NNH + LEED for Homes

Documentation and Submission

LEED for Homes is a national, voluntary certification system, developed by national experts and experienced builders, that promotes the design and construction of high-performance green homes and encourages the adoption of sustainable practices by the homebuilding industry.

LEED Certification is based on 18 prerequisites and 67 credits. The prerequisites are basic performance standards: they are mandatory for every project, and no points are awarded for meeting them. To achieve certification, builders earn credit points by exceeding the minimum standards of the prerequisites. In total, 136 credit points are available.

The LEED for Homes Rating System works by requiring a minimum level of performance through prerequisites and rewarding improved performance in each of the categories. The level of performance is indicated by four performance tiers– Certified, Silver, Gold, and Platnium– according to the number of points earned.

Intro to LEED for Homes

The following documentation is the culmination of two and a half years of work. At its core, the New Norris House is an academic and research endeavor, which has enabled the project team to explore and investigate all avenues to a very high degree.

Innovation and Design Process

ID 1	**Integrated Project Planning**		
1.2		Integrated Project Team	1
1.4		Design Charrette	1
ID 2	**Durability Management Process**		
2.3		Third-Party Durability Management Verification	3
ID 3	**Innovation or Regional Design**		
3.1		Exemplary Performance: MR 2.2	1
3.2		Exemplary Performance: MR 2.2	1
3.3		Exemplary Performance: SS 2.2/2.5	1
3.4		Exemplary Performance: MR 1.5	1
*3.5		Innovation: Monitoring and Evaluation	0
*3.6		Exemplary Performance: MR 2.2	0
*3.7		Exemplary Performance: WE 2.3	0
*3.8		TWACS Smart Meter	0
*3.9		Credentialed Professional	0
		total ID points of 11 points possible	**9**

Location and Linkages

LL 2	**Site Selection**		
2.0		Site Selection	2
LL 3	**Preferred Locations**		
3.2		Infill	2
3.3		Previously Developed	1
LL 4	**Infastructure**		
4.0		Existing Infrastructure	1
LL 5	**Community Resources / Transit**		
5.3		Outstanding Community Resources / Transit	3
LL 6	**Access to Open Space**		
6.0		Access to Open Space	1
		total LL points of 10 points possible	**10**

Sustainable Sites

SS 1	**Site Stewardship**		
1.2		Minimize Disturbed Area of Site	1
SS 2	**Landscaping**		
2.5		Reduce Irrigation Demand by at least 20%	6
SS 3	**Local Heat Island Effects**		
3.0		Reduce Local Heat Island Effects	1
SS 4	**Surface Water Management**		
4.1		Permeable Lot	3
4.2		Permanent Erosion Controls	1
4.3		Management of Run-off from Roof	2
SS 5	**Nontoxic Pest Control**		
5.0		Pest Control Alternatives	2
		total SS points of 22 points possible	**16**

Water Efficiency

WE 1	**Water Reuse**		
1.1		Rainwater Harvesting System	4
WE 2	**Irrigation System**		
2.3		Overall Irrigation Demand	4
WE 3	**Indoor Water Use**		
3.1		High-Efficiency Fixtures and Fittings	1
3.2		Very High-Efficiency Fixtures and Fittings	4
		total WE points of 15 points possible	**13**

* LEED for Homes does not recognize credits past ID 3.4

Energy and Atmosphere

EA 1	**Optimize Energy Performance**	
1.2	Exceptional Energy Performance	23
EA 7	**Water Heating**	
7.1	Efficient Hot Water Distribution	2
7.2	Pipe Insulation	1
EA 11	**Residential Refrigerant Management**	
11.2	Appropriate HVAC Refrigerants	1
	total EA points of 38 points possible	**27**

Materials and Resources

MR 1	**Material-Efficient Framing**	
1.5	Off-site Fabrication	4
MR 2	**Environmentally Preferable Products**	
2.2	Environmentally Preferable Products	8
MR 3	**Waste Management**	
3.2	Construction Waste Reduction	2
	total MR points of 16 points possible	**14**

Indoor Environmental Quality

EQ 2	**Combustion Venting**	
2.2	Enhanced Combustion Venting Measures	2
EQ 3	**Moisture Control**	
3.0	Moisture Load Control	1
EQ 4	**Outdoor Air Ventilation**	
4.2	Enhanced Outdoor Air Ventilation	2
4.3	Third-Party Performance Testing	1
EQ 5	**Local Exhaust**	
5.2	Enhanced Local Exhaust	1
5.3	Third-Party Performance Testing	1
EQ 6	**Distribution of Space Heating and Cooling**	
6.3	Multiple Zones	2
EQ 8	**Contaminant Control**	
8.1	Indoor Contaminant Control during Construction	1
8.3	Preoccupancy Flush	1
EQ 10	**Garage Pollutant Protection**	
10.4	Detached Garage or No Garage	3
	total EQ points of 16 points possible	**15**

DRAFT

Awareness and Education

AE 1	**Education of the Homeowner or Tenant**	
1.2	Enhanced Training	1
1.3	Public Awareness	1
	total AE points of 3 points possible	**2**
	total LEED points	**106**
		Platinum

Project Information

Number of stories	1	Type of building	Single detached
Number of bedrooms	1	Type of builder	Custom
Number of homes in project	1	Floor Area (square feet)	768 sf.
IECC climate Zone	4	Home Size Adjustment	-10 pts.
EPA Radon Zone	1	EA Pathway	Performance

Certification Levels (after home size adjustment)

Certified: 35 - 49
Silver: 50 - 64
Gold: 65 - 79
Platinum: 80 - 136

LEED for Homes: Platinum

A LEED for Homes Platinum rating will be a landmark achievement for the University of Tennessee. This will be the first LEED Platinum project in the university building stock and only the sixth LEED for Homes Platinum project in the state of Tennessee.

LEED: Innovation + Design [ID]

The Innovation and Design category rewards efforts for preliminary planning, coordination, and design innovations.

Innovation and Design Process

ID 1	**Integrated Project Planning** [Max. Points 4]	
1.1	Preliminary Rating	PREQ
1.2	Integrated Project Team	1
1.3	Professional Credentialed with LEED for Homes	1
1.4	Design Charrette	1
1.5	Building Orientation for Solar Design	1
ID 2	**Durability Management Process** [Max. Points 3]	
2.1	Durability Planning	PREQ
2.2	Durability Management	PREQ
2.3	Third-Party Durability Management Verification	3
ID 3	**Innovative or Regional Design** [Max. Points 4]	
3.1	Exemplary Performance: MR 2.2	1
3.2	Exemplary Performance: MR 2.2	1
3.3	Exemplary Performance: SS 2.2/2.5	1
3.4	Exemplary Performance: MR 1.5	1
*3.5	Innovation: Monitoring and Evaluation	0
*3.6	Exemplary Performance: MR 2.2	0
*3.7	Exemplary Performance: WE 2.3	0
*3.8	TWACS Smart Meter	0
*3.9	Credential Professional	0
	total ID points of 11 points possible	**9**

ID

* LEED for Homes does not recognize credits past ID 3.4

ID 1.1
preliminary rating

APPROACH+IMPLEMENT

The New Norris House project meets the ID 1.1 prerequisite by satisfying the below credit requirements.

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(LEED for Homes Reference Guide, 2008)

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CREDIT REQUIREMENTS

A. Conduct a preliminary LEED for Homes meeting, with the participation of key members of the project team
B. Target LEED for Homes Platinum award level
C. Indentifiy LEED for Homes credits to meet targeted award level
D. Select party accountable for meeting the LEED for Homes requirements for each selected credit

prerequisite

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ID 1.2
integrated project team

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for ID 1.2 by satisfying the below credit requirements.

Designing and constructing a home using an integrated approach can reduce the frequency and signifigance of errors in design. It is not uncommon for the various trades to act independently, leading to ad hoc on-site fixes that are inefficient and sometimes ineffective. Integrated project planning improves coordination, leading to reduced construction costs and fewer problems that lead to call-backs.

(LEED for Homes Reference Guide, 2008)

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CREDIT REQUIREMENTS

A. Project team members have backgrounds in Architecture, Landscape Architecture, Interior Design, Mechanical Engineering, Civil Engineerng, Planning, and Sustainable Design
B. The team worked together during all phases of design and construction
C. Full project team meetings occurred at least weekly. (Typically every Monday, Wednesday. and Friday in a collaborative design studio setting.)

VERIFICATION + SUBMITTIALS

*1 Full project team spreadsheet

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ID 1.2

* see appendix

ID 1.4
design charrette

1 point

APPROACH + IMPLEMENT
The New Norris House project earns 1 points for conducting a LEED design charrette, meeting the requirements of ID 1.4.

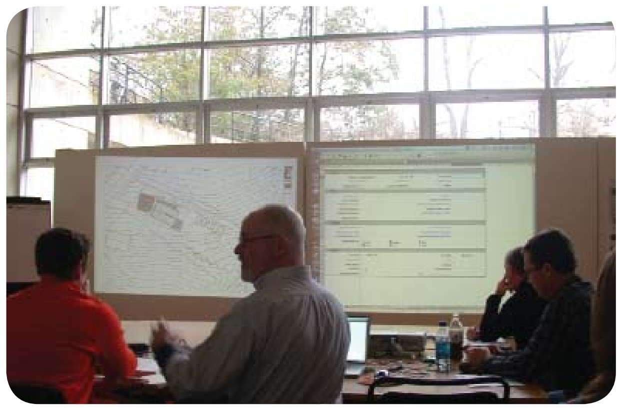
Improved upfront design can often yield signifigant environmental benefits at a much lower cost than a high-technology alternative. Examples are provided in various credits throughout the Rating System and include measures like advanced framing techniques, compact plumbing design, low-maintenance landscapingl passive solar design, and proper building orientation.

(LEED for Homes Reference Guide, 2008)

The design charrette happened at a key phase in the project's development. After the partnership with Clayton Homes was finalized in December 2010, the design was already well into the design development phase. This necessitated many changes to meet the production requirements of working with a modular builder and the LEED charrette helped set the tone for these alterations and finalizations over the course of the next eight months.

IMPLEMENTATION
Charrette Date: January 29, 2010
Location: University of Tennessee, Art+Architecture Building Reading Room

VERIFICATION + SUBMITTIALS
*2 A New Norris House LEED Charrette, Participant List



Bruce Glanville, LEED Green Rater, conducts LEED charrette with project team. Many students from college who were not participating with project came to observe and learn about the LEED process. (above)

Bruce Glanville discusses implications of site related credits within Sustainable Site category. (left)

ID 1.4

* see appendix

ID 2.1
durability planning

APPROACH + IMPLEMENT

The New Norris House project meets the ID 2.1 prerequisite by developing a durability plan based on regional and site specific evaluation criteria.

All homes eventually suffer problems or failures because of moisture (indoor or outdoor, too much or too little), pests, and/or storm damage. Builders who evaluate and address durability risks during the design process are more likely to produce a home with fewer failures, and any failures that do occur will be less damaging and less expensive for the occupant to fix.

(LEED for Homes Reference Guide, 2008)

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VERIFICATION + SUBMITTIALS

*3 LEED for Homes, Durability Evaluation Form
Completed by project team

*4 LEED for Homes, Durability Inspection Checklist
Completed by project team; Checked off by builder/ green rater

prerequisite

Footing drains were properly detailed and installed. Also seen here, sub-grade foundation walls have been waterproofed. (above)

A steel overhang shades large windows on the southern facade. Interior shades within also contribute to UV management. (left)

ID 2.1

ID 2.2
durability management

prerequisite

APPROACH + IMPLEMENT

The New Norris House project meets the ID 2.2 prerequisite by developing and implementing a durability management plan.

Durability management is designed to ensure that the design decisions related to durability are implemented properly during construction. For this reason, durability management processes should go hand-in-hand with on-site training of trades and crew members.

(LEED for Homes Reference Guide, 2008)

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VERIFICATION + SUBMITTIALS

*4 LEED for Homes, Durability Inspection Checklist
Completed by project team; Checked off by builder/ green rater

The skylight curb is flashed and sealed. This component was identified early as a potential durability concern and was thoroughly addressed in shop drawings and roofing specifications. (above)

An insect screen is applied to horizontal furring. The insect screen will prevent "mud daubers" (the common name for several regional species of wasps) from nesting behind rain screen siding. (left)

ID 2.2

* see appendix

ID 2.3
third party durability verification

3 points

APPROACH + IMPLEMENT

The New Norris House earns 3 point for obtaining third party verification of the durability checklist, satisfying the credit requirements of ID 1.4.

Third-party verification of the durability measures should be conducted by the Green Rather, and should consist of inspections and observations of each measure ont he durability inspection checklist. The Green Rater can provide feedback and insight about the durability measures, but it is not the role of the Green Rather to verify or validate either the choice of durability measures or the effectiveness with which they were implemented.

(LEED for Homes Reference Guide, 2008)

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VERIFICATION + SUBMITTIALS

*4 LEED for Homes, Durability Inspection Checklist
Completed by project team; Checked off by builder/ green rater

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ID 2.3

* see appendix

ID 3.1 + 3.2
Exemplary Preformance: MR 2.2

2 points

** beyond maximum exemplary performance credit, see ID 3.6

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for the specification and installation of 20 environmentally preferable components, satisfying the exemplary performance requirements of MR 2.2.

Environmentally preferable products have reduced environmental impact compared with conventional alternatives. Many new products are less harmful to the environment and to humans because they are sustainably produced, include recycled content, are rapidly renewable, or have lower emissions. Products procured from local sources require less transport. The use of these materials can significantly improve the overall environmental performance of the home.

(LEED for Homes Reference Guide, 2008)

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VERIFICATION + SUBMITTIALS

*5 Environmentally Preferable Products Spreadsheet MR2.2

*6 Accountability form signed by the project team indicating that each component represents the required percentage of applicable content

Paints and Coatings

The New Norris House project earns 0.5 points for the specification and installation of multiple low emmission paints and coatings.

Interior Architectural Paints and Coatings

Sherwin Williams Premium Wall and Wood Interior Latex Primer (Flat; Cabinets, Doors, and Walls)
41g/L VOC

KILZ 2 Low VOC Latex Primer (Flat, Walls)
10g/L VOC

Sherwin Williams PROMAR® 200 Zero VOC Interior Latex Semi-Gloss, Ultradeep Base (Non-flat, Walls)
0g/L VOC

Sherwin Williams, ProClassic Interior Acrylic Latex, Semi-gloss (Non-flat, Cabinets and Doors)
145g/L VOC

Floor Coatings

Osmo 5125 Polyx Professional Hardwax Oil (Floor)
50g/L VOC

0.5 pts

Decking and Patio

US Gypsum SHEETROCK®MH Brand
25% recycled content.
Bridgeport, Alabama (XXX miles)

0.5 pts

ID 3.1

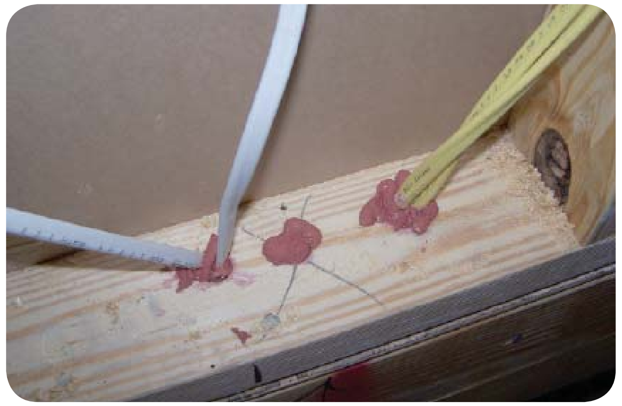
* see appendix

ID 3.1 + 3.2
Exemplary Preformance: MR 2.2

Adhesives and Sealants

0.5 pts

The New Norris House project earns 0.5 points for the specification and installation of multiple low emmission paints and coatings.



Alpha P5101 (Drywall and Panel Adhesives)
0.000001g/L VOC content

ITW T.A.C.C F6400LVR (Drywall and Panel Adhesives
GREENGUARD

DAP Alex Plus Arcylic Latex Caulk
39.1g/L content

DOW Corning 795 Silicone Building Sealant
30g/L VOC content

TEC Accucolor Unsanded Siliconized Arcylic Caulk
28g/L VOC content

GE Silicone I Kitchen/Bath Caulk
36g/L VOC content

DOW Great Stuff: Gap and Crack Foaming Sealant
133g/L

Interior Doors

1 pt

The New Norris House project earns 0.5 points for the specification and installation of urea-formaldehyde free, Forest Service Certifed MDF in the fabrication of custom made bypass and pocket doors.

Flakeboard, Medium Density Fiber Board
FSC, Urea-Formaldehyde free
Bennettsville, South Carolina (353 miles)

2 point

Counters

1 pt

The New Norris House project earns 1 point for the specification and installation of locally produced, reclaimed butcher block.

Reclaimed Butcher Block
Venore, Tennessee (100 miles)

Trim

0.5 pts

The New Norris project earns 0.5 points for the specification and installation of locally harvested poplar trim.

XXX, North Carolina (XXX miles)

ID 3.2

Cabinets

0.5 pts

The New Norris House project earns .5 points for the specification and installation locally harvested wood.

United Forest Products, Purebond Plywood (75%)
Urea-Formaldehyde free
Old Fort, North Carolina

Flakeboard, Medium Density Fiber Board (25%)
FSC, Urea-Formaldehyde free
Bennettsville, South Carolina (353 miles)

ID 3.3
Exemplary Preformance: SS 2.2/2.5

1 point

APPROACH + IMPLEMENT

The New Norris House satisfies the below requirements of SS2.2, which in conjunction with the successful completion of SS2.5, earns 1 point for ID 3.3

Many conventional practices, such as planting turf in sloped areas, can lead to an unsustainable site that requires considerable water, chemicals, and time to maintain. The use of drought-tolerant species and the application of mulch reduce irrigation demand and conserve local and regional potable water resources.

