

# GREATER HOUSTON BUILDERS ASSOCIATION

GREEN BUILDING INITIATIVE™  
GUIDELINES AND SUPPLEMENT INFORMATION  
VERSION 1.0



GREATER HOUSTON BUILDERS ASSOCIATION  
9511 WEST SAM HOUSTON PARKWAY NORTH  
HOUSTON, TX 77064  
PHONE: (281) 970-8970  
FAX: (281) 970-8971  
[WWW.GHBA.ORG](http://WWW.GHBA.ORG)



"Greening The American Dream"

# TABLE OF CONTENTS

<b>INTRODUCTION</b> .....	<b>3</b>
<b>SECTION I. SITE DEVELOPMENT</b> .....	<b>4</b>
<b>SECTION II. MATERIALS</b> .....	<b>10</b>
<b>SECTION III. ENERGY</b> .....	<b>25</b>
<b>SECTION IV. HEALTH</b> .....	<b>27</b>
<b>SECTION V. WATER</b> .....	<b>39</b>
<b>SECTION VI. OPERATIONS, MAINTENANCE AND HOMEOWNER EDUCATION</b> .....	<b>43</b>
<b>APPENDIX: TOP WEB SITES FROM U.S. DEPARTMENT OF ENERGY</b> .....	<b>47</b>
<b>ENERGY STAR PARTNER LIST</b> .....	<b>49</b>
<b>LOW AND NO-VOC PAINTS</b> .....	<b>50</b>
<b>GREENSEAL PAINTS AND COATINGS: PRODUCT LIST</b> .....	<b>51</b>

## INTRODUCTION

The Greater Houston Builders Association (GHBA) Green Building Initiative™ Guidelines and Supplement Information is designed to provide a brief discussion of the Program's requirements, builder options, building product and/or building application as applicable and a list of resources. The Supplement uses a range of information provided by the National Association of Homebuilders Green Builders Guidelines, the Green Building Institute, the US Department of Energy's Building America Program, ENERGY STAR®, a joint program of the US Department of Energy and the US Environmental Protection Agency and the Houston Advanced Research Center as primary resources along with additional resources as highlighted.

*Disclaimer: This publication is not intended to be exhaustive and all-inclusive and the enclosed supplemental information provided is not to be considered the only method(s) of green building.*

*The "Additional Information" provided within are not requirements but are provided for reference only, and is not an endorsement of any product, service or company by the Greater Houston Home Builders Association and/or its members. The GHBA, its membership, the publication's authors and publishers expressly disclaim any responsibility for any damage arising from the use, application, or reliance on the recommendations and information contained herein.*

## SECTION I. SITE DEVELOPMENT

### PROGRAM GUIDELINES:

Must select a minimum of 4

- SD1. \_\_\_\_ Locate new homes on sites with access to existing utility infrastructure, roads, water, sewers and other infrastructure within or contiguous to existing development.
- SD2. \_\_\_\_ Use reasonable efforts to protect all trees during construction including the use of tree fencing, limiting the amount of fill dirt on the root system and limiting any trenching around the trees.
- SD3. \_\_\_\_ Mulch vegetation.
- SD4. \_\_\_\_ Minimize site disruption by designating parking, equipment and material storage and staging away from root protection zones.
- SD5. \_\_\_\_ Provide surface drainage away from foundation.
- SD6. \_\_\_\_ Conform with local or state regulations or implement EPA Best Management Practices for erosion and sedimentation control during construction.
- SD7. \_\_\_\_ Build on an infill site.

Resource efficient site design and development practices help reduce the environmental impacts and improve the energy performance of new housing. For instance, site design principles such as saving trees, constructing onsite storm water retention/infiltration features, and orienting houses to maximize passive solar heating and cooling are basic processes used in the design and construction of green homes.

Carefully planned building placement should:

- Minimize storm water runoff
- Minimize habitat disturbance
- Protect open space
- Reduce the risk of erosion
- Save energy by providing for passive solar, natural ventilation, and daylighting.

**SD1.** Locate new homes on sites with access to existing utility infrastructure, roads, water, sewers and other infrastructure within or contiguous to existing development.

**Requirement:** Locate within existing communities, within or contiguous to existing development. Avoid building on environmentally sensitive areas; locate new projects with access to existing infrastructure.

**Documentation:** Site plans

**Additional Information:** During the site selection process, preference should be given to the development of appropriate building sites that do not include sensitive site elements and restricted land types. Select a suitable building and location to minimize the negative impact on the environment. Align road or extended driveway with natural topography to minimize its grade and reduce cut and fill.

Give preference to urban sites with high development densities, protecting greenfields and preserving habitat and natural resources.

Select a suitable location and design the building with the minimal footprint to minimize site disruption to conserve existing natural areas and restore damaged areas.

Reducing landscaping cost and preserving trees, topsoil, and plants can increase the property value. Using indigenous plants reduce the maintenance cost of the building over time since less water, fertilizers, and pesticides are required. A structure with a smaller footprint is usually more resource efficient.

Design the project site to maintain natural stormwater flows by minimizing stormwater runoff, increasing on-site infiltration and reducing contaminants.

If drainage systems are incorporated at the beginning of site planning, the systems can be implemented economically into the overall development. Although water detention and retention devices require cost for installation, these features can add significant value as site amenities.

## **RESOURCES:**

Society of American Foresters, <http://www.safnet.org/certifiedforester/>.

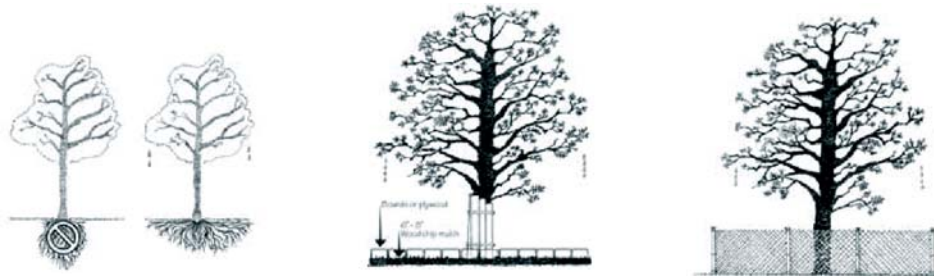
American Society of Landscape Architects,  
<http://www.asla.org/members/pigroups.cfm>.

The Practice of Low Impact Development, U.S. Department of Housing and Urban Development (HUD); <http://www.huduser.org/publications/destech/lowimpactdevl.html>

Low-Impact Development Center at [www.lowimpactdevelopment.org](http://www.lowimpactdevelopment.org)

**SD2.** Use reasonable efforts to protect all trees during construction including the use of tree fencing, limiting the amount of fill dirt on the root system and limiting any trenching around the trees.

**Requirement:** Minimize disturbance of and damage to trees and other vegetation designated for protection through installation of fencing and avoidance of trenching; avoid significant changes in grade, and compaction of soil and critical root zones.



Prepare designated existing trees and vegetation for the impacts of construction through pruning, root pruning, fertilizing, and watering.

**Documentation:** Site plans

**Additional Information:** The City of Houston Tree and Shrub Ordinance provides standards for planting trees and shrubs and installing landscaping buffers. The ordinance further protects Houston's greenery by offering incentives to property owners who preserve and care for existing trees on private properties. Based on a property's size, the ordinance establishes minimum planting requirements for street trees, parking lot trees, and shrubs. These minimum requirements ensure that Houston will have aesthetically pleasing developments and enhanced greenspace, making it a better place to live. The ordinance's planting requirements apply to all new commercial and multi-family residential developments that require a building permit or any property expansion exceeding 1,000 square feet. The ordinance also applies to all new single family construction.

Tree and shrub analysis forms are available at the Planning and Development's Code Enforcement Division at 3300 Main Street.

## RESOURCES:

National Arbor Foundation, Building With Trees,  
<http://www.arborday.org/programs/Buildingwithtrees/index.cfm>.

City of Houston:

Parks Department 713-845-1000

Urban Forester 713-867-0378

Treescape 713-942-0587

Information about the City's Tree and Shrub Ordinance can be found in Chapter 33 of the City's Code of Ordinances at [www.cityofhouston.gov](http://www.cityofhouston.gov). Tree lists can be found on the Planning & Development Department web site at [www.houstonplanning.com](http://www.houstonplanning.com) under Development Regulations. [www.treescape.org](http://www.treescape.org)

### **SD3.** Mulch Vegetation

**Requirement:** Mulch existing vegetation for use on site.

**Additional Information:** Tree trimmings can be used as protective mulch during construction or used in the landscape. Mulch helps to reduce weeds, keep roots cool, keep soil moist and reduce the frequency of required watering.

#### **RESOURCES:**

**The Agriculture Program at Texas A&M:** <http://aggie-horticulture.tamu.edu/extension/easygardening/mulching/mulching1.html>

### **SD4.** Minimize site disruption by designating parking, equipment and material storage and staging away from root protection zones.

**Requirement:** Minimize site disruption where vegetation is present.

**Additional Information:** Use alternative means to install utilities; use of smaller equipment, hand trenching or shared trenches or easements, and placement of utilities under streets instead of yards. Demarcate limits of clearing and grading and limit access to site.

Create construction "no disturbance" zones using fencing or flagging to protect vegetation and sensitive areas from construction vehicles, material storage, and washout.

#### **RESOURCES:**

National Association of Home Builders (NAHB), *Storm Water Permitting: A Guide for Builders and Developers*, 2004, <http://store.builderbooks.com> or 800-368-5242 x8163.

King County Department of Natural Resources, King County, *Washington Surface Water Design Manual Appendix D: Erosion and Sediment Control Standards* (Seattle: September 1998), <ftp://ftp.metrokc.gov/ddes/acrobat/esa/kcswdm-d.pdf>.

Dr. James R. Fazio, National Arbor Day Foundation, *Trenching and Tunneling: A Pocket Guide for Qualified Utility Workers* (Nebraska City, Nebraska: 1998), <http://www.arborday.org/shopping/merchandise/merchdetail.cfm?id=62>.

**SD5.** Provide surface drainage away from foundation.

**Requirement:** Any rain collected from a roof gutter system shall be directed away from the foundation. Additional requirement: Any rain water collected from the roof without gutters shall be directed away from the foundation.

**Additional Information:** Divert water flow from the building that spreads runoff over a large area and eliminates focused flow that might cause erosion. Moisture intrusion of foundations is avoided by moving runoff water beyond the foundation. Divert surface water from all sides of the building by sloping the soils and installing drainage swells.

**SD6.** Conform with local or state regulations or implement EPA Best Management Practices for erosion and sedimentation control during construction.

**Requirement:**

Implement erosion and sedimentation controls during construction, follow EPA's Best Management Practices (EPA 832-R-92-005); Storm Water Protection Plan

**Documentation:** Sediment and Erosion Control Plans

**Additional Information:** information about the federal Phase I and II storm water permitting program and the equivalent requirements for state storm water permits (see Resources section). Storm Water Permitting also contains technical information, including recommendations for use and cost estimates, on over 50 of the most commonly used Best Management Practices; sample Storm Water Pollution Prevention Plans; and tips on compliance.

Methods for preventing erosion include silt fences, sediment traps, vegetated buffer areas, and mulching. More permanent solutions include biomechanical devices such as swales and vegetated buffers. Another highly effective, environmentally responsible method to preventing erosion is to use compost filter berms, compost erosion socks and/or surface application of compost erosion control. The compost should be from organic sources like bioshields, yard waste, and wood chips. Turf and plant material - which help to facilitate the reestablishment of a natural environment - are established more quickly when organic compost is used.

**RESOURCES:**

National Association of Home Builders (NAHB), *Storm Water Permitting: A Guide for Builders and Developers*, 2004, <http://store.builderbooks.com> or 800-368-5242 x8163.

*King County Department of Natural Resources, King County, Washington Surface*

Water Design Manual Appendix D: Erosion and Sediment Control Standards (Seattle: September 1998), <ftp://ftp.metrokc.gov/ddes/acrobat/esa/kcswdm-d.pdf>.

**SD7.** Build on an infill site.

**Requirement:** Build on an infill site.

**Additional Information:** Infill areas are vacant or underutilized lots of land, served by existing physical installations such as roads, power lines, sewer and water, and other infrastructure. Infill site may be considered as a street where on average the adjacent sites have homes that are ten or more years old. Building on an infill site can effectively conserve resources (e.g., infrastructure) and preserve open space. An important economic benefit of infill development is the reduction or elimination of new infrastructure, utility services, and other amenities already in place. Look for means to reduce automobile traffic and promote walking or biking; provide or locate near pathways and/or mass transit to schools and/or retail services and other public facilities.

#### **RESOURCES:**

Policy Link, Equitable Development Toolkit, Infill Incentives, <http://www.policylink.org/EDTK/Infill/>.

Northeast-Midwest Institute and Congress for the New Urbanism, *Strategies for Successful Infill Development* (2001), <http://www.nemw.org/infillbook.htm>.

