North Courthouse Road Library, Chesterfield County, Virginia Sustainable Design Case Study

The North Courthouse Road Library is Chesterfield County's second LEED Certified Building. The first was the Community Development Building at the County Government Complex.

INTRODUCTION:

The North Courthouse Road Library has been planned to support the Chesterfield County Public Library's program requirements including book stacks, public computers, a multi-function flexible meeting room, quiet study rooms, special areas and collections for children and teens, an outdoor reading veranda, a business center, staff areas, support spaces and more.

The North Courthouse Road Library is a sustainable building designed to achieve LEED certification.

SUSTAINABLE DESIGN ACCOMPLISHMENTS:

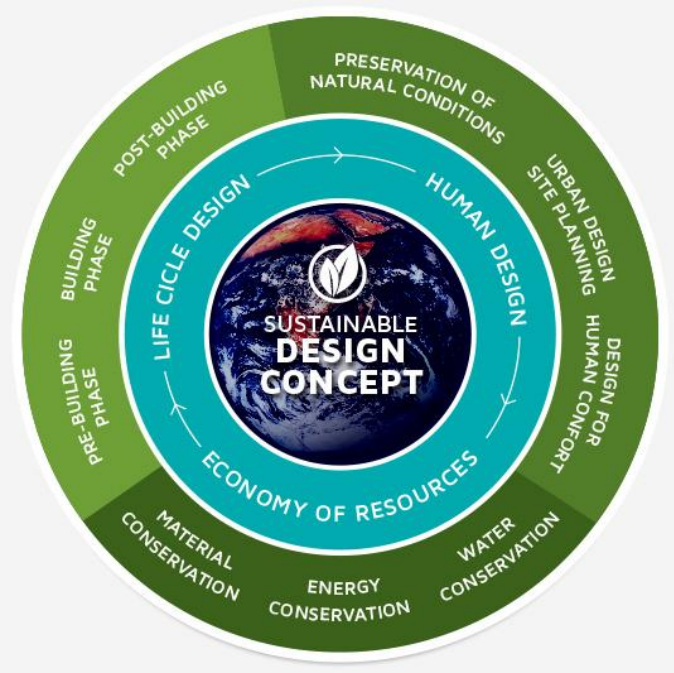
24.8%	Estimated Annual Energy Savings Compared to Code Compliant Building
90%	Of Normally occupied rooms have natural daylighting and views
100%	Of Landscape Irrigation water is from rainwater or wells
30%	Reduction in overall water consumption as compared to baseline
16.9%	Reduction in lighting power density (watts/square foot) compared to baseline
16.5%	Of the materials (by cost) consists of recycled content
99%	Of new wood (by cost) is Forest Stewardship Council certified
87%	Of all construction waste and debris (by weight) was diverted from land-fills.

SUSTAINABILITY:

A sustainable or green building incorporates features, materials, equipment, technology, operations and other strategies that support some or all of the following goals:

- Reduce the consumption of non-renewable resources such as oil.
- Reduce the consumption of valuable resources such as water.
- Reduce negative impacts on the natural environment such as air and water pollution.
- Encourage the use of renewable resources such as solar energy.
- Improve the health and comfort of building occupants by providing benefits such as improved air quality, thermal comfort, daylighting, and views.

The United States Green Building Council (USGBC) is a non-profit organization founded in 1993 with the goal of encouraging the creation and operation of sustainable or green buildings.



LEED is short for Leadership in Energy and Environmental Design. Buildings which successfully comply with one of the USGBC LEED Rating Systems earn a LEED plaque certifying their achievement.

The USGBC LEED-NC 2.2 Rating System for New Construction was used as a guideline to inform and organize the sustainable design and construction process for The North Courthouse Road Library.

The LEED-NC 2.2 Rating System offers the opportunity to earn up to 69 points in 6 major categories. We anticipate earning 40 points as follows:

- Sustainable Sites: 7 points anticipated out of 14 possible points.
- Water Efficiency: 4 points anticipated out of 5 possible points.
- Energy & Atmosphere: 6 points anticipated out of 17 possible points.
- Materials and Resources: 8 points anticipated out of 13 possible points.
- Indoor Environmental Quality: 10 points anticipated out of 15 possible points.
- Innovation & Design Process: 5 points anticipated out of 5 possible points.