(LEED for Homes Reference Guide, 2008)

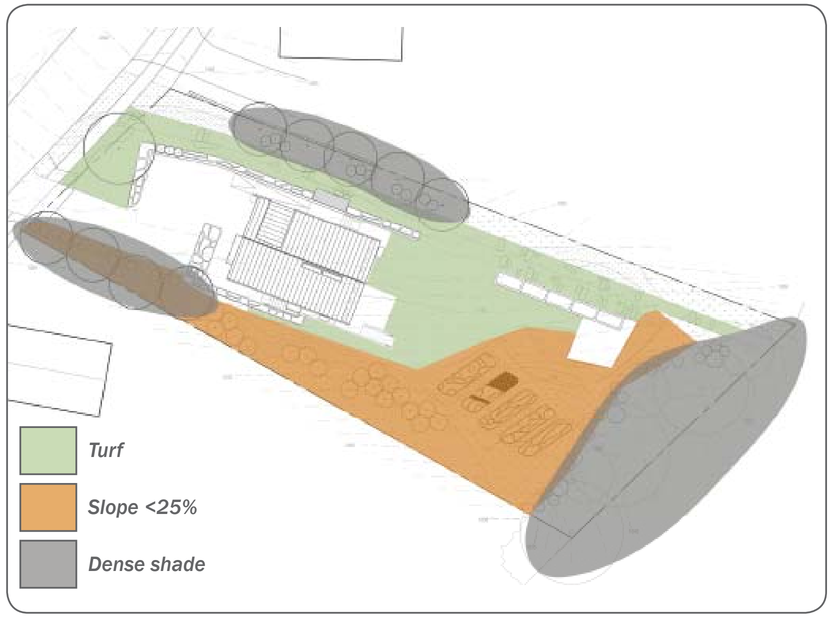
The landscape design for the site utilized an integrated and innovative approach. Rain and greywater storage and filtration was combined with older methodologies, such as a hand pump and raised vegetable beds, to create a simple, yet efficient, on-site water management system. Improving the on-site species diversity while maintaining a modern aesthetic was another component of the design. Many of these texturally and chromatically interesting plantings also serve to filter and absorb storm water on site, prevent soil erosion, and provide diverse habitat and forage for other forms of life. Deciduous trees planted along the west side shade the house through the summer months and allow for the sun to warm the structure during the winter. All hardscape materials are locally sourced, durable, and permeable in the areas where they are covering soil. The pre-existing drainage swales, along the road on the south side of the property, and near the woodland on the north side, have been re-graded and re-vegetated. Now, instead of rapidly channeling it away, the swales slow and treat the on-site storm water, including sheet flow from properties and town infrastructure uphill from the site. The turf grass selected (Zenith Zoysiagrass) requires no extra irrigation post-germination, is non-invasive, and only has to be mowed monthly during the growing season.

CREDIT REQUIREMENTS

A. Do not use turf in densely shaded areas
B. Do not use turf in areas with a slope of 25%
C. Add mulch or soil amendments as appropriate

VERIFICATION + SUBMITTALS

*6 Accountability form signed by the project team indicating that the credit requirements have been met.



Terraced bio-retention beds planted with native vegetation (top-left)

eaque exceperit est et aut lant il is repra qu (top-left)

eaque exceperit est et aut lant il is repra qu (top-left)

ID 3.3

ID 3.4
Exemplary Preformance: MR 1.5

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for ID 3.4 by satisfying the below credit requirements.

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IMPLEMENTATION

A. Stud spacing greater than 16” OC - 1 point
B. Ceiling joist spacing greater than 16” OC - 1/2 point
C. Floor joist spacing greater than 16” OC - 1/2 point
D. Roof rafter spacing greater than 16” OC - 1/2 point

ID 3.4

Modular units are set on-site
24” O.C. roof joist spacing (top-left)

Modular units in Clayton facility
24” O.C. stud spacing (middle-left)

24” O.C. ceiling joist spacing (top-right)

Typical 16” framing model (bottom-left)

24” O.C. advanced framing model
17% reduction of lumber (left)

* see appendix

ID 3.5
Innovation: Evaluation

0 points

APPROACH + IMPLEMENT

The New Norris House earns no points for this innovation, as all possible ID 3 points have already been earned.

As part of the fourth and final phase of the project, a comprehensive year long evaluation period has begun. As part of this multi-faceted effort, graduate students from the University of Tennessee, in conjunction with two live-in subjects, will be evaluating, monitoring, and recording qualitative and quantitative information about the home.

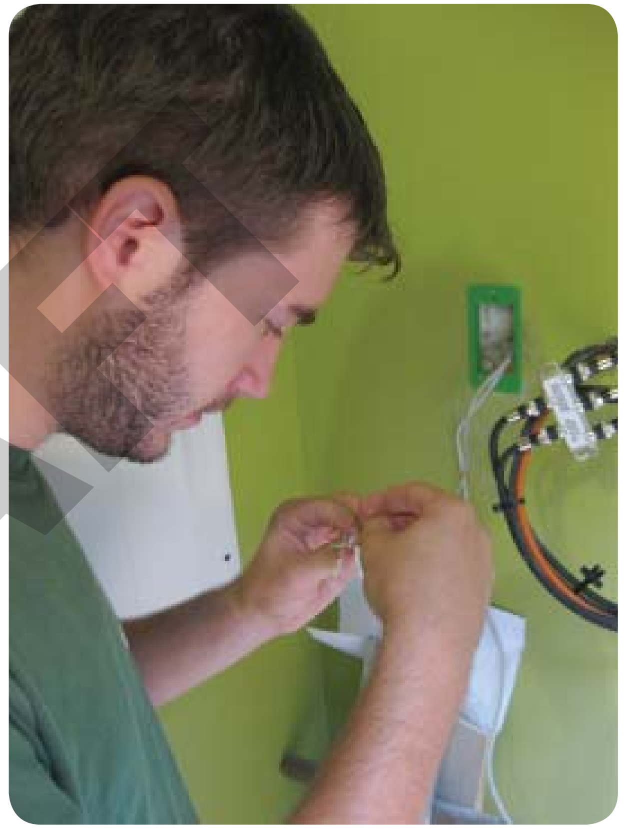
IMPLEMENTATION

Partnering with Oak Ridge National Laboratory, a sophisticated energy monitoring system has been installed for use duing the research period. Automated monitoring will include an outdoor weatherstation, indoor temperatures and RH, efficiency of ERV, efficiency of hot-water system, electrical usage in house of all major applicances, mechanical systems, and plug loads. Furthermore, extensive water quality testing and usage rates will be evaluated for both the greywater and rainwater systems. All findings will be broadcast across and array of academic, industry, and social networks.

Live-in subjects have been tasked with the evaluation of day to day life in the home and the documentation of all experiential aspects. As part of these efforts, they will be regularly blogging and posting related media.

VERIFICATION + SUBMITTIALS

*7 A New Norris House Monitoring Plan and Installed Equipment List



Students worked with ORNL researchers and installed monitoring equipment and hardware (top-left)

Temperature and RH are monitored inside the home. The sensors hidden where possible and allow day-to-day life to proceed regularly. (top-right)

Current transducers are installed on the panelboard to monitor individual breaker loads. Utilizing the eMonitor suite of software and hardware to monitor power use, data acquisition and subsequent interpretation has been made easy. (left)

ID 3.4

ID 3.6
Exemplary Preformance: MR 2.2

APPROACH + IMPLEMENT

The New Norris House earns no points for this innovation, as all possible ID 3 points have already been earned.

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Insulation

The New Norris House project earns 0.5 points for the specification and installation of multiple low emmission paints and coatings.
The New Norris House project earns 0.5 points for the specification and installation of multiple low emmission paints and coatings. The New Norris House project earns 0.5 points for the specification and installation of multiple low emmission paints and coatings.

Icynene L-D-R50 (Roof and foundation rim)

Johns Manville Kraft Face (walls)

Harborlite 400, Perlite (Foundation cores)

John Manville Polyisosyanurate (Ceiling, Walls, Foundation)

0 points

Sheathing (Floors, Walls, and Roof)

Norbord Windstrom

1 pt

DWH Supply Piping

NIBCO Durapex piping system

Driveway

Though not recognized by LEED for Homes, the New Norris House project has installed a driveway of locally quarried limestone gravel.

#57 Gravel
Heiskell, Tennessee (10 miles)

#7 Gravel
Maynardville, Tennessee (21 miles)

ID 3.6

ID 3.7
Exemplary Preformance: WE 2.3

APPROACH + IMPLEMENT

The New Norris House earns no points for this innovation, as all possible ID 3 points have already been earned.

Landscape irrigation practices in the United States consume large quantities of potable water. Outdoor uses, primarily landscaping, account for 30% of the 26 billion gallons of water consumed daily in the United States. Irrigation typically uses potable water, even though nonpotable rainwater, greywater, or recycled water is equally effective. A holistic approach to landscape design can signifigantly reduce potable water sonsumption by focusing both on site-appropriate vegetation to reduce demand.

(LEED for Homes Reference Guide, 2008)

In order to reduce the demand for irrigation on site, a number of landscape features were implemented. Rainwater from the roof is collected in a 400-gallon cistern, located in the North side of the house, where it is filtered and pumped to the exterior hose bibs when needed. Overflow from this cistern is pumped to a second 200-gallon cistern, located within the structure of the planter beds. From here it can be hand-pumped into a watering can and used to water the adjacent vegetable and fruit crops. The other culinary plantings are herbs native to the Mediterranean, and are extremely drought-tolerant. From the vegetable beds, the excess rainwater is pumped to a series of terraced rain gardens, which also receive and treat grey water from the house. Although the plants in these beds thrive in moist to wet conditions, they are also species which can sustain long periods of drought by going dormant and re-emerging as moisture levels change. Zoysia grass, used in the turf areas, has little to no irrigation demand, post-germination. The remainder of the plantings, consisting mostly of native grasses, are adapted to the natural climatic patterns of the region and thrive in periods of abnormally high rainfall or extended drought. Although it is advised that a regular watering schedule be maintained during the first one to two years after planting, all of the species used require no extra watering once established.

0 points

VERIFICATION + SUBMITTIALS

*8 LEED for Homes Calculator for Percent Reduction in Outdoor Water Demand
Completed by project team

*9 Accountability form signed by the project team indicating that the installed landscape and irrigation system correspond to the design used in calculations

*10 Plant list for as specified and installed in New Norris House landscape
Completed by project team

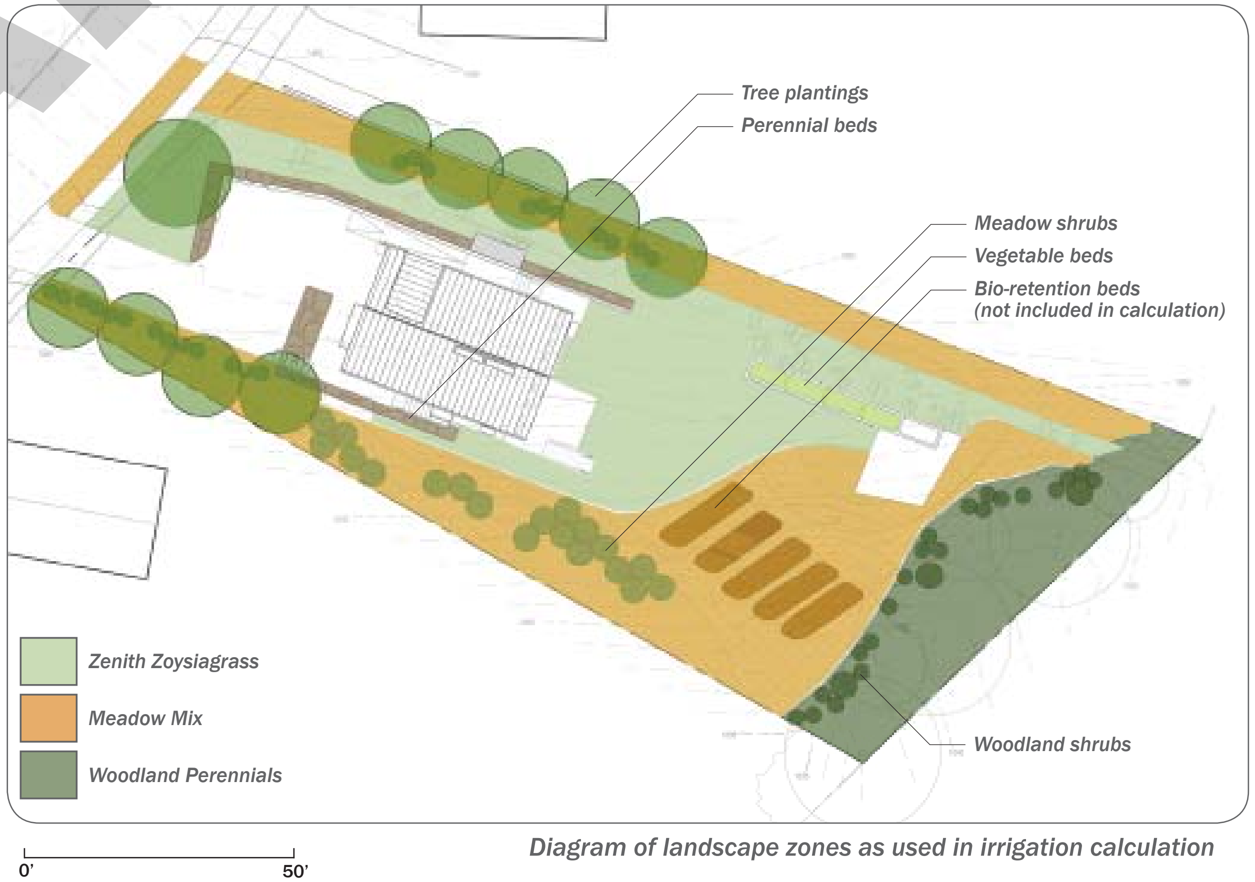

Diagram of landscape zones as used in irrigation calculation

ID 3.7

* see appendix

ID 3.8
TWACS Smart Metering

0 points

APPROACH + IMPLEMENT

The New Norris House earns no points for this LEED for homes pilot credit, as all possible ID 3 points have already been earned.

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* see appendix

ID 3.9
credentialed professional

0 point

APPROACH + IMPLEMENT

The New Norris House project team has one faculty advisor of the design team that is a LEED AP, as well as one student member. Additionally, another student member is a LEED Green Associate. As a project begun before LEED for Homes credentials became available, this ID 1.3 was not available for the project team to pursue.

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LEED ACCREDITED PROJECT MEMBERS

Ted Shelton, AIA, LEED AP; Assistant Professor, University of Tennessee
Registration # 48125

Nick Richardson, LEEP AP; University of Tennessee, MArch '10
Registration # 10118315

Clint Harris, LEED Green Associate; University of Tennessee, BArch '10
Registration # 10536496

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ID 1.3

LEED: Location + Linkages [LL]

Location and Linkages credits reward builders for selecting home sites that have more sustainable land-use patterns and offer environmental advantages over convential developments.

Location and Linkages

LL 1	**LEED for Neighborhood Development** [Max. Points 3]	
1.0	LEED for Neighborhood Development *or LL2-6*	10
LL 2	**Site Selection** [Max. Points 2]	
2.0	Site Selection	2
LL 3	**Preferred Locations** [Max. Points 3]	
3.1	Edge Development *or LL3.2*	1
3.2	Infill	2
3.3	Previously Developed	1
LL 4	**Infastructure** [Max. Points 1]	
4.0	Existing Infrastructure	1
LL 5	**Community Resources / Transit** [Max. Points 3]	
5.1	Basic Community Resources/ Transit *or LL5.2*	1
5.2	Extensive Community Resources/ Transit *or LL5.3*	2
5.3	Outstanding Community Resources / Transit	3
LL 6	**Access to Open Space** [Max. Points 1]	
6.0	Access to Open Space	1
	total LL points of 10 points possible	**10**

LL

LL 2.0
Site Selection

APPROACH + IMPLEMENT

The New Norris House project earns 2 points for LL 2.0 by satisfying the below credit requirements.

Careful cummunity designs can integrate the natural surroundings with the neighborhood, providing a strong connection between the built and natural environments and minimizing adverse impacts on the nonbuilt portions of the site. This credit rewards builders for choosing building sites that avoid environmentally sensitive areas or contain precious resouces (e.g., prime farmlands, unaltered land, wildlife habitat).

(LEED for Homes Reference Guide, 2008)

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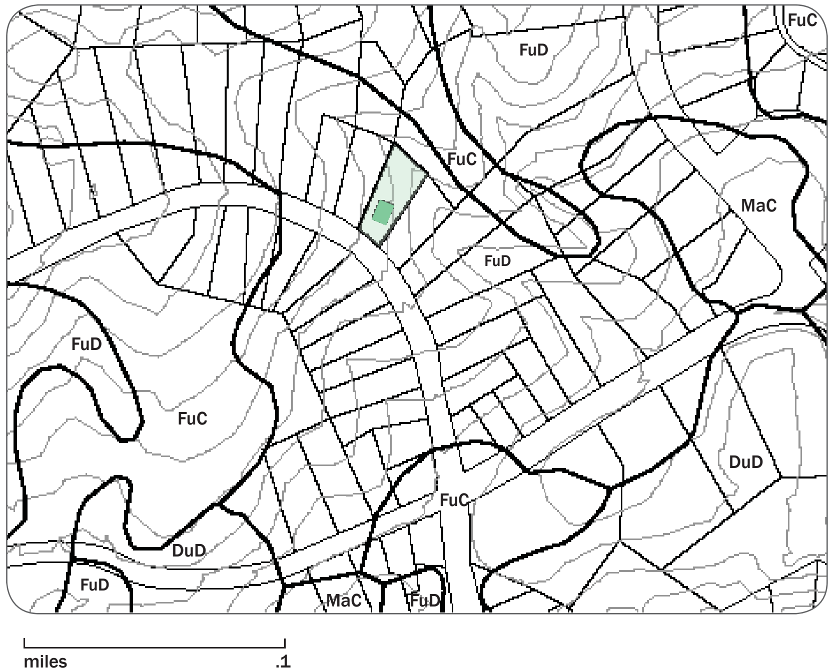
CREDIT REQUIREMENTS

A. Site elevation is at not or below the 100-year floodplain
B. Land is not specifically identified as habitat for species on federal or state endangered lists
C. Land is not within 100 feet of any water, including wetlands as defined by US Code of Federal Regulations
D. Prior to acquisition for the project, land was not public parkland
E. Land doesn't contain 'prime soils' or 'unique soils'

VERIFICATION + SUBMITTIALS

*6 Signed by the project team indicating the soil and site data meets all stipulations of the credit

2 points



After soil type was identified, more indepth analysis took place to determine permeablity. This was particularly relevant in sizing and estimating the feasability of the bio-retention beds. (above)

Soil map indicates variety of soils in immediate context- none of which are considered prime or unique. Also, as shown, site selection exceeds minimum 100' buffer from nearest natural water source. (left)

LL 2.0

LL 3.2
infill

APPROACH + IMPLEMENT

The New Norris House project earns 2 points for bordings at least 75% previously developed land, satisfying the credit requirements of LL 3.2.

Frequently, new developments are located remote from existing communities. Such communities often fragment habitat or farmland, usually require extensive expansion of basic infrastructure and community services, and typically force their residents to rely solely on cars for all transportation needs. Infill sites within exisiting neighborhoods have a low environmental impact by promiting the efficient use land.

(LEED for Homes Reference Guide, 2008)

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CREDIT REQUIREMENTS AND CALCULATION

A. At least 75% of the site perimeter must immediately border previously developed land

Perimeter 510'
Previously Developed 423' (South, East, and West edges)
Percentage 83%

2 points

View of home down Oak Road. As a previously developed, infill site, three edges of site perimeter were developed many years ago when the city of Norris was built in 1933. (above)

Diagram of developed perimeter edges, totaling 83% of total. (left)

LL 3.3
previously developed

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for building on a previously developed lot, satisfying the credit requirements of LL 3.3.

