



CULPEPER COUNTY
Green Building
Model Program

GREEN BUILDING RESOURCE CENTER

The Culpeper County Building Department established the first “Green Building Resource Center” in the region in February 2010. In partnership with The Daniel Technology Center, Germanna Community College, and Planning District 9, the Center provided a contemporary source for information on energy conservation and green building practices. The term “Green Building” refers to energy efficiency, sustainable building practices, the use of alternative energy resources and water and land conservation and use. The project was funded by the Energy-Efficiency and Conservation Block Grant (EECBG) awarded to the Culpeper County Building Department in February 2010. The Grant is part of the American Recovery and Reinvestment Act and was administered through the Department of Mines, Minerals and Energy. Culpeper County and Planning District 9 partnered together to develop the project, and were among 26 grantees from a pool of nearly 150 proposals submitted.

An input session to inform the document content was held on December 8th, 2011 at the Culpeper Town Police Department Community Room. There were 15 attendees, with representation from local builders, Culpeper County Public Schools, the Town of Culpeper and the County of Culpeper. A conference call was held on December 20th to receive input from commercial real estate and builders that were unable to attend the previous input session, with 6 attendees. Further input was received from the Culpeper Soil & Water Conservation District. All this information was collected under the following five topics: Opportunities/Challenges to Culpeper County Green Building Future, Sustainable Design Technologies and Principles with Express Interest or Applicability in Culpeper County, Brainstorm of Potential Incentives for Culpeper County, Policy and Procedural Barriers and Opportunities and Visioning the Success of the Culpeper County Green Building Model Program.

At the time of publication there were not any current incentives available in the County of Culpeper, but here are some great ideas from the input session that may have traction in the future.

- Tiered utility rate for green building technology implementation, such as:
 - Reduce the sewer rates for buildings with low flow fixtures installed
 - Allow a one-time credit on the tap fee for water efficient design in a new building
- Create a green builder recognition program by identifying pre-qualified projects with a ‘Green Permit’. The Green Permit could be a different color and listed online.
- Reduce stormwater management fees if Low Impact Development is implemented on a commercial project
- Create a program that will allow the developer to increase the green developments value, such as a density bonus or an increased floor to area ratio (FAR)

Visit the Culpeper County Green Building Resource Page for links to any federal or state incentives, and if there are any new local incentives:

<http://web.culpepercounty.gov/CountyGovernment/BuildingDepartment.aspx>



GOAL STATEMENT

This document will help educate Culpeper County residents, builders and business owners on opportunities to green their existing or future building and the benefits of these decisions. Focus has been put on reducing energy use and water use, and helping to create health interiors for home owners or building users.

Benefits of reduced energy and water use can be easily reflected in savings on utilities. There are many easily implemented strategies that can be used on an existing building or home or in planning a new building that are presented.

On average, Americans spend about 90 percent of their time indoors. Considering the level of pollutants found indoors may be two to five times higher that outdoor levels, and occasionally more than 100 times higher, any improvement we can make to our indoor environment will only benefit our health and quality of life.

The strategies presented here have intentional application to Culpeper County and the surrounding area.

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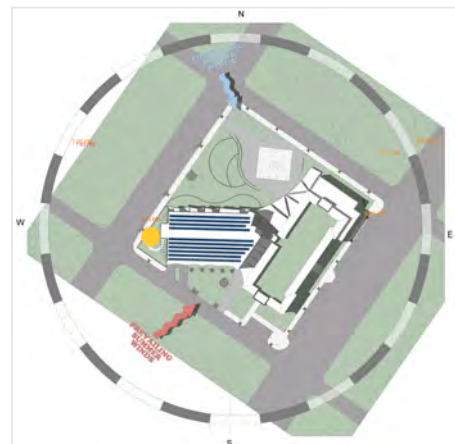
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ORIENTATION

The selected orientation of a new building combined with the incorporation of overhangs and shading devices can have a great impact on the building's energy use and the comfort of the interior. The **combined effect of these 3 strategies** has the potential to **reduce a building's total energy use by up to 60%**.