## SECTION II. MATERIALS

### SELECT A MINIMUM OF 6:

- M1. \_\_\_\_\_ Optimum framing standards/advanced framing techniques are used.
- M2. \_\_\_\_\_ Recycled or reclaimed content materials are used for the foundation.
- M3. \_\_\_\_\_ Recycled or reclaimed content materials or materials manufactured from renewable resources are used for framing.
- M4. \_\_\_\_\_ Recycled, reclaimed content materials or materials manufactured from renewable resources (e.g., bamboo) are used for flooring.
- M5. \_\_\_\_\_ Recycled or reclaimed content materials or materials manufactured from renewable resources are used for the exterior construction/structural framing and insulation of the building envelope of the home.
- M6. \_\_\_\_\_ Certified wood for wood and wood based materials and products
- M7. \_\_\_\_\_ Use locally available indigenous materials
- M8. \_\_\_\_\_ Provide minimum twenty-five year manufacturer's performance warranty for roof (recommend Energy Star roofing requirements).
- M9. \_\_\_\_\_ Outdoor structures, decking and landscaping materials made with 50% or greater recycled content.
- M10. \_\_\_\_\_ Submit and adhere to protocol for sorting, recycling and disposal of construction waste.

A building's components from the foundation to the roof are literally the building blocks that make the building. These components can either degrade the energy efficiency of the building or enhance its performance and increase occupant comfort.

The benefits from these components won't be realized without being integrated into the whole-building design. Building components influence each other. To make sure they perform optimally, component performance should be modeled during the design phase.

Many new energy-saving and resource efficient components are available. Many of these products do double duty, performing their primary jobs while also saving energy or providing a health benefit. Insulated concrete forms and structural insulated panels for example, can provide a structural building envelope, provide added insulation and minimize the use of additional building resources. Decking can be made from recycled composites. Roof shingles, for example, are coated with heat-reflective coatings that send the sun's heat away from the building, rather than being absorbed into it. Roof shingles can even generate electricity for us in the building.

**M1.** Optimum framing standards/advanced framing techniques are used.

**Requirement:** Utilize “Advanced Framing or Optimum Value Engineering” framing techniques are used.

**Additional Information:** An optimum value engineered assembly tends to use less energy for space conditioning because the omitted (and redundant) structural components can be displaced with insulation.

As referenced by the [NAHB Green Building Guidelines](#) advanced framing elements can be applied independently, or adopted in the entirety, depending upon the specific requirement(s) of the project. Framers unfamiliar with the techniques may need training, and the initial use of these techniques may temporarily slow down framing operations. In general, more planning is needed to implement these elements.

In addition to the advanced framing techniques described below for wood, homes with steel framing can incorporate similar techniques using advanced framing techniques, including 24” o.c. spacing for steel floors and walls, described in the HUD USER’s [Prescriptive Method for Residential Cold-Formed Steel Framing](#) (see Resources section of this line item for additional information).

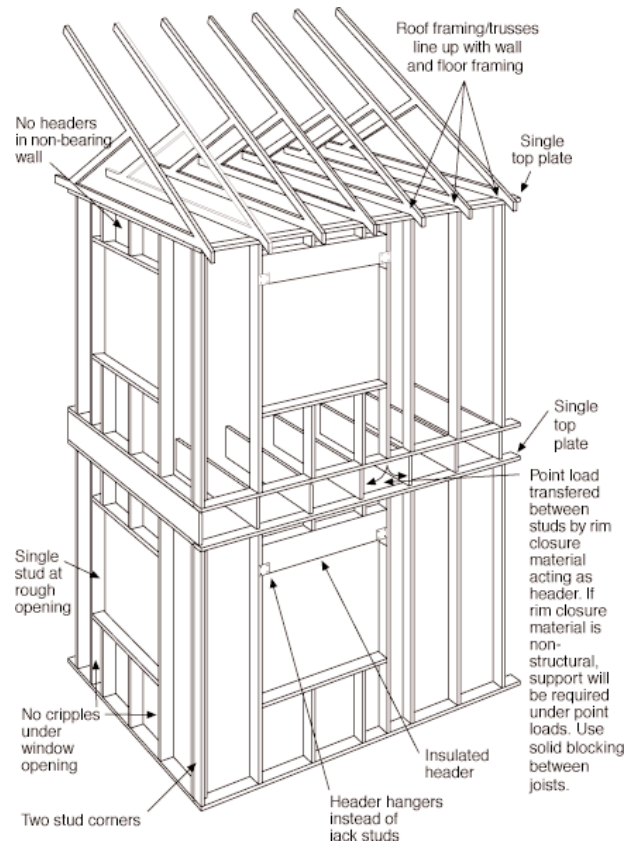
Recognize the benefits of careful planning in the design, purchase, and installation phases. A framing plan provides a blueprint for the layout of each piece of lumber. A plan eliminates redundant (off-layout) studs at window openings or joists at stair and mechanical chase openings that can act as thermal bridges. The layout provides and accurate count for generating a bill of materials that reduces jobsite waste.

A detailed framing plan can be as complex as a three dimensional perspective generated in a computer assisted design (CAD) program or as simple as a 1/8” scale drawing detailing the floor, wall, roof, lumber or component layout, dimensions for rough opening(s), headers and girders, and blocking locations.

Some of the benefits of advanced framing include:

- Reduced first cost (3 to 5% of framing cost)
- Improved energy efficiency (2 to 5% per year)
- Improved resource efficiency (less wood consumption and waste)

Advanced framing uses engineering principles to minimize material usage while meeting model building code structural performance requirements.



The following list covers different principles that form an advanced framing system:

- 19.2" or 24" on-center framing, floor systems
- 19.2" or 24" on-center framing, bearing walls
- 24" on-center framing, roof systems
- 24" on-center interior partitions
- Single top plate walls
- Right-sized headers or insulated (box) headers (where required)
- Eliminate headers in non-bearing walls
- Doubling the rim joist in lieu of header (2x6 or deeper wall framing)
- Ladders blocking at interior-wall-to-exterior-wall intersections
- Two stud corner framing

## 19.2" AND 24" ON-CENTER FRAMING

**Details:** Wall and floor framing spacing can often be engineered for 19.2" (1/5 of an 8-foot sheet) or 24" on center (1/4 of an 8-foot sheet). Roof framing that utilizes *trusses is most frequently spaced at 24"*. This strategy can be combined with *modular layout and single top plate* for added economy, but can also be used independently. **Installation:** Installation should be in accordance with manufacturer's specifications and model building code prescriptive methods. Bracing and fastening schedules and sheathing thickness requirements increase with framing spacing.

Careful spacing of window and door openings will maximize the economy of wider spacing. Designs that are built repeatedly should include wall framing layout drawings to guide the framing crew. When first implementing advanced framing elements, crews are likely to be slowed down until they become more familiar with the method.

**Benefits/Costs:** Approximately one-third of the lumber can be eliminated from the wall and floor framing of a value-engineered house, over walls and floors spaced 16 inches on center. Floor joists may need to be deeper for wider spans, but the reduction in lumber required for the building usually offsets the price increase from having larger floor joists. The need for thicker deck sheathing will also offset a portion of the savings.

A careful analysis or a trial prototype is needed to determine whether the wider spans make economic sense for a particular plan. In general, simpler plans designed on a two-foot module are much more likely to result in savings with 24" on center framing than are complex plans with odd dimensions and many small offsets.

However, resource savings will occur regardless of economic savings. Wider stud spacing contributes to energy efficiency by reducing the amount of lumber in a wall cavity. Since more insulation and less lumber is used, and since insulation has a higher R-value than lumber, increasing stud spacing increases the overall Rvalue of the wall system. Limitations: Floor decking, wall cladding, roof sheathing and interior finish material (such as gypsum wall board) need to be sized to span the added dimension without undesirable deflection. If floor joists are chosen that have wide flanges, this will reduce the clear span of the floor decking. Material fastening schedules and sheathing thicknesses become more stringent when wider spans are employed, which may affect quantities, installation time, and cost of accessories.

One-half-inch thick gypsum board will deflect somewhat more over 24" framing than 16" framing, although it is commonly used. An alternative would be to use half-inch "anti-sag" or 5/8" gypsum board.

Some manufacturers do not make insulation batts for 19.2" on center framing. Therefore, using this spacing in an insulated wall assembly may require changing type or brand of insulation.

In some markets, there is a perception that wide-spaced framing is a mark of inferior construction. Attention to all of the details of assembly, including fastening and bracing schedules, will assure that the system performs well.

**Code/Regulatory:** Model codes allow bearing walls framed with 2x4 studs spaced 24" on center or single top plates on bearing walls within defined structural guidelines. Designs in high-wind zones or with tall walls may not allow 24 inch on-center spacing.

## SINGLE TOP PLATE - EXTERIOR AND BEARING WALLS

**Details:** Single top plates are typically incorporated with advanced framing designs that include 24" on center framing. By stacking the wall and roof framing, it is possible to use a single top plate because the top plate merely transfers compressive vertical loads to the stud below. Steel plates or straps are used to maintain continuity of the plate in the absence of a second, overlapping plate.

**Installation:** Temporary bracing is needed to steady and plumb newly erected walls. As with all light frame structures, temporary bracing should be left in place until the floor and, or roof is completed to permanently brace the structure.

**Benefits/Costs:** In a 28' x 40' two-story house, the savings by eliminating second top plates in bearing and non-bearing walls is equivalent to eliminating about 35 studs. Because one plate is omitted, the amount of wall insulation is increased, slightly improving energy performance.

**Limitations:** May not work on homes in high-wind or earthquake zones. Requires purchasing a longer stud.

**Code/Regulatory:** Meets model codes in some designs, but is more likely than other OVE practices to raise questions from building officials.

## SINGLE TOP PLATE - INTERIOR NON-BEARING PARTITIONS

**Details:** Any non-bearing partition can be built with a single top plate.

**Installation:** Bracing is needed to steady and plumb recently erected walls. This bracing should be left in place until the floor or roof above the walls is completed, tying the structure together.

**Benefits/Costs:** Savings depend on the design's linear feet of non-bearing walls. In a 2,200 sq. ft. home, the equivalent of 2 or 3 dozen studs are likely to be saved on interior walls.

**Limitations:** If used along with a normal double plate on bearing and exterior walls, two lengths of wall studs are required on the job, which could be confusing.

**Code/Regulatory:** Meets codes, but is more likely than other OVE techniques to inspire questions from the building official.

## RIGHT-SIZED HEADERS OR INSULATED BOX HEADERS

**Details:** Instead of sizing all headers in bearing walls to accommodate the greatest load case, size each header for its actual load and span using the appropriate wood species. Also consider the benefit of using a deeper, single-ply, and engineered wood header. If the tedium of framing different header depths to uniform head heights at

openings is daunting, use insulated box headers that facilitate load transfer above openings and use fewer resources than 2-ply solid sawn members. Typically, a boxed header design consists of a top and bottom 2x4 on the flat, some end and interior cripples and a plywood face on one or two sides. The hollows in the header interior allow insulation to be added.

**Installation:** Headers of various sizes require framers to pay attention to plans and customize openings. An alternative would be to site-fabricate and insulate box headers of a consistent depth and install these in lieu of dimensional or engineered wood headers.

**Benefits/Costs:** Material cost and usage economies must be balanced against the chance of installing the wrong sized header and slowing down the framing process by making opening head framing inconsistent. Similarly, material economies associated with fabricating box headers of consistent depth will be offset by labor involved with fabricating these on site. The need to have an additional material, insulation, on hand at the rough frame stage makes the bill of materials more complex. Reducing the use of large-dimensioned lumber is environmentally desirable.

**Limitations:** Without thoughtful implementation, right sizing headers could result in uneven window and door head heights. The practice requires cutting different sized cripples over headers.

**Code/Regulatory:** Model building codes include prescriptive methods for sizing headers and girders, as well as sizing and constructing box headers.

## **NO HEADERS IN NON-BEARING PARTITIONS**

**Details:** Although it is obvious that headers are not needed in non-bearing partitions, it is not always obvious which partitions are load bearing and which are not. Thus, framers often put headers over every opening to be safe. Eliminating these headers saves both material and labor.

**Installation:** If a method of identifying the bearing walls versus the non-bearing partitions is included on the plans, the layout framer can determine which openings need headers. For instance, solid blue walls can denote bearing and uncolored walls would be non bearing.

**Benefits/Costs:** Saves material and labor cost, and conserves resources by reducing the use of wide dimension lumber.

**Limitations:** None.

**Code/Regulatory:** Model codes do not prescribe headers in non-bearing locations, although it may be necessary to demonstrate to the inspector that a partition is nonbearing.

## LADDERS AT PERPENDICULAR WALL INTERSECTIONS

**Details:** Use flat horizontal blocking between studs to secure a perpendicular wall rather than solid vertical framing. (With 24" on center wall framing, three 22-1/2" scrap pieces are set at 24" on center vertically to replace two studs.)

**Installation:** Cutting and nailing three pieces of blocking requires approximately the same labor as installing two studs.

**Benefits/Costs:** Less lumber is used, and scrap pieces can be used for blocking. The horizontal blocking stiffens the wall junction. Most important, insulation in the exterior wall can be installed continuously behind the ladder frame.