Projects can earn one of 4 levels of recognition. The Library is on track to earn Gold.

- Certified: 26 to 32 points
- Silver: 33 to 38 points
- Gold: 39 to 51 points
- Platinum: 52 or more points

SUSTAINABILITY STRATEGIES AND ACHIEVEMENTS:

1. SUSTAINABLE SITES SUSTAINABILITY STRATEGY: PROTECT OR RESTORE HABITAT:

- The existing stream and most forested areas have been protected.
- The existing pond has been repaired and restored. (See photo below.)
- Existing wetlands have been preserved.
- These areas serve as habitat for plants and animals.

2. SUSTAINABLE SITES SUSTAINABILITY STRATEGY: STORMWATER DESIGN:

- Stormwater includes rain, snow, ice, and hail.
- Stormwater naturally runs off into our streams, rivers, lakes, wetlands, underground aquifers, and eventually to the ocean.
- Stormwater runoff can carry harmful pollutants into our waterways and underground aquifers.
- Pollutants can include fertilizers, pesticides, heavy metals, industrial waste.
- Stormwater runoff from parking lots, drives and the building roof is collected and temporarily detained in two underground structures.
- By detaining and slowing down the rate of flow of the stormwater the potential for environmental damage is greatly reduced.
- Portions of the parking lot use porous concrete pavers which allow stormwater to pass directly into the ground below. (See photo below.)

Porous Concrete Pavers

Asphalt Pavement

3. WATER EFFICIENCY SUSTAINABILITY STRATEGY: WATER EFFICIENT LANDSCAPING:

- A variety of low and average water-consuming plant species were used to minimize water consumption. (See photo below.)
- A water efficient drip landscape irrigation system is used.
- The lawns are not irrigated except for small areas at the building entry.
- The landscape irrigation system uses rainwater and non-potable well water exclusively. This conserves potable drinking water.
- All landscape watering is sourced from an underground cistern that harvests non-potable water generated from roof and site stormwater runoff. Well water is used as back up.

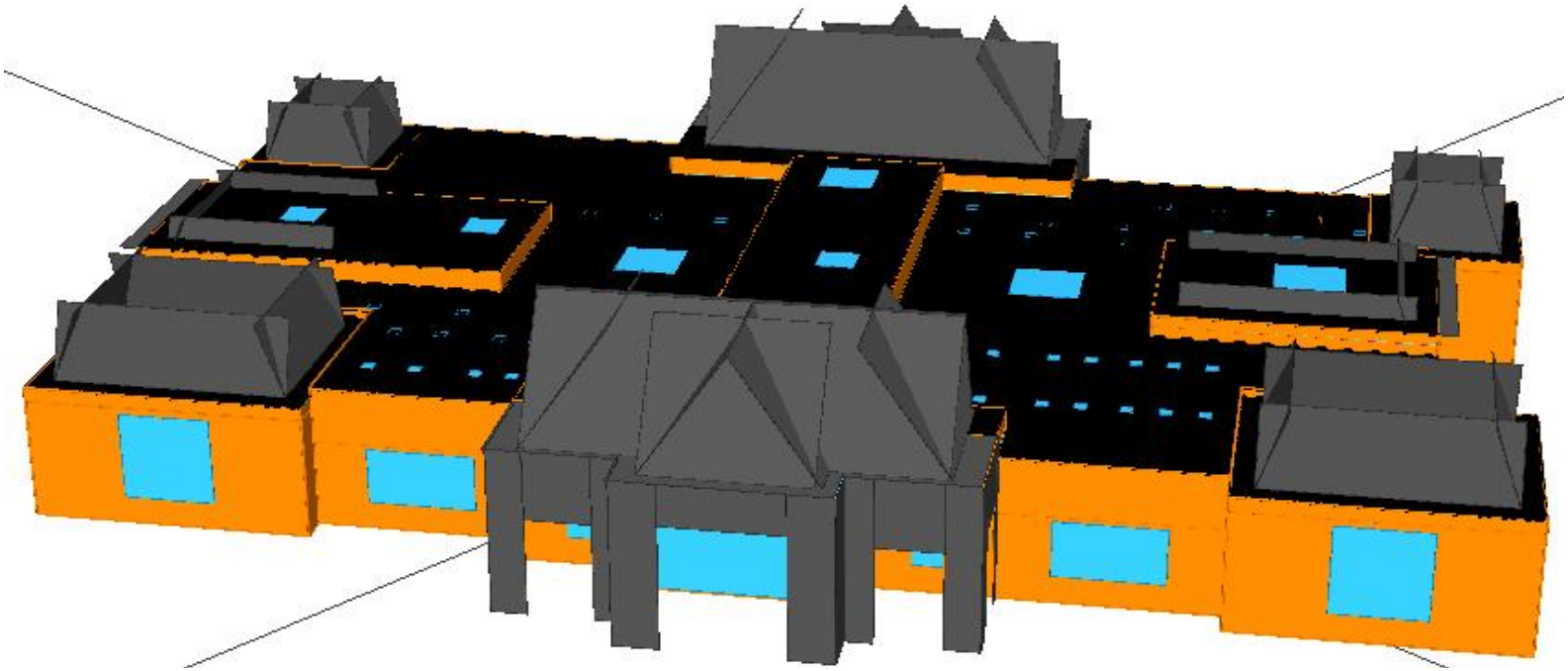
4. WATER EFFICIENCY SUSTAINABILITY STRATEGY: WATER USE REDUCTION:

- Low flow sink faucets, drinking fountains and toilets reduce water consumption to conserve valuable drinking water.
- The use of water-saving plumbing fixtures is estimated to save 30% in indoor potable water use as compared to Energy Policy Act 1992 standards.
- Rainwater is collected to irrigate the landscape plantings.

Construction photo of rainwater collection underground cistern

5. ENERGY & ATMOSPHERE SUSTAINABILITY STRATEGY: OPTIMIZE ENERGY PERFORMANCE:

- The Library is estimated to operate on about 24.8% less energy than a comparable building designed to code.
- A sophisticated computer energy model was used to evaluate and optimize energy efficient strategies.



Energy Model graphics were used to illustrate the effects of building orientation relative to the sun and how building shading affects energy use

- Energy efficient strategies include high-efficiency heating and cooling equipment, high efficiency light fixtures, natural daylighting, automatic daylight dimming of light fixtures and 'cool' roofs which reflect heat.

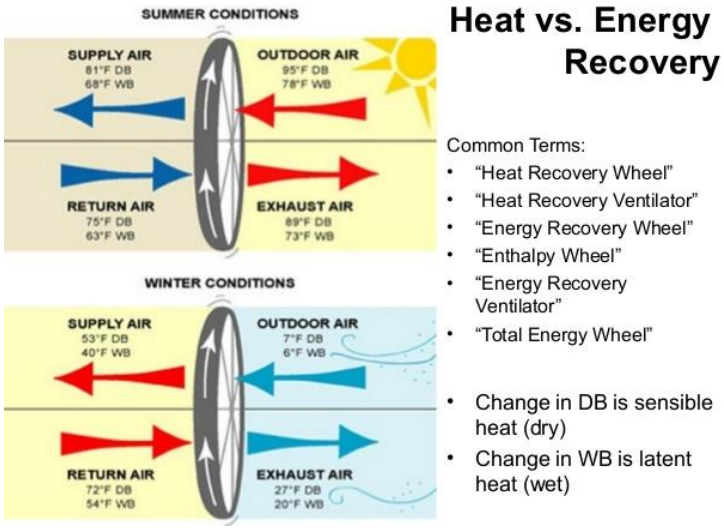
Energy Efficient, Low Glare Skylights provide natural daylighting

6. ENERGY & ATMOSPHERE SUSTAINABILITY STRATEGY: ENERGY EFFICIENT LIGHTING:

- Energy efficient LED lamps are used to light the parking lot and for most interior lighting.
- Most of the interior lights are automatically dimmed to save energy when natural daylight is sufficient.
- Occupancy sensors are used in selected rooms to turn the lights on or off based on actual occupancy.
- Lighting Power Density: A reduction of 16.9% in Lighting Power Density (watts/square foot) when compared to the ASHRAE 90.1-2004 baseline was achieved through the use of high efficiency LED and fluorescent lamps.