The location of a new development can have a large environmental impact. The best strategies are to avoid developing previously undisturbed areas. This minimizes environmental impact because it prevents further loss or fragmentation of wetalnds and habitat and minimizes the need for new impervious cover that increases stormwater runoff.

(LEED for Homes Reference Guide, 2008)

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1 point

View of previously exisiting home from bottom corner of site. This steep slope now supports a series of bio-retention beds which process all stormwater and grey-water on-site. (top-left)

View of interior of home. (middle-left)

View of previous home from street level (left)

View of interior of home. Concrete block structure has been stripped of interior finishes and was found in general disrepair. (above)

LL 4.0
existing infrastructure

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for its 1/2 mile proximity to exisiting water and sewer lines, satisfying the credit requirements of LL 4.0.

Locating near existing infrastructure reduces or obviates the need for further infrastructure development, which saves materials and embedded energy. Sites near existing water and sewer lines are also likely to have other infrastructure, including roads, electrical power, and natural gas.

(LEED for Homes Reference Guide, 2008)

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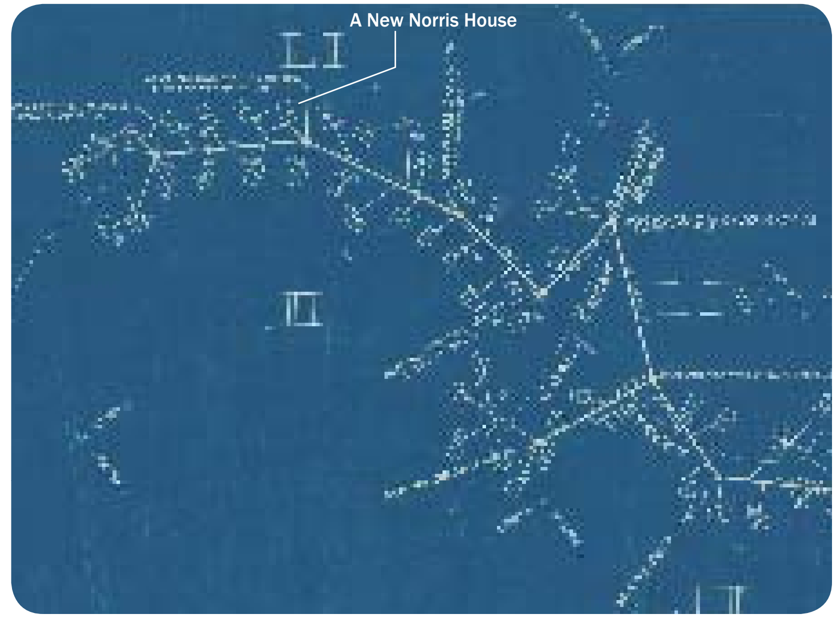

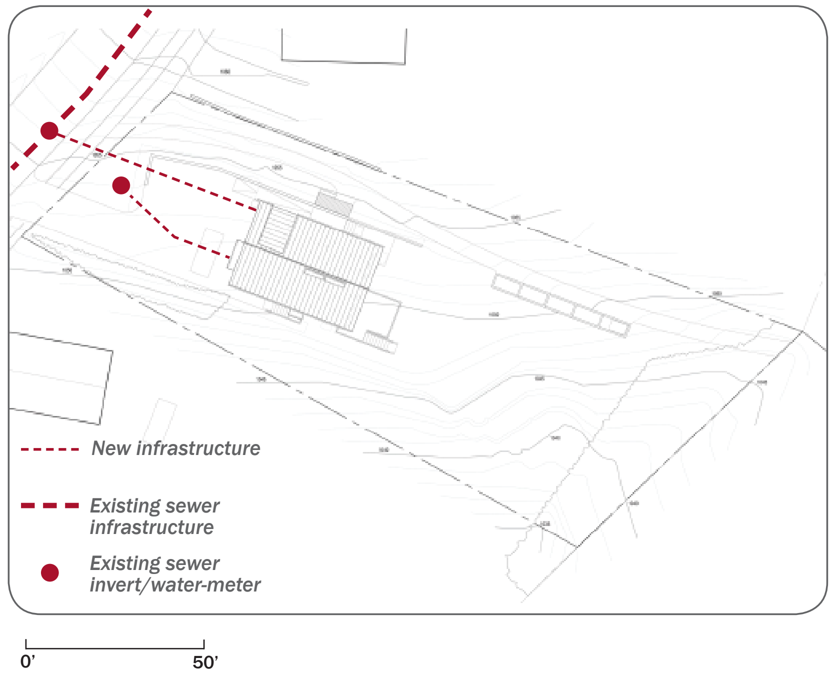

Apart from water infrastructure, much of the other original infrastructure from 1933 still remains. Hand set stone culverts and detached walking paths parallel every street in Norris. (top-left)

Original sewer plans from 1933 which still serve the community. The state of the aging system has aided the project team in developing partnerships with the city to treat greywater on-site. (top-right)

Diagram of exisiting sewer and potable water infrastructure. As a previously developed site, these lines have existed for many years. (left)

LL 5.3
outstanding community resources

3 of 3 points

APPROACH + IMPLEMENT

The New Norris House project earns 3 points for its 1/2 mile proximity to 14 basic community resources, satisfying the credit requirements of LL 5.3.

Locating housing in communities with nearby existing resources reduces the number of cars that households need and therefore reduces a family's overall expenses and time spent in the car. It also creates more vibrant neighborhoods with better access to employment centers, transportation systems, schools, shopping, general services, and civic amenities.

(LEED for Homes Reference Guide, 2008)

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COMMUNITY RESOURCES

A. Norris United Methodist Church
B. Norris Day School
C. St. Francis Episcopal Church
D. Regions Bank
E. Archers Food Center
F. Hensley Happenings
G. J. Dan Startup, DDS
H. United States Postal Service
I. Norris Service Station
J. Hensley Happenings Catering
K. Police and Fire Departments
L. Norris Community Library
M. Norris Middle School
N. Benchmark Physical Therapy

View of Norris town center. The town center is the center of most activity in town, largely due to the central location of the post office. Several years ago, the town was given the option of retaining on-street letter boxes, or losing their in town post office. By referendum Norris residents chose to keep their centrally located post office, and thus all Norris residents must cross paths daily to retrieve their mail. (above)

Plan of the City of Norris indicating the proximity of 14 basic community resources. The town center is exactly a 1/2 mile walk from the project site when utilizing the revitilized walking path. Present in original town plans, the path eroded over time, but has been reconstituted by the project team in effort to stregthen larger existing network of walking paths and trails. (left)

LL 5.3

LL 6.0
access to open space

APPROACH + IMPLEMENT

The New Norris House project earns 1 points for its 1/2 mile proximity to 3.58 combined acres of city park and undeveloped land, satisfying the credit requirements of LL 6.0.

Publically accessible green spaces promote outdoor activity, and provide calming and restorative settings, community gathering places, and space for environmental education. Open spaces also facilitate outdoor activity, leading to improved human health. Locating new housing close to exisiting open spaces can reduce residents need to drive and enjoy outdoor recreational activities.

(LEED for Homes Reference Guide, 2008)

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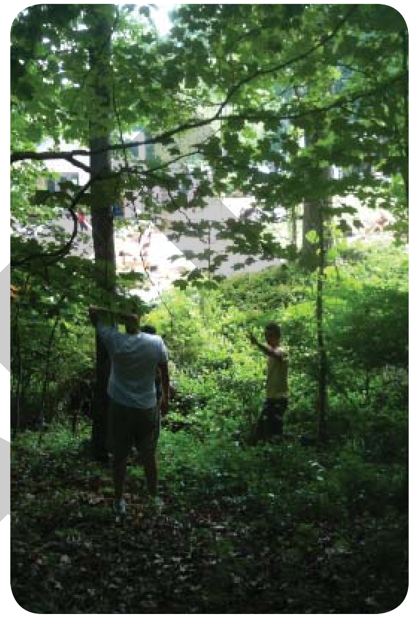
1 point



Undeveloped land to the North-east of the project site is held in a community land trust. In the town's inception a walking path went through this area, connecting Oak Road to a larger network of paths. This path has been reconstituted by the project team. (top-left)

A small city park, only a short walk from the project site. (top-right)

Diagram of open space proximity to project site. (left)

LEED: Sustainable Sites [SS]

The ways in which land is developed and energy allocated in the modern age have had devastating effects on the ecological networks in which we participate. The Sustainable Sites credits encourage proper planning and construction practices that minimize or eliminate the effects of site development upon the environment, both on-site and at a broader regional scale.

Sustainable Sites

SS 1	**Site Stewardship** [Max. Points 1]	
1.1	Erosion	PREQ
1.2	Minimize Disturbed Area of Site	1
SS 2	**Landscaping** [Max. Points 7]	
2.1	No Invasive Plants	PREQ
*2.2	Basic Landscape Design	2
2.3	Limit Conventional Turf	3
2.4	Drought Tolerant Plants	2
**2.5	Reduce Overall Irrigation Demand by at Least 20%	6
SS 3	**Local Heat Island Effects** [Max. Points 1]	
3.0	Reduce Local Heat Island Effects	1
SS 4	**Surface Water Management** [Max. Points 7]	
4.1	Permeable Lot	4
4.2	Permanent Erosion Controls	1
4.3	Management of Run-off from Roof	2
SS 5	**Nontoxic Pest Control** [Max. Points 2]	
5.0	Pest Control Alternatives	2
SS 6	**Compact Development** [Max. Points 4]	
6.1	Moderate Density	2
6.2	High Density	3
6.3	Very High Density	4
	total SS points of 22 points possible	**17**

SS

* exemplary performance credit earned, see ID 3.3
** exemplary performance credit earned, see WE 2.3 and ID 2.7

SS 1.1
erosion controls

APPROACH + IMPLEMENT

The New Norris House project meets the SS 1.1 prerequisite by satisfying the below credit requirements.

Site clearing and earth moving can contribute to considerable runoff, leading to soil erosion and alteration of natural drainage patterns both on- and off-site. Each year, roughly 80 to 100 tons of soil per arce are lost because of construction. This runoff can carry pollutants and debris to regional lakes and streams and damage stormwater management infrastructure. Proper measures can prevent soil erosion and preserve the quality of water in the surrounding areas.

(LEED for Homes Reference Guide, 2008)

The New Norris House project meets the SS 1.1 prerequisite by protecting the on-site soil quality as well as preventing pollution and contamination of off-site resources both during and after construction. Before construction, silt fencing was installed along the Eastern property line, at the toe of the slope, and along the treeline on the North end of the property. As construction proceeded, straw was spread to control surface run-off, check dams were built with stone and/or straw bales, and areas prone to erosion were lined with 12-month erosion control fabric, once seeded. Due to the steep nature of the site, with some areas exceeding 25% slope pre-construction, native grass meadows were designed along the western edge of the property to slow and absorb surface runoff from adjacent properties once entering the property. Also, a compacted soil and gravel strip between the road and sidewalk at the south end of the property has been converted into a meadow swale to catch and infiltrate runoff from the road. All areas exceeding 25% slope on the finished topography have been planted with native grasses, forbs, and shrubs to stabilize the soil and treat surface flow from rain events.

prerequisite

CREDIT REQUIREMENTS

A. Stockpile and protect disturbed soil from erosion (for reuse).
B. Control the path and velocity of runoff with silt fencing
C. If soils in a sloped area (25% slope or greater) are disturbed during construction, use tiers, erosion blankets, compost blankets, filter socks and berms, or some comparable approach to keep soil stabilized.
D. Protect on-site storm water inlets, streams and lakes with straw bales, silt fencing, silt sacks, rock filters or comparable measures.
E. Provide swales to divert surface water from hillsides.

SS 1.2
minimize disturbed area of site

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for developing a vegetation preservation plan with 'no-disturbance' zones. Furthermore, the lot has been rehabilitated by undoing previous soil compaction, restoring the natural swale, removing invasive plants, and meeting the requirements of SS 1.2.

On sites that may have been previously developed, preservation may not be the appropriate strategy. For example, brownfield sites may have unwanted paved areas or structures. In these cases, a project can earn points by remediating or rehabiltitating the portion of the site unaffected by construction.

(LEED for Homes Reference Guide, 2008)

To promote the future sustainability of the site, several diseased and invasive exotic trees were removed from the East and West edges of the property. The pre-existing ground strata of exotic turf grass species and noxious weeds, which covered the majority of the site, were eradicated during construction. A variety of exotic invasive shrub and vine species (as defined by the Tennessee Exotic Pest Plants Council) were removed from the forest edge on the Northern end of the property, using both physical and chemical means. The site will undergo monitoring and ongoing treatment to remove non-native invasive species as they emerge within the landscape. Invasive exotic species have severe impacts on the natural ecosystems of East Tennessee, as they out-compete native flora for resources and alter the diets of the indigenous fauna, thereby completely destroying the ecological web of a given habitat. Having adapted elsewhere, they have tend to have few, if any, natural checks and balances. Therefore, their populations and ranges can grow at an accelerated pace. Thus, it is up to man to identify, monitor, and eradicate these problem species. On our site, the species in question have been given designations by the Tennessee Exotic Pest Plant Council and the definitions for those classifications can be found in the appendix.

Invasive Removal

Severe Threat:
Elaeagnus umbellata, Autumn Olive
Ligustrum sinense, Chinese Privet
Pueraria montana var. lobata, Kudzu
Rosa multiflora, Multiflora Rose

Significant Threat:
Glechoma hederacea, Ground Ivy
Schedonorus phoenix, Tall Fescue
Vinca major, Greater Periwinkle

Lesser Threat:
Euonymus alatus, Burning Bush
Hibiscus syriacus, Rose of Sharon

Alert:
Mahonia beali, Oregon Grape

Apart from exotic species, several of the existing trees on-site were either dead or dying. Here a diseased ___ tree before removal. (top-left)

Chinese privet previously lined the east edge of the property. It has been removed and replaced with a native meadow mix. (top-right)

The most forbiding task in site remediation was the restoration of the natural swale area. Hidden underneath dense areas of kudzo were large amounts of debris, both natural and mad-made. (left)

SS 1.2

SS 2.1
no invasive plants

prerequisite

APPROACH + IMPLEMENT

The New Norris House project meets the SS 2.1 prerequisite by introducing no landscape species labeled ‘invasive’ by the Tennessee Exotic Pest Plant Council into the landscape.

Invasive species cause economic, environmental, and sometimes even human harm by killing established trees, clogging drainage systems, overtaking and destroying the natural plant ecosystems, including wetlands, and resisting control without toxic hericides. Nearly half of endangered species and endangered ecosystems in the country are signifigantly affected by invasive species.

(LEED for Homes Reference Guide, 2008)

With the exception of the canopy trees in the mature woodland on the North side of the property, the existing plant species on site were not indigenous to the United States. In order to create a sustainable site, their removal was mandatory. In designing the planting plan, careful attention was paid to the drought-tolerance, maintenance requirements, and invasive tendencies of the species selected. With the exception of culinary herbs, non-invasive turf grass, and a limited palette of Spring bulbs, the plants used are indigenous to the Southeastern U.S. and were sourced from a local native plant nurseries. For the dry sunny slopes, a diverse mixture of native grasses, wildflowers, and shrubs were used. Shade-tolerant shrubs, ferns, and wildflowers replaced the dense undergrowth of exotic plants along the woodland edge. Terraced gardens, specifically designed to treat, store, and allow for the infiltration of rainwater from the roof and grey water from the house, are planted with a variety of native wet meadow species that are tolerant of both rapid inundation and long periods of drought. Indigenous ornamental tree and shrub species, planted along the Eastern and Western flanks of the property, were chosen for more than just their aesthetic qualities; all provide immense benefit to the local fauna by providing food and shelter.

VERIFICATION + SUBMITTIALS

*10 Plant list for as specified and installed in New Norris House landscape
Completed by project team

*6 Accountablity form signed by the project team indicating that the plants installed match those on the list provide to the Green Rater

*11 “Invasive Plants Of Tennessee”, Second Edition (2008)
Prepared by the Tennessee Exotic Pest Plant Council

Bio-retention beds are filled with a variety of native species

SS 2.1

SS 2.5
reduce overall irrigation demand

APPROACH + IMPLEMENT

The New Norris House project earns 6 points for design and installation of an irrigation reducing landscape– calculated to require 66% less water than a baseline model, and exceeding the credit requirements of SS 2.5.

Landscape irrigation practices in the United States consume large quantites of potable water. Outdoor uses, primarily landscaping, account for 30% of the 26 billion gallons of water consumed daily in the United States. Irrigation typically uses potable water, even though nonpotable rainwater, greywater, or recycled water is equally effective. A holistic approach to landscape design can signifigantly reduce potable water sonsumption by focusing both on site-appropriate vegetation to reduce demand.

(LEED for Homes Reference Guide, 2008)

In order to reduce the demand for irrigation on site, a number of landscape features were implemented. Rainwater from the roof is collected in a 400-gallon cistern, located in the North side of the house, where it is filtered and pumped to the exterior hose bibs when needed. Overflow from this cistern is pumped to a second 200-gallon cistern, located within the structure of the planter beds. From here it can be hand-pumped into a watering can and used to water the adjacent vegetable and fruit crops. The other culinary plantings are herbs native to the Mediterranean, and are extremely drought-tolerant. From the vegetable beds, the excess rainwater is pumped to a series of terraced rain gardens, which also receive and treat grey water from the house. Although the plants in these beds thrive in moist to wet conditions, they are also species which can sustain long periods of drought by going dormant and re-emerging as moisture levels change. Zoysia grass, used in the turf areas, has little to no irrigation demand, post-germination. The remainder of the plantings, consisting mostly of native grasses, are adapted to the natural climatic patterns of the region and thrive in periods of abnormally high rainfall or extended drought. Although it is advised that a regular watering schedule be maintained during the first one to two years after planting, all of the species used require no extra watering once established.