**Limitations:** Blocking should be set so that it does not conflict with light switches and outlets.

**Code/Regulatory:** The system has no impact on model codes.

## TWO STUD EXTERIOR CORNER FRAMING

**Details:** Only two studs are needed at an outside building corner, one at the end of each intersecting wall end. Any additional framing is needed only to support the gypsum board at the inside corner. Gypsum can be supported either with a flat stud, to leave an open-ended cavity at the corner; or with drywall clips, thus eliminating the need for a third stud.

**Installation:** If using a third stud for gypsum board backing, the extra stud can be a 2x4, even if the wall is composed of 2x6 studs.

**Benefits/Costs:** With a two-stud corner, one stud is eliminated. In all cases, the open cavity at the corner can be insulated along with the wall, eliminating the need for the framer to insulate a closed cavity before the sheathing goes on.

**Limitations:** Drywall clips are unfamiliar to some builders and subcontractors. Exterior corner trim or cladding may result in being secured to the sheathing only and not to the stud.

**Code/Regulatory:** More studs may be required at corners in high-wind or earthquake zone construction.

**Availability:** Drywall clips are readily available.

## DOUBLING THE RIM JOIST IN LIEU OF HEADER (2x6 or wider wall construction)

**Details:** In thick wall construction, 5" or greater actual wall dimension, it is possible to have the floor system rim board act as the header, or one member of a 2-ply girder or header assembly, at the door or window openings located below that member.

**Installation:** The joists that frame into this structural member will be shorter than other joists if the design requires a two-ply member to carry the span across the opening. Multiple-member headers should be properly fastened to assure load sharing.

**Benefits/Costs:** Some labor may be saved in framing the header, but extra labor and thought is involved in fitting perpendicular joists inside the two-ply assembly and framing the opening height down. The concept works best for long spans where the extra depth of the member or additional height of the opening is needed. The design is also an efficient method for use above openings in foundations.

**Limitations:** If the rim joist is intended to act along with the extra member (or by itself), it must be continuous across the opening.

**Code/Regulatory:** This is an unusual technique and may inspire questions from the inspector.

**Pre-assembled building systems or methods** Utilizing materials that do not require additional resources and/or onsite assembly optimizes plant manufacturing efficiencies and offers protection from the elements. Less time (site impact) and resources are spent onsite.

**Precut material packages** – A precut floor or roof package can be bundled and shipped for sequencing of use in layout and covered to minimize exposure to the elements. Pieces are marked by location on a layout plan that is provided on the blueprint or with the package. Package delivery can be scheduled for just-in-time delivery to minimize site disturbance. Not having to cut or calculate the position of the components of the floor system speeds assembly, eliminates onsite waste, and saves labor. Contractor-focused lumberyards and component manufacturers that supply engineered wood will have the resources to provide this value-added service. Another resource is building material supply dealers who supply steel stud framing packages.

**Pre-manufactured component packages** – Open-web floor or roof truss packages also benefit from the efficiencies listed above for precut material packages. Because building components can be engineered with 2x4 and 2x6 lumber to perform as capably as wide dimension lumber, components present an opportunity to reduce the resources in a home. Often, the reduced amount of board feet of lumber in the component facilitates easier handling because of the reduced weight.

**Panelized construction** – Open wall panels, manufactured in a factory, benefit from efficient purchasing and use of materials, automated cutting and fastening methods, and assembly in an environment that is protected from the elements. Panels are custom manufactured and delivered to meet the builder's schedule. A layout plan aids the carpenter in assembling the walls on site. Using panels can save several days in the critical path of assembly and speed the process of "closing-in" the home.

**MODULAR CONSTRUCTION** – entire sections of the home are constructed and transported to the site. Modular housing goes further in reducing waste on site, since the unit is delivered to the site 70 to 85% finished. Modules are moved onto a site-built foundation, connected, repaired at common junctions, and tied in to utilities. Homes can be made ready for move-in within one week.

### RESOURCES:

NAHB Research Center, *Advanced Framing Techniques: Optimum Value Engineering*, <http://www.nahbrc.org/tertiaryR.asp?TrackID=&DocumentID=2021&CategoryID=70>.

HUDUSER, *Prescriptive Method for Residential Cold-Formed Steel Framing*, <http://www.huduser.org/publications/destech/pm2.html>

Building America, DOE, *Optimum Value Engineering Best Practices*, (September, 2002), <http://www.ibacos.com/pubs/OptimumValueEngineering.pdf>.

DOE, *Advanced Framing for Walls and Ceilings*, <http://www.energy.state.or.us/code/respub/res10.pdf>

International Code Conference, *2003 International Residential Code®*, Panel Box Headers, Table R602.7.2, pg. 123, and Fig. R602.7.2, pg. 124.2.1.3.

*Reduce Framing Costs with Advanced Framing Techniques*, U.S. EPA: [http://www.energystar.gov/ia/partners/bldrs\\_lenders\\_raters/downloads/BuilderGuide3D.pdf](http://www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/BuilderGuide3D.pdf)

*Advanced Framing Fact Sheet*, U.S. DOE: [http://www.toolbase.org/docs/MainNav/WoodFrameConstruction/3949\\_advanced\\_wallframing1.pdf](http://www.toolbase.org/docs/MainNav/WoodFrameConstruction/3949_advanced_wallframing1.pdf)

*Advanced framing*: <http://www.buildingscience.com/housethatwork/advancedframing/default.htm>

*Cost Effective Homebuilding: A Design and Construction Handbook*, 1994,

NAHB, Building Systems Council, *Fast Facts: Systems-Built Housing*, <http://www.nahb.org/generic.aspx?sectionID=455&genericContentID=10216> and [www.buildingsystems.org](http://www.buildingsystems.org)

U.S. HUD, *Builders' Guide to Residential Steel Floors*, <http://www.huduser.org/Publications/PDF/steelfloor.pdf>

**M2.** Recycled or reclaimed content materials are used for the foundation.

**Requirement:** Use performance based concrete mix. Resource efficient building materials can be used in all types of foundations.

**Additional Information:** Post-industrial products can include waste materials from within a manufacturing site that is fed back into the manufacturing process and materials from outside the plant that is waste elsewhere, has not gone to a landfill or consumer yet, but is incorporated into a product's manufacturing process (e.g., fly ash for concrete).

Flyash is a byproduct of coal burning power plants and can be an inexpensive substitute for a portion of the Portland cement used in concrete. This not only provides for the recycling of materials but also reduced the energy requirements in the manufacturing of Portland cements. In some cases, as much as 40% of the cement can be substituted while maintaining required strength and durability. Many concrete suppliers are familiar with recycled content options and some have reported that the use of flyash or slag is standard practice. Check with you local concrete supplier.

**RESOURCES:**

DOE's 124-page Builder's Foundation Handbook (PDF 1.94 MB).

**M3.** Recycled or reclaimed content materials or materials manufactured from renewable resources are used for framing.

**Requirement:** Use recycled or reclaimed content framing materials that use post consumer or post industrial waste by-products; this also includes using resource efficient materials for framing that are manufactured from renewable resources.

**Additional Information:** Framing materials can be from agricultural byproducts such as compressed straw board or manufactured from non-solid sawn wood, such as laminated or finger-jointed studs, TJIs, microlams, OSB, and I Joists.

**RESOURCES:**

HARC at [www.localgreenmaterials.org](http://www.localgreenmaterials.org)

Environmental Depot at [www.environmentaldepot.com](http://www.environmentaldepot.com)

**M4.** Recycled, reclaimed content materials or materials manufactured from renewable resources are used for finished flooring.

**Requirement:** Use recycled, reclaimed content materials or materials manufactured from renewable resources for finished flooring.

**Additional Information:**

**Example Materials:**

Wood - salvaged/recycled, FSC source  
Wood/plastic composite  
Bamboo  
Recycled Rubber  
Recycled Carpet  
Linoleum  
Wool (carpet)  
Grasses (sisal, etc. carpet/mats)  
Cork  
Ceramic tile (on concrete slab)  
Exposed concrete (stained and/or scored, or neither)  
Brick (on concrete slab)  
Brick (on compacted earth)  
Saltillo (or similar tile) on concrete  
Recycled glass content tile

**RESOURCES:**

Path Net: Recycled content materials:  
<http://www.toolbase.org/secondaryT.asp?TrackID=&CategoryID=72>

HARC at [www.localgreenmaterials.org](http://www.localgreenmaterials.org)  
Environmental Depot at [www.environmentaldepot.com](http://www.environmentaldepot.com)

**M5.** Recycled or reclaimed content materials or materials manufactured from renewable resources are used for the exterior construction/structural framing and insulation of the building envelope of the home.

**Requirement:** Recycled or reclaimed content materials or materials manufactured from renewable resources are used for the exterior construction/structural framing of the building envelope of the home.

**Additional Information:** *Measures may include but are not limited to:*

Polystyrene-based structural insulated panels  
Agri-based Structural Insulated Panels  
Autoclaved aerated concrete (AAC)  
Expanded polystyrene (EPS) wall-forms  
Insulated Concrete Forms (ICF)  
Light or heavy steel framing (with recycled content)  
Precast concrete plank  
Earthen & Rammed Earth  
Adobe  
Straw bale  
Light straw & clay  
Stone (non-veneer)

**Exterior siding and finishes:**

Fiber/cement siding  
Brick or stone  
Natural Plasters  
Certified wood or recovered wood siding

**Insulation:** Many of the exterior building systems such as structural insulated panels (SIPS) or ICF based materials offer advantages such as greater insulation and often the reduction of other building materials such as drywall. Note: improved insulation levels will also assist in meeting Energy requirements.

**Additional Insulation Material examples:**

Cotton  
Soy-based foam  
Expanded polystyrene foam  
Cellulose (borate-treated)  
Extruded polystyrene (XPS) rigid board  
Expanded polystyrene (EPS) rigid board  
Non-HCFC polyisocyanurate or urethane

**RESOURCES:**

DOE's Energy Efficiency and Renewable Energy, *Energy and Environmental Guidelines for Construction*,

<http://www.eere.energy.gov/buildings/info/design/construction.html#construction>

Building America at [www.buildingamerica.gov](http://www.buildingamerica.gov)

PATH at [www.pathnet.org](http://www.pathnet.org)

Building Envelope

<http://www.toolbase.org/secondaryT.asp?TrackID=&CategoryID=1397>

<http://www.toolbase.org/secondaryT.asp?TrackID=&CategoryID=1400>

## **M6.** Certified wood for wood and wood based materials and products

**Requirement:** Use certified wood for wood and wood-based materials and products from all credible third party certified sources.

**Additional Information:** Preserving our natural resources includes the commitment to best practices in forest management, like practices that maintain and restore the health of the forests and its ecosystems. Forest certification systems help identify producers that assure a reliable supply without damaging the forests.

### **RESOURCES:**

A comparison list of the North American certifiers is provided by the Forest Certification Resource Center.

Find list of FSC manufacturers at: [http://www.fsc.org/en/getting\\_involved/how\\_to\\_find](http://www.fsc.org/en/getting_involved/how_to_find)

Below is a list of the third-party certified wood sources:

- The American Tree Farm System®

- The Canadian Standards Association's Sustainable Forest Management System Standards (CAN/CSA Z809)

- Forest Stewardship Council (FSC)

- Program for the Endorsement of Forest Certification Systems (PEFC), and Other such credible programs as they are developed and implemented.

Forest Certification Resource Center, *Comparison of Forest Certification Systems*, <http://www.certifiedwood.org>

Forest Stewardship Council (FSC) <http://www.fsc.org/fsc>

Program for the Endorsement of Forest Certification Systems (PEFC) <http://www.pefc.org/internet/html>

The Sustainable Forestry Initiative® Program, <http://www.aboutsfi.org/>

GreenSpec at Building Green: [www.buildinggreen.com](http://www.buildinggreen.com)

**M7.** Use locally available indigenous materials

**Requirement:** use locally available indigenous materials within the State of Texas.

**Additional Information:** To make the home building process more environmentally acceptable by minimizing transportation and processing costs and using materials that are common in the local region., e.g. Texas clay brick and limestone

**RESOURCES:**

Houston Advanced Research Center's listing of locally available green materials:  
<http://www.localgreenmaterials.org/hgbm/>

**M8.** Provide minimum twenty-five year manufacturer's performance warranty for roof

**Requirement:** Provide minimum twenty-five year manufacturer's performance warranty for roof

**Additional Information:**

Recommend Energy Star roofing materials.

**RESOURCES:**

<http://eetd.lbl.gov/coolroof/>

[http://www.pathnet.org/sp.asp?mc=systems\\_roofs](http://www.pathnet.org/sp.asp?mc=systems_roofs)

<http://www.toolbase.org/tertiaryT.asp?TrackID=&CategoryID=1392&DocumentID=2141>

PV Roofing:

<http://www.toolbase.org/tertiaryT.asp?TrackID=&CategoryID=1392&DocumentID=2143>

<http://www.consumerenergycenter.org/homeandwork/homes/construction/roofing.html>

**M9.** Outdoor structures, decking and landscaping materials made with 50% or greater recycled content.

**Requirement:** Construct outdoor structures, decking and landscaping materials with 50% or greater recycled content

## RESOURCES:

<http://www.toolbase.org/secondaryT.asp?TrackID=&CategoryID=1285>

List of recycled decking providers:

<http://www.toolbase.org/tertiaryT.asp?TrackID=&CategoryID=1285&DocumentID=2059>

**M10.** Submit and adhere to protocol for sorting, recycling and disposal of construction waste.

**Requirement:** Job site shall have a construction waste management plan posted and each subcontractor shall be educated on the aspects of the plan that pertains to their work. Waste management plan must either provide for on-site separation of materials to be recycled or provide for separation of recyclable materials by clean-up or waste hauling firms.

