writing.

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

At this time, the Hawaii BuiltGreen™ Program is a self-certification program. The BIA-Hawaii does not warrant whether or not a builder has taken a specific action. The builder warrants their actions by signing the appropriate Self-Certification Checklist, which is available separately from the BIA-Hawaii.

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INTRODUCTION

This User Guide is a reference for building industry professionals enrolled in the Hawaii BuiltGreen™ Program of the Building Industry Association of Hawaii. It is designed to support the Self-Certification Checklist used to certify Hawaii BuiltGreen™ Home Builder projects. The Checklist functions as a menu of environmentally friendly features and strategies to include in your residential construction project and has more than 250 Action Items to choose from.

BuiltGreen™ is a market-driven program. Consumer education and outreach is critical to using it successfully. Please contact the BIA-Hawaii office about marketing tools you can use to promote your BuiltGreen™ homes. The BIA-Hawaii will also provide support through marketing seminars and a public marketing campaign.

WHY BUILD HAWAII BUILTGREEN™?

Your customers will get more home for their money. Homes built using the Hawaii BuiltGreen™ Program incorporate environmentally friendly features that can add value and reduce the lifecycle cost of the home. Often these features add little or nothing to the first cost of the home. At the highest level of the program, additional costs to achieve a 3-star rating are far outweighed by the added value that results.

Hawaii BuiltGreen™ adds Quality - Many environmentally friendly products provide multiple benefits that translate to improved performance of the home and increased customer satisfaction. For example, Hawaii Built Green™ promotes use of more durable building products. This not only saves resources, but also reduces maintenance and replacement costs and saves the owner valuable time.

Hawaii BuiltGreen™ adds Affordability - Buyers save money because energy efficient homes generate lower utility bills and maintenance costs. It may be possible to qualify for a higher loan amount and buy a better home for a lower monthly cost.

PURPOSE OF THIS USER GUIDE

The User Guide describes what is required to score points for each Action Item in the Self Certification Checklist.

The Guide is divided into Sections, similar to the Checklist. At the beginning of each Section, there is a list of “Top Picks,” recommended by local technical experts. These strategies offer a combination of environmental and economic benefits in the Hawaii housing market. Top Picks also lists the specific Action Items required to make up each strategy.

Also, throughout the User Guide you will find informative sidebars that provide additional information on technical topics, such as “Forest Certification” and “What does ‘Low-VOC’ mean?” to help you with your project.

Additional information about BuiltGreen™ HomeBuilder Action Items is provided through technical seminars and other resources. For further information about BuiltGreen™ resources, contact the BIA-Hawaii office:

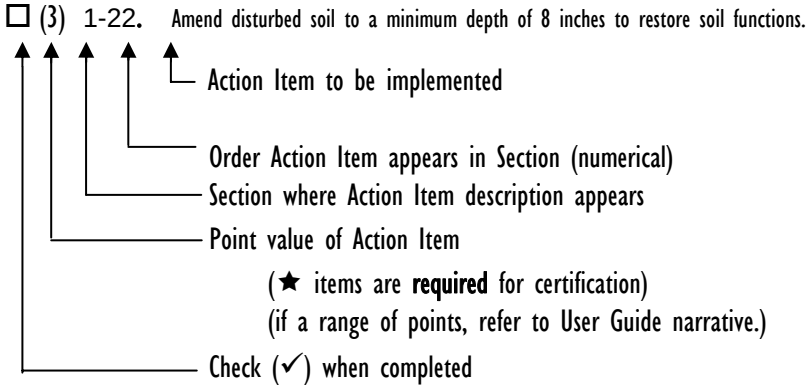
Phone (808) 847-4666, ext 210; E-mail RTC@bia-hawaii.com; or visit www.bia-hawaii.com.

HOW TO USE THE CHECKLIST

For ease of use, the User Guide coordinates directly with the Home Builder Self-Certification Checklist 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:

In this example, the action *Amend disturbed soil to a minimum depth of 8 inches to restore soil functions* is assigned 3 points and is described in Section **One (1)** (*Site & Water*), Action Item **22**.



HOW TO QUALIFY YOUR PROJECT

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

When your project is completed:

- Check the boxes for all the Action Items you have included and subtotal the points scored for each Section;
- Add the subtotals to come up with your total points and fill out the Rating Information box on the back of the checklist;
- Send a signed copy of the checklist to the BIA-Hawaii, certifying that the home identified in the checklist contains the identified features.

Based upon the information you provide in the checklist, and after reviewing the application, the BIA-Hawaii will award the appropriate Certificate of Merit indicating that the home has received a 1-, 2-, or 3-star rating.

This Certificate can be an important part of your marketing effort. It should be given to your client/homeowner as part of the handover package, along with the Homeowner Information Kit (see Section Five). You might refer to the Checklist when doing you final walkthrough.

STAR RATINGS

Requirements to Qualify at 1-Star Level

- Program Orientation (one time only)
- Complete all ★'d items
- Earn minimum of points:
    - o For Naturally Ventilated (NV) homes, 35 pts.
    - o For Air-Conditioned (A/C) homes, 45 pts.
      (Also see ★'d requirements under "A/C homes only" sections.)

Requirements to Qualify at 2-Star Level
(minimum 115 points NV; 125 points A/C)

- Meet 1-Star requirements
- Earn 85 additional points; at least 5 points to come from each section.

Requirements to Qualify at 3-Star Level
(minimum 210 points NV; 220 points A/C)

- Meet 2-Star requirements plus 95 additional points.
- Attend a workshop on green building topic within past 12 months (e.g., Green Building Conference or construction waste management seminar)

Air-Conditioned (A/C) homes require more energy to operate and add cost to the consumer's energy bill. Hawaii BUILTGREEN™ strongly encourages well-designed Naturally Ventilated (NV), energy-efficient homes. The Program recognizes, however, special circumstances where A/C may be warranted, such as areas where microclimates require greater heat or humidity control, when occupants have special needs, or existing conditions include environmental noise, dust, and pollution. To create equivalency between NV and A/C homes, there are some requirements that apply to A/C homes only. These are the ★'d items in the A/C-only sections. In addition, because there are additional items that are applicable only to A/C homes there are more points available to those homes; hence the higher thresholds for A/C homes.

QUICK REFERENCES

General

- HABiT Guide to Resource Efficient Building in Hawaii (copies available at BIA-Hawaii and DBEDT)

Section 2: Energy Efficiency

- Field Guide for Energy Performance, Comfort, and Value in Hawaii Homes: available at <http://www.hawaii.gov/dbedt/info/energy/efficiency/fieldguide> or contact Department of Business, Economic Development and Tourism, phone (808) 587-3807, E-mail ertd@dbedt.hawaii.gov
- For information on Model Energy Code see <http://www.co.honolulu.hi.us/refs/roh/32a1_3.htm>
- For information about Energy Star® Mortgage Program and other financial incentives call Hawaii Electric Company (Oahu) (808) 947-6937; Hawaii Electric Light Company (Big Island) (808) 969-0127; Kauai Electric Company (808) 246-8280; or Maui Electric Company 1-888-632-6786.

Section 4: Durability and Materials Conservation

- Contractor's Waste Management Guide: Best Management Practices and Tools for Job Site Recycling and Waste Reduction in Hawaii (copies available at BIA-Hawaii and DBEDT), and <http://www.hawaii.gov/dbedt/info/energy/publications/cwmg.pdf>
- DBEDT Buy Recycled in Hawaii Directory, <http://www.hawaii.gov/dbedt/info/energy/publications/brg02.pdf>

Section 5: Environmentally-Friendly Home Operations

- For information on Energy Star® products, see http://www.energystar.gov/index.cfm?c=products.pr_index, e-mail labeling@energystar.gov or call the ENERGY STAR® hotline at 1-888-STAR-YES

Section 1:

Protecting Your Site's Features and Functions

Top Picks

Strategy	Direct Benefits to Sell	Action Item
Maintain natural water drainage	Clean water for families and wildlife; healthy soil for healthy plants; community stewardship	1-2
Minimize impervious surfaces	Clean water for families and wildlife; healthy soil for healthy plants; community stewardship	1-5;1-6
Flag and protect sensitive areas during construction	Clean water for families and wildlife; healthy soil for healthy plants; community stewardship	1-9
Separate and properly dispose hazardous wastes	Clean water for families and wildlife; community stewardship	1-11
Stockpile topsoil and protect with mulch during excavation for post-construction use	Healthy soil for healthy plants	1-18
No significant change to topography	Clean water for families and wildlife; healthy soil for healthy plants	1-19
Amend disturbed soils to depth of 4" / 8"	Clean water for families and wildlife; more water for potable uses	1-21;1-22
Use mulch for landscaping to minimize evaporation	More water for potable uses; healthy soil for healthy plants	1-24
Install drought-resistant native plants for 50% of landscaped area	More water for potable uses; water savings	1-26; 5-2
Install irrigation system with water saving features	More water for potable uses; water savings	1-27

DESIGN CHOICES

1-1	Use plastic, low toxic wood preservatives (no CCA), or naturally rot-resistant wood for landscaping.	1 Point

Use non- or low-toxic materials in the landscape to help preserve soil and water quality. Examples include low-toxic wood preservatives, naturally rot-resistant woods, and plastic lumber (preferably with recycled content).

Beginning in December 2003, CCA-treated wood will be phased out of production. By January 2004, the Environmental Protection Agency will no longer allow CCA products to be used in any residential applications. (See sidebar on CCA Phase Out in Section 4: Durability and Materials Conservation)

1-2	Natural water drainage maintained.	3 Points

Minimize scraping, grading and backfilling of site. Preserving the natural topography and water drainage patterns of the site will result in more effective management and infiltration of surface water, and minimize impact on areas "downstream."

1-3	Surface water managed with detention ponds, grassy swales and drywells.	3 Points

Where natural water drainage is not maintained, use a range of strategies to micro-manage surface water, improving the site's ability to catch, hold, and absorb water. In addition to those mentioned, other strategies include mulching, contour trenches, terraces, check dams, and sand traps. These strategies 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.

1-4	Water management system allows groundwater to be recharged.	3 Points

Preserve and maintain groundwater recharge zones. There are a range of strategies to achieve this, including: Maintaining natural water drainages; managing surface water with infiltration ponds, grassy swales and drywells; and minimizing and disconnecting impervious surfaces. To implement these strategies effectively it is important to understand the hydrology of your site.

1-5	Minimum impervious surfaces on the site (no more than 15% of site, excluding house and garage). (See Porous Pavers in Energy Section.)	5 Points

Keep impervious area of driveways, paths and patios to a minimum. For example, install a "Hollywood" driveway, consisting of two long strips of pavement where the car wheels need support, with the area between vegetated (preferably with a low–grow turf, such as Zoysia, Bermuda, St. Augustine, or Seashore Paspalum) or filled with gravel. Other alternatives include using "no fines" porous concrete, porous pavers and cellular gravel containments (e.g. Gravelpave) to minimize gravel compaction.

15% impervious surface is a moderate improvement over standard practice. See also Action Item 1-6 below

1-6 Minimum impervious surfaces on the site (no more than 10% of site excluding house and garage). (See Porous Pavers in Energy Section.) 10 Points

As with Action Item 1-5 above. 10% impervious surfaces is a significant improvement over standard practice.

JOB SITE OPERATIONS

1-7 No soil exposed during job (protected with mulch). ★

Protect exposed or stockpiled topsoil from erosion by covering with mulch (preferred) or plastic (less preferred because it can cause rapid runoff and becomes waste after use) until ready for reuse. Surround all stockpiles with a compost berm or silt fence and inspect regularly for proper coverage or signs of erosion, especially after a large storm. Screen soil to remove debris before redistributing for final grading and landscaping.

Absolutely no topsoil should be disposed of in low areas or wetlands. See Action Item 1-8, *No fill in sensitive areas* and 1-9, *Sensitive areas flagged and protected during construction.*

1-8 No fill in sensitive areas. ★

Disposing of topsoil in lowlands or wetlands threatens water quality and quantity and endangers wildlife habitat. See Action Item 1-9, *Sensitive areas flagged and protected during construction.*

1-9 Sensitive areas flagged and protected during construction. ★

Sensitive areas include wetlands, riparian zones bordering water bodies, areas of special natural interest and root zones of trees. These areas should be flagged and protected, using silt fences, compost berms and other best management practices to ensure they are not damaged by heavy vehicles, hazardous and other waste materials and sediment in stormwater runoff.

Numerous federal, state 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.

1-10 Post cleanup procedures for spills. ★

Post procedures prominently in a central location and refer to them regularly during safety meetings. Requirements for cleaning spills or releases vary with the material. As part of your safety program, make sure your field crews and subs are familiar with cleanup procedures for the materials you use regularly.