7. ENERGY & ATMOSPHERE SUSTAINABILITY STRATEGY: ENERGY EFFICIENT HVAC HEATING AND COOLING SYSTEM:

- A high efficiency VAV (variable air volume) HVAC heating and cooling system saves energy and allows for numerous comfort zones.
- Energy efficient HVAC features include an energy recovery heat wheel, outside air economizer, automatic humidity control and high efficiency VFD fan motors.
- An Energy Recovery Heat Wheel transfers heat between incoming and outgoing air to save energy.
- In large buildings like the North Courthouse Road Library the building code requires that fresh outside air be added on an on going basis. At the same time, inside air is exhausted to the outside so fresh air is exchanged for inside air to keep indoor air pressure balanced.



Heat/Energy Recovery Wheel Explanation

Heat Wheel partially removed for inspection

Energy Efficient Central HVAC Unit - Heat Energy Recovery wheel not visible

- Building Automation System (BAS): The HVAC system is monitored and controlled by the BAS to ensure that the system is working efficiently.

8. ENERGY & ATMOSPHERE SUSTAINABILITY STRATEGY: COMMISSIONING OF ENERGY SYSTEMS:

- Heating, Cooling, Plumbing, Lighting, Electrical Power and the Building Automation systems were fully reviewed and tested by an independent commissioning agent to ensure that they are installed and operating as designed.

9. MATERIALS & RESOURCES SUSTAINABILITY STRATEGY: RAPIDLY RENEWABLE MATERIALS AND CERTIFIED WOOD:

- Rapidly renewable materials are made from plants that are typically harvested within a 10 year life cycle or shorter.
- Rapidly renewable bamboo plywood panels are used for the library shelving end panels, shelving tops, kiosk displayers, and other casework.
- The Forest Stewardship Council (FSC) certifies wood provided by forest managers who adopt environmentally and socially responsible forest management practices.
- FSC certified wood was utilized for 99% of all new wood.

Bamboo Plywood End Panel

Kiosk Displayer

10. MATERIALS & RESOURCES SUSTAINABILITY STRATEGY: REGIONAL MATERIALS:

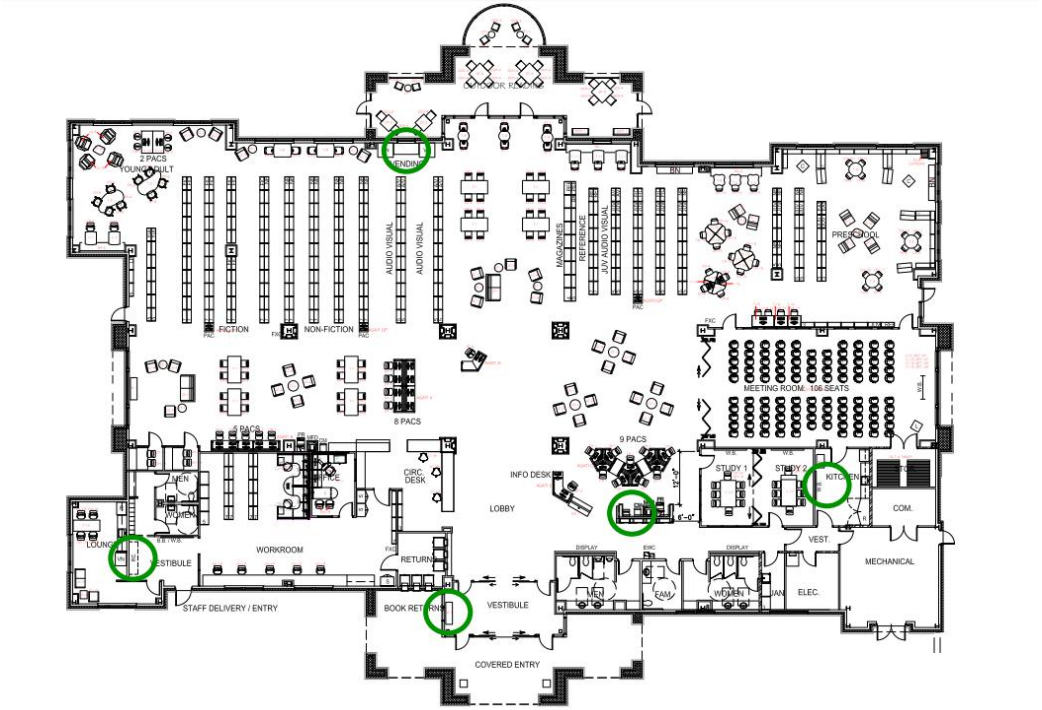
- Regional building materials or products have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the site.
- The use of local and regional materials conserves fuel and reduces pollution.
- Examples of regional materials used in the library include brick, concrete block, concrete, and pavement. (See photo below.)