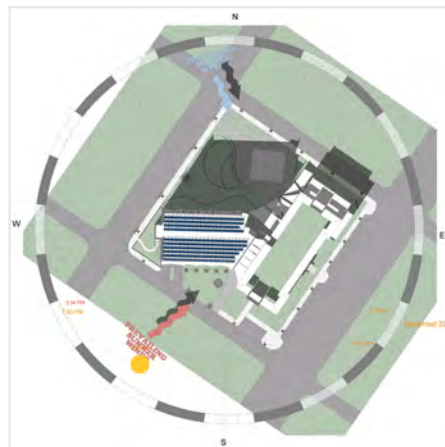
Sun

A building with the long axis orientated east to west and windows on the south facing wall, will allow the building to be passively heated with the winter sun. Minimizing the number of window on the north face will assist in reducing the heat loss in the winter time.



Summer sun directly overhead minimizes shadows and shading prevents direct sunlight to enter, while prevailing summer winds from the southeast allow for cross ventilation if the building is oriented to accommodate.

Long shadows in the winter time demonstrate the sun's ability to easily warm the south facing wall with sun entering under the shading device, while prevailing winter winds can be blocked with tree plantings to protect the building.



Wind

A building orientated to allow for the spring and fall prevalent winds to cross ventilate the interior allows for more days where the interior temperature is comfortable and it is not necessary to turn on the air conditioning.

DAYLIGHTING

Providing daylighting to an interior building space reduces the demand for electric lighting, lowering energy use. Studies have shown that building occupants with access to natural daylight and views to the exterior are more productive and have reduced illness and absenteeism.

Floor Plan Configuration

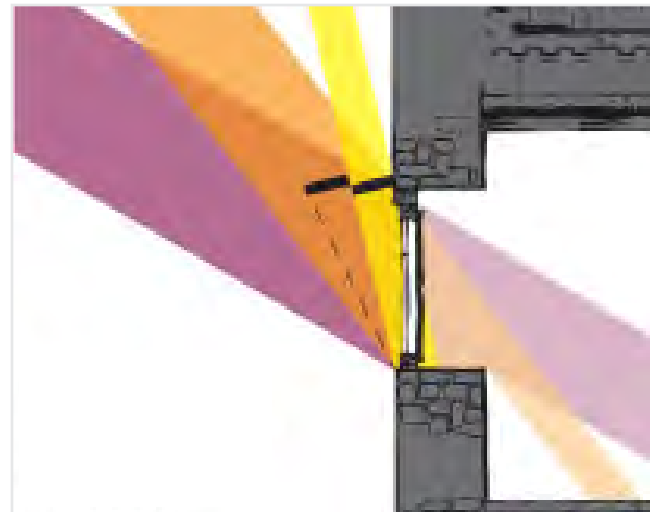
Building designs with shallow floor plates, clerestory windows, skylights, atriums and courtyards can ensure all building occupants have access to a daylit space with a view to the exterior. Partition walls, furniture systems and surface color and texture should be factored in as well. Glare control should be considered when incorporating daylighting, which may include light shelves, blinds and shades.

Light Shelves

To reflect daylight deeper into a building, a light shelf at the window can be placed right above eye level with a highly reflective top surface. This light shelf will also effectively reduce the hot sun and glare from the summer sun.

Overhangs & Shading Devices

Include overhangs and shading devices over the south facing windows to block the summer sun while allowing the sun to enter in the winter and warm the interior.



Demonstration of an overhang shade providing protection from the higher, more intense summer sun, while letting the winter sun enter to warm the building.

LANDSCAPING

When designing a landscape there are many strategies that can be easily incorporated to reduce the maintenance, required pesticides and amount of water used to maintain the beauty, and add to the biodiversity of an area. Reduced water usage conserves municipal and private water resources, while reduced fertilizer and pesticide use protects the vulnerable groundwater sources in Culpeper County from contamination.