1-11 Hazardous wastes separated and properly disposed of. ★

Most builders qualify as a Conditionally Exempt Small Quantity Generator (CESQG) under the State definitions. A small quantity generator produces less than 220 pounds of hazardous waste per month (about half of a 55-gallon drum), or less than 2.2 pounds of extremely hazardous waste, and never accumulates more than 2,200 pounds. CESQGs must send their wastes to a site permitted to manage hazardous wastes. There are fewer regulations and less paperwork required for CESQGs.

If you generate more than 2,200 pounds, you are classified as a Small or Large Quantity Generator (SQG or LQG) and must contract to have your hazardous waste sent to a site permitted to manage hazardous waste. There are more regulations that SQGs and LQGs must follow, including obtaining an EPA ID number and tracking of waste from "cradle to grave."

1-12 Sediment traps installed for construction. ★

Sediment traps help prevent non point source pollution by allowing sediment to settle out of stormwater before the water leaves the site. Such traps usually consist of a small pond with overflow spilling over a washed gravel outlet. Additional measures, such as compost berms, strawbale 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). Locate traps anywhere stormwater runoff may leave the site. Consult an engineer to calculate pond size if higher level of protection is needed due to sensitive downstream conditions. Provide extra traps as backups.

1-13 No adverse impacts on adjoining properties or critical areas during construction. ★

Take steps to ensure activities and materials on your project site do not adversely impact adjoining properties. Control dust and stormwater movement, keep noise to acceptable levels and during normal working hours, do not allow equipment or materials to block access. If some impact is unavoidable (temporary location of a crane, load but temporary noise, etc.), contact the property owner in advance to discuss and get their approval.

1-14 Water quality monitored during construction. ★

Establish water quality monitoring stations where natural surface drainage leaves the project site. Establish a monitoring schedule with qualified personnel or subcontractor to ensure that water leaving the site is within acceptable limits for sediment, etc.

1-15 Concrete trucks and pumps washed in designated areas (not in planned pervious areas). ★

Wash out concrete trucks and pumps in slab or pavement subbase areas, such as driveways, where slurry can be contained and will be useful. 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.

1-16 Slopes stabilized with mulch. 1 Point

Soil left exposed on slopes will erode. Use organic mulches (compost is recommended), organic textiles or hydroseeding to protect and stabilize slopes. Research has shown that use of compost as a mulch can often outperform conventional slope stabilization methods. While most of these materials will provide food for termites, it is unlikely that they will lead to an increase in the numbers of termites inhabiting a site. As long as adequate steps to protect structures from termite damage, the use of mulches and compost have a positive impact.

1-17 Balance cut and fill. 1 Point

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. Avoid radically altering the basic topography of the site, which will affect existing water functions.

1-18 Topsoil stockpiled and protected with mulch during excavation for post-construction use. 1 Point

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. Protect stockpiled topsoil from erosion by covering with mulch (preferred) or plastic (less preferred because it can cause rapid runoff and becomes waste after use) until ready for reuse. Locate the pile out of the wind if possible and moisten regularly to preserve mulch cover. Surround all stockpiles with a compost berm or silt fence 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.

Absolutely no topsoil should be disposed of in low areas or wetlands. See Action Item 1-8, *No fill in sensitive areas*.

1-19 No significant change to topography. 2 Points

To preserve the existing water functions, avoid radically altering the basic topography of the site.

1-20 Least-toxic form releases used. 2 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 vegetable oil spray, or waxing or painting the forms prior to use.

1-21 Amend disturbed soil to minimum depth of 4" to restore soil functions. (See 1-22 as alternate) 2 Points

Amend with compost to improve soil biology, nutrient availability and water-holding capacity. Use sand or gravel for improved drainage, and lime or other pH modifiers. Preferably, have the soil tested by a reputable soil lab to get data about the soil's chemical and physical condition, as well as its biological health. turf aesthetics

Amending soil to a depth of 4" will give moderate improvement in soil function. For best results, thoroughly mix 4 cubic yards per 1,000 sqft (approx 1 ¼" layer application) of well-degraded compost into the top four inches of topsoil. If topsoil has been removed and stockpiled, scarify sub-soil surface before replacing and amending topsoil. See Soil Amendment sidebar.

1-22 Amend disturbed soil to min. depth of 8" to restore soil functions. (See 1-21 as alternate) 3 Points

See 1-21 above.

Amending soil to a depth of 8" will give optimum improvement in soil function. For best results, thoroughly mix 8 cubic yards per 1,000 sq.ft. (approx 2 ½" layer application) of well-degraded compost into the top eight inches of topsoil. If topsoil has been removed and stockpiled, scarify sub-soil surface before replacing and amending topsoil. See Soil Amendment sidebar.

Soil Amendment

Compost as a soil amendment improves aeration of the soil, reduces the need for chemical fertilizers, moderates the temperature of the soil, and can lower the acidity. You should do a thorough soil analysis before adding amendments. A sample of each distinctively different soil type on site should be submitted to a reputable soil laboratory.

Special blends of compost are locally available to amend specific deficiencies of the disturbed soil. Locally-produced materials add microorganisms that are part of the local ecosystem and are beneficial to the native plants. Using locally produced compost also helps divert green waste from local landfills.

Other amendments may include pH modifiers to adjust the acidity (using calcium carbonate, calcium hydroxide, or dolomite) or the alkalinity (using soil sulfur or iron sulfate) of the soil, dune sand, volcanic cinders, silica sand, and blue rock to improve drainage (although dune sand and volcanic cinders will compact and break down over time), and gypsum (see Action Item 4-69).

Chemical fertilizers may also be used to amend soil nutrient deficiencies. This program *does not recommend them* because they are generally made from non-renewable resources, do not deliver as many benefits as organic amendments, and often leach out of the soil, resulting in surface and groundwater pollution.

Specifications for Organic Soil Conditioning Compost: Nitrogen (organic or ammonic: 0.5%; C:N ratio: 25:1 to 20:1; pH less than 6.8; salinity: 2.5; ash content not to exceed 10%; iron (expressed as metallic): 0.08%; organic matter: 35%; particle size: 95% passes through a screen of ½" or smaller.

Execution of Soil Amendments: Soil amendments should be applied only in areas that will be planted promptly after preparation.

Grade planting areas specification, then evenly apply soil amendments. Till soil to a homogenous, fine texture free of lumps, clods, and extraneous matter to the specified 4" or 8" depth. Make a minimum of two alternating passes.

Screen stockpiled topsoil to remove stones over 1 ½ inches, sticks, roots, rubbish, etc. Rip subsoil of planting areas to a minimum 6 inches. Spread topsoil to minimum depth required (taking into consideration compaction from light rolling and settlement), add soil amendments and thoroughly mix them into the top 4 inches of topsoil. OR Spread half of the topsoil and work into the loosened subgrade; then spread the remaining topsoil. Apply the specified soil amendments and mix thoroughly into the top 4 inches of topsoil.

1-23 Native vegetation saved and reused or donated. 3 Points

Native vegetation is adapted to the local climate. Retaining native vegetation in a landscape (rather than removing them and then replanting) also provides excellent erosion, sediment, dust, and pollution control. Desirable native plants and trees to be removed due to construction can often be reused on site or elsewhere. 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.

OUTDOOR WATER CONSERVATION

1-24 Mulch used in landscaping to minimize evaporation. 1 Point

Use a two inch layer of mulch wherever the landscape is not densely planted. Mulching provides additional soil nutrients and enhances structure, increasing the capacity of the soil to retain moisture and resist compaction, moderating soil temperature, and limiting soil erosion. It is the next best solution to dense groundcovers to reduce the number of weeds and make weed removal easier, which in turn, helps to minimize herbicide use.

Non-woody mulches, compost, cut grass clippings, or leaves, and woody mulches, wood chips or bark, can be used for different applications. 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.

Mulch should be placed at least 24 inches from building foundations and at least 6 inches below wood elements of buildings. Generally, mulch does not come with termites nor does it attract termites from other areas than directly adjacent to where it is installed. (See Action Item 4-68, *Compost or mulch used in landscaping*)

1-25 Rainwater recovery from roof for irrigation. 2 Points

Rainwater collected from the roof is a free source of landscape irrigation water. This Action Item covers only systems used for irrigation. 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. Let the homeowner know that rainwater supply is not intended for drinking.

1-26 Drought-resistant, native plants (site-appropriate) used for 50% of landscaped area. 3 Points

Use drought-resistant, native vegetation over at least 50% of the landscaped area. These species are adapted to the local climate. Although most of the drought-tolerant species of native plants grow naturally in the coastal and lowland areas, they are adaptable to the inland and upland, cooler and wetter areas, where they can reduce water needs.

Do not remove native plants from the wild. There are many local growers that supply native plants. 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.

1-27 Irrigation system has water-saving features, such as drip irrigation, electronic timer, valves with manual flow control, and rain shut-off device. 3 Points

Water is a vital and limited resource, particularly in Hawaii. Conventional sprinkler systems often waste large volumes of water through over spraying and evaporation.

Use low-trajectory nozzles on automatic sprinkler heads whenever possible, and use smaller-radii nozzles in windier areas, or install drip irrigation systems. Group plants with similar watering needs in each irrigation zone to reduce the demand on water. Use timers and soil moisture detectors or rain shut-off devices that ensure irrigation only when it is needed, at optimal times of day to minimize evaporation and in the ideal quantities for deep hydration of the soil profile.

Drought-Resistant Native Hawaiian Species for the Landscape

BOTANICAL NAME	HAWAIIAN NAME
Ground Covers	
Dianella sandwicensis	‘Uki’uki (Lily Family)
Heliotropium anomalum var. argenteum	Hinahina (Borage Family)
Jaquemontia ovalifolium subsp. sandwicensis	Pa’uohi’iaka (Morning Glory Family)
Lipochaeta integrifolia	Nehe (Sunflower Family)
Plumbago zeylanica	Ilie’e (Plumbago Family)
Sida fallax (creeping form)	‘Ilima papa (Hibiscus Family)
Vitex rotendifolia	Pohinahina (Verbena Family)
Small Shrubs	
Achyranthea splendens	‘Ewa Hinahina (Amaranth Family)
Artemisia mauiensis	‘Ahinahina (Sunflower Family)
Wikstroemia uva-ursa	‘Akia (‘Akia Family)
Medium Shrubs	
Abutilon menziesii	Ko’oloa ‘ula (Hibiscus Family)
Capparis sandwichiana	Maiapilo, Pilo (Caper Family)
Gossypium tomentosum	Ma’o (Hibiscus Family)
Hibiscus brackenridgei (state flower of Hawai’i)	Ma’o hau hele (Hibiscus Family)
Nototrichium sandwicense	Kului (Amaranth Family)
Osteomeles anthyllidifolia	‘Ulei (Rose Family)
Scaevola taccada	Naupaka kahakai (Naupaka Family)
Sida fallax	‘Ilima (Hibiscus Family)
Large Shrubs/Small Trees	
Chenopodium oahuensis	‘Aheahea, ‘Ahea (Goosefoot Fam.)
Dodonaea viscosa	‘A’alii (Soapberry Family)
Gardenia brighamii	Nanu, Na’u (Coffee Family)
Hibiscus waimaea	Koki’o ke’oke’o (Hibiscus Family)
Myoporum sandwicensis	Naio, Bastard Sandalwood (Naio Family)
Psydrax odorata	Alahe’e (Coffee Family)
Medium Trees	
Erythrina sandwicensis	Wiliwili (Bean Family)
Reynoldsia sandwicensis	‘Ohe (Ginseng Family)
Sapindus saponaria	Manele, A’e (Soapberry Family)
Vines	
Canavalia galeata	‘Awikiwiki, Puakauhi (Pea Family)

Sources: Fred D. Rauch and Paul R. Weissich, Plants for Tropical Landscapes: A Gardener’s Guide (Honolulu, HI: University of Hawai’i Press, 2000); City and County of Honolulu, Board of Water Supply, “List of Plants at Halawa Xeriscape Garden” (www.hbws.org).

Bonus Points for Custom Homes

1-28	Set aside 20% of site to be left undisturbed.	5 Points

Set aside undisturbed areas to preserve soil, water, and vegetation. Coordinate with the grading designer and equipment operators to let them know about this goal and to help you come up with creative solutions. Review the set aside plans with subs, especially grading and excavation crews.

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.

1-29	Limit grading to 20 ft. outside building footprint.	5 Points

Soil that is compacted or contaminated by construction activity may become lifeless. Design for minimal grading to help retain healthy soil and natural water infiltration. Where grading is unavoidable, carefully remove and stockpile existing topsoil, replacing it after rough grading.