6 of 6 points

* exemplary performance credit earned, see WE 2.3 and ID 2.7

VERIFICATION + SUBMITTIALS

*8 LEED for Homes Calculator for Percent Reduction in Outdoor Water Demand
Completed by project team

*9 Accountability form signed by the project team indicating that the installed landscape and irrigation system correspond to the design used in calculations

*10 Plant list for as specified and installed in New Norris House landscape
Completed by project team

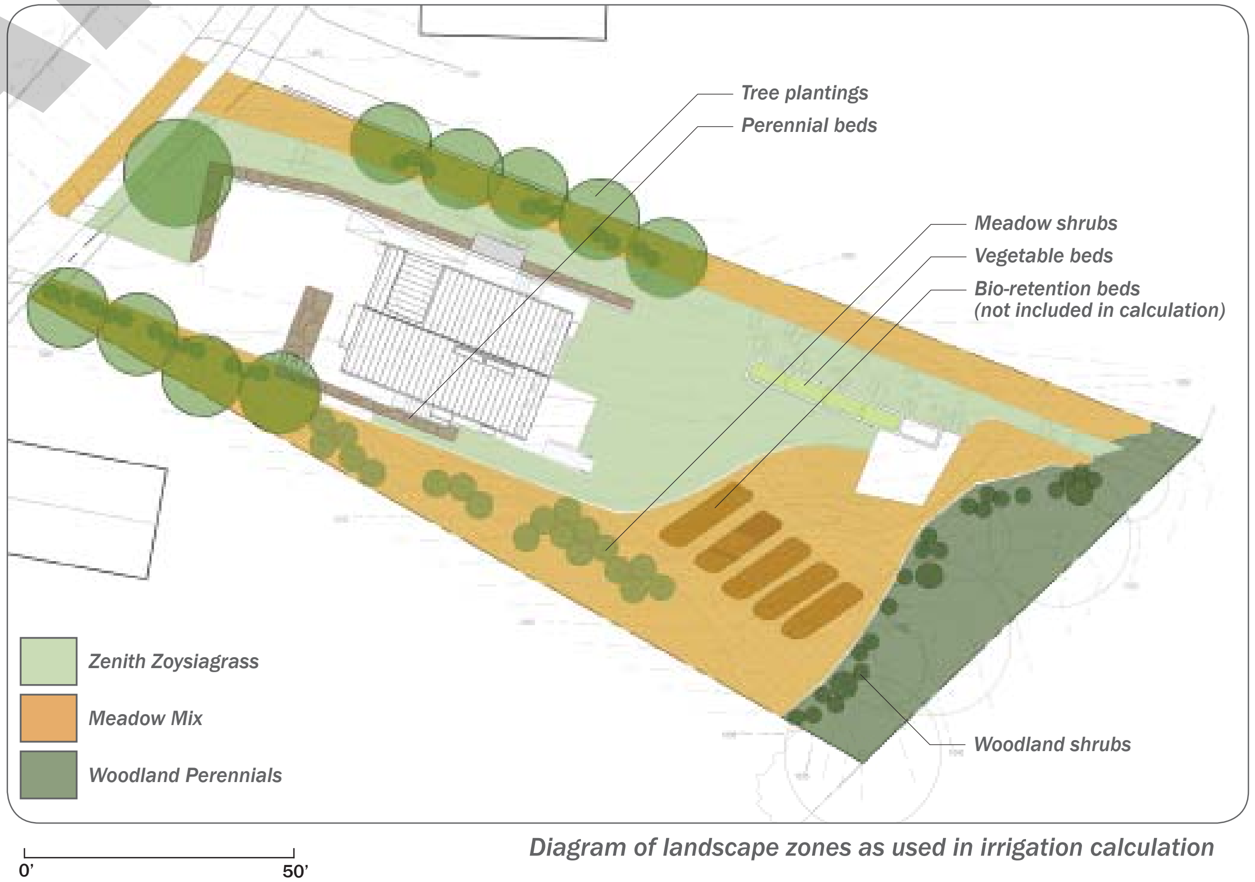


Diagram of landscape zones as used in irrigation calculation

SS 3.0
reduce local heat island effects

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for the design and installation of light-colored, high-albedo materials or vegetation for all sidewalks, patios, and driveways within 50 feet of the home, meeting the credit requirements of SS 3.0.

"Heat island effect" refers to the absorption of heat by hardscapes, such as pavement and buildings, and its radiation to the surrounding areas. The heat island effect causes higher temperatures, leading to increased demand for air-conditioning and potential disruption of local ecosystems. Reduction of heat island effect minimizes distrubance of local microclimates and reduces summer cooling loads, which in turn reduce energy use, ground-level ozone, greenhouse gas and smog generation, and infrastructure requirements.

(LEED for Homes Reference Guide, 2008)

After implementation of the landscape, the site has 89% vegetative cover. This significantly reduces the heat island effect, as plants not only shade the ground from excess heat absorption, but they also release moisture through transpiration and cool the surrounding air. The remaining 11% of the site, including the roof and hardscape elements, all use light-colored materials that reflect heat versus absorb it. Local gravel is processed from limestone bedrock, and thus is a chalky white to light gray color. The light gray concrete has the same substance as its main constituent. Factoring in their gradual fading over time, both the gravel and the concrete have an SRI factor of 35.

VERIFICATION AND SUBMITIALS

*6 Accountablity form signed by the project team indicating that the material choices meet the requirements of the credit

The aggregate used in the concrete retaining wall and gravel driveway is locally quarried limestone bedrock. This type of stone is chalky white in color and in both applications produces a solar reflectivity index (SRI) of 35. (top-left)

Parking court in front of house offsets typical application of asphault or poured concrete. (top-right)

Diagram indicates locations of hardscapes and material application. Gravel plinth in backyard is more than 50' away from home, and thus not included. (left)

SS 3.0

SS 4.1
permeable lot

APPROACH + IMPLEMENT

The New Norris House project earns 3 points for the design and installation of a 99% permeable lot, meeting the credit requirements of SS 4.1.

Runoff can be greatly reduced by maintaining a high level of permeability that creates the opprotunity for stormwater to infiltrate the ground on the project site. Increased permeability has multiple benefits: reduced transport of fertilizer and chemicals in runoff; reduced erosion of valuable topsoil, which is essential for healthy landscape plants; reduced sedimentation of downstream rivers and lakes; and replenishment of underground aquifers.

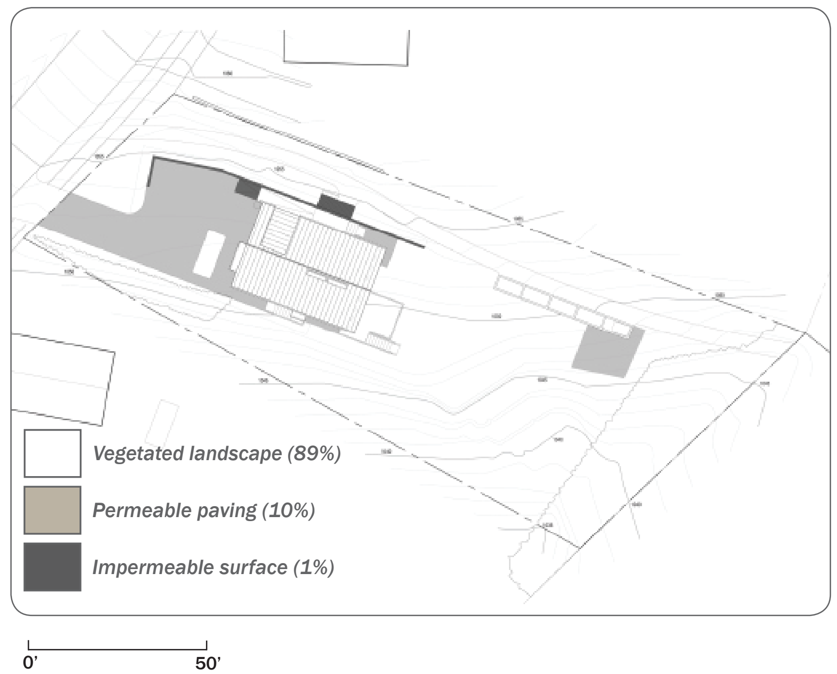
(LEED for Homes Reference Guide, 2008)

Efforts to minimize impermeable surfaces on the site have resulted in 99% permeability throughout. Using gravel for the driveway, forecourt, and plinth areas, as an alternative to paving, result in 100% rainwater absorption in areas that would typically produce runoff from sheet flow. Although sheet flow is still possible in mown turf areas, the extent of our lawn areas are completely surrounded by a mixture of meadow and shrub plantings which absorb more rainwater than do the turf areas. Post-construction, areas of compacted soil were de-compacted. Much of the exposed soil was loamy and rich in organic matter, which is loose and friable, thus allowing for quick infiltration. In areas of compacted clay soils, topsoil consisting of organic matter and sandy loam was added and worked into the strata. The sand constituent has a high percentage of pore space that allows water to move freely down into the soil. A similar sand/ compost mixture was used for the rainwater and grey water filtration beds, to fill the felt fabric beds with which the terraces are constructed, and to provide the growing media for the perennial beds. The swale areas along the road and at the edge of the woodland on the North flank of the property underwent a process of grading, soil de-compaction, and planting to slow the velocity of storm water and allow it to settle out before flowing off of the site.

3 of 4 points

VERIFICATION + SUBMITTIALS

*6 Accountability form signed by the project team indicating that the landscape features installed match those in the design



Gravel plinth in back yard (top-left)

A concrete block retaining wall is the only impermeable surface in the landscape (top-middle)

The majority of the landscape has been vegetated, allowing infiltation back into the water table (above)

Diagram showing various zones of permeability in the landscape (left)

SS 4.2
permanent erosion controls

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for the design and installation of terracing, sheet flow capturing ground cover, and shrubs on steep slopes to reduce long-term runoff effects, meeting the credit requirements of SS 4.2.

Many permanent erosion control features have been implemented on the site, due to the significant slope of the hillside on which it was constructed. To combat the potential for erosion on the rather precipitous site, plants were selected that have the capacity to hold soil in place rapidly and effectively. Native grasses, particularly the Bluestems, have complex fibrous systems that hold soil in place. Intermixed with the grasses on the steeper slopes and around drainage pipe outflows are native shrubs such as Gro-Low Fragrant Sumac, whose prostrate-spreading habits create a network of runners just below the soil surface, which freely sucker and create new root systems. Sloped areas planted with trees are under planted with other freely suckering shrubs, including Virginia Sweetspire, Sweetshrub, and Oakleaf Hydrangea. The steepest corner of the property is designed as a terraced bed system, and is also the location of the rainwater and grey water infiltration gardens. Excess water is held in each bed, where it either infiltrates quickly or flows into the next bed, where it either infiltrates or overflows yet again. The beds are designed to handle the most voluminous influxes of precipitation. Check dams, constructed of local stone, much of which was salvaged from the site itself, are placed in swale areas to allow for the slowing of runoff velocity and the deposition of silt during heavy rains. The silt can periodically be harvested from behind the dams and added, along with compost, back into the vegetable and rainwater beds, where its nutrient content can be beneficial to plant growth.

1 point

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SS 4.3
management of run-off roof

2 points

APPROACH + IMPLEMENT

The New Norris House project earns 2 points for the professional design and installation of permenant stormwater management controls, sized to manage all water runoff from the home through on-site design elements, meeting the requirements of SS 4.3.

Erosion problems are worsened by stormwater runoff from impervious surfaces, such as rooftops, decks, driveways, and paved walkways. Runoff not only erodes the soil, but also collects sediment containing nutrients from fertilizers and toxic chemicals from pesticides, all of which pollute the environment and lead to property damage, loss of fish and wildlife habitat, and reduced water quality in our lakes and streams.

(LEED for Homes Reference Guide, 2008)

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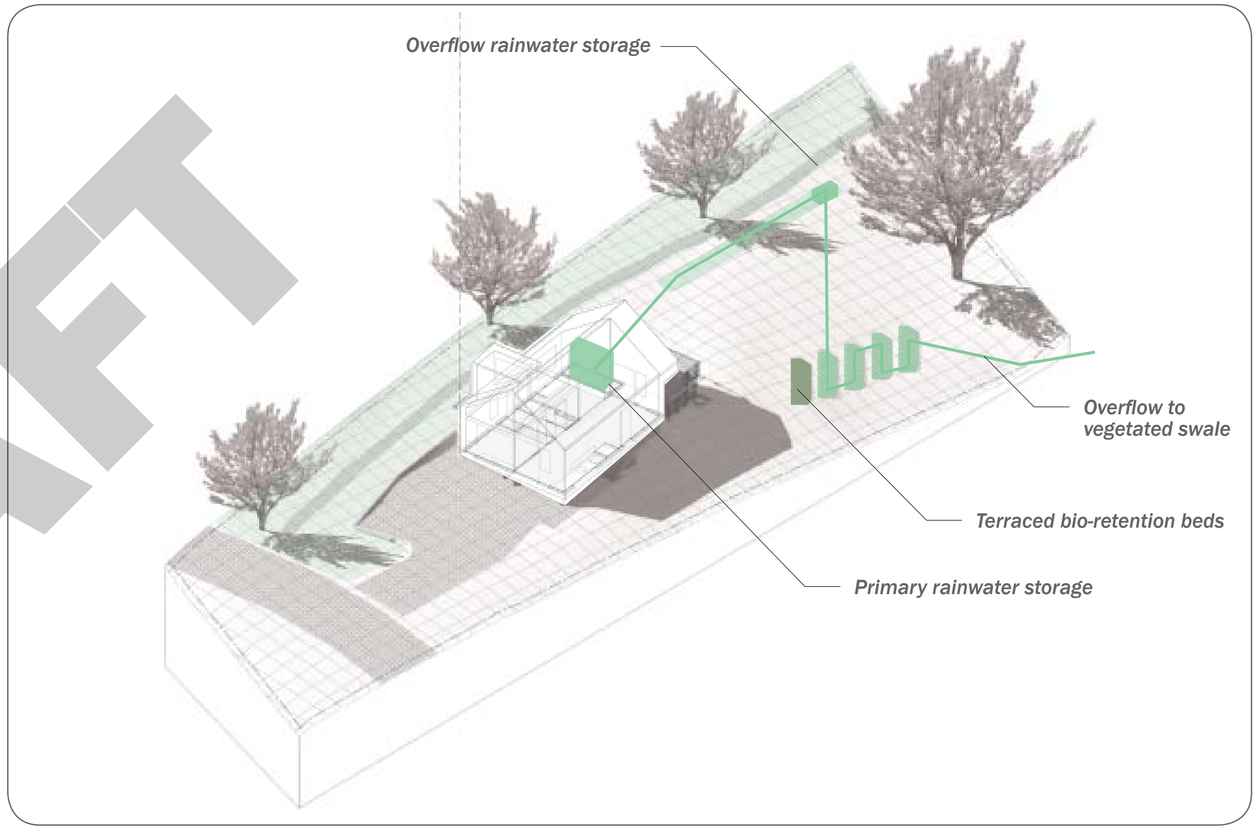
VERIFICATION AND SUBMITIALS

*12 Accountablity form signed by an engineering professional indicating that the features on the site are designed to manage all water runoff from the home.



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SS 4.3

SS 5.0
pest control alternatives

APPROACH + IMPLEMENT

The New Norris House project earns 2 points for the use of the following pest control alternatives, meeting the credit requirements of EQ 2.2.

Toxic chemicals, frequently used to control pests in homes, expose occupants to harmful or hazardous chemicals and practices. Proper placement and installation of physical barriers can help protect homes from termintes, ants, mice, and other pests.

(LEED for Homes Reference Guide, 2008)

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CREDIT REQUIREMENTS

A. Use of masonry wall with top course of solid concrete bond beam
B. Use of nontoxic termite bait system
C. Installing landscaping such that all parts of mature plants are at least 24 inches from home
D. All wood kept at least 12 inches above soil
E. Sealing all external cracks, joints, penetrations, edges, and entry points with caulking (where openings can't be caulked, rodent and corrosion-proof screens are installed)
F. The home also incorporates a bug screen into the exterior cladding

2 of 2 points

A typical operable window condition with all external cracks and joints adequately sealed (top-left)

Lowest siding to soil-grade elevation, 19" (middle-left)

Solid concrete bond beam is poured on-site. (left)

An insect screen has been integrated into the facade system to prevent flying insects from nesting behind the siding boards (above)

LEED: Water Efficiency [WE]

Water rights and increasingly short supplies of fresh water are making water efficiency more important than ever in the Southeast United States. While the original series of Norris homes emphasised the novelty of bringing running water into the home, the New Norris House has taken this a step further by decentralizing several facets of both water supply and treatment.

Water Efficiency

WE 1	**Water Reuse** [Max. Points 5]	
1.1	Rainwater Harvesting System	4
1.2	Greywater Reuse System	1
1.3	Use of Municipal Recycled Water System	4
WE 2	**Irrigation System** [Max. Points 4]	
2.1	High-Efficiency Irrigation System	3
2.2	Third-Party Inspection	1
*2.3	Reduce Overall Irrigation Demand by at least 45%	2
WE 3	**Indoor Water Use** [Max. Points 6]	
3.1	High-Efficiency Fixtures and Fittings	1
3.2	Very High Efficiency Fixtures and Fittings	4
	total WE points of 15 points possible	**11**

WE

* exemplary performance credit earned, see ID 3.3

WE 1.1
rainwater harvesting system

4 of 4 points

APPROACH + IMPLEMENT

The New Norris House project earns for 4 points for credit WE 1.1 by designing and installing a rainwater harvesting system to capture 85% of the total roof area. This water is distributed for use inside the home, as well as exterior rainwater gardens and hose bibs.

A rainwater harvesting system captures rainwater from a home site and stores it for future use. Such a system can signifigantly reduce or completely eliminate the amount of potable water used for irrigation and select indoor uses.

(LEED for Homes Reference Guide, 2008)

The New Norris House uses a rainwater harvesting system that collects water from 85% of the roof. This water is stored and directed to hose bibbs, the clothes washer, and to flush the toilet. The design team worked closely with state and local officials throughout the project to gain acceptance for this system, which is outside of the guidelines of existing regulations. The system includes both charcoal and UV filtration and should meet standards for potable use, though regulators would not allow it to supply interior faucets. Water quality will be monitored over the first year of occupancy and the results supplied to state and local officials in the hope that potable use of similar systems will be permitted in the future.