Native Plants

Select plants native to the region, such as butterfly weed, highbush blueberry, flowering dogwood and white oak when planning landscaping. Native plants require less watering, fertilizer and pesticides, while maintaining or improving the soil quality and reducing erosion. (1)



Native to Culpeper County, the Flowering Dogwood, appropriately used in wildlife, horticulture, landscaping, conservation and restoration in shade or partial sun and low or medium moisture.



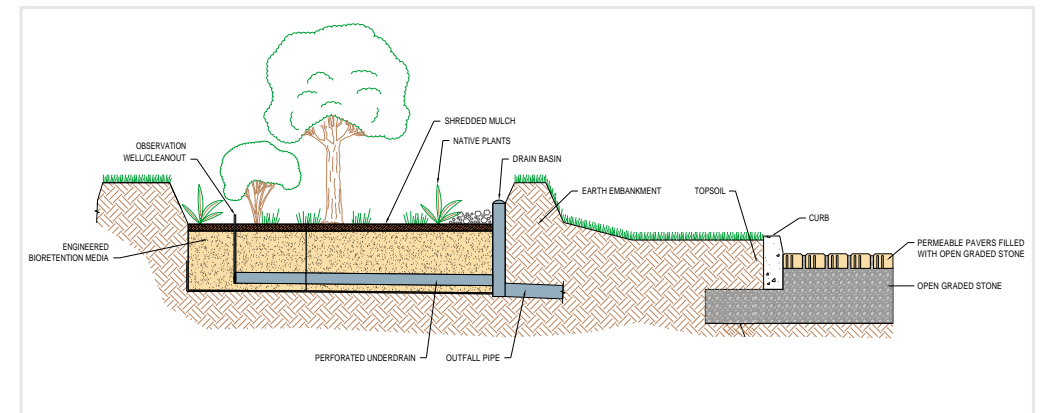
Native to Culpeper County, the Butterfly Weed, appropriately used in wildlife, horticulture, landscaping, conservation and restoration in full sun and low moisture.

Rain Garden & Bioswales

Rain gardens capture and divert clean rainwater from your roof, driveway and sidewalks where it can slowly soak into the ground, filter contaminants and keep clean water from running down into the sewer system. They slow down the rush of rainwater from the hardscape surfaces, hold the water for a short time and allow it to naturally infiltrate into the ground. Rain gardens are an inexpensive, beautiful and simple way to implement an environmentally sound solution to urban stormwater runoff.

Permeable Pavers

Permeable pavers are a smart alternative to paving and asphalt. Permeable pavers provide a solid enough surface for vehicle traffic to drive over, while allowing rainwater to filter through the surface to reach the directly underlying soils. This keeps rainwater from sheet flowing pollutants directly into adjacent waterways while recharging the natural groundwater. Permeable paving allows for reduced sizes of drainage systems and storage or retention areas.



Cross Section of a bioswale and permeable pavers installation.



Bioswales integrated into a landscape, filtering and retaining water from the adjacent parking lot.

WATER EFFICIENCY

Reducing Water Use

Water is one of our most precious natural resources, and we require it in all we do. Two-thirds of the United States have had water shortages or are bracing for them (1). Using water efficiently will ensure there is a clean reliable supply for the future. Saving water is easy, and it saves money. Small changes in our homes and businesses, amount to large savings in a community.

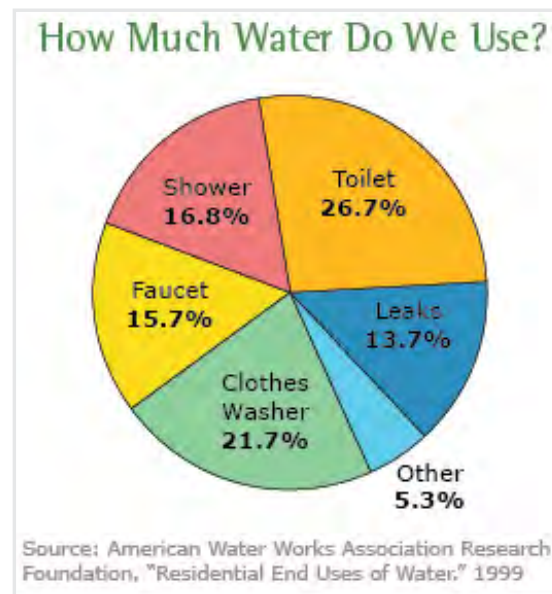
Potable water is water that has been treated and purified to be suitable for human consumption. Potable water has most commonly been collected by a municipality from a natural source, purified, treated and then transported via a complex piping system, to be available every time you turn a faucet on. Any reduction in the amount of potable water used by a building, and that needs to be treated and transported, has a very positive impact in many ways. Less water needs to be drawn from natural sources and less infrastructure needs to be built and maintained to treat and transport the water.