Section 2:

Energy Performance and Comfort

Top Picks

Strategy	Benefits to Sell	Action Item
Minimize energy required for water heating	Energy and water savings; community stewardship	2-56 to 2-65
Minimize A/C where possible	Energy savings; healthier indoor environment; community stewardship	2-46 to 2-55; 5-1
Control heat gain with: building orientation insulation/radiant barrier high performance windows light-colored roofing shading devices	Energy savings; greater thermal comfort; healthier indoor environment; community stewardship	 2-3; 2-6 2-15; 2-16 2-21 2-9 2-4; 2-14; 2-31; 2-32
Naturally ventilate with ample fresh air	Energy savings; connection to outdoors; greater range of comfort; healthier indoor environment	2-1; 2-17 to 2-25; 2-35/2-36; 2-41; 2-44
Use energy efficient appliances	Energy and water savings; community stewardship	2-78 to 2-83; 5-3
Minimize electrical lighting energy	Energy savings; a cooler, more comfortable house; better indoor visual quality; community stewardship	2-71 to 2-77; 5-7

DESIGN CHOICES

Site

2-1	Space and arrange (stagger) buildings so all structures have good air flow.	1 Point

Energy-conscious layout of a development can reduce energy costs for the homeowner, and offer enhanced comfort and aesthetics.

Stagger and space buildings so that they all present windowed, exterior walls to prevailing air flow.

2-2	Porous paving materials installed to reduce thermal mass, heat gain, and glare.	1 Point

Solid paved areas (poured concrete, stone or concrete pavers, etc.) can reflect solar radiation (glare) towards the house and absorb and hold thermal energy. This energy is released at night, reducing the potential for night-time cooling of the structure and the air surrounding it.

Use porous/no fines concrete – poured in place or pre-poured pavers for exterior paving areas. Paving that can handle foot and auto traffic while allowing grass to grow through it (such as GrassPave) is a better alternative.

2-3	Longer sides of home oriented to face north and south to reduce heat build-up.	2 Points

The long walls of a home 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 plantings.

2-4	Existing or new landscape elements (trees) shade buildings and paved areas.	2 Points

Preserve existing trees and/or add new plantings that will effectively shade east and west sides of buildings and paved areas to reduce solar heating. They block the heat before it gets to the window or pavements.

2-5	Built elements (e.g., trellises, carports) shade paved areas.	2 Points

Shade paved areas from direct sunlight using built elements such as trellises and carports. Solid paved areas (poured concrete, stone or concrete pavers, etc.) can reflect solar radiation (glare) towards the house and absorb and hold solar energy. This energy is released at night, reducing the potential for night-time cooling of the structure and the surrounding air.

2-6	Buildings oriented to maximize cooling potential of prevailing winds.	2 Points

Orient buildings at about 45° to the prevailing wind and stagger them so that buildings all present windowed, exterior walls to prevailing air flow.

2-7	Landscaping elements used to improve air flow around structure.	2 Points

Use appropriate plantings to channel breezes towards homes for cooling effect. For example, if a home is sheltered from the prevailing wind by another structure, a “hedge” line of dense trees or

shrubs, extended out beyond the shelter can be used to redirect airflow towards windows or doors in the home.

2-8	Generous areas of planting and ground cover (less hardscape) included to reduce site temperature.	3 Points

Minimize hardscape around the home by using plantings and groundcovers rather than large paved areas. Unfinished or gravel pathways are preferable to concrete. Vegetated areas reflect less solar radiation than hardscape surfaces, and have little thermal mass for storage and subsequent release of heat. In addition, natural living processes actively cool the air around plants.

Shell

2-9	Light colored roofing installed.	1 Point

Light colored roofing materials absorb less solar radiation than dark colors, keeping the roof space cooler and reducing radiant heating of the surroundings.

2-10	Light colored exterior wall surfaces included.	2 Points

Light colored exterior wall surfaces absorb less solar radiation than dark colors. Not only will this keep the house cooler, it will also result in less heat radiating from your walls, which would otherwise heat the surroundings.

2-11	Attic or roof cavity vented with continuous ridge and eave vents.	2 Points

Install baffled continuous ridge vents to exhaust hot air from the roof, and eave or soffit vents to allow cooler outside air to be drawn in to replace the hot air.

Keeping the attic or roof cavity well ventilated will make it easier to maintain comfortable temperatures in the living space, while also increasing the lifespan of roofing materials.

2-12	Attic or roof cavity vented with gable end vents.	2 Points

Gable end vents can be effective if located on both windward and leeward sides of the house. Total vent area should be at least 1 square inch per 1 square foot of attic space.

2-13	Sill vents, floor vents, and venting skylights used to allow hot air to escape the building by thermal convection.	2 Points

Install floor vents and trickle vents at ground floor window sill level, and venting skylights high up in the open core of the house. This setup employs thermal convection or stack effect to draw cool air into the lower levels of the house while exhausting warm air at roof level, even when windows are closed.

2-14	Shading on at least 50% of east and west wall surfaces.	5 Points

Use trees and other natural landscaping to effectively shade at least 50% of east and west sides of buildings from low elevation solar radiation in the mornings and afternoons. This will make it significantly easier to maintain a comfortable temperature inside the home.

2-15	Radiant barriers and/or insulation installed in walls exposed to the sun, beyond any applicable local codes and ordinances.	5 Points

Where exterior walls cannot be shaded from direct solar radiation, install radiant barriers and/or extra insulation to reduce the rate of heat transfer from the exterior of the envelope to the interior of the home. Radiant barriers should be attached to the exterior face of framing if possible, although the interior face is also acceptable. The shiny face should face the air gap in either case, i.e., shiny face to the studs.

If local jurisdiction requires insulation and/or radiant barriers (example: City & County of Honolulu's R-19 roof insulation or equivalent ordinance), points are awarded ONLY IF the installation EXCEEDS the local requirement.

2-16	Radiant barriers and/or insulation installed in ceilings and attic spaces, beyond any applicable local codes and ordinances.	5 Points

Even well ventilated attic spaces will gain some heat from direct solar radiation. Install radiant barriers and extra insulation in ceilings and attic spaces to reduce the rate of heat transfer from these spaces to the interior of the home. Radiant barrier should be attached to the exterior face of framing if possible, although the interior face is also acceptable. The shiny face should face the studs and a ¾" gap should be maintained between the radiant barrier and other insulating materials if possible.

If local jurisdiction requires insulation and/or radiant barriers (example: City & County of Honolulu's R-19 roof insulation or equivalent ordinance), points are awarded ONLY IF the installation EXCEEDS the local requirement.

Openings

2-17	Orient to minimize heat build-up through openings.	1 Point

Locate largest windows on north and south walls so they can be more easily shaded from direct sun penetration using overhangs.

2-18	Inlet openings (air comes in) slightly larger than outlet openings (air goes out) to enhance air flow.	2 Points

Ensure that the operable area of windows on the sides of the house that face the prevailing wind direction is slightly larger than on the leeward side. Effective operable area depends on window type: Casement – 90% of operable area, Awning & Jalousie – 75%, Sliding – 45% to 50%, Single hung & Hopper – 45%

2-19	Windows located at body level.	2 Points

Natural ventilation provides the greatest cooling effect when occupants feel direct air movement. Place windows at body height for maximum effectiveness.

2-20	Generous screened openings protected from rain.	2 Points

Living areas contained by screened openings (screened porches, sleeping porches and lanais) provide comfortable living space with good ventilation and no insect problems. Screened areas

should be protected from rain penetration by adequate roof overhangs, guttering, etc., particularly on the windward side of the house.

2-21	High performance glazing used on windows exposed to the sun (SHGC = .65 or less; U-value - .45 or less; VLTC of .7 or more; designed to keep heat out but let light in).	2 Points

Where window openings cannot be shaded from direct sunlight, install windows that minimize both solar heat gain (SGHC) and heat transmittance (U-value). The higher visible light transfer (VLTC) ensures sufficient light passes through the window to provide natural light, rather than making supplemental electric light necessary.

2-22	For spaces with openings on adjacent walls, windows located far apart and at diagonal.	2 Points

Orient openings to ensure airflow across the greatest part of the space. Windows placed close together will tend to "short-circuit," leaving most of the room without effective air movement.

2-23	For spaces with openings on same wall, appropriately spaced casement windows or wing walls used.	2 Points

Casement windows can be used to effectively catch airflow. For windows on same wall, select opening direction so that upwind windows open to scoop air in, and downwind windows open so that they shelter the opening from wind, creating low pressure that will help draw air out of the window. This generally means placing hinged edges towards each other rather than away from each other.

Wing walls are vertical exterior wall partitions placed perpendicular to adjoining windows to enhance ventilation through non-casement windows. Located to leeward of upwind windows and to windward of downwind windows, they will promote air flow into and out of those windows.

2-24	Operable openings equal to at least 12% of floor area.	2 Points

Calculate using effective area of openings, not total window area. (See Action Item 2-18 for Effective Openings)

2-25	At least two operable windows to the outside included in each space.	2 Points

Enhance natural ventilation by locating separate inlet and exhaust openings in each space. There is relatively little movement of air in and out of a single opening in a space.

2-26	Diffuse glare from skylights through baffles, splaying, or use of translucent glazing.	2 Points

Avoid direct sunlight through skylights, which can result in increased inside temperatures. Glare creates light "hotspots" which can make nearby areas of a house seem dark and gloomy.

2-27	All skylights used have SHGC of 0.5 or less.	3 Points

Skylights with low SHGC ratings will help prevent solar gain inside the house.

2-28	Operable skylights or skylights with built-in vents (on leeward side of skylight) installed.	3 Points

Install operable or vented skylights to vent warm air from living spaces. Vented skylights allow venting even during rainfall, when an operable skylight might have to be closed.

2-29	Casement or jalousie windows used for best air flow.	3 Points

Use windows that offer the greatest opening area as a percentage of total window area - casement (90%) and jalousie (75%). They offer the best trade off of ventilation versus solar heat gain. By comparison, sliding and single-hung windows offer only about 50% operable area.

Jalousie windows are best on walls that are near perpendicular to the prevailing wind direction. Casement windows are preferred on walls that are angled or near parallel to the prevailing wind direction.

2-30	No more than 25% of total glass area is located on east and west walls combined.	3 Points

Minimize windows on the east and west walls. They are the hardest to protect from the lower elevations of direct sunlight during the mornings and afternoons.

2-31	Exterior horizontal shading installed for north and south windows (sufficient to protect completely from direct sun).	3 Points

Use a 45° angle for overhangs on south side, 70° angle for overhangs on north side. Angle is measured between horizontal, and a line connecting bottom of window and outer edge of overhang.

2-32	Exterior vertical shading installed for east and west windows (sufficient to protect completely from direct sun).	3 Points

Exterior shades can be permanent (landscape features, fences, screens, etc.) or retractable blinds or shutters. Exterior shading on east and west walls intercepts sunlight before it enters the envelope, and is therefore more effective at reducing heat gain than interior blinds or curtains.

2-33	Light shelves used for sidelighting.	3 Points

A light shelf is a horizontal surface installed on the outside of a window. It is used to bounce daylight deeper into an interior space for lighting purposes. The shelf is installed about 20% down from the top of the glass. The shelf blocks sunlight from the lower area of glass, but bounces light into the room through the upper area. Direct sunlight is blocked from the upper area of glass by an overhang.

2-34	For toplighting, roof monitors or clerestories used. (No skylights.)	3 Points

Install clerestories and roof monitors to bring daylight deeper into the home. Clerestories are vertical openings located high in the wall. Roof monitors are vertical glazed openings located in the roof or in the roof plane. Because they are vertical, they are much easier to shade and much less likely than skylights to produce excessive heat gain.

Interior Layout and Finishes

2-35	For spaces with openings on opposite walls, orient rooms at approximately 45 degrees from wind direction.	1 Point

Locate window openings to avoid a direct cross-ventilation path from one opening of the space to the other (wind flow perpendicular to the openings and parallel to the path between them. This Action Item will provide 20% better internal airflow than if the window walls are perpendicular to the wind.

2-36	Design floor plans to provide effective cross ventilation and air flow at body level.	2 Points

Create spaces that have body-level windows on opposite or adjacent walls, oriented 45° to the prevailing wind. Use partial height partition walls in the interior to facilitate air flow.

2-37	Layout designed so activities with highest illumination needs are daylighted.	2 Points

Provide adequate windows and skylights for kitchen, home office and other rooms requiring good lighting. Consider light shelves, clerestories or light tubes to bring daylight deeper into these spaces.

2-38	Floor plan allows deep daylight penetration.	2 Points

Narrow floor plans with high ceilings and few internal walls on the long axis of the building allow deeper penetration of daylight. Rooms should be no more than 2.5 times deeper than the height of the window wall. Also consider clerestories, light shelves and roof monitors to bring daylight further into core of building.

2-39	Use light colored interior finishes to enhance daylight (but avoid glare).	3 Points

Light colored walls optimize daylight in an interior. Pastel colors and satin or flat finishes produce less glare than bright whites and gloss finishes.

Mechanical Venting and Cooling

2-40	Timers installed on bathroom fans.	1 Point

Install crank or electronic timers to ensure effective use of bathroom fans without wasting energy. Alternately, wire a humidistat into the fan circuit. The fan will automatically shut off when the desired humidity is reached.