**Additional Information:** As tipping fees rise and landfills become less available, the economics of recycling become more attractive.

- Bundle end pieces from framing to be used as blocking for the next unit.
- Optimize building dimensions to conform to standard lumber dimensions.
- Use large drywall scraps for filler pieces in areas like closets.
- Estimate masonry material needs carefully to avoid waste.
- Install leftover insulation in interior wall cavities or on top of attic insulation
- Stack and reuse materials

Look for opportunities in the community to donate usable materials to service groups and organizations like Habitat for Humanity.

Depending on the local market, the following materials can be recycled:

- Brush and trees
- Cardboard and paper
- Lumber
- Masonry (in reusable form or as fill)
- Metals
- Plastics (numbered containers, bags, sheeting)
- Roofing

## RESOURCES:

For a comprehensive list of ideas and options on minimizing job site waste, see The NAHB Research Center's Residential Construction Waste Management – A Builder's Field Guide., available at the HBA or online here:

<http://www.nahbrc.org/tertiaryR.asp?TrackID=&DocumentID=2776&CategoryID=34>

## SECTION III. ENERGY

E1. \_\_\_\_\_ Make sure home exceeds latest version of International Energy Conservation Code (2001 IECC) by 15% or be a certified ENERGY STAR® home; third party documentation is required.

**Requirement:** *If you are building and participating in good standing as an ENERGY STAR® Builder, your home will meet this requirement.*

If you are not an **ENERGY STAR®** builder you must follow the latest Texas Legislative requirement (IECC 2001), and surpass the state requirement by 15 percent. You can determine if your home meets this requirement by using **REScheck**, a free, easy-to-use software package, or other approved software as approved by GHBA.

An independent 3rd party rater must conduct on-site verification of the home's energy performance compliance. Self or Builder certification will not be allowed.

**Documentation:** **ENERGY STAR®** documentation by HERS rater or a third party documentation of the energy performance of the home.

Third party inspection can verify installation of energy related features such as:

- A. Duct installation and sealing
- B. Building envelope air sealing details
- C. Proper installation of insulation including: no gaps, voids, or compression
- D. Batt insulation cut accurately to fit cavity.
- E. Windows and doors flashed, caulked, and sealed properly.

A third-party inspection can be performed by any objective, experienced, outside party such as a certified energy inspector (For information on inspection companies contact RESNET at [www.natresnet.org](http://www.natresnet.org) ; or the Greater Houston Builders Association.

**Additional Information:** Some builders are now achieving a 30% or 50% improvement over the Texas IECC. Use REScheck to examine the effect of different levels of insulation, window U values and SHGC factors, and space conditioning equipment efficiencies to identify a cost-effective system for your project. The appropriate level of energy performance above IECC will vary depending upon the severity of the climate, but building to the equivalent of ENERGY STAR is usually cost effective for consumers.

As stated above many builders are building homes 30% or 50% over code by maximizing whole building system design and operation. US Department of Energy conducts systems engineering research to do the following:

- Produce homes on a community scale that use on average 30% to 90% less energy
- Integrate onsite power systems leading to "zero-energy" (ZEH) homes that will ultimately produce as much energy as they use by 2020 (PDF 852 KB) Help home builders reduce construction time and waste
- Improve builder productivity
- Provide new product opportunities to manufacturers and suppliers
- Implement innovative energy- and material-saving technologies.

Many energy features offer additional benefits such as increased comfort, reduced noise, greater fire safety and improved building performance.

### RESOURCES:

US DOE Building America at [www.buildingamerica.gov](http://www.buildingamerica.gov)

ENERGY STAR at [www.energystar.gov](http://www.energystar.gov)

Energy Efficiency Building Association (EEBA) at [www.eeba.org](http://www.eeba.org)

RESNET at [www.natresnet.org](http://www.natresnet.org)

**REScheck** is a free software tool that can be downloaded at <http://www.energycodes.gov/rescheck/>.

*International Energy Conservation Code (IECC) 2003.* Available from the International Code Council, <http://www.iccsafe.org>

State Energy Conservation Office at [www.seco.tx.us](http://www.seco.tx.us).

Residential Energy Services Network at [www.natresnet.org](http://www.natresnet.org)

Energy Systems Laboratory at <http://energysystems.tamu.edu/about/about.htm>

Sustainable Buildings Industry Council at: [www.SBICouncil.org](http://www.SBICouncil.org)

## SECTION IV. HEALTH

### SELECT A MINIMUM OF 8:

- H1. \_\_\_\_ Provide power sealed combustion or mechanical/induced venting providing fresh combustion air for gas furnaces and water heaters located inside conditioned space;
- H2. \_\_\_\_ Vent kitchen range hoods to the exterior (for single family detached homes).
- H3. \_\_\_\_ Indoor humidity controlled by dehumidification systems or controls.
- H4. \_\_\_\_ Forced air systems should be designed to provide balanced air-flow to all conditioned spaces and zones
- H5. \_\_\_\_ Install controlled mechanical ventilation system.
- H6. \_\_\_\_ Use 1" pleated paper filters for central air conditioners or install whole house Media filter
- H7. \_\_\_\_ If garage has common wall(s) with house, make walls airtight; or have no attached garage.
- H8. \_\_\_\_ For homes with gas appliances or attached garage, install one carbon monoxide detector with American Gas Association (AGA) IAS696 Blue Star Certification Seal every 1,000 sq.ft. (near bedrooms) at a minimum of one per floor.
- H9. \_\_\_\_ Any fireplace installed must have combustion air direct from exterior; or no fireplace installed.
- H10. \_\_\_\_ Seal ducts during construction before first use.
- H11. \_\_\_\_ Choose low-VOC interior paint, sealants and adhesives.
- H12. \_\_\_\_ Do not use vapor retarding materials on the interior of building envelope surfaces.
- H13. \_\_\_\_ Use Carpet and Rug Institute's Green Label certified carpet in carpeted areas; or no carpet installed.

A healthy home is an objective of many people who are looking for a green home. Building materials are chosen based on the absence or low levels of chemicals and other additives common in non-green building materials. Among the factors that may impact the quality of the indoor air in your home is the air drawn from outside. Other factors may be tobacco smoke and cooking odors, as well as renovating and redecorating products, such as wallpaper, furniture and cabinetry, carpet, paints, varnishes, particle board, wood finishes, caulking, and adhesives. Interior products in the home have the potential to impact the indoor air because they emit volatile organic compounds (VOCs) into the air.

**H1.** Provide power sealed combustion or mechanical/induced venting; providing fresh combustion air for gas furnaces and water heaters located inside conditioned space.

**Requirements:** Install direct vent equipment or install induced/mechanical draft combustion equipment or install space heating and water heating in an isolated mechanical room, closet, or attic with an outside source of combustion and ventilation air.

**Additional Information:** Mechanical draft equipment (a.k.a., induced draft, power vented) where by-product are exhausted through a vent due to pressure differences created from a fan, blower, or ejector located in the vent or;

Direct vent equipment where all the combustion takes place in a sealed chamber, Combustion air is drawn form the outdoors into the chamber. Products of combustion are then vented directly outdoors. Direct vent space heating also has an energy benefit as compared to natural draft or mechanical draft equipment.

Alternatives to direct vent equipment include installing electric equipment or isolating combustion equipment from the conditioned space.

There are concerns that exhaust vents (bathroom, kitchen, etc.) can depressurize a tight home and cause by-products of combustion from appliances to be drawn into the home. If installing combustion space and water heating appliances, minimize the back drafting potential by choosing direct vent (sealed combustion) or mechanical/induced draft (power-vented) equipment. All space and water heating appliances must meet this criteria.

## RESOURCES:

*Implications of Results from North American Field Studies.* ASHRAE Winter Meeting; January 12–16, 2002, Atlantic City, New Jersey. AC-02-3-2. Atlanta, GA: American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc., 2002.

National Fire Protection Association, *American Gas Association. National Fuel Gas Code.* 2002 Edition. NFPA 54-2002. ANSI Z2223.1-2002. Section G2406 (303) Appliance Location

American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. *ASHRAE Standard 62-1989*

Lstiburek, J., *Builder's Guide: Hot-Humid Climates.* Westford, MA: Building Science Corporation, January 2002.

Efficiency and Renewable Energy, U.S. Department of Energy. *Combustion Equipment Safety: Provide Safe Installation for Combustion Appliances.* Page 3, Combustion Closet Design chapter

## H2. Vent kitchen range hoods to the exterior (for single family detached homes).

**Requirements:** Direct vent to the exterior.

**Additional Information:** There are concerns that exhaust vents (bathroom, kitchen, etc.) can depressurize a tight home and cause by-products of combustion from appliances to be drawn into the home.

Install a range hood that is vented to the outside. Because a vented hood requires another puncture in the building envelope, be sure to tightly seal around the penetration. Take caution not to over-ventilate. Large kitchen exhaust fans can increase the potential for backdrafting if there are other combustion appliances in the home. The Home Ventilating Institute recommends a range hood with a minimum rate of 40 CFM per lineal foot of range top for wall-mounted hoods and 50 CFM per lineal foot for island hoods. For cooking that generates heavier steam or smoke, check HVI for recommended levels.

### RESOURCES:

Home Ventilating Institute, <http://www.hvi.org>

American Society of Heating, Refrigeration and Air-Conditioning Engineers, ASHRAE Standard 62-1989

2003 IRC page 302, Section M1506.3 Ventilation Rate

State of California. *Reducing Indoor Air Pollution*, <http://www.arb.ca.gov/research/indoor/rediap.htm> (Sept 2004)

Doiron, Jacques, *Cleaner cooking*. [http://www.canadianhomeworkshop.com/quickfix/kitchen\\_vent.shtml](http://www.canadianhomeworkshop.com/quickfix/kitchen_vent.shtml) (Sept 2004)

Miltner, Karen, *Keeping Kitchen Smells Fresh*. [http://www.democratandchronicle.com/homes/buyersguide/1010G221OKH\\_HO ODS11\\_Homes.shtml](http://www.democratandchronicle.com/homes/buyersguide/1010G221OKH_HO ODS11_Homes.shtml) (Sept 2004)

## H3. Indoor humidity controlled by dehumidification systems or controls.

**Requirements:** Control excessive humidification, which can result in moisture damage.

**Additional Information:** Indoor humidity should be between 30 and 60 percent. Indoor humidity below 30 percent causes dry eyes, nose, and throat which is not only uncomfortable, but also an invitation for bacteria and viruses. At the other extreme, indoor humidity above about 57 percent can contribute to the potential for mold growth. Given temperatures between 40 and 80 degrees Fahrenheit and a food

source (wood, paint, dirt, dust), mold will grow within 24-48 hours. Therefore, if a whole-house humidification system is installed, it should have an adjustable humidistat control or dehumidifier to avoid excessive humidification.

Often, bath fans are used infrequently because of their noise, a lack of understanding of their importance by the homeowner, or simply because the homeowner is not in the habit of doing so. Installing controllers on fans, especially timers or humidistats that remove residual humidity after a person leaves the bathroom, is an effective method for removing interior generated moisture at its source. Timers can also prevent unnecessary fan energy use that occurs when a fan is inadvertently left on. Timers and humidistats are basically upgraded switches. They are wired in and mounted like a typical switch. Humidistats will automatically cycle the fan on and off to maintain proper humidity levels. Bath fans are also available with integral humidistats and timers.

## RESOURCES:

Size, design, and install duct system using ANSI/ACCA Manual D® or equivalent.

*ACCA Manual D®, Residential Duct Systems* (available for purchase at <http://www.acca.org>)

*Air Distribution System Design* (U.S. DOE fact sheet)  
[http://www.toolbase.org/docs/MainNav/Energy/4074\\_doe\\_airstributionsystemdesign.pdf](http://www.toolbase.org/docs/MainNav/Energy/4074_doe_airstributionsystemdesign.pdf)

*A Builder's Guide to Placement of Ducts and HVAC Equipment in Conditioned Spaces*, 2000, NAHB Research Center. Available for \$5 from NAHB Research Center bookstore at  
<http://nahbrc.org/tertiaryR.asp?TrackID=&DocumentID=2570&CategoryID=110>

*Design and Construction of Interior Duct System*, Florida Solar Energy Center, (2002)  
[http://www.fsec.ucf.edu/bldg/baihp/pubs/Papers/interior\\_ducts.pdf](http://www.fsec.ucf.edu/bldg/baihp/pubs/Papers/interior_ducts.pdf)

**H4.** Forced air systems should be designed to provide balanced air-flow to all conditioned spaces and zones.

**Requirements:** Install return ducts or transfer grilles in every bedroom.

**Additional Information:** Supply and return registers located in every room and sized according to industry standards provide the best assurance that airflow to each room is balanced. However, having supply and return vents in each room increases the installation cost of a forced air heating or cooling system. Common practice is to locate a single central return on each floor of the home. This method pulls return air from all areas of the home in most cases, but return airflow is restricted when doors are closed. Doors cannot be undercut sufficiently to provide an adequate path for air flow. When return air flow is restricted from a particular room, that area becomes

pressurized and air leakage to the outdoors increases. Other areas of the home may become depressurized causing the opposite effect, i.e., outdoor air is drawn through cracks and crevices. Transfer grilles in interior walls are a cost effective compromise to ensuring that all rooms have adequate supply and return airflow.