Plumbing Fixtures

In new construction or renovation, select plumbing fixtures that have the Water Sense Label. Products bearing the Water Sense Label are 20% more efficient than average products, while delivering the flush, rinse or spray you expect.

In an existing home, begin by renovating your bathroom. A bathroom accounts for more than half of all water that families use indoors. **Replacing your faucets, showers and toilets saves the average household 7,000 gallons of water annually, or nearly 5,500 WaterSense toilet flushes, 200 kilowatt hours annually or a 60 watt light bulb burning for more than 3,000 hours and \$80 in utility bills annually. (2)**



Rainwater Harvesting and Use

Rainwater harvesting captures the naturally falling rainwater on a site, filters and/or purifies it and stores the water for later use. Using rainwater collected on a home or building site can easily reduce the amount of potable water used for purposes not requiring purified drinking water, such as landscaping and toilet flushing.

If you were to collect the naturally falling rain from a 1000 square foot roof in Culpeper County, you could on average collect 40,500 gallons of water annually. That's equivalent to more than 31,000 Water Sense toilet flushes!

Rainwater collected on a site receives minimal treatment, prefiltration, before it can be used for landscaping and irrigation. For toilet flushing an additional treatment of a sediment filter will remove suspended solids which can clog and damage valves, and an activated-carbon filter will remove dissolved organic matter which can cause discoloration and odors.



Rainwater harvesting tank, collecting water directly from the roof.

Green Roof

A green roof or living roof is a roof of a building that is partially or completely covered with vegetation and a growing medium, planted over a waterproofing membrane. It includes additional layers such as a root barrier, filter cloth and drainage. Green roofs contribute to several green building purposes, such as:

- reducing or slowing the amount of rainwater rushing into the stormwater system, thereby decreasing the stress on sewer systems at peak rain flow.
- providing insulation,
- creating a habitat for wildlife, and helping to lower urban air temperatures and mitigate the heat island effect.
- There is currently a **business in Culpeper County that produces vegetation blankets for green roofs.**



Green roofs offer biodiversity, a natural habitat and beauty while providing environmental benefits.

Grey Water Re-use

Grey water is any waste water from a home, except for the toilet and kitchen sink. Grey water can be collected and re-used on a site for toilet flushing or landscaping irrigation with minimal treatment. The benefits of grey water recycling include:

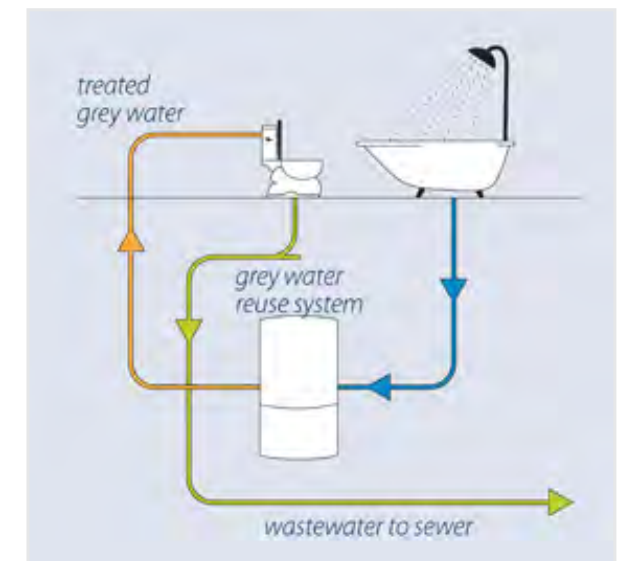
- Lower potable water use. Residential water use is almost evenly split between interior and landscaping. Re-using the majority of interior used water for irrigation drastically reduces the demand for potable water use.