2-41	All bedrooms and family room wired for ceiling fans.	2 Points

Provide wiring and switching needed for a ceiling fan in the original electrical plan. A ceiling fan can be used as a low-energy option to provide cooling on hot summer days.

2-42	Solar powered attic vent installed.	2 Points

Install a solar powered attic vent that uses a small photovoltaic array to power the fan motor. The fan will operate whenever there is adequate sunlight ensuring good attic ventilation whenever there is a significant heating load, without using grid electricity.

2-43	Whole house fan installed.	3 Points

Install a whole house fan system that exhausts interior air from the house, drawing fresh air in from the outside. Such a system should have a control with the capability of continuous, manual or automatic, timed operation. For best results, the fan should be run for at least 8 hours per day, preferably on a 10 minutes on, 20 minutes off cycle.

2-44	Ceiling fans installed in all bedrooms and family room.	3 Points

Install ceiling fans in rooms that have the most frequent occupancy. They should be installed and wired so that they can be switched off when a room is unoccupied. Fans must be sized correctly for the room size and installed with adequate clearance from the walls, roof and floor to ensure effective operation.

Ceiling fans create gentle breezes that can greatly enhance comfort in a naturally ventilated house on still days. They may also be a preferable source of air movement where external conditions (noise, dust, etc.) make keeping windows open impractical.

2-45	No air conditioning.	10 Points

By employing a combination of strategies to reduce heat transmission through the roof, walls and windows, to maximize natural ventilation, and to reduce ambient and radiant heat on the exterior of the house, it is quite possible to keep a home comfortable without air conditioning.

This can free up to $18,000 in construction costs to be applied to other detail features of the home, while reducing the operating costs of the home by up to $400 per year.

AIR CONDITIONING (A/C) HOMES ONLY

2-46	House meets Hawaii Model Energy Code standards for A/C buildings. (See Quick References for further details.)	★

The requirements include:

- SEER must be greater than 10 for split systems and 9.7 for packaged systems;
- Ducts in unconditioned space must be insulated;
- Windows must be shaded or tinted;
- Doors and windows must be tight fitting;
- Walls must be insulated or shaded;
- Skylight size limited

For more information, see the Quick References.

2-47 A/C system sized for efficient operation (not oversized). ★

Perform detailed load calculations to ensure that the installed system is appropriately sized for the home. Oversized systems are more expensive to install and are less energy efficient in operation, since they tend to cycle on and off more frequently that a correctly sized system. Short run cycles prevent the system from effectively removing humidity from the air, leaving the air feeling damp and possibly leading to mold and mildew problems.

2-48 Programmable thermostats provided. ★

Install programmable thermostats to control the air conditioning system. These allow the homeowner to establish different set-points for different times of the day, depending on occupancy and activity (e.g., less conditioning at night and during day if the house is unoccupied).

2-49 Provide alternate means to balance air flow (e.g., undercut doors, return air ducts). 2 Points

Forced air systems require free flow of air from outlet ducts to returns to ensure optimum operating efficiency. Rooms should either have both outlet and return ducts, suitably positioned for maximum flow across the room, or else ample provision should be made to ensure free airflow to central returns, even when the room is closed. This is typically done by undercutting doors or installing passive registers in partition walls.

2-50 Duct unions and joints sealed with low-toxic mastic and fibrous tape. 2 Points

Efficiency of the cooling distribution system can be improved by 15% if the ducts located in the crawlspace or attic are sealed better than standard practice. Use mastic and fibrous tape to seal commonly-used fittings or use improved duct fittings with gaskets.

2-51 Ducts in conditioned space OR insulated to R-11. 3 Points

Locate the air conditioning system and ducts within the conditioned space to significantly increase the system's energy efficiency. Ducts that must be located outside the conditioned space should be insulated to R-11. In many cases this will be a no-cost measure. For forced air 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.

2-52 Insure easy access to A/C system for maintenance and repair. 3 Points

Ensure easy and convenient access to major components of the A/C system for maintenance and repair. From regular replacement or cleaning of filters to proper maintenance and repair, an easily accessible system is much more likely to continue to operate at its design efficiency than a system that is difficult and inconvenient to get to and work on.

2-53 Minimum SEER 12 A/C system. 3 Points

Specify an A/C system with a seasonal energy efficiency rating (SEER) that goes beyond code. This will reduce the overall energy consumption of the home. A SEER of 12 is a moderate improvement (Code is currently 10 for split systems, 9.7 for packaged units). Units with a SEER of 14, 16 or more are available.

2-54 Duct Blaster Test conducted. 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 for ducting can be accomplished by the same contractor who performs blower door tests. Contact your local energy utility for further information.

2-55 House is Energy Star® compliant (Hawaii MEC for A/C, PLUS options defined by EPA; see Quick References for further details). 5 Points

In addition to the requirements of the Hawaii MEC, Energy Star® compliance for Hawaii requires specific performance levels, depending on window configuration and duct placement:

Homes with:	1) Std Windows, ducts in unconditioned space	2) Std Windows, ducts in conditioned space	3) High Performance windows, ducts in unconditioned space
Window Spec (SHGC)	0.55	0.55	0.40
Window Area (% of floor area)	18%	22%	25%
Window Location (Max % on south & west walls)	62.5%	62.5%	62.5%
Programmable Thermostat	Yes	Yes	Yes
A/C SEER >= 12	Yes	Yes	Yes
Ducts and Unions sealed with mastic or fibrous tape and visually verified	Yes	No	Yes

For further information, see Quick References: DBEDT Field Guide for Energy Performance, Comfort, and Value in Hawaii Homes, Appendix F: Equivalencies for Energy Star® Homes in Hawaii

WATER HEATING

Distribution

2-56 Electric water heater upgrade w/min .93 EF (energy factor). 1 Point

Current code requires domestic hot water systems meet the requirements of the 1987 National Appliance Energy Conservation Act (NAECA). Upgrading 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.

2-57 Water heater timer installed. 1 Point

Install a timer that can be set to heat the tank only during times of high demand, usually in the early morning and evening, perhaps longer during the weekend. Without a timer, a conventional tank water heater operates to maintain the set-point temperature in the water tank at all times, whether the water is being used or not. This can result in wasted energy even in a well insulated tank.

2-58 Gas water heater upgrade w/min .60 EF. 1 Point

Current code requires domestic hot water systems meet the requirements of the 1987 National Appliance Energy Conservation Act (NAECA). Upgrading a propane water heater from an EF of .55 to .60 will save 16 gallons of propane per year. Be careful to avoid heat loss (through heat traps) when you have a hot water tank on lower floors feeding upper stories. EF is a combined measure of thermal efficiency and standby loss.

2-59 Heat trap installed or 1-inch pipe insulation on at least first 8' of outlet pipe from water heater (Required (★) for A/C homes as part of meeting MEC). 1 Point

This measure reduces standby heat loss from the water tank. The piping and the water in it are continuously heated by the tank even when no water is being used. It acts as a "cooling rod." Insulating it reduces the rate of heat loss.

2-60 Solar water heater or heat pump for swimming pool heaters. (Required (★) for A/C homes as part of meeting MEC) 1 Point

Water heating for a swimming pool requires a significant amount of energy. In Hawaii, because of the large thermal mass of the pool and the reliable frequency of direct sunlight available, a relatively small, solar heater installation is adequate to maintain suitable pool temperatures year round. Flat, poolside matt-type or roof mounted models are available.

2-61 Water heater located within 20' pipe length of bathroom fixtures. 1 Point

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

2-62 Heat pump water heater w/min. 1.9 EF. 2 Points

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

2-63 Hot water lines insulated to min. R-3 throughout house. 2 Points

A significant amount of heat is lost from hot water standing in uninsulated pipes, particularly on long runs. Once that water has cooled somewhat, it tends to be run out down the drain, waiting for hotter water. The result of this is wasted energy and wasted water. R-3 insulation will maintain temperature of water standing in the lines for significant time

2-64 South-facing roof area designed for future solar collector (min. 80 sq. ft within 30º of south) and plumbing necessary for solar water heating system roughed in. 5 Points

Solar energy can meet part or all of a home's domestic hot water needs in Hawaii. Geographic location, system design, collector orientation, size and storage capacity will determine how much energy can be provided for domestic water heating.

Include an appropriate location (within 30º of true – not magnetic – south) for solar water panels, rough in the plumbing, and perform other services required for installation. By doing this during construction, you greatly reduce the cost of post-completion installation of a system when market conditions or owner finances facilitate it. (See also Action Item 2-65, *Solar water heater installed)*

2-65	Solar water heater installed.	10 Points

Solar energy can meet part or all of a home's domestic hot water needs in Hawaii. Geographic location, system design, collector orientation, and collector size will determine how much energy can be provided for domestic 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. The State of Hawaii and local electrical utilities offer financial incentives.

Check local building codes to determine requirements for the installation of solar water heaters. The Solar Ratings and Certification Corporation certifies solar water heating systems. Hawaiian Electric Company (HECO) has a list of approved solar water heating contractors available on their website, www.heco.com, in the Residential Services menu under Energy Solutions. Neighbor Island resources are also listed.

INDOOR WATER CONSERVATION

2-66	Low flow shower heads & sink faucets used (2.5 gpm).	★

Federal law requires that faucets and shower heads have flow rates no greater than 2.5 gpm. Faucets typically use 11.4 gallons per person per day.

2-67	Low flow bath faucets used (2.0 gpm).	★

Selecting low flow faucets (less than 2.5 gpm) can help reduce overall water usage. Faucets with flow rates of 2.0 or 1.5 gpm are available. 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. Ask your supplier.

2-68	Front-loading, horizontal axis, or equal clothes washer provided.	2 Points

Horizontal-axis (H-axis) clothes washers offer significant water and energy efficiencies (up to 30% less) compared to vertical-axis machines. Additionally, clothes coming out of the H-axis washer at the end of the wash cycle contain less water compared to conventional washers. This reduces *dryer* energy use as well. Finally, H-axis wasters are gentler on clothes so they last longer. All these benefits are features you can "sell" to your clients.

2-69	Rainwater collection for potable use (with filtration as required). *Double points in locations that have municipal supply.	5 Points

Install a rainwater collection system, taking steps to ensure water quality that is adequate for potable use. This includes careful selection of inert materials for collector system, screens to keep guttering clear, first flush diverters to exclude initial, pollutant-loaded catchment runoff from collection, and effective filtration systems.

Information about the operations and maintenance of a rainwater catchment system, whether for potable or irrigation use, should be included in the Homeowners kit at move in.

Refer to the University of Hawaii, College of Tropical Agriculture's "Guidelines on Rainwater Catchment Systems for Hawaii," by Patricia Macomber of the Department of Natural Resources and Environmental Management.
http://www.ctahr.hawaii.edu/ctahr2001/PIO/FreePubs/FreePubs09.asp#Water

ELECTRIC LIGHTING

2-70	Reflectors in can fixtures to maximize available light.	1 Point

Install parabolic reflectors in recessed can fixtures, behind the bulb, to significantly increase the available light from a fixture. This can result in installing fewer fixtures and/or using lower energy consumption bulbs.

2-71	Dimmers for spaces where low-level lighting is appropriate.	1 Point

Where incandescent lamps are used, dimmers can reduce energy consumption by tailoring the amount of light used to the task at hand. Dimmable compact fluorescent bulbs are also available.

2-72	Light tubes installed to reduce need for electric lighting.	2 Points

Install light tubes as an alternative to skylights for delivering daylight to spaces that do not get adequate light from windows. These devices are tested to be 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 supplemental illumination at night).

2-73	Compact fluorescent lamps (CFLs) used in three high-use locations (including kitchen and entry light).	3 Points

Install CFLs in the kitchen, porch and living room. Fluorescent lighting uses about 75% less electrical energy, produces less heat than incandescent lighting, and bulbs can last up to ten times longer. Because they are more expensive, fluorescent fixtures should be installed in the locations that get the greatest use to be cost-effective.

Dedicated CFL fixtures with built-in ballasts are more cost effective in the long-term than using screw-in CFLs in conventional fixtures, where you replace the ballast with every new bulb.

2-74	Fluorescent lamps (T-8 or T-5) used in service areas of the home. (Bulbs with CRI > than 80 and CCT of 3000K)	3 Points

T-8 and T-5 fluorescent tubes (smaller diameter than old T-12 standard tubes) optimize the performance of light fixtures and give better quality light with sharper focus and less flicker. T-8 tubes are a direct retrofit into T-12 fixtures, offer better color quality and are about 30% more energy efficient. T-5 tubes usually require dedicated fixtures, which are smaller, and are significantly more energy efficient. The quoted Color Rendering Index (CRI) and Color Temperature (CCT) suggested for this Action Item offer light and color quality similar to incandescent.

2-75	Electronic ballasts for all fluorescents installed.	3 Points

Specify electronic ballasts when selecting fluorescent lighting fixtures. Electronic ballasts eliminate the hum, flicker, heat and delayed illumination time often associated with older models, while offering better energy efficiency than magnetic ballasts.