CALCULATIONS + TECHNICAL DATA

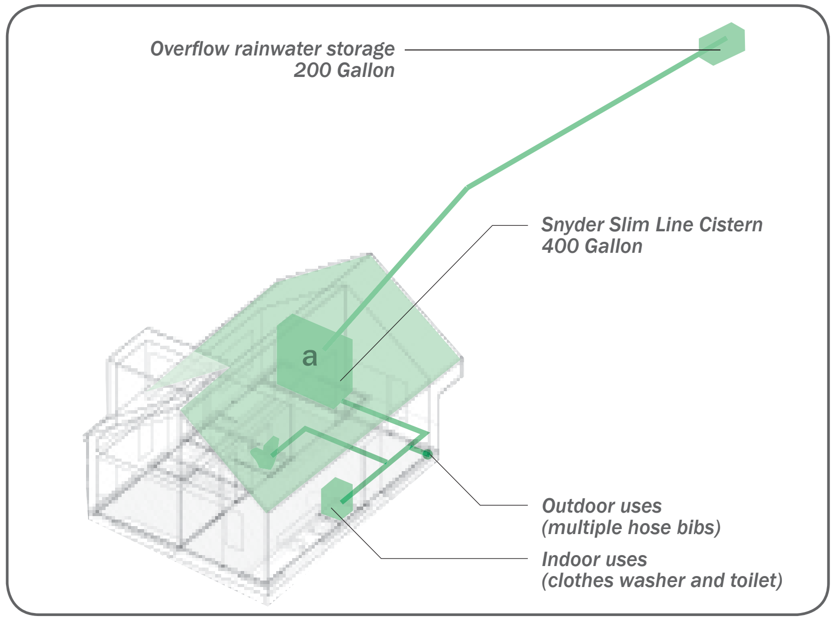
System Size (%) = Harvest Area / Total Roof Area
System Size (%) = 773 ft² / 910 ft²
System Size (%) = 85%

Minimum Storage Capacity= 0.62 Gal/ft² x Harvest Area
Minimum Storage Capacity= 0.62 Gal/ft² x 773 ft²
Minimum Storage Capacity= 479 Gallons
Actual Storage Capacity= 600 gallons

Storage tanks: Snyder Slim Line Above Ground cistern, 400 gallon
Chem-Tainer PCO Transport Tank, 200 gallon

VERIFICATION + SUBMITTALS

*18-22 Any equipment and product literature (e.g. user's manuals, brochures, specifications present in occupant operations and maintenance manual



Primary rainwater storage, treatment, and pumping equipment is housed in a dedicated mechanical space on the rear of the home. (top-left)

Diagram of rainwater harvesting system (top-right)

The secondary cistern, shown here, receives overflow rainwater from the primary system. This water is accessible via a handpump to water vegetable gardens. Once full, this cistern will overflow into the bio-retention beds in the landscape. (left)

WE 1.1

WE 2.3
reduce overall irrigation demand

APPROACH + IMPLEMENT

The New Norris House project earns 6 points for design and installation of an irrigation reducing landscape– calculated to require 66% less water than a baseline model, and exceeding the credit requirements of SS 2.5.

Landscape irrigation practices in the United States consume large quantites of potable water. Outdoor uses, primarily landscaping, account for 30% of the 26 billion gallons of water consumed daily in the United States. Irrigation typically uses potable water, even though nonpotable rainwater, greywater, or recycled water is equally effective. A holistic approach to landscape design can signifigantly reduce potable water sonsumption by focusing both on site-appropriate vegetation to reduce demand.

(LEED for Homes Reference Guide, 2008)

In order to reduce the demand for irrigation on site, a number of landscape features were implemented. Rainwater from the roof is collected in a 400-gallon cistern, located in the North side of the house, where it is filtered and pumped to the exterior hose bibs when needed. Overflow from this cistern is pumped to a second 200-gallon cistern, located within the structure of the planter beds. From here it can be hand-pumped into a watering can and used to water the adjacent vegetable and fruit crops. The other culinary plantings are herbs native to the Mediterranean, and are extremely drought-tolerant. From the vegetable beds, the excess rainwater is pumped to a series of terraced rain gardens, which also receive and treat grey water from the house. Although the plants in these beds thrive in moist to wet conditions, they are also species which can sustain long periods of drought by going dormant and re-emerging as moisture levels change. Zoysia grass, used in the turf areas, has little to no irrigation demand, post-germination. The remainder of the plantings, consisting mostly of native grasses, are adapted to the natural climatic patterns of the region and thrive in periods of abnormally high rainfall or extended drought. Although it is advised that a regular watering schedule be maintained during the first one to two years after planting, all of the species used require no extra watering once established.

4 of 4 points

VERIFICATION + SUBMITTALS

*8 LEED for Homes Calculator for Percent Reduction in Outdoor Water Demand
Completed by project team

*9 Accountability form signed by the project team indicating that the installed landscape and irrigation system correspond to the design used in calculations

*10 Plant list for as specified and installed in New Norris House landscape
Completed by project team

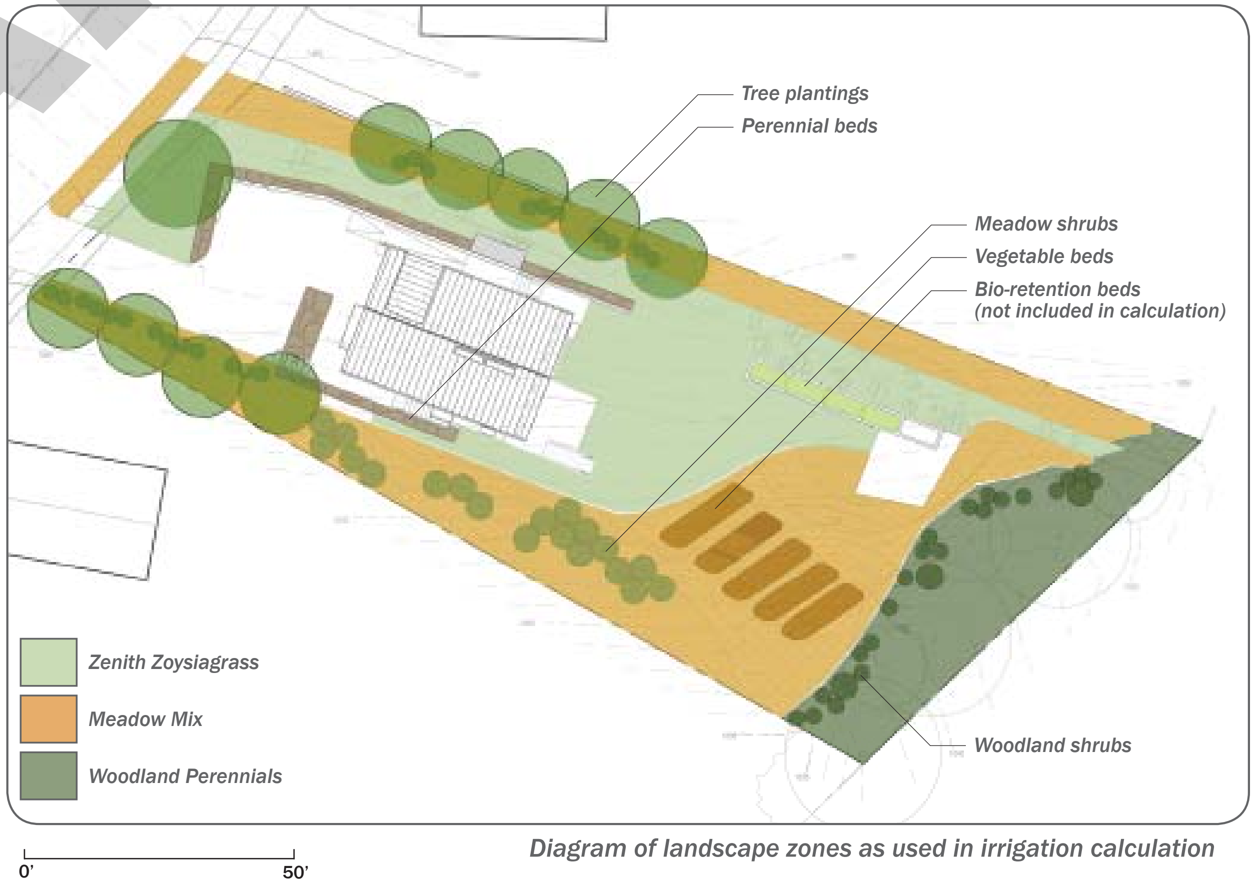


Diagram of landscape zones as used in irrigation calculation

WE 3.1
high-efficiency fixtures and fittings

1 of 3 points

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for the high efficiency rating of the home's dual flush toilet, meeting the credit requirements of WE 3.1.

Faucets, showers, baths, and toilets typically account for two-thirds of a home's indoor water use and one-third of its total water use. High efficiency toilets (HETs) have an average flush volume of 1.28 gallons or less. HETs generally accomplish this by employing imprioved hydraulic designs, improved technologies, better valving, and smaller tanks. Not all high-efficiency toilets operate equally well, and poor design can lead to inneffective flushing and the need for multiple flushes. The U.S. Environmental Protection Agency's WaterSense program certifies toilets that achieve both water efficiency and operational effectiveness.

(LEED for Homes Reference Guide, 2008)

The New Norris House has been equipped with a dual-flush toilet, certified by the EPA's WaterSense program. This fixture is supplied by rainwater and is an integral part of the total water efficiency effort. Dual-flush toilets are a technology that relies on proper use to achieve much of their efficiencies. Accordingly, correct use of the dual-flush toilet is covered in the Users' Guide.

CALCULATIONS + TECHNICAL DATA

*16 Toilet
Brand and Series: Kohler PERSUADE
Type: Dual Flush Toilet
Model # K-3654
Flow Rate: Meets EPA WaterSense specifications

WE 3.1

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WE 3.2
very high-efficiency fixtures and fittings

4 of 6 points

APPROACH + IMPLEMENT

The New Norris House project earns 4 points for the very high efficiency rating of the home's lavatory faucet and shower, meeting the credit requirements of WE 3.2 A and B.

Installing high-efficiency fixtures and fittings is an easy strategy for reducing indoor water use: the most efficient fixtures and fittings use less than half the water of the conventional alternatives. High-Efficiency fixtures can also signifigantly reduce the energy demand associated with domestic water heating. Kitchen faucets are not included in this credit because studies have shown that most water consumption in the kitchen is volume based. Low-flow faucets only increase the amount of time required to complete a filling task.

(LEED for Homes Reference Guide, 2008)

The very high-efficiency fixtures in the bathroom of the New Norris House help to achieve significant water and energy use reductions over a range of daily uses. As most bathroom water consumption is result based - wetting a toothbrush, rinsing off soap - reducing overall flow while still accomplishing the desired task provides and effective method of realizing savings while not adversely affecting occupant comfort.

CALCULATIONS + TECHNICAL DATA

*14 **Lavatory Faucets**
Brand and Series: Moen LEVEL
Type: Single-Hand Lavatory Faucet
Model # 6100
Flow: 1.5 gpm maximum

Shower
*15 Brand and Series: Moen LEVEL
Type: Single Handle Shower with one-function eco-performance showerhead
Model # 2702 (w/ 6399EPBN Shower head)
Flow: 1.75 gpm

Low-flow shower by Moen. High-efficiency showers use 30% less water than conventional models. (above)

Low-flow faucet by Moen. High-efficiency faucets use 40% less water than conventional models (left)

WE 3.2

* see appendix

LEED: Energy + Atmosphere [EA]

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Energy and Atmosphere

EA 1	**Optimize Energy Performance** [Max. Points 34]	
1.1	Performance of ENERGY STAR for Homes	PREQ
1.2	Exceptional Energy Performance	23
EA 2	Insulation	
EA 3	Air Infiltration	
EA 4	Windows	
EA 5	Heating & Cooling Distribution Systems	
EA 6	Space Heating and Cooling Equipment	
EA 7	**Water Heating** [Max. Points 3]	
7.1	Efficient Hot Water Distribution	2
7.2	Pipe Insulation	1
7.3	Efficient Domestic Hot Water Equipment	-
EA 8	Lighting	
EA 9	Appliances	
EA 10	Renewable Energy	
EA 11	**Residential Refrigerant Management** [Max. Points 1]	
11.1	Refrigerant Charge Test	PREQ
11.2	Appropriate HVAC Refrigerants	1
	total EA points of 38 points possible	**27**

EA

EA 1.1 energy star for homes

prerequisite

APPROACH + IMPLEMENT

The New Norris House project meets the EA 1.1 prerequisite by achieving a HERS index of 49, thirty-six points below the ENERGY STAR threshold of 85—automatically deeming the project to be in compliance with EA 1.1.

The mandatory minimum level of energy performance in the LEED for Homes rating system requires that a qualifying home be designed to meet the energy performance requirements of the ENERGY STAR for Homes program. As part of the modeling process, every aspect of a home is evaluated and may contribute to its efficiency. The HERS index reflects insulation levels, air sealing, window size and specifications, distribution system, space heating and cooling equipment size, water heating, lighting, appliances, and even renewable energy.

(LEED for Homes Reference Guide, 2008)

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IMPLEMENTATION

IECC Climate Zone 4
HERS Index: 49
Percent above IECC 2004: 51

VERIFICATION + SUBMITTIALS

*1 Any equipment and product literature (e.g. user's manuals, specifications) present in occupant operations and maintenance manual

Bruce Glanville, LEED Green Rater, conducts blower door test on home. Test results revealed only .04 natural air changes/ hour. (above)

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EA 1.1

* see appendix

EA 1.2
exceptional energy performance

APPROACH + IMPLEMENT

The New Norris House project earns 23 points by achieving a HERS (Home Energy Rating System) index of 49.

Locating housing in communities with nearby existing resources reduces the number of cars that households need and therefore reduces a family's overall expenses and time spent in the car. It also creates more vibrant neighborhoods with better access to employment centers, transportation systems, schools, shopping, general services, and civic amenities.

(LEED for Homes Reference Guide, 2008)

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IMPLEMENTATION

IECC Climate Zone 4
HERS Index: 49
Percent above IECC 2004: 51

VERIFICATION + SUBMITTIALS

*1 Any equipment and product literature (e.g. user's manuals, specifications) present in occupant operations and maintenance manual

23 of 34 points

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EA 7.1
efficient hot water distribution

2 points

APPROACH + IMPLEMENT

The New Norris House earns 2 points for the design and installation of an efficient hot water distribution system, meeting the requirements of EA 7.1C.

Approximately 10% to 15% of energy use in hot water system is wasted in distribution losses. Such losses can be greatly reduced by ensuring that all fixtures and appliances that use hot water are located as close as possible- within 10 to 20 feet - to the hot water heater. The distance from the water heater has a great impact ont he temperature of the water that arrives at a fixture and how long it takes for the hot water to be delivered.

(LEED for Homes Reference Guide, 2008)

With such a small footprint, the hot-water distribution in the home is intrinsically efficient by nature. However, effort was made to design and install an efficient branched system which would limit heat loss in plumbing runs.

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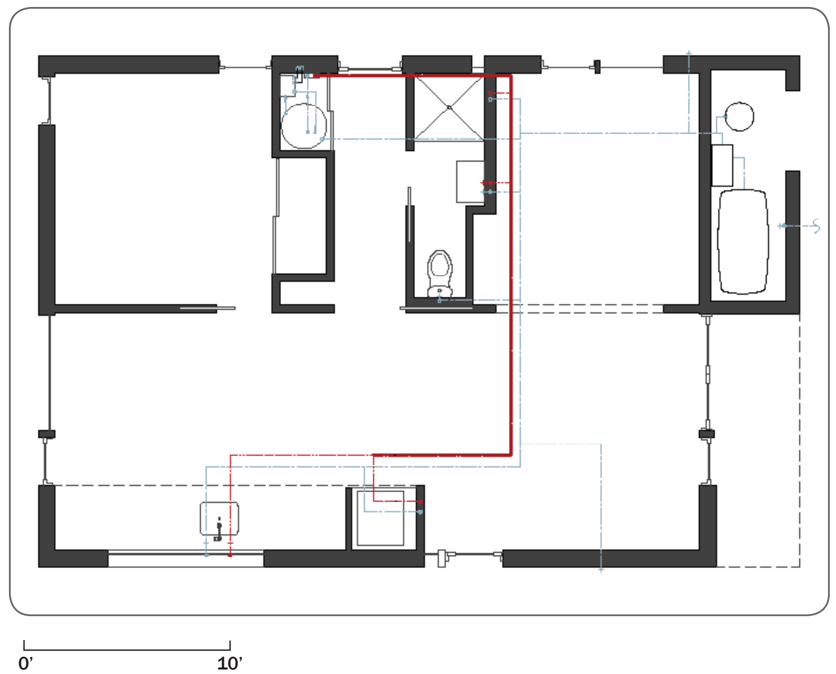
VERIFICATION + SUBMITTIALS

***13** Accountability form signed by the plumbing contractor indicating that the hot water system is installed according to the credit requirements.



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Hot-water distribution branch (left)

EA 7.1

* see appendix

EA 7.2 pipe insulation

1 point

APPROACH + IMPLEMENT

The New Norris House earns 1 point for the installation of R-5.6 insulation on all domestic hot water piping, meeting the requirements of EA 7.2.

As much as one-third of a home's total energy bill is spent on heating water. Insulate the pipes to minimize heat losses in both the conditioned and unconditioned parts of the home. This helps reduce energy use and keep the water termperature as high as possible.

(LEED for Homes Reference Guide, 2008)

Partnering with Clayton Homes, the majority of the hot and cold-water distribution runs came roughed-in and pre-insulated from the factory. On-site, the hot-water systems (solar with instaneous make-up) were insulated after installation.

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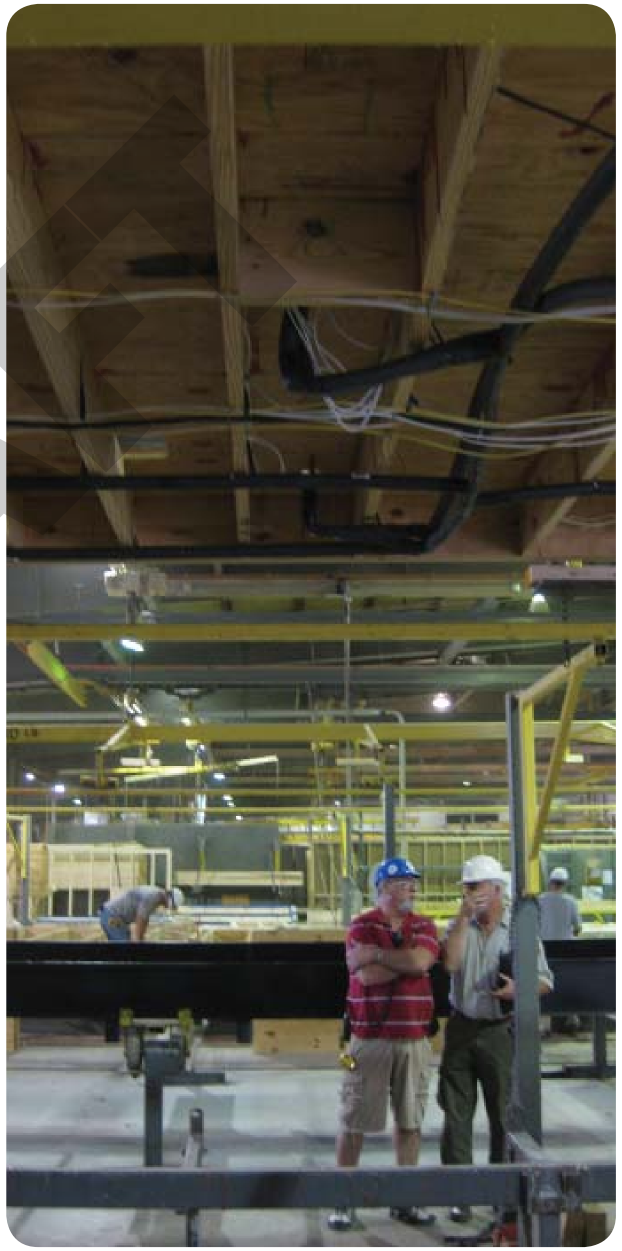
CALCULATIONS + TECHNICAL DATA

TABLE 5
TUNDRA® [illegible] and TUNDRA® SEAL [illegible] "R" VALUES

[illegible]	[illegible]	"R" Value [illegible] Wall	"R" Value [illegible] Wall	"R" Value [illegible] Wall	"R" Value [illegible] Wall
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



All hot and cold water lines were pre-insulated at Clayton Homes manufacturing facility (left)

Any additional hot-water lines added on-site were insulated by plumbing contractor (above)

EA 7.2

EA 11.1
refrigerant charge test

prerequisite

APPROACH + IMPLEMENT

The New Norris House project meets the EA 11.1 prerequisite by testing the refrigerant charge of the cooling system.