- Less energy and chemical use. Less potable water is required to be treated and pumped to the building and site, directly reducing the burden on the community's utility infrastructure.

There are several commercial or industrial applications in Culpeper County that may benefit from the collection and re-use of grey water in their product processes. There is potentially great savings to be realized through the reduced fees associated with water and sewer by utilizing grey water.



Greywater can be captured from your sinks, showers and washing machines and easily used for landscape irrigation.



Water use in a home with a grey water system

MINIMIZE ENVIRONMENTAL IMPACT

Culpeper County Public Schools promotes healthy interiors in their selection of paper, cleaning products and pest control by specifying the purchase of a minimum of 30% post consumer recycled content paper.

Minimize the Impact of our Building Materials

The materials that we selected to construct and renovate our buildings, as well as the way we dispose of them, have a significant impact on our environment. From the extraction or harvesting of the raw material, to the manufacturing process, the transportation, the installation process and then disposal at the products' end of life, there many opportunities to minimize environmental impact.

Construction and demolition (C&D) debris account for a very large portion of the waste in our landfills. According to the EPA, building related C&D debris total 160 million tons per year, accounting for more than a quarter of total non-industrial waste generation in the US. Approximately 48 percent of the C&D debris is from demolition, 44 percent is contributed to renovations and new construction is 8 percent. (3)

Reduce

Durable materials allow for a reduction in the required maintenance, as well as the necessity to remove and replace the material at its end of life. Every time a new floor is installed, the old flooring material has to be disposed of, and many times it is in a landfill. Porcelain tile, with a matte finish, can be used in kitchen, bathroom, or any high traffic area. It is one of the most durable flooring surfaces, being resistant to chipping, scratching and staining, and doesn't require a sealer be applied regularly for maintenance.



Porcelain tile is highly durable, and most tiles have potential to contain recycled or regional materials.



Re-using brick is a great way to retain an area's architectural character. While reducing waste and the use of raw materials for new brick.

Recycled Content

Products containing recycled content reduce the requirement for extraction or harvesting of virgin materials and reduces solid waste volumes by diverting the material that is being recycled from the waste stream. There are many commonly used building products that contain recycled content, including concrete, masonry, gypsum wallboard, acoustic tile, carper, ceramic tile, insulation and metal. Care should be taken to ensure the durability of the recycled-content product matches that of its counterpart, however most recycled-content materials perform just as well.

Regional Content

Purchase building materials that are manufactured and harvested, or extracted, as locally as possible. The use of a regional material reduces the environmental impact by minimizing fuel burned for transportation, and supports regional manufacturers and labor forces, contributing to the local tax base and a healthier local economy.

AIR QUALITY

Finishes

Many building materials and finishes contain Volatile Organic Compounds (VOCs), which contribute to smog generation and degrade the quality of indoor air. The new building smell, new carpet smell and paint odor are actually all the toxic indicators of VOCs. Select paints, coatings and sealants that are indicated as a low-emitting material. Install carpet and carpet cushion that meets the Carpet and Rug Institute's Green Label Plus Program. Select composite wood products, such as plywood and particleboard that don't contain any urea-formaldehyde resins.

ENERGY EFFICIENCY

The **Culpeper County School Board's** Environmental Sustainable Practices include items to **encourage energy efficiency in the school's operations** by "Developing guidelines that encourage energy conservation and regulate energy use throughout the division" as well as "Purchasing Energy Star appliances and electronics when deemed fiscally possible."

Energy Efficiency in Your Home

There are many opportunities to improve the energy efficiency of your home. From do-it-yourself to hiring a professional, small investments in your homes energy efficiency can have a great impact on your utility bills.