2-76	CFLs substituted for incandescent down lights.	3 Points

Install CFL bulbs in incandescent downlights or select dedicated CFL fixtures. New styles of compact fluorescent are specifically designed for use in down light fixtures originally designed for incandescents. CFLs use about 75% less energy than incandescent for similar light output, producing much less heat in the process. In addition to the energy saving from the light fixture, the reduced heat output can have a significant impact on comfort in a naturally ventilated home.

APPLIANCES

2-77	Provide a microwave oven to reduce reliance on range.	2 Points

Microwave cooking consumes a fraction of the amount of energy used by a conventional range/oven using radiant elements or gas combustion. In addition to the direct energy savings, the reduced heat output can have a significant impact on comfort in a naturally ventilated home.

2-78	Energy efficient range provided.	2 Points

Install an energy efficient range. Although Energy Star® does not currently certify ovens and ranges, there are plenty of choices in the marketplace. The U.S. Department of Energy offers guidance on purchasing energy efficient ovens and ranges at http://www.eere.energy.gov/buildings/consumer_information/ovens/.

2-79	Energy Star® clothes dryer provided.	2 Points

Install an Energy Star® clothes dryer. The EPA lists online products that currently qualify for the ENERGY STAR® label and a store locator, see Quick References. The ENERGY STAR® database provides a calculation of the annual energy use based on the number of loads dried per week. Savings to the homeowner depend on the cost of energy and the number of loads dried per week. (See Action Item 5-4 *Provide a laundry line*).

2-80	Energy Star® clothes washer provided.	3 Points

Install an ENERGY STAR® clothes washer. The EPA lists online products that currently qualify for the ENERGY STAR® label and a store locator, see Quick References. The ENERGY STAR® database provides a calculation of the annual energy use based on the number of loads washed per week. Savings to the homeowner depend on the cost of heating hot water and the number of loads washed per week.

2-81	Energy Star® dishwasher provided.	3 Points

Install an ENERGY STAR® dishwasher. Dishwashers with increased efficiency are most easily identified by the ENERGY STAR® label. The EPA lists online products that currently qualify for the ENERGY STAR® label and a store locator, see Quick References.

2-82	Energy Star® refrigerator provided.	5 Points

Install an ENERGY STAR® refrigerator. The EPA lists online products that currently qualify for the ENERGY STAR® label and a store locator; see Quick References. The refrigerator is typically the second biggest energy user in Hawaii homes.

Bonus Points for Custom Homes

2-83	Photovoltaic or other renewable source for electricity (>10% of electric load) installed.	10 Points

Photovoltaic (PV) modules convert sunlight directly into electricity. Newer PV modules can be integrated into roofing materials such as shingles. These installations replace conventional roofing, enhancing visual appearance and reducing overall installation cost.

Once installed, PV roofing produces free electricity from sunlight that can power certain home functions or supply the entire electrical needs of a home, reducing dependence on, or completely eliminating the need to connect to the utility grid.

Net Metering, available through the electric utility, can replace the need to install batteries. Net Metering allows the homeowner to feed surplus energy from PVs back into the electric grid, literally running their meter backwards, while still using grid-supplied electricity when needed, e.g., at night. Billing is based on the "net" difference between energy consumed from the grid and energy pumped into it. However, there are no rebates if you produce more surplus than you consume.

Section 3:

Health and Indoor Air Quality

Top Picks

Strategy	Benefits to Sell	Action Item
Design termite protection in with a focus on health	Reduced health risk; healthier indoor and outdoor environment	4-5 to 4-18
Provide airflow & cross ventilation	Energy savings; healthier indoor environment; community stewardship	2-1; 2-17 to 2-25; 2-29; 2-35; 2-36; 2-41; 2-44
Design for moisture control	Reduced health risk; more durable structure	3-21; 3-24; 3-25; 3-26; 3-29; 3-32; 4-37
Seal against moisture & air leaks in A/C homes	Reduced health risk; energy savings; more durable structured	3-29; 2-50
Size A/C for good moisture control	Reduced health risk; energy savings; a cooler, more comfortable house; more durable structure; community stewardship	2-47
Control particulates in A/C homes	Reduced health risk	3-28; 3-30
Use Low-VOC Finishes	Reduced health risk	3-1; 3-3 to 3-9; 3-14 to 3-16; 3-18 to 3-20
Use hard surface floor treatments in place of carpet	Reduced health risk; lower maintenance; more durable finish	3-10; 3-11; 3-12

What does "Low-VOC" mean?

VOC stands for Volatile Organic Compounds; a name given to organic chemicals which evaporate readily into the air. Once airborne, these chemicals are easily breathed, with potentially negative effects on human health.

An accepted industry standard for "low-VOC," is the State of California, South Coast Air Quality Management District Rule #1168. Based on these guidelines, Table 4-1 provides recommended limits for VOCs in adhesives and paints.

Table 4-1—Recommended Limits for VOCs in Adhesives, Paints, etc.
(in grams per liter, less water and example compounds)
(Source: State of California, South Coast Air Quality Management District)

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
Flat Paint	100
Non-Flat Paint	150

DESIGN

See Section 2: Energy and Comfort, for several Action Items that enhance airflow and cross ventilation naturally, an important aspect of achieving and maintaining good Indoor Air Quality.

FLOORS

3-1 If using carpet, specify with Carpet and Rug Industry (CRI) Indoor Air Quality (IAQ) label. 1 Point

Ensure the carpets you select have, as a minimum, the CRI IAQ label, which certifies that samples of that carpet type have been tested by an independent laboratory and do not exceed maximum allowable levels for Total VOCs, Styrene, 4-PC and formaldehyde. For more strict specifications, look for carpets with total VOCs below 100 micrograms/m3/hour (Washington State University).

3-2	Ceramic tile grout seams sealed to control mold growth.	1 Point

Seal grout between ceramic tiles to prevent the establishment and growth of mold. Conventional sealers may off-gas large amounts of toxic VOCs (including solvents and aromatic hydrocarbons). Choose healthier low-VOC options (See VOC Limit sidebar). This will reduce potential harmful impacts on the health of the occupants from both mold spores and VOCs, and reduce installers' exposure to the VOCs.

3-3	Water-based finishes used on wood floors.	2 Points

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

3-4	If using carpet, install by tacking (no glue).	2 Points

Use tack strips to install carpet instead of adhesives, which can be 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. See VOC Limits sidebar.

3-5	Use plywood and composites of exterior grade or formaldehyde-free.	2 Points

Particleboard, interior grade medium density fiberboard (MDF), and similar interior use 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.

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

3-6	Low toxicity, low solvent mastics, sealants, and adhesives used for flooring.	2 Points

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

3-7	Formaldehyde-free subfloor and underlayment material used.	2 Points

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

3-8	Low-pile or less allergen-attracting carpet and pad (w/ CRI IAQ label) installed.	3 Points

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 or an all-nylon carpet, which is less attractive to dust mites and mold. Also look for recycled-content carpets; the processed materials used in them tend to be less toxic than virgin synthetics.

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.

3-9	Natural linoleum with low-toxic adhesive or backing used.	3 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 flooring, which is often mistakenly referred to as linoleum.

Many linoleum manufacturers offer low-toxic adhesives and backing for their products (See also VOC Limit sidebar).

3-10	Hardwood or tile floors installed in 50% of living area.	5 Points

Install hardwood or tile floors in at least 50% of the living area, using low-toxic, low VOC adhesives are for installation (See VOC limit sidebar). Use measured square footage of living areas, excluding garages, etc. as the basis for calculation. Although their first cost is a little higher than carpet, hard surface floors such as hardwood or tile are more durable and last longer. Also, they are easier to clean and maintain than carpets, and do not require vacuuming, which tends to stir up dust, pollen and other allergens into the air. Hardwood and tile do not contain volatile compounds that will off-gas after installation. .

3-11	Carpet limited to one-third of home-square footage.	5 Points

Use measured square footage of living areas, excluding garages, etc., as the basis for calculation. The program recognizes carpet's popularity and function, but suggests limiting the amount of carpeting because of its tendency to capture dust and other allergens. The healthiest floor choices are smooth surfaces, such as tile, linoleum, and wood, which do not harbor 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.

3-12	No carpet.	10 Points

Install hardwood, tile or other hard-surface floors throughout the house. 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.

CABINETRY AND TRIM

3-13	Ceramic tile grout seams sealed to control mold growth.	1 Point

Seal grout between ceramic tiles on cabinetry, splashbacks, etc., to prevent the establishment and growth of mold. Conventional sealers may off-gas large amounts of toxic VOCs (including solvents and aromatic hydrocarbons). Choose healthier low-VOC options (See VOC Limit sidebar). This will reduce potential harmful impacts on the health of the occupants from both mold spores and VOCs, and reduce installers' exposure to the VOCs

3-14	Water-based finishes applied on woodwork.	2 Points

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

3-15	Low-toxicity, low solvent mastics, sealants, and adhesives used for cabinetry, trim, and countertops.	2 Points

Conventional mastics, sealants and adhesives used to fabricate cabinetry, lay countertops, etc., may off-gas large amounts of toxic VOCs (including solvents and aromatic hydrocarbons). Choose healthier low-VOC options (See VOC Limit sidebar). This will reduce potential harmful impacts on the health of the occupants as well as installers.

3-16	Cabinets and trim made with formaldehyde-free board and low-VOC finish.	3 Points

Cabinets are often built from particleboard, which off-gasses formaldehyde for a long time. Instead, purchase cabinets made from a formaldehyde free material, such as Medex grade MDF, solid wood, or plywood, which adds little additional cost to the overall cabinet budget. Cabinets should be finished with a low toxic finish.

INTERIOR WALLS

3-17	Ceramic tile grout seams sealed to control mold growth.	1 Point

Grout between ceramic tiles should be sealed to prevent the establishment and growth of mold. Conventional sealers may off-gas large amounts of toxic VOCs (including solvents and aromatic hydrocarbons). Choose healthier low-VOC options (See VOC Limit sidebar). This will reduce potential harmful impacts on the health of the occupants from both mold spores and VOCs, and reduce installers' exposure to the VOCs

3-18	Formaldehyde-free fiberglass insulation (available with BIBs or spec'd. Not standard batts).	1 Point

Standard fiberglass batt insulation, the most common for new houses, has up to 14% formaldehyde, which can contribute to poor indoor air quality. Look for formaldehyde-free fiberglass insulation, preferably one with recycled content. If you use rigid insulation, make sure it is formaldehyde-free, CFC-free, and HCFC-free. CFCs and HCFCs are not an indoor air quality problem, but should be avoided because they are believed to cause deterioration of the earth's ozone layer, certainly a general threat to the environment and human safety.

3-19	Low-VOC/low-toxic interior paints and finishes for large surface areas (VOCs no more than 50 g/l).	3 Points

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 (See VOC Limit sidebar). 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.

3-20 Low toxicity, low solvent mastics, sealants and adhesives used for wallcoverings. 3 Points

Conventional mastics, sealants and adhesives used for wall coverings may off-gas large amounts of toxic VOCs (including solvents and aromatic hydrocarbons). Choose healthier low-VOC options (See VOC Limit sidebar). This will reduce potential harmful impacts on the health of the occupants as well as installers.

MECHANICAL AND OTHER CONTROLS

3-21 Clothes dryer vented to outdoors. ★

Vent clothes dryer exhaust to the outdoors and ensure outlet is well clear of any ventilation air intake. Do not locate dryer exhaust immediately upwind (prevailing direction) of operable windows. Clothes dryer exhaust contains moisture, lint and other allergens. If not vented to the outdoors, the moisture can lead to mold growth and the lint and dust particles will degrade IAQ and comfort in the home.

3-22 Exhaust fans installed in home office areas. 1 Point

Office equipment and the supplies associated with it can emit VOCs and gases, including ozone, which is carcinogenic in high concentrations.

Install a spot fan in home office areas to reduce health risks by dealing with the pollution at its source. Locate exhaust to the outdoors, well clear of any ventilation intakes and not immediately upwind of operable windows. Make sure you allow for fresh air intake elsewhere in the building to balance the system and ensure adequate ventilation. Look for a quiet fan rated 1.5 sones or less.

3-23 Polyethylene piping used for supply plumbing. 1 Point

Use polyethylene piping for plumbing. Some studies indicate that increased incidence of bronchial obstruction (asthma) in children is related to the use of PVC plastics (flooring and wall coverings) in the home (source: American Journal of Public Health 1999 Vol. 89: pg188-192). 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.

3-24 Crawl and attic spaces ventilated to prevent moisture accumulation. 3 Points

Venting of crawl and attic spaces beyond code requirements is an effective way to reduce moisture buildup in the home. Take care to make sure venting "communicates" with "dead" spaces in the crawl and attic spaces.

3-25 Quiet fans (1.5 sones or less) installed in baths and kitchens to encourage use. (Include 60-minute timer) 3 Points

Spot ventilation, exhausted outside the building envelope and away from any ventilation intakes, is an effective way to deal with significant moisture sources (such as showers, stoves, etc.).