11. MATERIALS & RESOURCES SUSTAINABILITY STRATEGY: RECYCLED MATERIALS:

- Recycled material is included in many building materials and products used for the library such as carpet, concrete, steel studs, structural steel, drywall, aluminum windows and doors. With the exception of plumbing, mechanical and electrical components, 16.5% of all the construction products and materials used (by cost) consists of recycled content.
- Recycling reduces the use of new materials which creates benefits such as reduced costs, reduced energy use, reduced pollution and conservation of resources.

12. MATERIALS & RESOURCES SUSTAINABILITY STRATEGY: STORAGE AND COLLECTION OF RECYCLABLES:

- Recycling containers are provided to collect and return recyclable materials for re-use and to minimize impact on landfills.
- Recyclable materials collected at the library include paper, cardboard, aluminum cans, plastic and glass bottles.
- There are 5 recycling collection and storage locations inside the Library (see floor plan below).



13. INDOOR ENVIRONMENTAL QUALITY SUSTAINABILITY STRATEGY: INDOOR AIR QUALITY:

- Materials used inside the Library, such as carpet and paint, have very low levels of undesirable volatile organic compounds (VOC's).
- Fresh outside air is provided by the HVAC heating and cooling system.
- Smoking is prohibited inside and near the Library.
- After construction was complete a full building flush out with fresh air was performed to ensure a quality indoor environment for building occupants.

14. INDOOR ENVIRONMENTAL QUALITY SUSTAINABILITY STRATEGY: DAYLIGHTING AND VIEWS:

- Windows, large prismatic skylights and tubular skylights provide natural daylighting which saves electricity and creates a pleasant environment.
- Over 90% of all normally occupied rooms and spaces have natural daylight and views to the outside. Studies have shown that these features create both objective and subjective benefits. Subjectively, people working in daylighted buildings report feelings of well being. Objectively, employers have measured fewer absentee days within their workforce in a daylighted building compared to a non-daylighted building.
- Automated roller shades control glare so that reading and computer use is enhanced.
- Daylight-Harvesting Dimming Controls: This automated system monitors the amount of natural daylight provided by the skylights and windows. When natural daylight is sufficient the electric lights are automatically dimmed or turned off.

Natural daylight at Children's Area is provided by windows and a skylight.

15. MISCELLANEOUS SUSTAINABILITY STRATEGIES:

- Measurement and Verification of energy performance. The Library's actual energy performance will be monitored and compared to the estimated energy performance in order to maximize the lessons learned from this project and to identify any issues that require improvement
- A Construction Waste Management Plan was utilized to reduce the quantity of construction debris disposed of in landfills. This was accomplished by redirecting recyclable and reusable materials to appropriate users. A total of 87% of construction waste and debris (by weight) was recycled or reused.
- A Green Educational Program has been provided consisting of signage at the library and this case study. The goal of the program is to educate occupants and visitors about the benefits of sustainable, green buildings
- The building roofing materials reflect heat to reduce the 'heat island effect.' Heat islands are thermal gradient differences between developed and undeveloped areas to minimize impact on microclimate and human and wildlife habitat

Energy Efficient VFD Pump

16. PROJECT TEAM:

North Courthouse Road Library		
Owner	Chesterfield County, Virginia	www.chesterfield.gov
Architect	The Design Collaborative	www.designcollaborative.cc
Interior Designer	KSA Interiors	www.ksainteriors.com
Civil Engineer	Austin Brockenbrough & Associates	www.brockenbrough.com
Landscape Architect	HG Landscape Architecture	www.1hg.net
Structural Engineer	Stroud, Pence & Associates	www.stroudpence.com
MEP Engineer	Cherwa-Ewing Engineers	ce@cherwaewing.com
Sustainability Consultant	Sustainable Design Consulting	www.sustaindesign.net
Commissioning Agent	Facility Dynamics Engineering	www.facilitydynamics.com
General Contractor	Gulf Seaboard General Contractors	www.gulfseaboard.com
Sitework Contractor	Shoosmith Construction	www.shoosmith.com