You can start off with a do-it-yourself home energy assessment.

- **Drafts.** Check around your windows and doors, baseboards, attic hatches, switch plates and electrical outlets. If you see light around a door or window frame, or if they rattle, you can usually seal these leaks with weather stripping or caulking.
- **Attic Insulation.** When your house was built, insulation was installed at the level that was required at the time. This insulation may have settled, shifted or been removed over the years. Take a look up in your attic. If your attic hatch is above a conditioned room, see if the hatch itself is insulated and weather stripped, and

closes tightly. While in the attic take a look at opening for the pipes, chimney and mechanical ductwork, and seal any gaps. **Reducing drafts in your home has the potential to save you 5-30% on your energy bills annually.** (4)

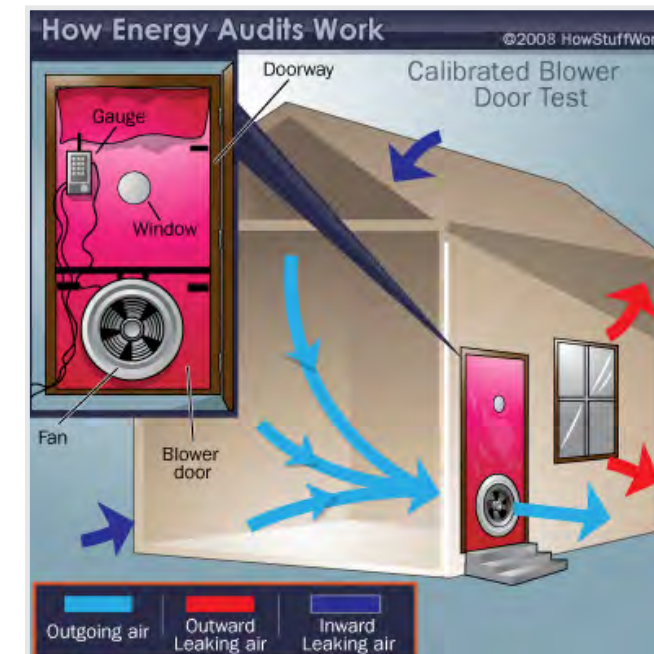
- **Change Filters Regularly.** If you have a forced air heating and cooling system, ensure your filters are changed regularly.
- **Programmable Thermostat.** Install a programmable thermostat if you don't have one.

Once you've done your own home energy assessment you may want to hire a professional to do a much more detailed home energy audit, helping you prioritize potential energy efficiency upgrades. An energy auditor can provide as detailed of an investigation and report as you'd like.

- Visual inspection
- Infrared images of the interior and exterior of your home
- Blower door tests and duct leakage testing

Energy Star recommends replacing your heating and cooling equipment if your heat pump or air conditioner is more than 10 years old, and replacing your furnace or boiler if it is more than 15 years old.

When purchasing new appliances and heating and cooling equipment, ensure you purchase **Energy Star**.



Green is good. Blue is better. Infrared images show locations (red, yellow and orange) where heat is escaping.

Geothermal

Geothermal heat pumps use the **constant temperature of the earth** as the heat exchange medium, instead of the highly variable outside air temperature, allowing for higher efficiencies than an air-source heat pump. The ground-source heat pump cycles water through an underground piping loop. The water piped through this loop uses soil temperature to warm or cool the heat pump's refrigerant. In the winter, with a ground temperature of 55 degrees F, the ground-source system needs to boost the heat 15 to 20 degrees to reach a comfortable temperature. In contrast, an air-to-air pump will have a much higher, 40 to 60 degree differential to overcome.