Ensure consistent use by selecting quiet fans, rated below 1.5 sones. Crank or electronic timers ensure effective use of bathroom fans without wasting energy. It can take 60 minutes of continuous running for a fan to fully dry out a bathroom after use. A timer ensures adequate drying, but prevents the fan from running unnecessarily. Alternately, a humidistat control in the fan circuit will switch the fan on and off automatically as humidity rises and falls.

3-26 Moisture barriers sealed prior to installation of flooring. 3 Points

Ensure that subfloor or slab moisture content is below 12% before installing flooring and make sure moisture barriers are sealed to prevent moisture intrusion, which might promote mold growth beneath flooring.

3-27 No electronic filters used in home. 3 Points

Electronic filters are a high maintenance item. Unless the filter elements are cleaned frequently, and in practice this is rarely done, the result will be air quality that is degraded, rather than improved.

AIR CONDITIONED (A/C) HOMES ONLY

3-28 Use construction filters and replace just prior to move-in. 3 Points

During construction, once the A/C system has been installed, seal it to prevent build up of construction dust inside ducts and air handling unit. If the unit is to be run prior to move-in, install "construction" filters to keep dust in the system to a minimum. Replace these filters with fresh ones at move in.

3-29 Seal at doors, windows and all penetrations against moisture and air leaks. 3 Points

Caulk all windows and doorframes, 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.

Ensure all weather stripping on doors and windows is effective.

3-30 A/C systems provide fresh air at 0.35 air changes per hour or 15 CFM per person (whichever is higher). 5 Points

To ensure adequate ventilation with fresh, outside air in a tight, air conditioned house, the A/C system intakes must be designed to deliver fresh air at a rate of 0.35 air changes per hour, or 15 CFM per person.

JOB SITE OPERATIONS

3-31	Use “green” cleaners for final cleanup.	1 Point

Cleaners and solvents can be sources of hundreds of potentially harmful chemicals. Use environmentally friendly alternatives, including biodegradable products and those that are zero-VOC or low-VOC (no- to low-volatile organic compounds).

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.

3-32	Protect building materials from moisture damage.	1 Point

Keep stored materials dry with tarps or in a protected place, or use just-in-time delivery to avoid problems with stored materials. Use a moisture meter to make sure moisture content of underlayment, sheathing, and framing materials does not exceed 15%. If readings exceed 15%, dehumidify before installing insulation and drywall. Protect woodwork from moisture damage during transit, delivery, storage, and handling.

3-33	Vacuum stud bays before drywalling.	2 Points

Remove construction dust and debris from the structure before closing in to reduce the risk of air quality problems once the home is occupied.

3-34	Vacuum floors before final flooring installation.	2 Points

Remove construction dust and debris from the structure before closing in to reduce the risk of air quality problems once the home is occupied.

3-35	Ventilate 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 application.

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, as well as A/C filters and later be re-released into the indoor environment.

3-36	No pollen-bearing shrubs and trees (e.g. mock orange, pikake, plumeria, and mango) or allergenic grasses (e.g. rye) planted next to operable windows.	3 Points

Pollen is a significant allergen. It will be carried in through windows by air currents with potentially negative health and comfort implications for the building occupants.

Keep pollen-bearing plants away from operable windows, to minimize this impact.

Section 4:

Durability and Materials Conservation

Top Picks

Strategy	Benefits to Sell	Action Item
Use standard dimensions	Construction savings; community stewardship	4-1
Use materials with longer life cycles	Less maintenance, reduced replacement costs; better retained value for resale	4-2
Design termite protection in with a focus on durability, through Termite-impervious or resistant materials Easy access for homeowner inspections Termite elimination system	Easier maintenance, reduced replacement costs; better retained value for resale	4-5 to 4-18
Install wood/composite windows	Reduced replacement costs; better retained value for resale; community stewardship	4-37
Use recycled content insulation	Community stewardship	4-39
Choose “Green” flooring, meaning recycled content sustainably sourced non-chlorine	Community stewardship	4-42 to 4-51
Offer construction waste management education	Safer, cleaner site; community stewardship	4-74; 4-76
Manage excess materials by Selling Donating to non-profit Giving away	Community stewardship	4-83; 4-84

DESIGN CHOICES

4-1 Standardize dimensions used to reduce waste. 2 Points

Incorporating standard sizes in the design will result in less wasted framing, sheathing, 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.

4-2 Install materials with longer life cycles. 2 Points

Choose materials that offer durability over lowest 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 based on its "cradle-to-grave," or "life-cycle" environmental impact.
- 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. For any given item, select the longest warranty product feasible for your project.

4-3 Use stacked floor plans. 2 Points

Reduce the building size and materials use 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.

4-4 Install materials produced in Hawaii. 2 Points

Using local materials is a key component of sustainable design, incorporating a sense of place. Construction materials tend to heavy and bulky, resulting in high energy consumption and cost to transport them from any significant distance. Furthermore, buying local materials helps to support the local economy, the health of which has a direct impact on your own business.

TERMITE DETAILS

4-5 Ensure that all wood used has EPA-approved chemical treatment. ★

Specify and use only treated wood in all areas of construction (interior, exterior and landscaping) to ensure adequate resistance to pests.

Specify and use lumber that is treated with EPA-approved chemicals. There are several types of pressure treated wood products available that are approved by EPA and City & County of Honolulu building codes.

- ACQ (Ammoniacal Copper Quaternary) and CBA (Copper Boron Azole) preservatives may be preferred where continuous wetting or ground contact is anticipated and protection from termites and other pests is required. However, the copper in them may have toxic impacts on the surrounding ecosystem.
- Borate preservatives are non-toxic to humans and the environment, but they can leach out of wood in exposed and continuous wetting conditions. They are effective for treatment against termites and decay when used in accordance with approved use specifications.

(See Sidebar on Wood Treatment Products – Page 57)

Alternately, recycled-content plastic lumber may be used for decking and landscaping applications.

Wood treatment products

Since January 2004 the U.S. Environmental Protection Agency has not allowed the use of Chromated Copper Arsenate (CCA) in residential applications.

There are several alternative pressure-treated wood products available:

ACQ (Ammoniacal Copper Quaternary) preservative may be preferred where long-term weather resistance is required in addition to protection from termites and other pests. Use only fasteners approved for use with ACQ treated lumber; it will corrode non-approved fasteners, resulting in potential structural failure. Check with your supplier for details.

CBA (Copper Boron Azole) provides long-term resistance to termites and fungal decay in ground contact and aboveground applications. Also can be used in fresh water, but not salt water applications.

Borate preservatives are much less toxic than copper-based preservatives, and may be more effective in deterring termites from "tubing over" treated lumber (borate is water-soluble, and will migrate into the moist termite tubes). Because it is water-soluble, borate treatment is not suitable for ground contact or continuous wetting conditions, but is an effective treatment against termites and decay when wood will not be exposed to weather.

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.

4-6 Field treat all cuts and drill holes in treated wood. ★

Ensure that all cuts and drill holes in treated wood framing are field treated to ensure termite and decay resistance is maintained.

4-7	All plantings at least 24 inches from the building perimeter.	1 Point

Plantings adjacent to the building perimeter can provide pathways for termites to gain access to the structure, bypassing ground level treatments. Also, a clear area around the perimeter will facilitate regular inspection for indications of termite ingress into the building.

Install a minimum 24" maintenance strip around the perimeter of the building foundation composed of the following elements: 3-4 inches of blue rock with geotextile fabric below and bordered on the outside by a landscape header. The maintenance strip physically and visually creates a buffer and allows for easy visual access for regular insect infestation inspections.

4-8	All roots thoroughly removed when vegetation cleared.	1 Point

Dig and pull stumps and root systems. Screen woody materials out of top- and sub- soils. Termites feed on cellulose materials. Leaving dead roots and other woody materials in the soil of a site will not attract new termites, but it will provide additional food to support a growing termite colony over time, increasing the risk of damage to structures on the site.

4-9	Regular inspection for termites during construction (post schedule).	1 Point

Post and follow a regular inspection schedule around building perimeter to ensure that termites do not find access into a building during construction, when woody debris can be left lying adjacent to the structure. Termites are much more easily dealt with if they are spotted early, and treated before building completion.

4-10	Easy access provided for termite inspection by homeowner.	1 Point

Provide and maintain easy access to crawl-space, foundations, footings, etc., to facilitate regular, thorough inspections for signs of termite damage. Whatever termite treatments and barriers are installed in and around the home, regular inspection may provide early warning of infestation.

4-11	Use only materials impervious or highly resistant to termites (pressure-treated lumber, concrete, masonry, galvanized steel, plastic lumber).	1 Point

Do not use untreated or field treated wood. While pressure treated lumber has good resistance to termites, it is still more vulnerable to attack than materials that do not represent any food for termites. Non-cellulose alternatives offer greater resistance to termites, but other sources of degradation must also be considered. For example, steel must be galvanized to protect against corrosion where moisture may be present. Steel and pressure-treated lumber should not be used in continuous wetting conditions.

4-12	Poured concrete in place of wood or CMU for building foundations.	1 Point

Poured concrete offers a continuous barrier to termite entry, except for penetrations. Care should also be taken during preparation, pouring and drying to avoid cracking. Even treated and termite resistant woods are vulnerable to attack, and CMUs have joints which can, over time, open up and allow termite entry into the structure.

4-13	All slab penetrations sealed with epoxy or non-shrink grout.	1 Point

There are a variety of effective solutions to ensure effective sealing of slab penetrations against termite entry. In addition to epoxy and non-shrink grout, a 4 inch basalt termite barrier can provide another effective alternative, if installed to specifications.

4-14	Galvanized termite pans separate foundations from wood structures.	1 Point

Galvanized metal termite pans represent a barrier to termites. While termites can navigate around pans using mud tubes, this activity is easily spotted during inspections, facilitating treatment. Care should be taken to ensure that pans are not compromised (penetrated) during the installation of hurricane ties.

4-15	Install termite colony elimination system.	2 Points

A "termite colony elimination system" starts with a monitoring system that is placed around the perimeter of a building. If termite activity is detected, bait is added to the system, which the termites will carry back to their colonies, eventually eliminating the colony. The monitoring system also checks for reinfestation. This and other similar systems are proving effective at eliminating termite damage to homes, although it is quite costly and does use chemicals that are toxic to some life forms.

4-16	Install 4-inch basalt termite barrier (BTB) around footings and beneath slabs (protect during construction).	3 Points

Basalt termite barrier is a granular material with particles too large for a termite to move with its mouth, but with void spaces too small for termites to squeeze through. Properly applied, it can provide an effective, non-toxic barrier to termites entering a home.

Take care during installation and afterwards to ensure that the barrier is not contaminated with soil or other materials that might allow passage of termites. Clean equipment and meticulous workmanship are required.

4-17	Install a non chemical ground treatment termite control system installed (steel mesh or equivalent).	3 Points

Install steel mesh or equivalent product during the early stages of constructions at all potential points of entry to the structure. Steel mesh is a physical mesh barrier to termites, which is too hard for termites to eat through and with spaces too small for them to squeeze through. This is a non-chemical barrier solution.

4-18	Use copper termite pans to separate foundations from wood structures.	3 Points

See Action Item 4-14 above. Copper termite pans will last longer than galvanized steel pans.

FRAMING

4-19	Use two-stud corners.	1 Points

Construct all framing corners using two instead of three studs, reducing amount of lumber used and leaving space for additional insulation. 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.

4-20	Deleted

4-21	Deleted

4-22	Deleted

4-23	Install recycled content fascia, soffits, or trim.	1 Point

Use structural fiberboard or other recycled-content board, molding and trim for fascia, soffits and trim. These items carry small structural loads and are therefore ideal locations for using recycled materials which might not meet code for structural uses. By choosing products made with a minimum of 50% pre- or post-consumer recycled content, you can have a significant impact on resource conservation. Refer to the DBEDT Buy Recycled in Hawaii Directory, http://www.state.hi.us/dbedt/ert/chc/brg02.html. Also consider specifying products made from certified sustainable wood (See “Forest Certification” sidebar).

Forest Certification

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 that are for sale in the USA: Forest Stewardship Council (FSC), Sustainable Forestry Initiative (SFI), CSA International, and American Tree Farm System.

According to the Certified Forest Products Council (CFPC) (see website at www.certifiedwood.org), "an effective system should lead to continued improvement in forest management standards and integrate environmental, social and economic interests."

CFPC uses the following key concepts as a basis for evaluating the effectiveness of certification systems:

- Openness and transparency of its standards development and governance
- Objectives of its standards for evaluating forest management
- 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, see http://www.metafore.org/index.php?p=About+Certification&s=153.

4-24 Use Intermediate Framing System (16" O.C. studs, with 2-stud corners, ladder partitions, let-in headers). 2 Point

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. Although this approach is primarily considered an energy efficiency strategy, this method contributes significantly to minimizing material use as well.