## RESOURCES:

ACCA Manual D® Residential Duct Systems

ACCA Manual D®, Residential Duct Systems (available for purchase at <http://www.acca.org>)

Air Distribution System Design (U.S. DOE fact sheet)

[http://www.toolbase.org/docs/MainNav/Energy/4074\\_doe\\_airdistributionsystemdesign.pdf](http://www.toolbase.org/docs/MainNav/Energy/4074_doe_airdistributionsystemdesign.pdf)

A Builder's Guide to Placement of Ducts and HVAC Equipment in Conditioned Spaces, 2000, NAHB Research Center. Available for \$5 from NAHB Research Center bookstore at

<http://nahbrc.org/tertiaryR.asp?TrackID=&DocumentID=2570&CategoryID=110>

Design and Construction of Interior Duct System, Florida Solar Energy Center, (2002) [http://www.fsec.ucf.edu/bldg/baihp/pubs/Papers/interior\\_ducts.pdf](http://www.fsec.ucf.edu/bldg/baihp/pubs/Papers/interior_ducts.pdf)

### H5. Install controlled mechanical ventilation system.

**Requirements:** Provide mechanical ventilation at a rate of 7.5 cfm per bedroom +7.5 cfm and controlled automatically or continuous with manual override. The ventilation equipment may be:

- A. Balanced exhaust-and supply fan(s)
- B. Energy recovery ventilator
- C. Fresh Air Supply Duct to Return

**Additional Information:** It is advantageous from an indoor environmental quality perspective and for energy efficiency purposes and comfort to construct a tight building envelope. Air infiltration not only contributes to energy loss but can also cause mold problems if warmer air condenses when it reaches a cooler surface as it moves through a wall cavity. However, a very tight building shell can create the need for an intentional means of introducing fresh air into the living space. Introducing outdoor air into the home in a controlled manner has both an energy and IEQ

advantage.

**Exhaust or Supply Fan:** In warm, humid climates because humid, outdoor air traveling through a wall cavity can create moisture problems. In these climates, supply-only, filtered and conditioned ventilation is preferable. For supply-only ventilation, locate the ducts carefully since cold or hot outdoor air can create comfort issues.

**Balanced Exhaust and Supply Fan:** Balanced ventilation does not contribute to pressure imbalances between indoors and out. As air is exhausted by one (or more) fans, fresh air is introduced by another. One option for balanced ventilation is to use bath fans for the exhaust and to install a small duct from outside to the return side of the air handler on a central heating or cooling system. Controls and timers are then used to operate the fans and air handler simultaneously or as desired. Outdoor air can also be supplied directly to the home with a separate fan, but take care in locating the ducts so that comfort is not compromised.

**Heat or Energy Recovery Ventilators:** These systems are also a form of balanced ventilation. In addition to supplying fresh air and exhausting stale air, they precondition the incoming air to some degree. Heat recovery ventilators exchange sensible heat while energy recovery ventilators transfer moisture to some extent as well. Thus, in a humid climate, some moisture from the incoming air is transferred to the exhaust stream. Energy recovery ventilators are not dehumidifiers; they transfer moisture from one air stream to another. For severely humid climates, one should consider a dehumidifying ventilator. Typically, heat recovery ventilators are recommended for cold climates and energy recovery ventilators for hot climates. However, if dry indoor air is a potential issue in a heating dominated climate, an energy recovery ventilator may be preferred.

## RESOURCES:

American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.  
ASHRAE Standard 62-1989

**H6.** Use 1" pleated paper filters for central air conditioners or install whole house Media filter

**Requirements:** Install 1" pleated filter or high efficiency whole house media filtration system. The system should have its own fan, and not rely on the fan in the homes HVAC system. Some dedicated dehumidification equipment contain such filtration device.

**Additional Information:** Pleated filters are readily available.

Typical filters trap only the larger dust particles in the air to keep the fan and coil clean, and are from 3-5% efficient. To trap a reasonable range of household pollutants, filters should block particles as small as 0.3 microns. High Efficiency Particle Arresting (HEPA) filters, by definition, will trap 99.97% of all particles down to 0.3 microns in size.

**H7.** If garage has common wall(s) with house, make walls airtight; or have no attached garage.

**Requirement:** The bottom plate and all penetrations (such as plumbing or electrical lines) in the connecting wall between an attached garage and house shall be sealed with caulk, spray foam, gasket or construction adhesive to prevent air movement.

Walls and ceilings between a garage and the living space should be tightly sealed to prevent car exhaust and other fumes from entering the living space. Pressure differences can cause fumes to be drawn into the living space through the common walls and ceilings between the garage and the living space. Providing a continuous, sealed air barrier along this wall and sealing all penetrations will greatly reduce the potential for contaminants to enter the home from the garage.

**Additional Information:** A continuous air barrier, which decouples garage air from living space air, can be accomplished in many ways. Before the framed wall is enclosed, seal or caulk all penetrations, gasket or seal sills, caulk inside edges of top and bottom plate, install cavity insulation, and install an air barrier such as rigid foam or a sheet barrier (not a vapor retarder) overlapped and taped at joints and corners and attached to the bottom plate, drywall walls and ceiling, tape and spackle all seams. Gasketed drywall or the airtight drywall approach may also be used.

At a minimum, caulk the drywall to the bottom plate, tape and spackle all drywall seams, and seal all penetrations. Only sealing the plates is not enough; air can enter between the drywall and the bottom plate, move through the stud bays, and out of the corresponding gap on the inside wall.

Besides sealing the garage from the conditioned space, an exhaust fan can be installed. The exhaust fan for an attached garage shall have an exhaust fan rated at a minimum of 100 cubic feet per minute of air flow and be controlled by a timer or motion detector if operated intermittently, or the fan shall be rated at a minimum of 25 cubic feet per minute if operated continuously.

Automated mechanical ventilation is sometimes used to exhaust air from the garage to the outdoors. Because this type of system creates negative pressure in the garage, pollutants are less likely to be drawn into the home. However, mechanical ventilation is not a substitute for air sealing since wind speed and direction affect the

performance of a mechanical exhaust system. An alternative to providing a continuous air barrier is to construct a detached garage.

**H8.** For homes with gas appliances or attached garage, install one carbon monoxide detector with American Gas Association (AGA) IAS696 Blue Star Certification Seal every 1,000 sq.ft. (near bedrooms) at a minimum of one per floor.

**Requirements:** Detectors should be installed near the entrance to each sleeping area and, if the home has an attached garage, one in the living area side of the garage door within the conditioned space.

**Additional Information:** These devices provided advanced warning to the homeowner of any intrusion of carbon monoxide to the living area of the home.

### RESOURCES:

American Lung Association:

<http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=35370>

EPA publication: <http://www.epa.gov/iaq/pubs/coftsht.html>

Consumer Product Safety Commission: <http://www.cpsc.gov/cpsc/pub/pubs/466.html>

**H9.** Any fireplace installed must have combustion air direct from exterior; or no fireplace installed.

**Requirements:** Direct vent sealed combustion gas fireplaces, or sealed wood burning fireplaces, and sealed woodstoves minimize the risk of smoke and combustion by-products backdrafting into the home. Outdoor air is also supplied directly to the combustion chamber so that indoor air is not required for combustion.

**Additional Information:** Direct vent fireplaces (a.k.a., sealed combustion) are more energy efficient than wood fireplaces and atmospherically-vented gas fireplaces. They use outside air for combustion and exhaust directly to the outside. Like vented gas fireplaces, they typically use a heat exchanger to circulate warm air through the room but keep combustion air separate from room air.

### RESOURCES:

U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy. Consumer Energy Information: EREC Reference Briefs. *Air Pollution from Wood-Burning Appliances and Fireplaces*

<http://www.eere.energy.gov/consumerinfo/factsheets/ja3.html>.

Hearth, Patio, and Barbecue Association (HPBA). <http://hpba.org> HPBA fact sheet on EPA-certified wood burning <http://www.hpba.org/communications/FactSheets/Fact03-EPAWoodBurn3.pdf>

HPBA fact sheet *Wood Burning Fireplaces*  
<http://www.hpba.org/communications/FactSheets/WoodBurningFireplace.pdf>

HPBA fact sheet, *Gas Fireplaces*  
<http://www.hpba.org/communications/FactSheets/GasFireplace.pdf>

National Fireplace Institute. <http://nficertified.org>. Find a certified installer. NFI

**H10.** Seal ducts during construction before first use.

**Requirement:** All duct openings must be sealed during construction. When possible, do not operate ducted HVAC equipment during construction.

Remove dust and dirt from supply and return ducts before putting the equipment into operation to minimize airborne pollutants.

**Additional Information:** Tightly cover openings with materials such as cardboard and tape, especially during tasks that create significant dust such as drywall or floor sanding. It is not necessary to professionally clean ducts in order to comply with this guideline. Rather, use a shop vacuum to remove dust and debris close to the openings.

### RESOURCES:

EPA guide: <http://www.epa.gov/iaq/homes/hip-concerns.html>

<http://www.epa.gov/iaq/pubs/airduct.html#how%20to%20prevent%20duct%20contamination>

**H11.** Choose low-VOC interior paint, sealants and adhesives.

### Requirements:

Interior-Flat paint: not to exceed 100 grams/liter

Interior-Non-Flat paint: not to exceed 150 grams/liter

Sealants and adhesives:

- Construction adhesives: the greater of 15% by weight or 200 grams/liter
- Sealants and caulks: the greater of 4% by weight or 60 grams/liter
- Contact adhesives: the greater of 80% by weight or 650 grams/liter

**Additional Information:** Although emissions of VOCs from paints can negatively affect indoor air, the half-life of VOCs in paints is usually shorter than the time between painting and homeowner occupancy. For example, paints cure and finish off-gassing in approximately four days; Although the builder's paint isn't a big indoor pollutant, homeowners can be informed about the use of low-VOC emitting paints when re-painting the home in the future. There are paints certified as low-VOC emitting which are certified through GREENGUARD—an independent air quality certification organization.

Note that, like low-VOC content paints, low-VOC content sealants is not the same as low-VOC emissions. The California Air and Resources Board created low-VOC content standards based on a set of ozone causing chemicals. Also, VOC content does not directly equate to VOC emissions. In addition, VOC emission rates and times are greatly affected by temperature, humidity, age, and other factors.

For other finishes, such as stains, lacquers and sealers, natural oil based products are available.

### RESOURCES:

- Green Seal certifies low content paints:  
<http://www.greenseal.org/certproducts.htm#paints>
- The GREENGUARD Environmental Institute (GEI) provides a guide to third-party certified low emitting interior products and building materials,  
<http://www.greenguard.org/>
- Master Painters Institute, <http://www.paintinfo.com>
- National Paints & Coatings Association (NPCA), <http://www.paint.org>
- EPA's Environmentally Preferable Purchasing Guide.  
<http://www.epa.gov/oppt/epp/documents/pfs.htm> (Sept 2004)
- <http://www.arb.ca.gov/consprod/consprod.htm>
- California Air Resources Board, <http://www.arb.ca.gov/consprod/regs/Cpreg.doc> (Sept 2004)

**H12.** Do not use vapor retarding materials on interior surfaces of the building envelope.

**Requirements:** No vapor barrier on interior wall of the building envelope.

**Additional Information:** Reduce risk of moisture accumulation which can lead to deterioration of building products and potential mold problems.

### RESOURCES:

International Energy Conservation Code (2003 IECC); <http://www.iccsafe.org/cs/>

Texas A&M Energy Systems Laboratory; [http://tmpwebesl.tamu.edu/www.eere.energy.gov/buildings/building\\_america/pdfs/db/33288.pdf](http://tmpwebesl.tamu.edu/www.eere.energy.gov/buildings/building_america/pdfs/db/33288.pdf)

**H13.** Use Carpet and Rug Institute's Green Label certified carpet in carpeted areas or no carpet installed.

**Requirements:** Use Carpet and Rug Institute's Green Label certified carpet in carpeted areas or no carpet installed.

**Additional Information:** The Carpet and Rug Institute (CRI) is the national trade association representing the carpet and rug industry. Headquartered in Dalton, Georgia, the Institute's membership consists of manufacturers representing over 90% of all carpet produced in the United States, and suppliers of raw materials and services to the industry. There is continued coordination with other segments of the industry, such as distributors, retailers, and installers.