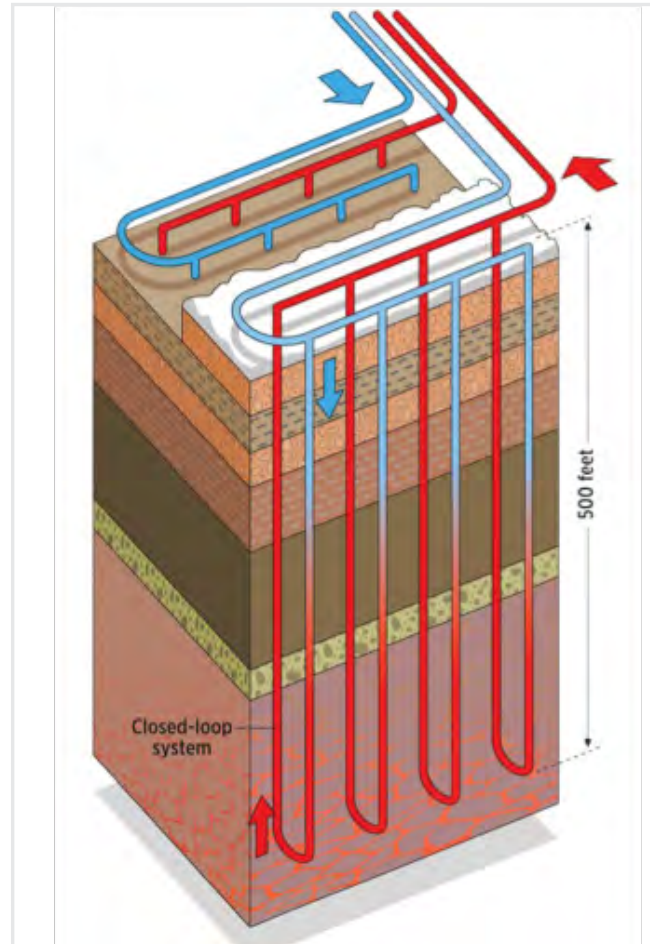
The installation price of a geothermal system can be several times that of an air-source system of the same heating and cooling capacity, however the **additional costs are returned to you in energy savings in 5-10 years.**

Cool Roof

Cool roofs have surfaces that reflect sunlight and emit heat more efficiently than a traditional dark or black roof. A cool roof reflects the sun's energy in the form of light back into the sky instead of allowing it to be absorbed into the building below as heat. Solar reflectance and thermal emittance are the two key material properties that determine a roof's temperature. These numbers range from 0 to 1, the larger these numbers, the more resistant the roof is to gaining and transferring the heat inside. A cool roof has the potential to **reduce air conditioning use by 10-30%.** (5)



Cool roofs reflect the sun's energy back into the sky instead of the energy being absorbed into the building.



Water piped through a geothermal loop uses the soil's constant 55° F temperature to preheat or cool a heat pump's refrigerant.

Solar hot water heaters can be a very cost effective way to generate hot water for your home. A solar hot water heater consists of solar collectors and storage tanks. An active system has pumps and controls and is typically more expensive, and a passive system does not have pumps and controls but is typically not as efficient. While there are several types of solar collectors, each consists of a dark colored surface to absorb the sun's heat, which water flows through or under. This heated water flows, or is pumped, to a well-insulated storage tank, which may act as a preheat to the conventional water heater.

GREEN BUILDING RATING SYSTEMS

Green building and energy rating systems are tools that can be used to evaluate and differentiate a green building, sustainable building or high performing building from the conventional counterpart. The Culpeper County School Board requires "All major building renovations and new construction strive for certification by a nationally recognized green building rating system."

Energy Star



To earn the ENERGY STAR, a home must meet strict guidelines for energy efficiency set by the U.S. Environmental Protection Agency.

Homes achieve this level of performance through a combination of energy-efficient improvements, including,

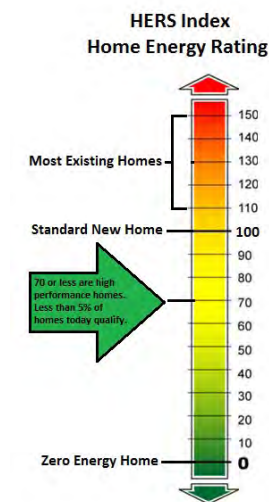
- Effective Insulation Systems
- High-Performance Windows
- Tight Construction and Ducts
- Efficient Heating and Cooling Equipment
- ENERGY STAR Qualified Lighting and Appliances

To ensure that a home meets ENERGY STAR guidelines, third-party verification by a certified Home Energy Rater (or equivalent) is required. (5)

Home Energy Rating System (HERS)

A home energy rating involves an analysis of a home's construction plans and onsite inspections. Based on the home's plans, the Home Energy Rater uses an energy efficiency software package to perform an energy analysis of the home's design.