Refrigerant charge is the ratio of refrigerant required (pounds) to cooling capacity provided (tons) by a piece of installed cooling equipment. Field tests of residential cooling systems have shown that many systems have incorrect refrigerant charge levels. Data from one of these studies indicate that about one-third were undercharged and one-third were overcharged. Both undercharge and overcharge can reduce cooling equipment longevity, capacity, and efficiency. An undercharge of as little as 15% can reduce the equipment's total capacity by as much as 20% and the energy efficiency ratio by as much as 15%.

(LEED for Homes Reference Guide, 2008)

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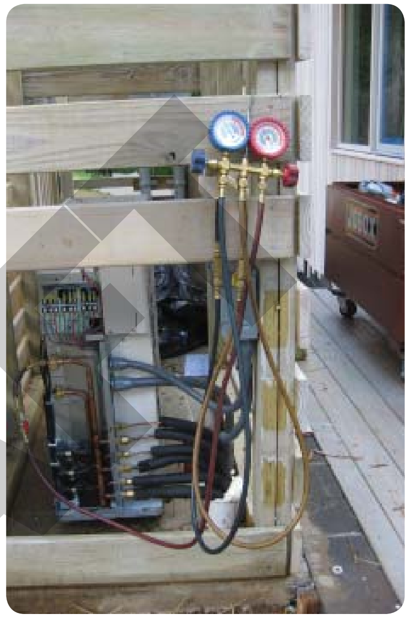

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EA 11.1

EA 11.2
appropriate HVAC refrigerants

APPROACH + IMPLEMENT

The New Norris House earns 1 point for the use of R410a refrigerant in the HVAC system, meeting the requirements of EA 11.2.

Hydrochlorfluorocarbons (HCFCs, such as R22) have been the refrigerants of choice for residential heat pump and air-conditioning systems for many than four decades. Most refrigerants commonly used in HVAC equipment are stable chemical compounds. However, when released to the environment, these compounds contribute to deterioration of the earth's protective ozone layer and emit greenhouse gases. Beginning in 2010, chemical manufacturers may produce HCFCs only for servicing existing equipment. Thereafter, HCFCs cannot be manufactured for use in existing equipment. Minimize refrigerant leakage. Refrigerants cannot damage the atmosphere if they are contained and never released to the environment. Unfortunately, in real-world applications some or all of the refrigerant in HVAC equipment is leaked during installation, operation, servicing, and decommissioning.

(LEED for Homes Reference Guide, 2008)

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1 point

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LEED: Materials + Resources

The intent of Innovation in Design Credit 1 is to provide design teams and projects the opportunity to be awarded points for exceptional performance above the requirements set by the LEED Green Building Rating System and/or innovative performance in green building categories not specifically addressed by LEED.

Materials and Resources

MR 1	**Material-Efficient Framing** [Max. Points 5]	
1.1	Framing Order Waste Factor Limit	PREQ
1.2	Detailed Framing Documents	1
1.3	Detailed Cut List and Lumber Order	1
1.4	Framing Efficiencies	3
*1.5	Off-site Fabrication	4
MR 2	**Environmentally Preferable Products** [Max. Points 8]	
2.1	FSC Certified Tropical Wood	PREQ
**2.2	Environmentally Preferable Products	8
MR 3	**Waste Management** [Max. Points 3]	
3.1	Construction Waste Management Planning	PREQ
3.2	Construction Waste Reduction	2
	total MR points of 16 points possible	**14**

MR

* exemplary performance credit earned, see ID 3.4
** exemplary performance credit earned, see ID 3.1, ID 3.2, and ID 3.6

MR 1.1
framing order waste factor limit

APPROACH + IMPLEMENT

The New Norris House project meets the MR 1.1 prerequisite by utilizing prefabricated and panelized components, ordering only as many modules as needed and cut to the requirements of the home. In this case, the framing waste factor is zero and the prerequisite is met.

When builders overestimate the amount of wood needed for framing, much of this wood ends up either going to a landfill or being unneccessarily incorporated into the house framing. According to one study, roughly 1/6 of the wood delivered to US homebuilding sites ends up going to a landfill. This wood represents wasted material, wasted energy, and an unneccessary waste management burden.

(LEED for Homes Reference Guide, 2008)

The home is a certified modular home and was manufactured by Norris Homes (a division of Clayton Homes) in their Bean Station, Tennessee production facility. A small portion of the framing was fabricated off-site by the University of Tennessee, College of Architecture and Design, Constructions Explorations class. These components include the dormer and the cistern enclosure end wall. These pieces were panelized off-site, and later transported and installed on-site.

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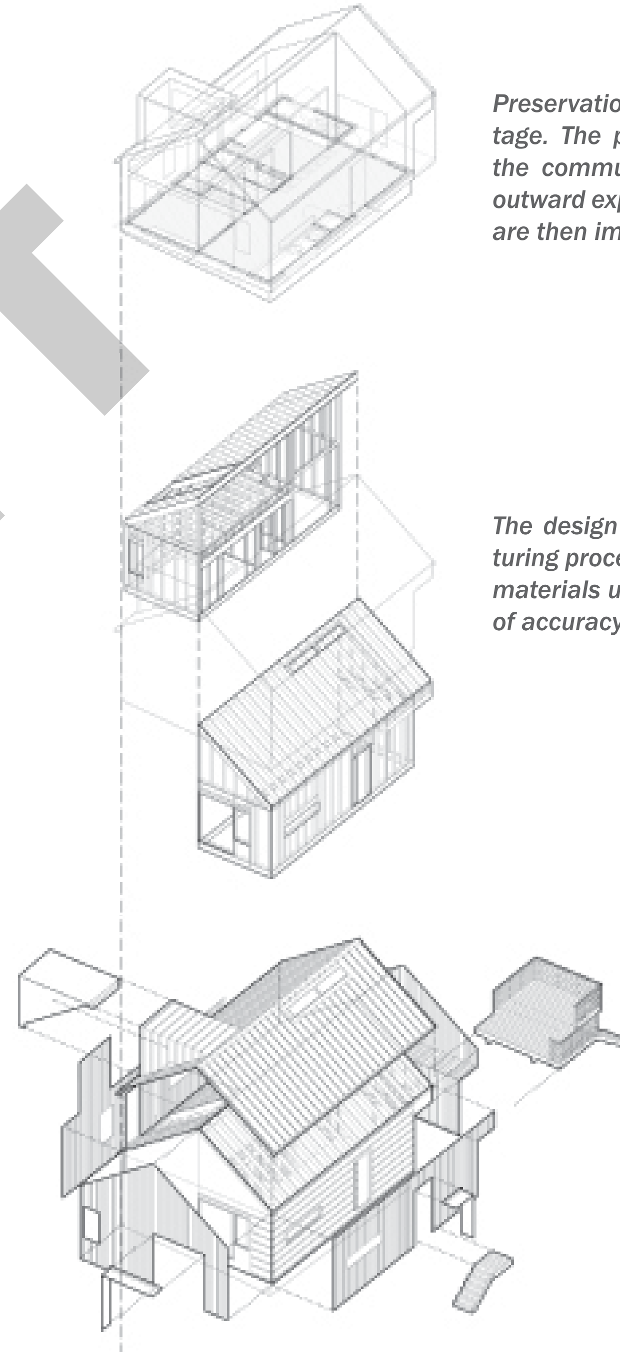
prerequisite



Preservation of the form of the original norris cottage. The project members worked adamantly with the community to create this "normal" form as an outward expression. From this state, the project ideals are then imbedded.

The design of the home is adapted to the manufacturing process. This process ensures high efficiency of materials use, quick "product" turnover, and a degree of accuracy which is not always possible in the field.

Many elements of the home were built or installed on-site. (Such as windows, doors, siding, decks, steel canopies, and landscape elements.) These efforts are led by students of the of architecture and design team.

MR 1.1

MR 1.5
off-site fabrication

APPROACH + IMPLEMENT

The New Norris House project earns 4 points for completing off-site fabrication, satisfying the credit requirements of MR 1.5. The home is approved under the State of Tennessee Modular Program.

Panelized, or modular, prefabricated homebuilding systems are produced off-site and then delivered by truck to the site for assembly. Off-site, prefabricated component construction provides a controlled factory environment that achieves resource efficiencies at the fabrication site and minimizes or even eliminates on-site job waste. This method also ensures a consistent, high quality product and reduces assembly time and associated costs.

(LEED for Homes Reference Guide, 2008)

Large elements of the home were also fabricated offsite by students in the University of Tennessee, College of Architecture and Design, Construction Explorations class during the Spring of 2010 - Summer of 2011. These elements include: All exterior stairs and decks, the dormer (panelized), the cistern enclosure (panelized), and the exterior mechanical enclosure.

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4 points

* exemplary performance credit earned, see ID 3.4

Interior walls are installed in modular unit. Rough electrical and plumbing work has already been stubbed out of the floor. Exterior walls are applied next. (top-left)

Hinged rood assmebly is fabricated (middle-left)

Second modular unit is backed in to site before house is lowered onto foundation (left)

Hinged roof of first unit is raised on-site (above)

MR 2.1
fsc certified tropical wood

prerequisite

APPROACH + IMPLEMENT

The New Norris House project meets the MR 2.1 prerequisite by providing notice to all wood product suppliers of preference for nontropical woods.

Poor forestry practices continue to degrade many tropical forests, resulting in signifigant climate change impacts as well as irrevesible harm to biological diversity. Many tropical woods can be replaced by nontropical woods. Where tropical woods are required to serve a particular function, the use of sustainably grown and harvested woods is required. Certification by the Forest Stewardship Council (FSC) is a "green" seal of approval awarded to forest managers who adopt environmentally and socially responsible forest management practice and to companies that manufacture and sell products made from certified wood.

(LEED for Homes Reference Guide, 2008)

As part of a typical Clayton Homes buildout, lauan (a tropical plywood) is used to stiffen interior walls for shipping. To avoid this, the New Norris House project was constructed using a Berry Plastics material called "Interior Board". Interior boad is a long fibered cross-laminated reinforced kraft panel that is formaldehyde free. This product increased the durability of the home for shipping, but more importantly fulfilled the desire to avoid tropical woods entirely.

VERIFICATION + SUBMITTIALS

*6 Accountability form signed by the project team indicating that no tropical woods were used except those that were FSC certified

*14 Notice to wood suppliers indicating preference for non-tropical wood

"Interior Board" is applied to marriage wall in Bean Station facility. (above-left)

Marriage wall, as seen from bedroom, before drywall is applied. (middle-left)

Marriage wall, as seen from kitchen, before Interior Board and drywall is applied to opposite side. (left)

Marriage wall, as seen from living room (above)

MR 2.1

* see appendix

MR 2.2
enviromentally preferable products

APPROACH + IMPLEMENT

The New Norris House project earns 8 points for the specification and installation of 10 environmentally preferable products, meeting the requirements of MR 2.2.

Environmentally preferable products have reduced environmental impact compared with conventional alternatives. Many new products are less harmful to the environment and to humans because they are sustainably produced, include recycled content, are rapidly renewable, or have lower emissions. Products procured from local sources require less transport. The use of these materials can significantly improve the overall environmental performance of the home.

(LEED for Homes Reference Guide, 2008)

Partnering with the University of Tennessee Institute for a Secure and Sustainable Environment's Clean Products Center, the project team has benefitted termendously from having a team member focused soley on the research and specification of environmentally perferable products.

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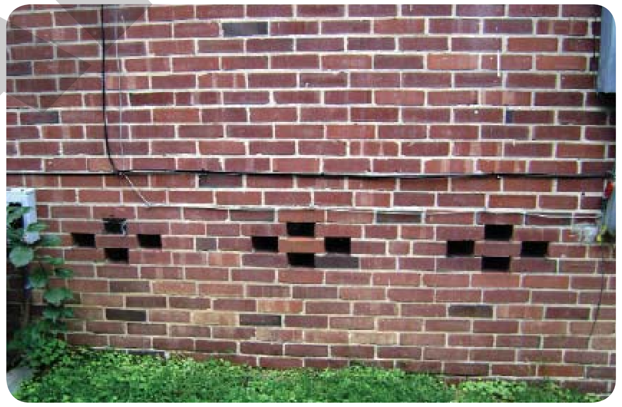
VERIFICATION + SUBMITTIALS

*5 Environmentally Preferable Products Spreadsheet MR2.2

*6 Accountability form signed by the project team indicating that each component represents the required percentage of applicable content

8 points

** exemplary performance credit earned, see ID 3.1, ID 3.2, and ID 3.6



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MR 2.2

MR 2.2 (continued)
enviromentally preferable products

8 points

** exemplary performance credit earned, see ID 3.1, ID 3.2, and ID 3.6

Framing
(exterior wall, interior wall, floor, and roof)

2 pts

The New Norris House project earns 2 points for the specification and installation of Weyhauser iLevel Framer series lumber, harvested and manufactured in North Carolina

Weyhauser iLevel Framer Series Lumber

Siding

0.5 pts

The New Norris House project earns 0.5 points for the specification and installation of Atlantic White Cedar siding. Atlantic white Cedar is a regional wood, harvested from Roanoke, Virginia. It is naturally rot resistant and when combined with Cabbot's Bleaching Oil, will weather well in the elements.

Atlantic White Cedar Siding Boards
Roanoke, Virginia (237 miles)

Flooring

2.5 pts

The New Norris House project earns 2.5 points for the specification and installation of reclaimed White Oak from Sanford, Kentucky. Working with a salvaging contractor, the oak used is over 150 years old and was reclaimed from the razing of a barn. The project has specified 100% hard floor area.

Reclaimed, salvaged White Oak Flooring Boards
Stanford, Kentucky (127 miles)

Foundation
(Aggregate and Cement)

1.5 pts

General Shale Conrete Masonry Units
45% recycled content
Knoxville, Tennessee (30 miles)

CEMEX Masonry Cement
Knoxville, Tennessee (30 miles)

Gypsum Board

1 pt

The New Norris project earns 1 point for the specification and installation of locally produced US Gypsum SHEETROCK with 25% recycled content.

US Gypsum SHEETROCK
XX% recycled content
Bridgeport, Alabama (163 miles)

Roofing

0.5 pts

The New Norris House project earns 0.5 points for the specification and installation of Galvalume metal roofing with XX% recycled content.

Galvalume Standing Seam Metal Roof
XX% recycled content

MR 2.2

MR 3.1
construction waste management

prerequisite

APPROACH + IMPLEMENT

The New Norris House project meets the MR 3.1 prerequisite by satisfying the below credit requirements.

Because landfill space is rapidly diminshing, incineration produces pollutants, and waste of materials in itself carries negative environmental impacts, waste should be avoided to the extent possible. The National Association of Homes Builders estimates that the construction of a "typical" 2,000 square-foot home generates about 8,000 pounds of waste that occupies roughly 51 cubic yards of landfill space. The equates to an average of about 4 pounds of waste per square-foot and a cost of roughly $500 per house for construction waste disposal.

(LEED for Homes Reference Guide, 2008)

The project team partnered with TnWaste of Knoxville, Tennessee to oversee all aspects of waste management. All onsite and offsite waste (including that produced at Clayton Homes' production facility) was collected and sorted by TnWaste for possible diversion.

CREDIT REQUIREMENTS

A. Investigate and document local options for diversion of all anticipated major constituents of the projct waste stream
B. Document the diversion rate for construction waste

VERIFICATION + SUBMITTIALS

*15 A New Norris House: Construction & Demolition Waste Progress Report, produced by TNWaste

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MR 3.1

* see appendix

MR 3.2
construction waste reduction

APPROACH + IMPLEMENT

The New Norris House project earns 2 points for diverting 70% of all waste from the landfill, meeting the requirements of MR 2.2 (option B).

Although recycling requires collecting, sorting, and converting the waste to a useful product, it is frequently more efficient than throwing away money in disposal costs. Recycling and reusing construction waste can help the economy by creating jobs related to salvaging and recycling of construction waste.

(LEED for Homes Reference Guide, 2008)

The integrated project team worked with Clayton Homes to reduce the production of waste through prefabrication. Any waste from the off-site fabrication process was processed by TNWaste, along with all waste generated on-site. Through this process, the project team was able to divert 10.6 tons of waste (70% of total generation) from possible landfill. Additionally, many materials were able to the saved for future projects in the college's expanding design|build program.

CONSTRUCTION WASTE DIVERSION RATES

Material	Quantity	%	Percentage Chart	Diverted To
Paper	1.0 tons	7%		Tennessee American Recycling
Plastic	0.5 tons	3%		Everst Corporation
Metal	0.7 tons	5%		Tennessee Metals
Aggregates	0.5 tons	3%		Riverside Road
Gypsum	1.4 tons	10%		Monterey Mushroom
Wood	5.7 tons	42%		Natural Resources
Disposed	4.4 tons	30%		Poplar View Landfill

Total Quantity of Waste	14.6	Percentage Diverted 70%
Total Quantity of Diverted	10.2	

2 of 3 points

VERIFICATION + SUBMITTIALS

*15 A New Norris House: Construction & Demolition Waste Progress Report, produced by TNWaste

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MR 3.2

LEED: Indoor Environmental Quality [EQ]

The quality of the indoor environment has profound impacts on human comfort and health. Furthermore, the methods by which temperature and humidity are controlled and conditioned air is delivered to occupants has significant implications for energy usage in the home.