To identify carpet products that are truly low-VOC, CRI has established a labeling program. The CRI Indoor Air Quality Carpet Testing Program green and white logo displayed on carpet samples in showrooms informs the consumer that the product type has been tested by an independent laboratory and has met the criteria for very low emissions.

The carpet sample is tested for chemical emissions by Air Quality Sciences, an Atlanta-based, independent laboratory using the latest, most up-to-date, dynamic environmental chamber technology. The test methodology was developed by consensus during an official dialogue with the EPA and has been adopted by the American Society for Testing and Materials (ASTM) as D 5116 – Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.



## RESOURCES:

See Carpet and Rug Institute Green Label Program at: <http://www.carpet-rug.org/index.cfm> and view member listings at:

[http://www.carpet-rug.org/drill\\_down\\_2.cfm?page=11&sub=2&MemberType=1](http://www.carpet-rug.org/drill_down_2.cfm?page=11&sub=2&MemberType=1)

[http://www.carpet-rug.com/drill\\_down\\_2.cfm?page=8&sub=4&requesttimeout=350](http://www.carpet-rug.com/drill_down_2.cfm?page=8&sub=4&requesttimeout=350)

[http://www.carpet-rug.com/drill\\_down\\_2.cfm?page=8&sub=11&listid=2](http://www.carpet-rug.com/drill_down_2.cfm?page=8&sub=11&listid=2)

Carpet and Rug Institute  
P.O. Box 2048  
Dalton, GA, 30722  
800-882-8846  
[www.carpet-rug.com](http://www.carpet-rug.com)

Carpet America Recovery Effort (CARE)  
[www.carpetrecovery.org/market/index.asp](http://www.carpetrecovery.org/market/index.asp)

Environment Protection Agency. <http://www.epa.gov/iaq/formalde.html>. (Sept 2004)

## SECTION V. WATER

### SELECT A MINIMUM OF 3:

- W1. \_\_\_\_\_ Utilize water efficient fixtures (2.5 gpm or less).
- W2. \_\_\_\_\_ Install low-flow toilets (less than 1.6 gallons/flush or less.)
- W3. \_\_\_\_\_ Locate water heaters or storage tanks within 30 feet of fixtures or install hot-water-on-demand system, or tankless water heaters or manifold plumbing systems utilizing tubing (for single family detached homes).
- W4. \_\_\_\_\_ The Dishwasher is an ENERGY STAR labeled product.
- W5. \_\_\_\_\_ Utilize only water-conserving & regionally appropriate or native landscaping.
- W6. \_\_\_\_\_ Divert water from roof surface away from foundation and into landscape areas.

Water efficiency is an integral part of every whole building design to reduce significant energy input for heating, pumping and process uses and in improving the conservation, preservation and protection of water resources.

**W1.** Utilize water efficient sink fixtures (2.5 gpm or less).

**Requirement:** Install faucets with a maximum flow rate of 2.5 gallons/per minute or less.

**Additional Information:** The National Energy Policy Act of 1992 (EPACT) requires that all installed faucets be rated at a maximum flow rate of 2.5 gallons/minute at 80psi.

### RESOURCES:

[http://www.eere.energy.gov/femp/technologies/eep\\_faucets.cfm](http://www.eere.energy.gov/femp/technologies/eep_faucets.cfm)  
[www.waterwiser.org](http://www.waterwiser.org)

HARC: <http://www.localgreenmaterials.org/hgbm/ShowCategory?categoryID=559>

[http://www.eere.energy.gov/femp/technologies/eep\\_showerhead.cfm](http://www.eere.energy.gov/femp/technologies/eep_showerhead.cfm)  
[www.waterwiser.org](http://www.waterwiser.org)

<http://www.publicworks.cityofhouston.gov/utilities/conservation/conservationtips.htm>

**W2.** Install low flow toilets (less than 1.6 gallons/flush or less).

**Requirement:** Install toilets that use less than the maximum flow rate allowed at 1.6 gallons/flush or less. There are toilets on the market today that have flow rates less than 1 gallons/flush: Power-assist and Dual flush.

**RESOURCES:**

EPA, *Low Flow Toilets*: [www.epa.gov/owm/water-efficiency/toilets.htm](http://www.epa.gov/owm/water-efficiency/toilets.htm)

<http://www.terrylove.com/crtoilet.htm>

**W3.** Locate water heaters or storage tanks within 30 feet of fixtures or install hot-water-on-demand system, or tankless water heaters or manifold plumbing systems utilizing tubing (for single family detached homes).

**Requirement:** Locate water heaters or storage tanks within 30 feet of fixtures or install hot-water-on-demand system, or tankless water heaters or manifold plumbing systems utilizing tubing (for single family detached homes).

**Additional Information:** To reduce energy use associated with water heating by eliminating standby losses that occur with tank heaters and to reduce energy use associated with waiting for hot water at taps and with hot water left standing in pipes after a hot water draw.

A hot-water-on-demand system functions by delivering hot water on an as-needed basis. At the push of a button, hot water is delivered at the tap. Cool water in the pipe is pumped back around to the water heater and heated before being released.

A manifold plumbing system, in which dedicated “home run” hot and cold water piping services each fixture, allows the most direct (and therefore shortest) pipe run and smaller diameter piping serving each fixture than a “tree” type piping configuration. Reduced pipe diameter means hot water is delivered faster to a faucet and that there is less water left in a pipe after a hot water draw—and therefore less energy waste. Most manifold piping is cross-linked polyethylene (PEX) pipe rather than copper or CPVC. Because PEX allows for gentle bends, fittings are reduced which saves installation time and minimizes the possibility of leaks. In order to maximize the benefits of a centralized water heater or manifold system, baths and kitchens should be located in close proximity to one another.

**RESOURCES:**

*Water Heating: Energy-Efficient Strategies for Supplying Hot Water in the Home* (U.S. DOE fact sheet),

[http://www.toolbase.org/docs/SubsystemNav/Plumbing/3946\\_waterheating.pdf](http://www.toolbase.org/docs/SubsystemNav/Plumbing/3946_waterheating.pdf)

[http://www.eere.energy.gov/femp/technologies/eep\\_gas\\_waterheaters.cfm](http://www.eere.energy.gov/femp/technologies/eep_gas_waterheaters.cfm)

HARC: <http://www.localgreenmaterials.org/hgbm/ShowCategory?categoryID=559>

**W4.** The Dishwasher is an ENERGY STAR labeled product.

**Requirement:** Install ENERGY STAR label product. The ENERGY STAR label identifies the dishwasher is at least 20 percent more energy efficient than the other appliances of similar size and model and uses less water than their standard counterparts.

### RESOURCES:

<http://www.energystar.gov> for a list of equipment meeting **ENERGY STAR** standards

[http://www.eere.energy.gov/femp/technologies/eep\\_dishwashers.cfm](http://www.eere.energy.gov/femp/technologies/eep_dishwashers.cfm)

HARC: <http://www.localgreenmaterials.org/hgbm/ShowCategory?categoryID=562>  
[www.aceee.org](http://www.aceee.org)

**W5.** Utilize water-conserving & regionally appropriate or native landscaping.

**Requirement:** Select turf grass, trees and other water conserving vegetation that are native or regionally appropriate species. Limit turf areas of landscaped area, selecting native and regionally appropriate trees and vegetation in a way that complements the natural setting. See Appendix for list of native flowers and plants.

**Additional Information:** Turf is generally the largest consumer of water in the landscape, minimizing the amount of turf and planting drought tolerant turf can reduce water usage.

Xeriscaping is a method of landscaping in which drought-tolerant plants are strategically placed for minimum water usage and maximum aesthetic affect.

*Natural landscaping* is designed with plants that are appropriate for the site's microclimate and topography. An example of natural landscaping is using drought-tolerant plants in areas that are dry and windy, and using plants appropriate for wet areas in spillways and waterways. It is also important to design landscaping in a manner that prevents water runoff.

### RESOURCES:

Lady Bird Johnson Wildflower Center, Native Plant Information Network National Suppliers Directory, <http://www.wildflower2.org/NPIN/Suppliers/suppliers.html>.

Houston native plant list: [http://www.npsot.org/Houston/plant\\_lists/PlantLists.htm](http://www.npsot.org/Houston/plant_lists/PlantLists.htm)  
[www.twri.tamu.edu](http://www.twri.tamu.edu)

## TEXAS WILDSCAPES

### List of Wildlife-Attracting Plants for the Houston Area

#### NATIVE FLOWERS:

Coreopsis (B,S)	<i>Coreopsis tinctoria</i>	Cardinal Flower (H,B)	<i>Lobelia cardinalis</i>
Indian Paintbrush (B)	<i>Castilleja indivisa</i>	Beebalm (H,B)	<i>Monarda fistulosa</i>
Claeping-leaf Coneflower (B)	<i>Dracopis amplexicaulis</i>	Gulf Coast Penstemon (H,B)	<i>Penstemon tenuis</i>
Purple Coneflower (B)	<i>Echinacea sp.</i>	Scarlet Sage (H,B)	<i>Salvia coccinea</i>
Indian Blanket (B)	<i>Gaillardia pulchella</i>	Mealy Blue Sage (H,B)	<i>Salvia farinacea</i>
Horsemint, Lemon Mint (H,B)	<i>Monarda citriodora</i>	Engelmann's Daisy (B,S)	<i>Engelmannia pinnatifida</i>
Drummond Phlox (H,B)	<i>Phlox drummondii</i>	White Gaura (H,B)	<i>Gaura lindheimeri</i>
Louisiana Phlox (H,B)	<i>Phlox divaricata</i>	Gayfeather (H,B)	<i>Liatris spp.</i>
Butterfly Weed (H,B)	<i>Asclepias tuberosa</i>	Maximilian Sunflower (W,B,S)	<i>Helianthus maximiliani</i>
Lance-leaf Coreopsis (B,S)	<i>Coreopsis lanceolata</i>	Violet Ruella (B)	<i>Ruellia nudiflora</i>
False Dragon-head (H,B)	<i>Physostegia digitalis</i>	Winkler Gaillardia (B)	<i>Gaillardia aestivalis</i>
Gayfeather (H,B)	<i>Liatris brachiata</i>	Pink-scale Gayfeather (H,B)	<i>Liatris elegans</i>
Queen Anne's Lace (B)	<i>Daucus carota</i>	Rough Coneflower (B)	<i>Rudbeckia grandiflora</i>
Brown-eyed Susan (B)	<i>Rudbeckia hirta</i>	Lance-leaved Violet (B)	<i>Viola lanceolata</i>
Primrose-leaved Violet (B)	<i>Viola primulifolia</i>	Yellow Star Grass (B)	<i>Hypoxis hirsuta</i>
Green Eyes (B)	<i>Berlandiera x betonicifolia</i>	Ox-eye Daisy (B)	<i>Helianthus angustifolia</i>
Obedient Plant (H,B)	<i>Physostegia intermedia</i>	Swamp Sunflower (B)	<i>Phyla incisa</i>
Lizard Tail (B)	<i>Saururus cernuus</i>	Texas Frogfruit (B)	<i>Dichromena colorata</i>
Blue Flag (B)	<i>Iris virginica</i>	White-topped Sedge (B)	<i>Justicia lanceolata</i>
Waterwillow (B)	<i>Justicia americana</i>	Lance-leaved Waterwillow (B)	
Southern Swamp Lily (B)	<i>Crinum americanum</i>		

#### NATIVE SHRUBS:

American Beautyberry (W,B,S)	<i>Callicarpa americana</i>	Carolina Buckthorn (W,S)	<i>Rhamnus caroliniana</i>
Chinquapin (W,S)	<i>Castanea pumila</i>	American Elderberry* (W,B,S)	<i>Sambucus canadensis</i>
Rough-leaf Dogwood (W,B,S)	<i>Cornus drummondii</i>	Texas Lantana* (W,H,B,S)	<i>Lantana horrida</i>
Flowering Dogwood (W,B,S)	<i>Cornus florida</i>	Common Spice Bush (W,B)	<i>Lindera benzoin</i>
Parley Hawthorn (W,B,S)	<i>Crataegus marshallii</i>	Southern Crab Apple (W,B,S)	<i>Malus angustifolia</i>
Western Mayhaw (W,B,S)	<i>Crataegus opaca</i>	Mexican Buckeye* (B,H)	<i>Ungnadia speciosa</i>
Texas Persimmon (W,S)	<i>Diospyros texana</i>	Viburnum (W,B,S)	<i>Viburnum spp.</i>
Eastern Coral Bean* (W,H,B,S)	<i>Erythrina herbacea</i>	Common Buttonbush (W,B)	<i>Cephalanthus occidentalis</i>
Strawberry Bush (W,B,S)	<i>Euonymus americanus</i>	Texas Azalea* (H,B)	<i>Rhododendron oblongifolium</i>
Possum-haw (W,B,S)	<i>Ilex decidua</i>	Autumn Sage (H,B)	<i>Salvia greggii</i>
Yaupon Holly (W,S)	<i>Ilex vomitoria</i>	Fringe Tree (W)	<i>Chionanthus virginica</i>
Holly (W,S)	<i>Ilex spp.</i>	Texas Kidneywood (W,B)	<i>Eysenhardtia texana</i>
Carolina Wolfberry (W,B,S)	<i>Lycium carolinianum</i>	Turk's Cap (H,B,S)	<i>Malvaviscus drummondii</i>
Southern Wax Myrtle (W,S)	<i>Myrica cerifera</i>	Red Chokeberry (W,B,S)	<i>Pyrus arbutifolia</i>
Chickasaw Plum (W,B,S)	<i>Prunus angustifolia</i>	Marsh Hibiscus (H,B)	<i>Hibiscus moscheutos</i>
Arrowhead, Wapato (W)	<i>Sagittaria latifolia</i>	Texas Mallow (H,B)	<i>Malvaviscus arboreus</i>
Salt Marsh Mallow (H,B)	<i>Kosteletzkya virginica</i>	Halberd-leaved Rose Mallow (H,B)	<i>Hibiscus militaris</i>
Texas Star Hibiscus (H,B)	<i>Hibiscus coccineus</i>	St. Andrew's Cross (B)	<i>Ascyrum hypericoides</i>
Arrowhead Viburnum (W,B,S)	<i>Viburnum dentatum</i>	Witch Hazel (B)	<i>Hamamelis virginiana</i>
Dwarf Wax Myrtle (W,B)	<i>Myrica pusilla</i>	Virginia Sweetpire (W,B)	<i>Itea virginica</i>
Coral Berry (H,B)	<i>Symphoricarpos orbiculatus</i>		

W = Other Wildlife (deer, squirrels, etc.)    B = Butterflies (nectar or larval food plant)    S = Songbirds    H = Hummingbirds

**W6.** Divert water from roof surface away from foundation and into landscape areas.

**Requirement:** Divert water from roof surface away from foundation into landscape areas; can include rainwater collection.