4-25 Use recycled-content sheathing. 2 Points

Use sheathing material with recycled content, such as structural fiberboard. Sheathing comprises a significant portion of the material use of a building 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. Refer to the DBEDT Buy Recycled in Hawaii Directory, http://www.hawaii.gov/dbedt/info/energy/publications/brg02.pdf. Also consider specifying products made from certified sustainable wood (See "Forest Certification" sidebar).

4-26 Deleted

4-27 Deleted

4-28 Deleted – Covered in 4-5

Using lumber with EPA-approved chemicals is covered in 4-5.

4-29 Use Advanced Framing System when permitted (24" O.C. studs, 2-stud corners), ladder partitions, let-in headers, etc. 3 Points

This Action Item incorporates 24-inch on-center studs and other materially-efficient framing techniques with increased insulation. Other features include two-stud corners and intersections, insulated headers, oversized or raised heel trusses to allow full depth of attic insulation, and full insulation where interior partition walls meet exterior walls. (see Action Item 4-19, Intermediate Framing System – the primary difference being 16" versus 24" O.C. stud walls and raised heel trusses).

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

FOUNDATION

4-30 Non-asphalt based damp proofing used for foundation and basement walls. 3 Points

Asphalt is derived from non-renewable resources, and represents a risk of petroleum-based chemicals leaching into the soil and groundwater.

Use modified EPDM "peel and stick" membranes or one of the liquid applied membranes for the damp-proofing treatment.

4-31 Use concrete with fly ash content. 3 Points

Fly ash is a byproduct of burning coal for electricity production. It can be added to concrete slabs and foundations mixes as a substitute for up to 60% of the Portland cement mixture. The general rule of thumb recommends 15% to 30%. It has been shown to improve the strength of concrete as well as increase its workability. Note: concrete with fly ash content sets up somewhat more slowly; it is easy to work with and has a slightly smoother finish. See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-32 Use recycled aggregate containing crushed concrete, brick, concrete block, asphalt, or glass cullet for base or fill. 3 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. See Quick References: DBEDT Buy Recycled in Hawaii Directory.

SUB-FLOOR

4-33 Use recycled-content underlayment. 2 Points

Use exterior grade plywood or formaldehyde-free wood fiberboard with recycled-content 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. 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.

See Quick References: DBEDT Buy Recycled in Hawaii Directory. Also consider specifying products made from certified sustainable wood (See "Forest Certification" sidebar).

WINDOWS AND DOORS

4-34 No luan doors used. 1 Point

Use doors made from domestic hardwoods or steel. Luan doors are made from limited and endangered tropical hardwoods.

4-35 Use window frames and doors made of wood certified as "sustainably-produced" (See "Forest Certification" sidebar for recognized certifiers).1-3 Points

Specify and use wood window frames and doors containing materials sourced from forests certified by a third party as sustainably managed (See "Forest Certification" sidebar). This material will generally carry a certifiers mark of some description.

4-36 Flashing to seal above doors, windows, and other openings. 2 Points

Use flashing rather than caulking to seal doors, windows and other openings against moisture. Although flashing takes longer to install, it lengthens the useful life of the components it protects.

4-37 Frames are wood/composite with recycled content. 3 Points

Install windows with frames made of a composite of recycled polyvinyl chloride (PVC) or high-density polyethylene (HPDE) plastics and waste wood fiber. This composite material has 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.

According to recent tests, the frames have roughly the same energy performance as solid wood, but perform slightly better than vinyl window frames.

4-38	Interior doors reclaimed.	3 Points

Older doors that have been reclaimed from demolition/deconstruction projects can be used in interior locations. They are often less expensive than new doors and can be made of better quality materials.

INSULATION

4-39	Use insulation with recycled content, including cellulose, fiberglass, expanded polystyrene (EPS), and mineral wool.	2 Points

Three commonly available types of insulation include recycled content: cellulose, fiberglass, and mineral wool.

- 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. When sprayed, the product leaves few voids, reducing problems with air infiltration. Cellulose is usually mixed with boric acid or sodium borate as a fire retardant. An additional benefit of boric acid is that it kills carpenter ants and termites.
- Several brands of fiberglass insulation batts 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.

See Quick References: DBEDT Buy Recycled in Hawaii Directory, http://www.hawaii.gov/dbedt/info/energy/publications/brg02.pdf.

4-40	Use environmentally-preferable foam insulation (formaldehyde-free, CFC-free, HCFC-free).	2 Points

Foam building materials that are manufactured using chlorofluorocarbons (CFCs) or hydrochlorofluorocarbons (HCFCs) are damaging to the environment and therefore to human health.

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.
- Blown-in cellulose (100% recycled newspaper content) or formaldehyde-free fiberglass.

See Quick References: DBEDT Buy Recycled in Hawaii Directory, http://www.hawaii.gov/dbedt/info/energy/publications/brg02.pdf.

INTERIOR WALLS

4-41	Use drywall with recycled-content gypsum.	1 Point

Specify and use drywall manufactured with recycled gypsum, which 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).

See Quick References: DBEDT Buy Recycled in Hawaii Directory.

FINISH FLOOR

4-42	Use wood flooring certified as "sustainably-produced" (See "Forest Certification" sidebar for recognized certifiers).	1-3 Points

Specify and use wood flooring containing materials sourced from forests certified by a third party as sustainably managed (See "Forest Certification" sidebar). This material will generally carry a certifiers mark of some description.

4-43	If installing vinyl flooring, use product with post-industrial recycled content.	1 Point

If you use vinyl flooring, specify vinyl composite tile (VCT) with recycled content. Vinyl sheet flooring is discouraged because of concern about negative environmental impacts of its manufacturing and its limited recycling options.

See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-44	Install 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 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.

See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-45	Use recycled-content or renewed carpet.	2 Points

A variety of cost-competitive resource-efficient carpet options are available. In general, these products have been found to be 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. See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-46 Use reclaimed wood. 3 Points

Use reclaimed wood flooring from deconstructed buildings and salvaged construction materials suppliers. Hardwood flooring is a valuable material, and if properly removed and refinished, can be reused.

4-47 Install cork or bamboo flooring. 3 Points

Install cork or bamboo flooring. Both are more rapidly renewable resources than conventional hardwoods and are preferred to synthetic 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. There are also indoor air quality advantages to using natural materials – less off-gassing due to fewer or no chemicals used in the manufacturing process.

4-48 Install laminated or veneered wood floor. 1 Point

Laminated or veneered wood flooring offers the appearance of solid wood while using less wood in fabrication. Look for products made from certified wood (see Action Item 4-24) and those which do not contain urea formaldehyde-based adhesives.

Also, consider laminated bamboo flooring (see Action Item 4-47).

4-49 Use concrete or indigenous stone flooring. 3 Points

Use poured concrete tiles and flagstones or poured-in-place floors featuring stains and other surface treatments.

Few types of indigenous stone are appropriate for flooring, but might form the basis for some innovative flooring solutions.

Use of regional materials helps keep material transport costs down, reinforce a regional aesthetic, and support the local economy.

4-50 Install recycled-content ceramic tile. 3 Points

Several manufacturers make ceramic, glass or porcelain tiles with recycled-content. These tend to be more costly, but are durable and offer an attractive opportunity to highlight (and market) the use of an environmentally-friendly material to your client or market.

See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-51 Use resilient flooring with no chlorine used during manufacturing. 1 Point

Install resilient flooring alternatives to vinyl flooring, such as linoleum or Vinyl Composition Tile (VCT).

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 flooring, which is often mistakenly referred to as linoleum.

VCT is a hard surface composite floor tile containing approximately 85% limestone and 15% plastic resins, some of which may be recycled vinyls including PVC.

CABINETRY AND TRIM

4-52 Cabinets made with medium density fiberboard or wheatboard. 3 Points

Install cabinets made with medium density fiberboard (MDF) or wheatboard. MDF is an engineered wood product made from small sized wood fiber which is either the by-product of other manufacturing, or comes from fast growing, small diameter trees. Wheatboard is made from wheat straw which might otherwise be burned or disposed of.

Both these materials offer resource efficiency benefits over solid timber.

4-53 Finger-jointed or engineered wood trim (including MDF). 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.

Trim boards and molding made from MDF are also widely available.

Interior trim is an excellent application for these products; it offers improved product consistency and durability, while at the same time uses harvested wood fiber more efficiently.

4-54 Use countertops with recycled content. 3 Points

Use countertops of recycled glass embedded in cement, or recycled glass or ceramic tile, or other proven recycled content product. Countertop substrate, such as Gridcore and countertops such as Environ may also be available locally.

See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-55 Install concrete or indigenous stone countertops. 3 Points

Use poured concrete countertops featuring stains and other surface treatments.

Few types of indigenous stone are appropriate for countertops, but might form the basis for some innovative flooring solutions.

Use of regional materials helps keep material transport costs down, reinforce a regional aesthetic, and support the local economy.

4-56 Use refurbished cabinets. 3 Points

Install cabinets that have been reclaimed and refurbished from building deconstruction or renovation projects. Check with dealers of salvaged construction materials and reuse centers. Cabinets can be successfully refurbished by adding new doors and details.

4-57 All hardwood trim or casework from wood certified as "sustainably-produced" (See "Forest Certification" sidebar for recognized certifiers). 1-3 Points

Specify and use hardwood trim sourced from forests certified by a third party as sustainably managed (See "Forest Certification" sidebar). These materials generally carry a certifiers mark of some description.

ROOF

4-58	Flash all roof-to-wall intersections.	1 Point

Protect all framing materials and wall cavities from potential moisture penetration by flashing all roof-to-wall intersections. Moisture penetration may lead to decay and potential failure of structural components.

4-59	Use resource-efficient roofing such as metal panels or composite shingles with recycled content.	1 Point

Several new composite options are available that provide low maintenance along with durability. Many of these options include recycled-content or reclaimed materials: asphalt shingles, plastic shakes, ridged sheet material made with fiber and asphalt, and metal shingles or panels.

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 additional to recycled aluminum shingles which may contain up to 100% recycled content.

See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-60	Install 30-year roofing material.	2 Points

Varieties of organic felt-based shingles are available with up to 30 year warranties. Talk to your local supplier about other options which provide a 30-year warranty.

4-61	Install 40-year roofing material.	3 Points

Use durable 40-year roofing materials. Some brands of aluminum or steel shingles have a 40-year or longer, limited warranty and in addition, come with a coating approved by the U.S. Department of Housing & Urban Development, which allows the roof to be used for collecting rain water.

EXTERIOR FINISH

4-62	Use resource-efficient siding such as metal, vinyl, cement fiberboard, and stucco.	1 Point

Use durable, low maintenance siding, preferably with recycled content.

The following products offer durable and low-maintenance alternatives to wood siding.

- Aluminum or steel siding products may contain high percentages of recycled metal—up to 100%. The scrap is also recyclable. Always ask your supplier for a statement of the recycled content of your materials – look for a minimum of 25%.
- 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 good fire rating when compared to wood or metal siding.

- Stucco is another resource efficient alternative.

4-63	Use 50-year siding product.	1 Point

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.

4-64	Use reworked paint.	1 Point

Use reworked or reprocessed paint. Reprocessed paint is post consumer latex paint that has been sorted by a variety of characteristics, including type (i.e., interior or exterior), light and dark colors, and finish (e.g., high-gloss versus flat). Reprocessed paint may contain significant percentages of post-consumer recycled paint. See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-65	Exterior coatings and paints have recycled content.	2 Points

Use exterior paint with recycled content, often called consolidated paint. Consolidated paint consists of 100% post consumer latex paint with similar characteristics (e.g., type, color family, and finish) that is consolidated at the point of collection. Consolidated paint is typically used for exterior applications or as an undercoat.

See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-66	Materials are factory finished.	2 Points

Specify and use materials with factory-applied finishes (doors, windows, trim, etc.). They are generally more durable than job site applied finishes because they are applied in ideal, controlled conditions. They also reduce operator health and environmental impacts by capturing and recycling over spray and off-gassing.

OUTDOOR FEATURES

4-67	Item Deleted – Covered in 4-5

Using EPA-approved pressure treated wood is covered in 4-5.

4-68	Compost or mulch used in landscaping.	1 Point

Use compost or mulch from local sources, preferably composts that are produced from green waste. Local materials add microorganisms that are part of the local ecosystem and are beneficial to the native plants. Using locally produced compost also helps divert green waste from local landfills. Mulching controls weeds, provides additional soil nutrients, increases the capacity of the soil to retain moisture, moderates soil temperature, and limits soil erosion. See Soil Amendment sidebar in Section 1.