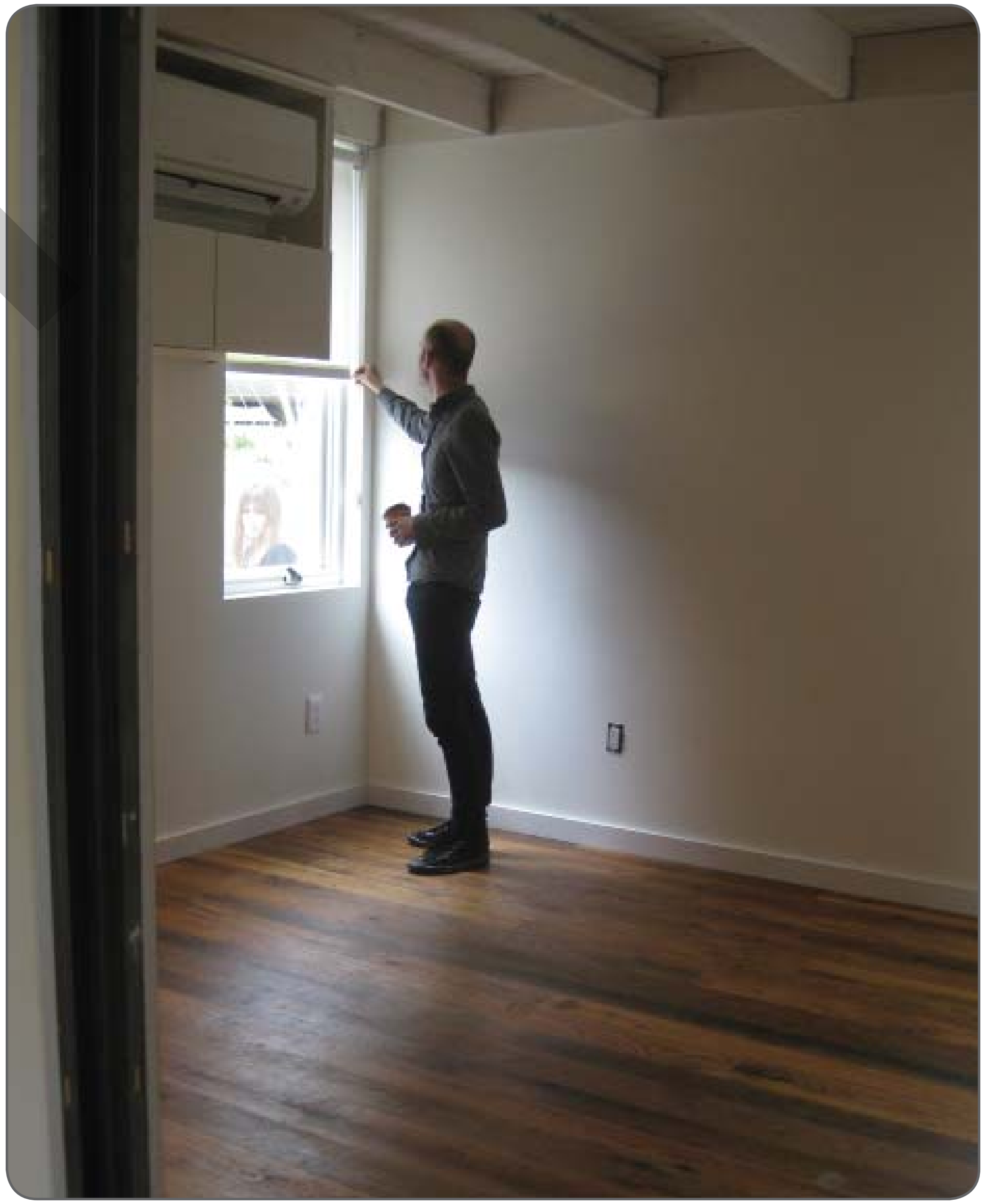
Indoor Environmental Quality

EQ 1	Energy Star with Indoor Air Package	13
EQ 2	**Combustion Venting** [Max. Points 2]	
2.1	Basic Combustion Venting Measures	PREQ
2.2	Enhanced Combustion Venting Measures	2
EQ 3	**Moisture Control** [Max. Points 1]	
3.0	Moisture Load Control	1
EQ 4	**Outdoor Air Ventilation** [Max. Points 3]	
4.1	Basic Outdoor Air Ventilation	PREQ
4.2	Enhanced Outdoor Air Ventilation	2
4.3	Third-Party Performance Testing	1
EQ 5	**Local Exhaust** [Max. Points 2]	
5.1	Basic Local Exhaust	PREQ
5.2	Enhanced Local Exhaust	1
5.3	Third-Party Performance Testing	1
EQ 6	**Distribution Systems** [Max. Points 3]	
6.1	Room-by-Room Load Calculations	PREQ
6.2	Room-by-Room Controls	1
6.3	Multiple Zones	2

CONTINUED NEXT PAGE

EQ

EQ 7	**Air Filtering** [Max. Points 2]	
7.1	Good Filters	PREQ
7.2	Better Filters	1
7.3	Best Filters	2
EQ 8	**Contaminant Control** [Max. Points 3]	
8.1	Indoor Contaminant Control during Construction	1
8.2	Indoor Contaminant Control	1
8.3	Preoccupancy Flush	1
EQ 9	**Radon Protection** [Max. Points 1]	
9.1	Radon-Resistant Construction in High-Risk Areas	PREQ
9.2	Radon-Resistant Construction in Moderate-Risk Areas	1
EQ 10	**Garage Pollutant Protection** [Max. Points 3]	
10.1	No HVAC in Garage	PREQ
10.2	Minimize Pollutants from Garage	2
10.3	Exhaust Fan in Garage	1
10.4	Detached Garage or No Garage	3
	total EQ points of 21 points possible	**15**



EQ

EQ 2.1
basic combustion venting

APPROACH + IMPLEMENT

The New Norris House project meets the ID 1.1 prerequisite by satisfying the below credit requirements.

The leakage of toxic combustion exhaust gases into the home can cause poor indoor air quality and human health impacts, particularly in homes that are well constructed and well sealed. The best way to block combustion gases from fireplaces and wood-burning stoves is to avoid installing them.

(LEED for Homes Reference Guide, 2008)

The New Norris House uses only electric appliances and a [backup] electric water heater. A fireplace, though made redundant by the introduction of electric heat, was nonetheless included in the 1930s Norris homes for largely nostalgic reasons. In addition to concerns about combustion gasses contaminating the interior atmosphere, fireplaces are relatively inefficient methods of heating with much of the heat escaping up the flue. The fireplace has been removed from the New Norris House all together. This traditional center piece of the home is hinted at by a fire ring in the rear garden, which allows for gatherings during the shoulder seasons while not contaminating the interior environment.

CREDIT REQUIREMENTS

A. No unvented combustion appliances
B. Carbon Monoxide monitors on each floor
C. No fireplace installed
D. No space- or water-heating equipment with combustion

prerequisite

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EQ 2.2
basic combustion venting

2 points

APPROACH + IMPLEMENT

The New Norris House project earns 2 points for the installation of no fireplace or woodstove, meeting the requirements of EQ 2.2.

The leakage of toxic combustion exhaust gases into the home can cause poor indoor air quality and human health impacts, particularly in homes that are well constructed and well sealed. The best way to block combustion gases from fireplaces and wood-burning stoves is to avoid installing them.

(LEED for Homes Reference Guide, 2008)

The New Norris House has no fireplace or woodstove. See description of credit EQ 2.1 for additional information on this credit.

EQ 2.2

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EQ 3.0
moisture load control

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for the installation of a Mitsubishi multi-split system capable of dehumidification functions. The system has a latent capacity of 5680btu/hr, exceeding the latent load from the home (3470 btu/hr), and meeting the credit requirements of EQ 3.0.

Traditional HVAC designs do not typically include moisture balance considerations. Extremely high or low humidity levels can create an uncomfortable living space and lead to premature durability failures. High humidity levels can foster mold growth, leading to human health problems. In hot and humid climates, dehumidification can also reduce energy demands associated with air-conditioning.

(LEED for Homes Reference Guide, 2008)

Humidity is one of the primary factors affecting human comfort. The ability to control humidity is crucial in humid climates, like the one in Norris, and can be an energy efficient method of maintaining comfort in summer months. Furthermore, controlling humidity helps to deter mold and mildew, which are common nuisances in the region. By providing units that easily meet the requirement for dehumidifying the interior spaces, the New Norris House provides occupants with a tool for modifying comfort and inhibiting the growth of mold and mildew.

CALCULATIONS + TECHNICAL DATA

Latent load from home = 3470 btu/hr

Total cooling capacity of system = 28,400 btu/hr
Sensible heat ratio of system = 80%

Latent capacity of system = (28,400 btu/hr) x (20%)
Latent capacity of system = 5680 btu/hr

VERIFICATION + SUBMITTIALS

*1 Any equipment and product literature (e.g. user's manuals, brochures, specifications) present in occupant operations and maintenance manual

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EQ 3.0

* see appendix

EQ 4.1
basic outdoor air ventilation

prerequisite

APPROACH + IMPLEMENT

The New Norris House project meets the EQ 4.1b prerequisite by designing and installing a continuous outdoor air ventilation system– providing 60cfm of ventilation and exceeding the minimum set forth in ASHRAE 62.2.

Outdoor air has historically been provided through leaks in the house envelope, but energy concerns have led to construction practices with reduced natural infiltration. Homes with insufficient outdoor air have problems with humidity, odors, and pollutants that can lead to discomfort and increased health risks. Designed ventilation systems help reduce occupants' exposure to indoor pollutants and improve comfort.

CALCULATIONS + TECHNICAL DATA

*8 Energy Recovery Ventilator
Brand: Fantech
Model # SE-704N
Airflow: 60cfm

Minimum per Equation 4.1a of ASHRAE 62.2-2010
Qfan = .01Afloor + 7.5 (Nbr + 1)
.01 (768) + 7.5 (2+1)
7.6 + 22.5
=30.1cfm

Minimum per Table 4.1a of ASHRAE 62.2-2010
=45cfm

VERIFICATION + SUBMITTIALS

*16 Accountablity form signed by the HVAC contractor indicating the system is installed according to design specifications

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EQ 4.1

EQ 4.2
enhanced outdoor air ventilation

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for the design and installation energy recovery ventilation system, meeting the requirements of EQ 4.2.

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(LEED for Homes Reference Guide, 2008)

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CALCULATIONS + TECHNICAL DATA

*8 Energy Recovery Ventilator
Brand: Fantech
Model # SE-704N
Airflow: 60cfm

2 points

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EQ 4.2

EQ 4.3
third-party performance testing

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for conducting third-party tests to verify the airflow of the designed system and its compliance with ASHRAE 62.2 standards, meeting the credit requirements of EQ 4.3.

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(LEED for Homes Reference Guide, 2008)

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CALCULATIONS + TECHNICAL DATA

*8 Energy Recovery Ventilator
Brand: Fantech
Model # SE-704N
Airflow: 60cfm

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EQ 4.3

* see appendix

EQ 5.1
basic local exhaust

prerequisite

APPROACH + IMPLEMENT
The New Norris House project meets the EQ 5.1 prerequisite by satisfying the below credit requirements.

The New Norris House project meets the EQ 4.1b prerequisite by designing and installing a continuous outdoor air ventilation system– providing 60cfm of ventilation and exceeding the minimum set forth in ASHRAE 62.2 of 45cfm. The New Norris House project meets the EQ 4.1b prerequisite by designing and installing a continuous outdoor air ventilation system– providing 60cfm of ventilation and exceeding the minimum set forth in ASHRAE 62.2 of 45cfm. [narrative]

CREDIT REQUIREMENTS

A. Design and install local exhausts systems in bathroom and kitchen to meet the requirements of Section 5 of ASHRAE 62.2-2010.
B. Exhaust air to the outdoors
** C. Using ENERGY STAR labeled bathroom exhaust fans

CALCULATIONS + TECHNICAL DATA

Minimum Air Flow Requirements for Local Exhaust (ASHRAE 62.2-2011 Table 5.1 and 5.2)
Kitchen: 100 cfm (Intermittent)
Bathroom: 20 cfm (Continuous)

Total Kitchen Air Changes per Hour (high speed)
ACHkitchen = (Fan Capacity * 60 minutes) / Kitchen Size
ACHkitchen = (240 cfm * 60 minutes) / 2790 cf.
ACHkitchen = 5.2

*8 Energy Recovery Ventilator
Brand: Fantech
Model # SE-704N
Airflow: 60cfm

*1 Vented Range Hood
Brand: General Electric
Model # JV536HSS
Airflow: 240cfm

VERIFICATION + SUBMITTIALS

*16 Accountablity form signed by the HVAC contractor indicating the system is installed according to design specifications

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EQ 5.1

* See Appendix

** *"Part C is waived for bathrooms with an ERV or HRV", LEED for Home Jan. 2010 Errata Document*

EQ 5.2
enhanced local exhaust

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for the installation of a continuously operating exhaust fan, meeting the credit requirements of EQ 5.2d.

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(LEED for Homes Reference Guide, 2008)

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CALCULATIONS + TECHNICAL DATA

*8 Energy Recovery Ventilator
Brand: Fantech
Model # SE-704N
Airflow: 60cfm

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EQ 5.2

EQ 5.3
third-party performance testing

1 point

APPROACH + IMPLEMENT
The New Norris House project earns 1 point for conducting third-party tests to verify the airflow of the designed system and its compliance with ASHRAE 62.2 standards, meeting the credit requirements of EQ 5.3.

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(LEED for Homes Reference Guide, 2008)

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CALCULATIONS + TECHNICAL DATA

*8 Energy Recovery Ventilator
Brand: Fantech
Model # SE-704N
Airflow: 60cfm

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EQ 5.3

* see appendix

EQ 6.1
room-by-room load calculations

prerequisite

APPROACH + IMPLEMENT

The New Norris House project meets the EQ 6.1 prerequisite by demonstrating that the heating and cooling loads are met by the distribution system installed.

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(LEED for Homes Reference Guide, 2008)

Through the use of a multi-split HVAC system that allows for localized control of the functional spaces of the home, the New Norris House provides occupants with the ability to finely tune temperature and humidity. This local adjustability provides the ability to meet human comfort needs while supplying conditioned air in an extremely energy efficient manner.

VERIFICATION AND SUBMITIALS

- *16 Accountablity form signed by the HVAC contractor indicating the system is installed according to design specifications
- *1 Any equipment and product literature (e.g. user's manuals, specifications) present in occupant operations and maintenance manual
- *17 Room-by-Room Load Calculations Completed by project team

Zone 1 *Mitsubishi MSZ-A09NA*

Heating load:	2277 BTU
Heating capacity:	10900 BTU
Cooling load:	4094 BTU
Cooling capacity:	9000 BTU

Zone 2 *Mitsubishi MSZ-A09NA*

Heating load:	5979 BTU
Heating capacity:	10900 BTU
Cooling load:	6015 BTU
Cooling capacity:	9000 BTU

Zone 3 *Mitsubishi MSZ-A15NA*

Heating load:	8935 BTU
Heating capacity:	18000 BTU
Cooling load:	12860 BTU
Cooling capacity:	15000 BTU

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Zone 1 (Bedroom)
Zone 2 (Kitchen/ Living)
Zone 3 (Swing Space)

EQ 6.1

EQ 6.3
multiple zones

2 point

APPROACH + IMPLEMENT

The New Norris House project earns 2 points for installing a ductless multi-split system with three distinct zones and independent thermostat controls.

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(LEED for Homes Reference Guide, 2008)

The New Norris House has avoided problems with the distribution system by utilizing a non-ducted multi-split HVAC system. From a single heat pump, refrigerant is delivered to three different air handlers, each serving a single functional area of the house. Air is then heated, cooled, and/or dehumidified locally providing fine controlability of comfort.

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Zone 1 (Bedroom)

Zone 2 (Kitchen/ Living)

Zone 3 (Swing Space)

EQ 6.3

* see appendix

EQ 7.1
good filters

APPROACH + IMPLEMENT

The New Norris House project is exempt from the EQ 7.1 prerequisite based on the specific combination of active ventilation and space conditioning systems installed.

Inadequate air filtration can have adverse health effects. Improved air filters that are installed properly remove more particles from the supply air stream. Filters with higher MERV (minimum efficiency reporting value) ratings remove both a greater percentage of airborn dust and a greater percentage of fine airbounce particles. Fine particulates float in the air longer and, when inhaled, go deeper into the respiratory system of the human body. Filters that capture a higher percentage of small particles help create healthier indoor environments.

(LEED for Homes Reference Guide, 2008)

The home utilizes a Fantech SE704N Energy Recovery Ventilator and a ductless Mitsubishi Multi-split system, deeming it eligible for the below credit interpretation ruling. The energy recovery ventilator brings a continuous supply of fresh air into the home, and is equipped with four factory standard electrostatic air filters. The multi–split system also is equiped with its own factory supplied filters– a washable catechin filter designed to removing odor causing gases, as well as an enzyme anti-allergen filter to reduce germs, bacteria, viruses, and dust.

CREDIT INTERPRETATION RULING

The air filter requirement is waived for HRV and ERV systems. If a home includes a forced-air AHU (air handling unit) and an HRV or ERV, the AHU must still meet the prerequisite EQ 7.1. Non-ducted HVAC systems such as PTACs and mini-splits are exempt from EQ7.1 per the requirements of ASHRAE Standard 62.2-2007, section 6.7.

(LEED for Homes January 2010 Errata Document)

prerequisite

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EQ 8.1
indoor contaminant control

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for sealing all permanent ducts during construction. Ductless multi-split air handler units were not installed until all major construction (and most finsh work) was completed, and a thorough cleaning program was implemented upon final completion.

Open duct work can get clogged with paint, debris, dust, and other particulates. This not only leaves residues in the ducts, with eventual exposure to occupants, but also damages th ducts, fans, and systems.

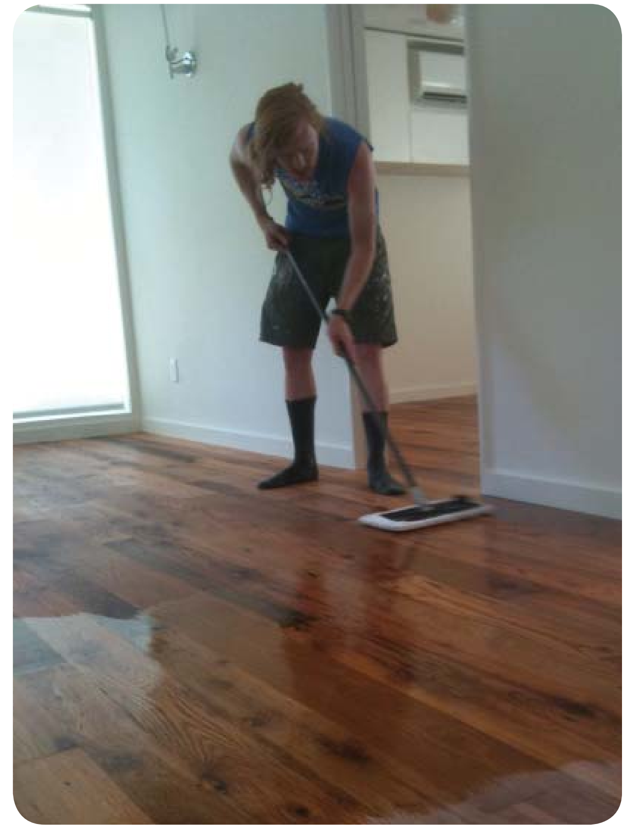
(LEED for Homes Reference Guide, 2008)

A house's ductwork is critical to the quality of its indoor environment. Because ducts move conditioned air around the home, any contaminants deposited in the ducts will be distributed throughout the house and worse, often sent into the air as particles. By assuring that all of the ducts in the New Norris House were thoroughly sealed during construction, contaminants from building processes were kept out of the air handling system. Mini-split units, which do not have duct work but rather move and condition air locally, were not installed until after the end of major construction eliminating the possibility of them becoming contaminated with construction particulates.