#### Additional Information:

Storm water can be diverted from the roof and into a rain garden. Such a technique can help beautify the yard, reduce the amount of mowing needed, and reduce the need to use potable water for watering. Rain water collection can also be used to provide a source of water for landscape irrigation.

#### RESOURCES:

Texas Residential Construction Commission:

[http://www.trcc.state.tx.us/publications/pub\\_index.htm](http://www.trcc.state.tx.us/publications/pub_index.htm) Rainwater Collection and Harvesting

## SECTION VI. OPERATIONS, MAINTENANCE AND HOMEOWNER EDUCATION

### SELECT A MINIMUM OF 2

- OP1.\_\_\_\_\_ Designate an employee or group of employees to oversee the builder's green building program
- OP2.\_\_\_\_\_ Provide Home Manual to owners/occupants on the use and care of their home.
- OP3.\_\_\_\_\_ Educate the homeowners/occupants on use and care of their home prior to closing.

Education and training are two basic elements necessary to develop and maintain a green building program. Builders have an unique opportunity to teach future homeowners about green building, energy efficiency, material choices, healthy living, water efficiency as well as how to take care of their green home for the future.

**OP1.** Designate an employee or group of employees to oversee the builder's green building program

**Requirement:** A qualified member(s) of the builder's team should be designated to oversee green building program to ensure that each objective is achieved according to targeted specifications.

**Additional Information:** Create an effective team to help implement best "green" practices throughout the process. Those involved in the development phase must understand the mission of the site, what it means to be "green" and why "green" practices should be followed. Once this baseline is established, coordination and communication with and among the various team members is essential to successfully develop a green building program.

Possible team members can include staff, site superintendents, utilities, excavators, trade vendors, landscape architects, wildlife biologists, ecologists, and arborists. Once the "green" intent of the builder is communicated, the builder should work with the team throughout the process to identify and delegate responsibilities of team members, as well as facilitate coordination between the members to achieve best green practices.

**OP2.** Provide Home Manual to owners/occupants on the use and care of their home.

**Requirement:** Provide Home Manual to owners/occupants on the use and care of the home.

### Additional Information:

Information in the manual to owners/occupants may include:

- A. Narrative detailing the importance of maintenance and operation to keep a green built home green.
- B. Local Green Building Initiative™'s certificate.
- C. Warranty, operation, and maintenance instructions for equipment and appliances.
- D. Household recycling opportunities if available.
- F. Explain the benefits of using compact fluorescent light bulbs in high usage areas.
- G. Provide a list of habits/actions to optimize water and energy use.

### RESOURCES:

Fannie Mae's, *Home Performance Power: Fannie Mae's Guide to Buying and Maintaining a Green Home*. For a copy, call Fannie Mae's Consumer Resource Center at 1-800-7FANNIE (1-800-732-6643).

NAHB's *Your New Home and How To Take Care of It*.

*The National Home Maintenance Manual*, by California Building Standards.

NAHB *Green Home Building Guidelines Operation, Maintenance & Homeowner Education Version 1 177 12-13-04*

Houston–Galveston Council of Governments at: [www.h-gac.com](http://www.h-gac.com)

Lighting energy savings calculator at  
[http://www.goodmart.com/light\\_bulb\\_energy\\_saving\\_calculator.aspx](http://www.goodmart.com/light_bulb_energy_saving_calculator.aspx)

Water saving tips at <http://www.h2ouse.org/>. Energy Saving tips:  
[http://www.eere.energy.gov/consumerinfo/energy\\_savers/](http://www.eere.energy.gov/consumerinfo/energy_savers/) and  
<http://www.aceee.org/consumerguide/chklst.htm>

**OP3.** Educate the homeowners/occupants on use and care of their home prior to closing.

**Requirement:** Ensure that homeowners are aware of the green features of their new home, know how to operate and maintain the home to achieve the highest level of environmental performance, and have a source for warranty issues.

**Additional Information:** Provide a list of local service providers that focus on regularly scheduled maintenance and proper operation of equipment and the structure.

Examples of information that could be included:

- List of the Green Building Guideline items that are included in the home.
- User-friendly maintenance checklist.
- Native or low-water landscape.
- Demonstrate to homeowners how to maintain home.

## RESOURCES:

National Association of Home Builders, *Your New Home and How to Take Care of It*. Washington, DC: BuilderBooks, 2001, 60 pages.

1. National Home Builders Association Green Building Guide at:  
[http://www.nahb.org/publication\\_details.aspx?publicationID=1994&sectionID=155](http://www.nahb.org/publication_details.aspx?publicationID=1994&sectionID=155)
2. Green Building Institute at: <http://www.thegbi.org/residential/>
3. US Department of Energy's Building America Program:

Building America Best Practices Series: Volume 2 [PDF 5.9 MB](#)

For your convenience, here are the individual chapters of the Best Practices Series, Volume 2:

1. H&D Front Cover May 2005 ([PDF 288 KB](#))
2. H&D Title Page ([PDF 221 KB](#))
3. H&D Acknowledgments ([PDF 217 KB](#))
4. H&D Contents ([PDF 271 KB](#))
5. H&D Introduction ([PDF 342 KB](#))
6. H&D Homeowners ([PDF 458 KB](#))
7. H&D Management ([PDF 384 KB](#))
8. H&D Marketers ([PDF 385 KB](#))
9. H&D Site Planners ([PDF 471 KB](#))
10. H&D Designers ([PDF 1.4 MB](#))
11. H&D Site Supervisors ([PDF 375 KB](#))
12. H&D Trades ([PDF 1.4 MB](#))
13. H&D Case Study A ([PDF 314 KB](#))
14. H&D Case Study B ([PDF 391 KB](#))
15. H&D Case Study C ([PDF 464 KB](#))
16. H&D Case Study D ([PDF 382 KB](#))
17. H&D Appendix I ([PDF 147 KB](#))
18. H&D Appendix II ([PDF 143 KB](#))
19. H&D Appendix III ([PDF 747 KB](#))
20. H&D Appendix IV ([PDF 169 KB](#))
21. H&D Appendix V ([PDF 356 KB](#))
22. H&D Back Cover ([PDF 196 KB](#))

## APPENDIX

### TOP WEB SITES FOR BUILDERS FROM US DEPARTMENT OF ENERGY

The top Web sites for builders of energy-efficient homes:

1. **Advanced Energy Corporation:** Great publications, particularly "Building Solutions On-line" and "High Performance Homes." <http://www.advancedenergy.org/>
2. **Building Energy Codes:** Your resource for tools to facilitate energy code compliance, development, adoption, implementation, and enforcement. <http://www.energycodes.gov/>
3. **BuildIQ:** BuildIQ is an Internet-based knowledge network that provides education in best homebuilding practices to production builders around the nation. We are totally committed to helping you integrate quality across the most important areas of your business-your customers, your homes and your team. <http://www.buidiq.com/resourcelist.htm>
4. **Energy & Environmental Building Association:** This is THE trade organization for energy-efficient builders. Especially go to "Building Info Central" and "Communications," and "Houses that Work" seminars. <http://www.eeba.org/>
5. **Environmental Building News:** Lots of news stories and feature articles offered on-line that deal with energy efficiency in design and construction. <http://www.buildinggreen.com/>
6. **DSIRE–Database of State Incentives for Renewable Energy:** This database is a comprehensive source of information on state, local, utility, and selected federal incentives that promote renewable energy. <http://www.dsireusa.org/>
7. **DOE's Efficient Windows Collaborative:** Great resources on why and how to select high performance, climate-tuning glazing. <http://www.efficientwindows.org/>
8. **EPA's ENERGY STAR™:** Really good product-specific information on high performance appliances and lighting for the home. [http://www.energystar.gov/index.cfm?fuseaction=find\\_a\\_product](http://www.energystar.gov/index.cfm?fuseaction=find_a_product).
9. **EPA's ENERGY STAR™ Homes: ENERGY STAR™** Web site just for high performance homes. Good subsection for homebuilders. <http://www.energystarhomes.com/>
10. **HUD's Partnership for Advancing Housing Technology:** Great resource for builders on technology and building components/systems. Go to "Inventory." <http://www.pathnet.org/>

11. [Incentive Insulation Database](http://www.simplyinsulate.com/): An on-line searchable database for access to local information on incentive programs for making energy-efficient improvements. This web site was created and is maintained by North American Insulation Manufacturers Association (NAIMA). <http://www.simplyinsulate.com/>
12. [Industrialized Housing Partnership](http://www.fsec.ucf.edu/): Building America team leader, Florida Solar Energy Center, has excellent technical resources, particularly on energy efficiency for hot, humid climates. <http://www.fsec.ucf.edu/>
13. [NAHB Research Center](http://www.nahbrc.org/): Key programs with builder resources include ToolBase, Energy Value in Housing Award, and "Research." <http://www.nahbrc.org/>
14. [National Energy Affordability and Accessibility Project](http://neaap.ncat.org/db/): The Residential Energy Efficiency Database helps consumers find out what energy efficiency programs a utility or state offers to help save energy and money. <http://neaap.ncat.org/db/>
15. [National Renewable Energy Lab](http://www.nrel.gov/buildings_thermal/buildings.html#residential): NREL does a wide range of work on energy-efficiency, but this section of their web site is dedicated to excellent technical resources for builders, particularly on renewable energy systems and energy analysis and building evaluation. [http://www.nrel.gov/buildings\\_thermal/buildings.html#residential](http://www.nrel.gov/buildings_thermal/buildings.html#residential)
16. [Partners for High Performance Homes](http://www.coloradoenergy.org/highperformance/default.htm): An informal network of industry professionals and advocates who wish to advance high-performing-home supply and demand in Colorado. <http://www.coloradoenergy.org/highperformance/default.htm>
17. [Residential Commissioning](http://commissioning.lbl.gov/): Procedures for new or retrofitted homes to ensure their construction and operation can achieve safety, health, comfort, and energy design goals. <http://commissioning.lbl.gov/>
18. [Residential Duct Systems](http://ducts.lbl.gov/): Information on problems concerning residential duct systems, including leakage testing, duct sealing, duct insulation and other topics. <http://ducts.lbl.gov/>
19. [Sustainable Buildings Industry Council \(SBIC\)](http://www.sbicouncil.org/): National resource clearinghouse for whole building design, product information, professional training, consumer education, and analytic tools. <http://www.sbicouncil.org/>
20. [ZIP-Code Program for Insulation](http://www.ornl.gov/sci/roofs+walls/insulation/ins_05.html): A computer program is available to help you calculate the amount of insulation appropriate for your house. The program is called the ZIP-Code because it includes weather and cost information for local regions defined by the first three digits of each postal service zip code. [http://www.ornl.gov/sci/roofs+walls/insulation/ins\\_05.html](http://www.ornl.gov/sci/roofs+walls/insulation/ins_05.html)