Upon completion of the plan review, the rater will work with the builder to identify the energy efficiency improvements needed to reduce the HERS Index. The rater then conducts onsite inspections, typically including a blower door test (to test the leakiness of the house) and a duct test (to test the leakiness of the ducts). Results of



these tests, along with inputs derived from the plan review, are used to generate the HERS Index for the home. (6)

EarthCraft



EarthCraft is a green building certification program that serves Georgia, Virginia, Tennessee, Alabama, South Carolina and North Carolina. By addressing the factors that impact homes in this region, including high heat, humidity and temperature swings, EarthCraft serves as a blueprint for energy, water and resource-efficient single-family homes, multifamily structures, renovation projects, community developments and light-commercial buildings. Homes, businesses and communities certified through the EarthCraft program must meet a number of criteria that ensure sustainable, efficient design and function. Areas of focus include:

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- Indoor air quality
- Energy efficiency
- Water efficiency
- Resource-efficient design
- Resource-efficient building materials
- Waste management
- Site planning (7)

Leadership in Energy and Environmental Design (LEED)



LEED provides building owners and operators with a framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions.

LEED certification provides independent, third-party verification that a building or community was designed and built using strategies aimed at achieving high performance.

LEED-certified buildings are designed to:

- Lower operating costs and increase asset value
- Reduce waste sent to landfills
- Conserve energy and water
- Be healthier and safer for occupants
- Reduce harmful greenhouse gas emissions
- Qualify for tax rebates, zoning allowances and other incentives in hundreds of cities (8)

RESOURCES

- (1) Virginia Department of Conservation and Recreation, www.dcr.virginia.gov
- (2) Water Sense Webpage, www.epa.gov/watersense
- (3) Buildings and their Impact on the Environment: A Statistical Summary, Revised April 22, 2009, www.epa.gov/greenbuilding
- (4) US Department of Energy, www.eere.energy.gov
- (5) Energy Star, www.energystar.gov
- (6) Residential Energy Service Network, www.resnet.us
- (7) EarthCraft, www.earthcraft.org
- (8) U.S. Green Building Council, www.usgbc.org

Culpeper County Awards:

Culpeper County Receive the “Green Government Challenge, Green Certified ” distinction in 2011, from the Virginia Municipal League. There were 33 entries and nine winners.

Culpeper County Schools were awarded First Place in the Student Population 5,001 – 10,000 last year – “The 2010 VSBA Green Schools Challenge.”

Culpeper County Vision Statement

Culpeper County will strive to achieve the highest quality of life possible for our community through comprehensive, innovative, responsive, and meaningful services effectively delivered by motivated and skilled employees guided by visionary leadership.

Culpeper County Mission Statement

Culpeper County Government will strive to provide an environment which promotes a prosperous community dedicated to the health and safety of its citizens while providing educational opportunities and data driven, citizen centered, performance based management.

Culpeper Town Vision Statement

Promote development and investment to create long-term sustainability through a coordinated effort which ensures that there is a balance between aesthetics, economics, public health and safety, and transportation and public services that can be maintained over the long-term resulting in a community that is equal to or better than the present day.

Culpeper County School’s Environmentally Sustainable Practices

The Culpeper County School Board recognizes the value of environmentally sustainable practices in the design and operation of its facilities. The School Board is committed to promote sustainable practices throughout the school division.

The purpose of this policy is to provide a quality environment for students and staff while conserving natural resources. By developing, adopting and implementing an Energy Improvement Plan, we will provide a long term cost savings to the taxpayers of Culpeper County.