Using mulches in moderate amounts (2" depth) for landscaping does not increase the risk of termite damage as long as the mulch is kept at least two feet from the house perimeter to ensure it does not provide a bridge over treated ground and other termite control measures. (See Action Item 1-24, *Mulch used in landscaping to minimize evaporation.*)

4-69 Use crushed/ground gypboard as a soil amendment. 1 Point

Scrap gypboard (sheetrock) can be ground up and used as a soil amendment, as long as it does not contain fiberglass. Application should be according to recommendations contained in a reputable soil analysis. It offers the following benefits:

- Improves water penetration and workability of an impermeable alkali soil.
- Softens soil with a high clay content.
- Helps neutralize soil acidity.
- Adds plant nutrients calcium and sulfur.

Also, Boron, which is added to gypboard as a fire retardant, is a valuable nutrient for plants in small quantities.

4-70 Reclaimed or salvaged material used for landscaping walls. 2 Points

Use discarded stone, brick, masonry, or wood materials to construct the landscaping walls to conserve resources, and provide a unique appearance to match the style of the home.

4-71 Recycled content materials used for fences, benches, decking, docks, retaining walls, picnic tables, and landscape borders. 2 Points

Use recycled plastic lumber or plastic/wood composite lumber, which 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 is unlikely to crack, splinter, or chip. Most products have a long life expectancy in exposed, sub-grade or marine applications, and do not leach chemicals into ground or surface water or soil, as treated wood may do.

See Quick References: DBEDT Buy Recycled in Hawaii Directory.

4-72 Create functional outdoor living spaces while limiting overall square footage of structure. 5 Points

The climate in Hawaii is ideal for outdoor living year round. Traditional building styles reflect this. Lanais and porches provide comfortable, spacious and healthy living spaces while consuming much less materials than a similar, enclosed space.

Waste Management Plan

Some key points to keep in mind when developing your plan include:

- Minimize hazardous material disposal by limiting their use on site as much as possible.
- Target only high-potential materials for recycling and reuse. Phase recycling based on construction activities.
- 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).

JOB SITE OPERATIONS

(For custom homes, triple points for each item in the Jobs Site Operations category, due to increased difficulty.)

4-73 Post job-site waste management plan (including reduce, reuse, recycle goals/actions). 1 Point

Post your plan in a prominent location. Sidebar is what a plan should include. Develop a job-specific waste management plan.

4-74 Waste management education conducted on site for field personnel. 1 Point

Make sure that your field personnel are fully aware of the waste management requirements, and include them in developing your waste management plan. If your team is fully aware of the savings available from reducing hazardous materials use, reusing materials and recycling, it will greatly enhance the effectiveness of your efforts.

4-75 Detailed take-off provided as cut list to framer. 1 Point

Create a piece-by-piece 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, minimizes the erroneous cutting of large pieces, reduces the overall volumes of material used, and can result in significant savings.

4-76	Recycling areas or containers well-signed.	1 Point

Make recycling facilities as convenient as disposal in order to get maximum participation in your program. Clearly mark containers or areas for stockpiling recyclables to avoid having to re-sort materials prior to recycling, reducing costs.

4-77	Central cutting area or cut packs.	1 Point

Designate a centralized cutting area to reduce waste, reduce the total amount of material that must be supplied to the site, and save time by making it convenient for carpenters to reuse cutoffs and scrap. This 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%.

A central cutting area also creates an ideal location for the scraps bin or pile, convenient for subcontractors so they will reuse leftover materials. Cut packs greatly reduce on-site waste since they are pre-measured and cut at the supply yard.

4-78	Subcontractors required to participate in waste reduction efforts.	1 Point

Sub-contractor contract includes language that requires them to participate in waste reduction efforts. (See sidebar)

Working with your Subs to Reduce Job-Site Waste

Part of successfully achieving subcontractor participation is clearly communicating your intentions to reduce waste on the jobsite. Here are some tips:

- Require waste reduction in written agreements with your subcontractors (see sample language below).
- 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.

4-79	Use suppliers offering reusable, recyclable or U-turn packaging.	1 Point

Cardboard, plastic shrink wrap, kraft paper, wood pallets or frames, and metal bands comprise a significant portion of the typical construction waste stream and in this way add to your project costs.

To make sure unnecessary and excessive packaging is avoided, inform your suppliers that you want packaging that is minimized and reusable for both economic and environmental reasons.

4-80 Reuse building materials. 1 Point

Reuse materials wherever possible to reduce project costs by avoiding disposal costs and the need to purchase new materials. To make temporary structures reusable, apply methods such as fastening with screws rather than nails to make dismantling convenient. If you have the storage space available, you may be able to store used materials for future projects.

When reusing structural materials, check with your local building authority regarding strength reductions or limits. They may be able to assist in determining the strength of various materials, such as reclaimed I-beams. Code may require some downgrading of structural capacity. In other cases, such as old timbers, structural capacity may actually be increased.

4-81 Reuse dimensional framing materials. 1 Point

Find applications for framing material cut offs.

Blocking, bracing, shims, back framing, and forming stakes can be fabricated from small pieces of framing material that would otherwise be wasted. Make this extra material available in a central area so everyone on site knows it can be reused (see Action Item 4-77, *Central cutting area or cut packs used*).

4-82 Use recyclable supplies, e.g., construction fences, tarps, etc. 1 Point

Use reusable and recyclable supplies, such as construction fences and tarps, which can be reused at the next jobsite, and refillable propane tanks can be reused again and again.

4-83 Excess materials donated to a non-profit organization (e.g., Hawaii Materials Exchange). 1 Point

Leftover materials will be costly to dispose of and may be difficult to inventory and store for a future project. Many non-profits that focus on affordable housing and reuse of building supplies will welcome your donation of these products.

Contact Hawaii Materials Exchange, www.himex.org or check the DBEDT Environmental Directory at http://www.state.hi.us/dbedt/ert/chc/00envdir.html

4-84 Wood scraps sold or given away. 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. This can be as simple as placing a container of scraps at a safe, accessible location on the site and putting a “Free Wood” sign on it.

4-85 Reusable items sold or donated. 1 Point

Rising raw materials costs and landfill tipping fees are making it more economical for builders to salvage materials for reuse than to pay for new materials and/or disposal costs. Prior to the start of a demolition or a renovation project, the builder, designer, and owner should schedule a walk-through 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.

Contact Hawaii Materials Exchange, www.himex.org or check the DBEDT Environmental Directory at http://www.state.hi.us/dbedt/ert/chc/00envdir.html

4-86 Use reusable forms. 1 Point

Use forms made from steel or aluminum for concrete pours. These forms are readily available. Besides providing a better finish, metal forms help to prevent unnecessary wood waste. On small projects, dimensional lumber forms for foundations, footings, etc., can be cleaned and reused many times.

4-87 Recycle cardboard. 1 Point

Cardboard waste is generated throughout most homebuilding and remodeling 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.

4-88 Recycle metal scraps. 1 Point

Recycle offcuts from steel framing, copper and aluminum scraps from flashing, and other metals. Metal may 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.

4-89 Recycle clean wood (borate-treated or untreated scrap), i.e., for composting. 1 Point

Any borate-treated or untreated wood and green waste can be recycled. Other types of treated wood waste must be disposed of through a certified landfill.

Many wood recyclers also accept pallets as part of their wood waste stream. Consult the Quick References and contact your wood recycler first.

4-90 Recycle packaging. 1 Point

Material packaging makes up a substantial percentage of construction material waste. Recycle packaging or have subcontractors make arrangements to take the packaging back to the supplier.

4-91 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 can be recycled in Hawaii and fees are slightly less than disposal fees at local landfill facilities.

4-92	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.

4-93	Least toxic materials selected to reduce disposal requirements (e.g., paints, termite treatments).	1 Point

Specify non-toxic materials for your project, to reduce hazardous waste disposal requirements which can be costly and onerous.

BONUS POINTS

4-94	Track and prominently post waste reduction results on site (similar to safety record signs).	5 Points

By giving feedback to your personnel and sub-contractors on the effectiveness of their waste reduction efforts, you communicate how important it is to you, and give them a greater sense of achievement and incentive to do more.

4-95	Home no larger than 1,800 square ft.	5 Points

Large homes are more expensive to condition, maintain and furnish but do not necessarily offer greater comfort and usability. Through careful layout and design, you can create functional, multi-purpose spaces that reduce materials usage and direct more of the budget to comfort, detail and/or energy efficiency features. Smaller homes 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).

4-96	Home no larger than 1,400 square ft.	10 Points

A well designed home of this size can provide ample accommodation for a family of four, particularly if outdoor living spaces are optimized. The reduction in materials used to build and furnish such a home and the ease of naturally lighting and ventilating it will result in substantial savings for the homeowner. These savings may be used to add more detail and quality features into the home.

4-97	More than 50% of wood used in home is certified as “sustainably-produced.”	10 Points

Specify and use wood sourced from forests certified by a third party as sustainably managed for 50% or more of the wood used on the project. Calculate percentage based on cost. (See “Forest Certification” sidebar.) Points are awarded for any combination of the available certification systems.

Section 5:

Environmentally-Friendly Home Operations

5-1	Owners provided with information on operating and maintaining their "green" home for optimum performance. If A/C, must include instructions about efficient O&M for A/C systems and operation of programmable thermostats.	★

Provide a personalized Home Operation and Maintenance Kit with information for the homeowner on how to maintain the green performance of their home (See sidebar for minimum requirements). Obtain owner's signature on a "sign-off" sheet indicating the information has been received.

5-2	Owners provided with information about maintaining their landscaping using "green" techniques. (Must include a list of native and drought-resistant plants.)	★

Provide a personalized Landscape Operation and Maintenance kit with infomration for the homeowner on how to protect and maintain their landscaping (See sidebar for minimum requirements). Obtain owner's signature on a "sign-off" sheet indicating the information has been received.

5-3	Provide a list of Energy Star® appliances for those not installed.	2 Points

For any common appliances that are not installed prior to move-in, provide a list of Energy Star® approved models (available from your local utility or www.energystar.gov).

Homeowner Kits

The Home Operation and Maintenance Kit must contain:

- A copy of the completed Self-Certification Checklist;
- 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, Action Item 2-43, if applicable;
- If A/C, information about operation and maintenance of the system, any installed air filter systems, and directions on programming the thermostat with desirable set-points for optimum comfort and efficiency.

Landscaping Operations and Maintenance Kit must include:

- Warranties and operating instructions for any irrigation system, other equipment or landscaping you have installed;
- A list of native and drought-resistant plants recommended for use in landscaping (See page 12; also, contact BIA-Hawaii and Honolulu Board of Water Supply);
- Information on mulching and other landscaping techniques that will not increase risk of termite damage to the home;
- Information on site-critical areas, such as buffer zones, that should be protected;
- Information on protecting and caring for major landscape features, such as mature trees, particularly if they contribute to the energy performance and comfort of the home.

5-4 Provide a laundry line. (If indoors, e.g., garage, provide adequate ventilation.) 2 Points

Install a laundry line – rotary or linear, permanent or retractable – preferably in a convenient outdoor location. If the line must be in a garage or utility room, ***you must ensure adequate ventilation*** to avoid moisture problems in the home, ***and educate the homeowner*** on the importance of using the ventilation. Using only a clothesline, instead of electric or gas dryer, saves an average of 1,000 kWh of electricity a year.

5-5 Recycling center with two or more bins included in or near kitchen (can be outdoors).2 Points

Provide a convenient, dry location for recycling bins near the kitchen where 80% of household waste is generated. 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. If not, most millwork manufacturers include recycling centers within their cabinetry line, allowing the homeowner

convenient pre-sorting, while keeping municipal containers outside for weekly or bi-weekly collection.

5-6	Build a lockable storage closet for hazardous cleaning and maintenance products, separate from occupied space.	2 Points

Provide a lockable storage closet in the garage (vented to the outside away from fresh air intakes such as windows), or a detached storage unit for toxic or otherwise dangerous chemicals and materials. 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 Operations & Maintenance Kit advising that all hazardous materials should be stored in original containers.

5-7	Furnish three Energy Star® compact fluorescent light bulbs to owners (encouraged if installing screw-in compacts).	3 Points

Provide replacement CFLs for all styles installed in the home at move-in (minimum of three bulbs). This is a convenience to the homeowner, and, for conventional screw-in fixtures, will reduce the likelihood of the homeowner going back to incandescent bulbs when the CFLs wear out.

5-8	Conduct consumer orientation during final walk-through (point out BuiltGreen™ features, how to maintain them, operate them).	3 Points

Draw the homeowner's attention to the green features of their new home during final walk-through, explaining the benefits and how to operate them for best effect. This will reinforce the value and importance of these features, as well as the quality of their new home, and help ensure that they take steps to maintain its performance.

5-9	Builder's own idea for education and encouraging consumers to take care of their home in an environmentally friendly way.	3 Points

This Action Item encourages your creativity in finding ways to educate and encourage the homeowner to maintain the "green" performance of their home. Providing additional information on green living, video instructions, or signing them up for attendance to a workshop or seminar on some aspect of environmentally-friendly living are some suggestions. The action must be a significant step beyond the other Action Items in Section 5.

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