## ENERGY STAR PARTNER LIST

NAME	PRODUCT TYPE	LOCATION
BSH Home Appliance Corporation	Clothes Washers, Dishwashers	California
Fisher & Paykel Appliances	Clothes Washers, Dishwashers	California
Dacor (Distinctive Appliance Corp.)	Dishwashers	California
Kuppersbusch USA	Dishwashers	Florida
Electrolux Home Products	Clothes Washers, Commercial Refrigerators/Freezers, Dehumidifiers, Dishwashers, Refrigerators & Freezers, Room Air Conditioners	Georgia
Amana Appliances	Clothes Washers, Dishwashers, Refrigerators & Freezers, Room Air Conditioners	Iowa
Maytag Corporation	Clothes Washers, Dishwashers, Refrigerators & Freezers, Room Air Conditioners	Iowa
Indesit Company S.P.A.	Clothes Washers, Dishwashers	Italy
GE Appliances	Clothes Washers, Dehumidifiers, Dishwashers, Refrigerators & Freezers, Room Air Conditioners, Water Coolers	Kentucky
Whirlpool Corporation	Air Cleaners, Central ACs and Air-Source Heat Pumps, Clothes Washers, Dehumidifiers, Dishwashers, Furnaces, Refrigerators & Freezers, Room Air Conditioners, Water Coolers	Michigan
Viking Range Corporation	Dishwashers, Refrigerators & Freezers	Mississippi
Ultra 8 International LLC	Clothes Washers, Dishwashers, Refrigerators & Freezers	Nevada
Miele, Inc.	Clothes Washers, Dishwashers	New Jersey
LG Electronics, Inc.	Audio/DVDs, Clothes Washers, Dehumidifiers, Dishwashers, Monitors, Refrigerators & Freezers, Room Air Conditioners, Televisions/VCRs	New Jersey
Haier America	Audio/DVDs, Dehumidifiers, Dishwashers, Room Air Conditioners, Televisions/VCRs	New York
Danby	Clothes Washers, Dishwashers, Refrigerators & Freezers, Room Air Conditioners	Ohio
Equator Corporation	Dehumidifiers, Dishwashers, Room Air Conditioners	Texas
Midea Refrigeration Equipment Co., Ltd.	Clothes Washers, Dishwashers, Refrigerators & Freezers	Texas
ApplUSA, Inc	Dishwashers	Texas
AM: Appliance Group	Clothes Washers, Dishwashers	Texas

## LOW AND NO-VOC PAINTS

AFM (American Formulating and Manufacturing) [www.afmsafecoat.com](http://www.afmsafecoat.com)

Benjamin Moore & Co. (Pristine® Eco-Spec® ) [www.benjaminmoore.com](http://www.benjaminmoore.com)

BioShield Paints [www.bioshieldpaint.com](http://www.bioshieldpaint.com)

Devoe Paint [www.devoe.com](http://www.devoe.com)

Duron Paints and Wallcoverings (Genesis Odor-Free products) [www.duron.com](http://www.duron.com)

ICI Dulux Paints [www.iciduluxpaints.com](http://www.iciduluxpaints.com)

Kelly Moore [www.kellymoore.com](http://www.kellymoore.com)

Miller Paint Company [www.millerpaint.com](http://www.millerpaint.com)

Old Fashioned Milk Paint Company [www.milkpaint.com](http://www.milkpaint.com)

Pittsburgh Paints Pure Performance [www.pittsburghpaints.com](http://www.pittsburghpaints.com)

Sherwin-Williams (HealthSpec® paints) [www.sherwin.com](http://www.sherwin.com)

Monarch Paint [www.monarchpaint.com](http://www.monarchpaint.com)

Greenseal Paints and Coatings: [www.greenseal.org](http://www.greenseal.org)

## PRODUCT LIST: PAINTS & COATINGS

MANUFACTURER	PRODUCT	STANDARD
Benjamin Moore	Benjamin Moore's EcoSpec Interior line (Latex Primer Sealer, Flat, Eggshell Enamel, and Semi-Gloss Enamel)	GS-11 Paints
Cloverdale Paint	Horizon Interior line (Latex Primer, Flat, Eggshell, Semi-Gloss)	GS-11 Paints
Miller Paint Co.	Acro Solvent Free Interior Acrylic line (Flat, Eggshell, Satin, and Semi-Gloss)	GS-11 Paints
Olympic Paint and Stain	Zero-VOC Olympic Premium Interior line (Flat, Eggshell, Satin, Semi-Gloss, Kitchen & Bath)	GS-11 Paints
PPG Architectural Finishes, Inc.	Pittsburgh Paints Pure Performance line (primer, flat, eggshell, semi-gloss)	GS-11 Paints
Rodda Paint Company	Horizon Exterior line (Latex Primer, Flat, Velvet Flat, Satin, Lowgloss Enamel, and Semigloss Enamel)	GS-11 Paints
Rodda Paint Company	Horizon Interior line (Latex Sealer, Flat, Satin, Lowgloss Enamel, Semigloss Enamel, and Pearl Lustre)	GS-11 Paints
Sico Inc.	Ecosource line (Primer-Sealer, Ceiling Flat and Velvet)	GS-11 Paints
Southern Diversified Products	American Pride line (primer, flat, eggshell, semigloss, ceiling) American Pro line (primer, flat, eggshell)	GS-11 Paints
V.ABC Paints Manufacturing (Shenzhen) Co., Ltd.	Ecobest Super Luxury Elastic Emulsion Ecobond Super Acrylic Exterior Coating Elastic Acrylic Exterior Coating Elastic Texture Acrylic Middle Coating	GS-11 Paints
V.ABC Paints Manufacturing (Shenzhen) Co., Ltd.	Rust Buster Primer Coating Water-based Zinc Rich Primer (2 pack) Water-based Epoxy Middle Coating (2 pack) Water-based Acrylic Top Coating	GC-03 Anti-Corrosive Paints
Vista Paint	Carefree Earth Coat line (Primer, Flat, Velva Sheen, Eggshell and Semi-Gloss)	GS-11 Paints
YOLO Colorhouse	YOLO Interior line (Latex Primer, Flat, Satin, Semi-Gloss)	GS-11 Paints

# TEXAS WILDSCAPES

## List of Wildlife-Attracting Plants for the Houston Area

### NATIVE FLOWERS:

<b>Coreopsis</b> (B,S)	<i>Coreopsis tinctoria</i>	<b>Cardinal Flower</b> (H,B)	<i>Lobelia cardinalis</i>
<b>Indian Paintbrush</b> (B)	<i>Castilleja indivisa</i>	<b>Beebalm</b> (H,B)	<i>Monarda fistulosa</i>
<b>Clasping-leaf Coneflower</b> (B)	<i>Dracopis amplexicaulis</i>	<b>Gulf Coast Penstemon</b> (H,B)	<i>Penstemon tenuis</i>
<b>Purple Coneflower</b> (B)	<i>Echinacea spip.</i>	<b>Scarlet Sage</b> (H,B)	<i>Salvia coccinea</i>
<b>Indian Blanket</b> (B)	<i>Gaillardia pulchella</i>	<b>Mealy Blue Sage</b> (H,B)	<i>Salvia farinacea</i>
<b>Horsemint, Lemon Mint</b> (H,B)	<i>Monarda citriodora</i>	<b>Engelmann's Daisy</b> (B,S)	<i>Engelmannia pinnatifida</i>
<b>Drummond Phlox</b> (H,B)	<i>Phlox drummondii</i>	<b>White Gaura</b> (H,B)	<i>Gaura lindheimeri</i>
<b>Louisiana Phlox</b> (H,B)	<i>Phlox divaricata</i>	<b>Gayfeather</b> (H,B)	<i>Liatris spp.</i>
<b>Butterfly Weed</b> (H,B)	<i>Asclepias tuberosa</i>	<b>Maximilian Sunflower</b> (W,B,S)	<i>Helianthus maximiliani</i>
<b>Lance-leaf Corcopsis</b> (B,S)	<i>Coreopsis lanceolata</i>	<b>Violet Ruella</b> (B)	<i>Ruellia nudiflora</i>
<b>False Dragon-head</b> (H,B)	<i>Physostegia digitalis</i>	<b>Winkler Gaillardia</b> (B)	<i>Gaillardia aestivalis</i>
<b>Gayfeather</b> (H,B)	<i>Liatris brachiata</i>	<b>Pink-scale Gayfeather</b> (H,B)	<i>Liatris elegans</i>
<b>Queen Anne's Lace</b> (B)	<i>Daucus carota</i>	<b>Rough Coneflower</b> (B)	<i>Rudbeckia grandiflora</i>
<b>Brown-eyed Susan</b> (B)	<i>Rudbeckia hirta</i>	<b>Lance-leaved Violet</b> (B)	<i>Viola lanceolata</i>
<b>Primrose-leaved Violet</b> (B)	<i>Viola primulifolia</i>	<b>Yellow Star Grass</b> (B)	<i>Hypoxis hirsuta</i>
<b>Green Eyes</b> (B)	<i>Berlandiera x betonicifolia</i>	<b>Ox-eye Daisy</b> (B)	<i>Heliopsis gracilis</i>
<b>Obedient Plant</b> (H,B)	<i>Physostegia intermedia</i>	<b>Swamp Sunflower</b> (B)	<i>Helianthus augustifolia</i>
<b>Lizard Tail</b> (B)	<i>Saururus cernuus</i>	<b>Texas Frogfruit</b> (B)	<i>Phyla incisa</i>
<b>Blue Flag</b> (B)	<i>Iris virginica</i>	<b>White-topped Sedge</b> (B)	<i>Dichromena colorata</i>
<b>Waterwillow</b> (B)	<i>Justicia americana</i>	<b>Lance-leaved Waterwillow</b> (B)	<i>Justicia lanceolata</i>
<b>Southern Swamp Lily</b> (B)	<i>Crinum americanum</i>		

### NATIVE SHRUBS:

<b>American Beautyberry</b> (W,B,S)	<i>Callicarpa americana</i>	<b>Carolina Buckthorn</b> (W,S)	<i>Rhamnus caroliniana</i>
<b>Chinquapin</b> (W,S)	<i>Castanea pumila</i>	<b>American Elderberry*</b> (W,B,S)	<i>Sambucus canadensis</i>
<b>Rough-leaf Dogwood</b> (W,B,S)	<i>Cornus drummondii</i>	<b>Texas Lantana*</b> (W,H,B,S)	<i>Lantana horrida</i>
<b>Flowering Dogwood</b> (W,B,S)	<i>Cornus florida</i>	<b>Common Spice Bush</b> (W,B)	<i>Lindera benzoin</i>
<b>Parsley Hawthorn</b> (W,B,S)	<i>Crataegus marshallii</i>	<b>Southern Crab Apple</b> (W,B,S)	<i>Malus angustifolia</i>
<b>Western Mayhaw</b> (W,B,S)	<i>Crataegus opaca</i>	<b>Mexican Buckeye*</b> (B,H)	<i>Ungnadia speciosa</i>
<b>Texas Persimmon</b> (W,S)	<i>Diospyros texana</i>	<b>Viburnum</b> (W,B,S)	<i>Viburnum spp.</i>
<b>Eastern Coral Bean*</b> (W,H,B,S)	<i>Erythrina herbacea</i>	<b>Common Buttonbush</b> (W,B)	<i>Cephalanthus occidentalis</i>
<b>Strawberry Bush</b> (W,B,S)	<i>Euonymus americanus</i>	<b>Texas Azalea*</b> (H,B)	<i>Rhododendron oblongifolium</i>
<b>Poosum-haw</b> (W,B,S)	<i>Ilex decidua</i>	<b>Autumn Sage</b> (H,B)	<i>Salvia greggii</i>
<b>Yaupon Holly</b> (W,S)	<i>Ilex vomitoria</i>	<b>Fringe Tree</b> (W)	<i>Chionanthus virginica</i>
<b>Holly</b> (W,S)	<i>Ilex spp.</i>	<b>Texas Kidneywood</b> (W,B)	<i>Eysenhardtia texana</i>
<b>Carolina Wolfberry</b> (W,B,S)	<i>Lycium carolinianum</i>	<b>Turk's Cap</b> (H,B,S)	<i>Malvaviscus drummondii</i>
<b>Southern Wax Myrtle</b> (W,S)	<i>Myrica cerifera</i>	<b>Red Chokeberry</b> (W,B,S)	<i>Pyrus arbutifolia</i>
<b>Chickasaw Plum</b> (W,B,S)	<i>Prunus angustifolia</i>	<b>Marsh Hibiscus</b> (H,B)	<i>Hibiscus moscheutos</i>
<b>Arrowhead, Wapato</b> (W)	<i>Sagittaria latifolia</i>	<b>Texas Mallow</b> (H,B)	<i>Malvaviscus arboreus</i>
<b>Salt Marsh Mallow</b> (H,B)	<i>Kosteletzkya virginica</i>	<b>Halberd-leaved Rose Mallow</b> (H,B)	<i>Hibiscus militaris</i>
<b>Texas Star Hibiscus</b> (H,B)	<i>Hibiscus coccineus</i>	<b>St. Andrew's Cross</b> (B)	<i>Ascyrum hypericoides</i>
<b>Arrowhead Viburnum</b> (W,B,S)	<i>Viburnum dentatum</i>	<b>Witch Hazel</b> (B)	<i>Hamamelis virginiana</i>
<b>Dwarf Wax Myrtle</b> (W,B)	<i>Myrica pusilla</i>	<b>Virginia Sweetspire</b> (W,B)	<i>Itea virginica</i>
<b>Coral Berry</b> (H,B)	<i>Symphoricarpos orbiculatus</i>		

W = Other Wildlife (deer, squirrels, etc.)    B = Butterflies (nectar or larval food plant)    S = Songbirds    H = Hummingbirds