VERIFICATION AND SUBMITIALS

*6 Accountablity form signed by the project team indicating contaminant control was conducted according to the credit requirments

1 point



EQ 8.1

Ductless multi-split air handler units were installed as late as possible in the construction process to avoid contamination of factory installed filters. (top-left)

Energy recovery intake was sealed, except to complete immediately adjacent tile. (middle-left)

Energy recovery exhaust was sealed, except to complete immediately adjacent wood floor. (bottom-left)

All air handler units were throughly cleaned before the pre-occupancy flush. (above)

* see appendix

EQ 8.3
preoccupancy flush

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 2 points for EQ 8.3 by satisfying the below credit requirements.

Many materials finish off-gassing their volatile chemical constituents within a relatively short time, but certain polutants will remain in th home until removed. Flushing the house removes VOCs, ureaformaldehyde, and other air pollutants that remain after construction. These pollutants aree mostly caused by off-gassing paints, adhesives, and sealants. Flushing the home also removes some of the dust and particulates that remain from construction, especially if the ductwork was not sealed.

(LEED for Homes Reference Guide, 2008)

Prior to the residents moving into the New Norris House a thorough flush was performed to remove VOCs and other pollutants. Even though extreme care was used in specifying products with little or no harmful offgassing, this flush assured that any small amount of pollutants that gathered in the home during construction, including common dust, was ejected prior to occupation.

CREDIT REQUIREMENTS

A. Flush prior to occupancy, but after all construction phases are complete
B. Flush the entire home, keep all interior doors open
C. Flush for a 48 total hours
D. Flush the home with all HVAC fans and exhaust fans operatiing continuously at the highest flow rate
E. Use additional fans to circulate air within the home
F. Replace of clean HVAC air filter afterward, as necessary

VERIFICATION AND SUBMITIALS

*6 Accountablity form signed by the project team verifying that the preoccupancy flush was conducted according to the credit requirments.

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EQ 8.3

* see appendix

EQ 9.1
radon-resistant construction

APPROACH + IMPLEMENTATION

The New Norris House project meets the EQ 9.1 prerequisite by designing and building with radon resistant construction techniques, as prescribed by the US Environmental Protection Agency.

According to Environmental Protection Agency estimates, radon is the number-one cause of lung cancer among nonsmokers in the United States, and the second learding cause of lung cancer overall. It is estimated that radon causes 5,000 to 20,000 lung cancer deaths each year. The risk associated with radon is directly related to the concentration of radon exposure.

(LEED for Homes Reference Guide, 2008)

Radon is a colorless odorless radioactive gas that is known to cause lung cancer. Radon originates from uranium and radon in the soil and is present in varying degrees throughout the world. Radon can collect and concentrate in buildings. The New Norris House is located in Anderson County, which places it in EPA Radon Zone 1 (high-risk). Therefore, a passive vent crawlspace system is provided. As recommended, the crawlspace is lined with a polyethylene radon barrier and a 4" vent allows for passive evacuation of any radon percolating through the soil.

VERIFICATION AND SUBMITIALS

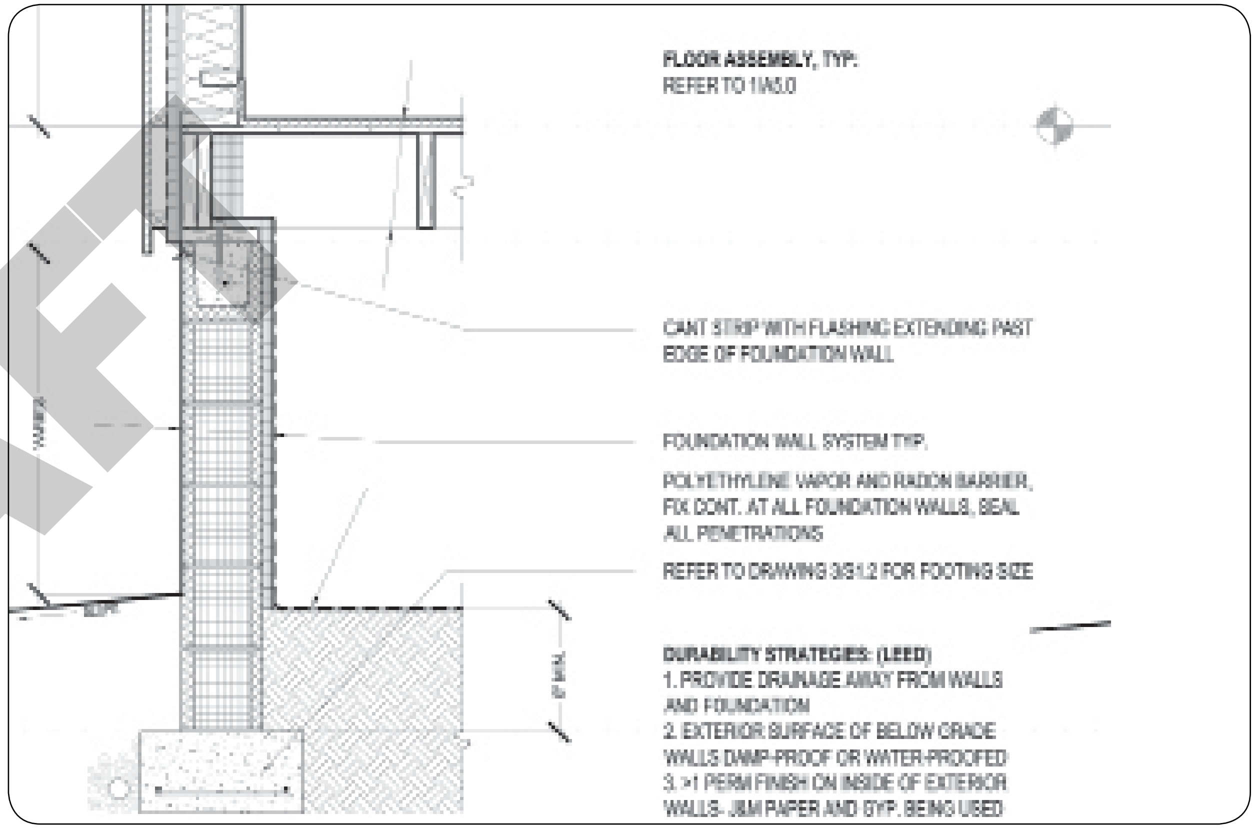
*6 Accountablity form signed by the Project Team indicating that the home was built with radon-resistant construction.

REFERENCE

Building Radon Out: A Step-by-Step Guide on How to Build Radon-Resistant Homes, United States Environmental Protection Agency

EPA/402-K-01-002

prerequisite



Foundation detail showing radon resistant construction techniques. The crawlspace has been covered with 12-mil polyethylene sheeting (exceeding the minimum 6-mil set forth by the EPA). (above)

All penetrations and edges of the radon barrier have been sealed and taped. The evacuation system vents directly to the roof. (left)

EQ 9.1

EQ 10.1
no HVAC in garage

prerequisite

APPROACH + IMPLEMENTATION

The New Norris House project meets the EQ 10.1 prerequisite by designing and constructing a home with no garage.

Occupants' health may be adversely affected by car emissions, such as carbon monoxide, leaking from the garage into the home. Carbon monoxide can even penetrate unfinished drywall through difussion. Sealing off the garage helps reduce exposure, since air from the garage can otherwise be pulled into the house by localized depressureization. Installing fans in the garage helps reduce the concentrations of pollutants, particularly airborne car emissions. Locating the HVAC system or ductwork in the garage can pull this polluted air into the system and circulate it throughout the home.

(LEED for Homes Reference Guide, 2008)

Attached garages can be a significant source of indoor air pollution when combustion gases from automobiles are transmitted to the living spaces of the home. By keeping a home's air distribution system out of this often contaminated environment opportunities for transmitting these pollutants to the indoor environment are eliminated. The New Norris House has no garage. (See EQ 10.4.) Rather, a parking court is integrated into the landscape design and serves as a fore court for the home. A planter creates a buffer between the parking court and the house.

The parking court prior to the installation of finish gravel. Planter bed has just been established.

EQ 10.1

EQ 10.4
detached garage or no garage

3 points

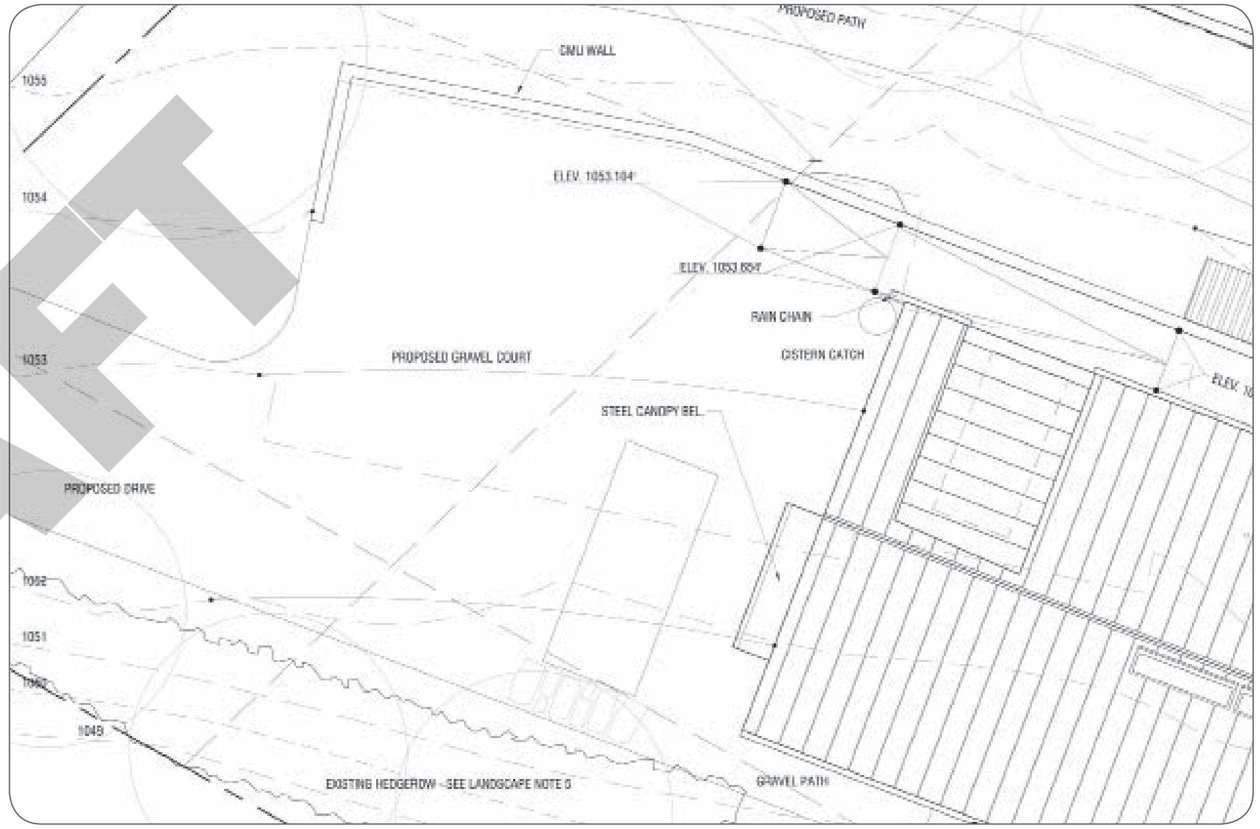
APPROACH + IMPLEMENTATION

The New Norris House project earns 3 points for designing and constructing a home with no garage.

Recent studies have demonstrated the potential for pollutants from attached garages to affect the quality of air in occupied spaces. Of special concern are vehicle exhaust, moisture, and off-gasing from stored chemicals, power tools, and other items commonly stored in garages.

(LEED for Homes Reference Guide, 2008)

The parking court at the New Norris House not only eliminates the possibility of automobile pollutants being transmitted to the house's interior atmosphere, it also connects the home with the patterns of the historic community. Having long ago abandoned the use of the original communal garages, many of the homeowners in Norris park their vehicles adjacent to or in front of their homes. Additionally, an angle in the low court wall registers the location of the first home to occupy the site.



Plan of the parking court. (above)

An original communal garage photographed in 1934. This shared amenity served several clustered homes, though none of the original remain today. (left)

EQ 10.4

LEED: Awareness + Education [AE]

While the effect of one sustainable home is great, the effects of this same home in an educated community that can embrace and understand its function can be enormous.

Awareness + Education

AE 1	**Education of the Homeowner / Tenant** [Max. Points 2]	
1.1	Basic Operations Training	PREQ
1.2	Enhanced Training	1
1.3	Public Awareness	1
AE 2	**Education of the Building Manager** [Max. Points 1]	
2.0	Education of the Building Manager	1
	total AE points of 3 points possible	**2**

AE

AE 1.1
basic operations training

APPROACH + IMPLEMENT

The New Norris House project meets the AE 1.1 prerequisite by satisfying the below credit requirements.

The LEED for Homes Rating System addresses the design and construction of new green homes– roles that are the responsibility of the home designer and the builder, respectfully. But the environment of the home continues throughout its lifecycle, well beyond the initial design and construction decisions. Most new homes are expected to last 50 to 100 years, during which the occupants will consume energy, water, and other resources. They will therefore play a substantial role in the resource use of a home overe its lifetime.

(LEED for Homes Reference Guide, 2008)

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CREDIT REQUIREMENTS

A. An operations and maintenance manual (including all listed items in LEED for Homes Reference Guide, p335)

B. A one-hour walk-through of the home with the occupants (including all listed items in LEED for Homes Reference Guide, p335)

VERIFICATION AND SUBMITIALS

*2 Accountablity form signed by the project team indicating that a walk-through has been conducted with the occupant.

prerequisite

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AE 1.1

* see appendix

AE 1.2
enhanced training

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for providing an additional walk-through held in another home that has similar green measures and equipment, meeting the credit requirements of AE 1.2.

Some homebuyers may know very little about green home construction. They may be unaware of the green features in the home, or they may be unfamiliar with how to use and maintain them. The performance and durability of a LEED home depends on the proper use of its features and the maintenance of its systems throughout its service life. Thus, awareness and education of the occupants are critical to achieving long-term sustainability goals in the residential sector.

(LEED for Homes Reference Guide, 2008)

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VERIFICATION AND SUBMITIALS

*6 Accountablity form signed by the project team indicating that additional training that meets the requirements has been provided to the occupant.

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AE 1.2

* see appendix

AE 1.3
public awareness

1 point

APPROACH + IMPLEMENT

The New Norris House project earns 1 point for ID 1.2 by satisfying the below credit requirements.

At the core of the project, the New Norris House has always been about education. As a multi-disciplined, university endeavor that will span the course of 4 years by the time it is completed, the project will have touched many lives in the academic, professional, and local communities.

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CREDIT REQUIREMENTS

A. Hold four advertised, attended public open houses (four hours in legnth) or participate in a green building exhibition
B. Publish a website with at least two pages that provide details about the features and benefits of LEED homes
C. Generate a newspaper article on the LEED for Homes project

VERIFICATION AND SUBMITIALS

*18 Comprehensive list of press, publications, exhibits, presentations, open houses, and research reports related to the New Norris House Project

eaque exceperit eaque exceperit est et aut lant il is repra quat et aut lant il is repra quat dolustill (top-left)

At the soft opening of the home, families of the project team, and the local community come to see progress as the project nears completion. (middle-left)

The New Norris House has exhibited in Washington DC three times as part of the US EPA's P3 Competition and Sustainable Design Expo. (bottom-left)

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AE 1.3

* see appendix

DRAFT

NNH Appendix

Verifications, Submittals, Addenda, Etc

Appendix Reference *

See full size appendix for these pieces of information.

* Appendix Reference

		History of A New Norris House
01		
02		
03		
04		
05		
06		
07		
08		
09		
10		
		NNH User's Guide
11		Mitsubishi Indoor Units– Operating Instructions
12		Mitsubishi Indoor Units– Service Manual
13		Mitsubishi Outdoor Unit– Service Manual
14		Mitsubishi Indoor Unit MSZ-A09NA– Submittal
15		Mitsubishi Indoor Unit MSZ-A12NA– Submittal
16		Mitsubishi Outdoor Unit MXZ-3A30NA– Submittal
17		Mitsubishi Mr. Slim System– Limited Warranty Statement
18		Fantech Energy Recovery Ventilator– Operations and Maintenance
19		Electrical Schematic of Switches Lights and Outlets in Home
20		Diagram of Electrical Panelboard
21		Exterior Electrical Service Diagram
22		Light fixture cut sheets and bulb replacement list
23		Moen LEVEL Single Handle Pull Out Kitchen Facuet, 7175 Series

24		Moen LEVEL Single Handle Lavatory Faucet, 6100 Series
25		Moen LEVEL Single Handle Shower, 2702 with 6399EPBN
26		Kohler PERSUADE Dual-flush Toilet, K-3654
27		Exterior Plumbing Service Diagram
28		LEADER Pump and Controller Manual
29		PURA BB3 Treatment System Manual
30		Pressure tank information
31		First flush information
32		Watts backflow preventer information
33		3-way valve information
34		EnerWorks Solar Thermal Water Heating Quick Guide
35		Whirlpool Front-Loading Automatic Washer Use & Care Guide
36		Whirlpool Electronic Dryer Use & Care Guide
37		Cabots bleaching oil Specifications
38		Sikken's deck coating Specifications
39		Sculpt Nouveau Metal Oil Information
40		Marine Grade Varnish Information
41		Anderson Window Maintenance and Care Information
42		Anderson Patio Door Maintenance and Care Information
43		Lockset information
44		Marine Grade Varnish Information
45		Moen LEVEL Facuet
46		Moen Camelot Undermount Sink Basin
47		Countertop Sealant Information
48		BLUM hardware guides

Sponsors

Sponsors

Without the help of these generous sponsors, the New Norris House project would not have been possible. We are grateful for the consultations, material donations, patience, and general support we received from each as the project pushed onward much longer than anyone originally anticipated. As the largest design|build project to date to take place within the College of Architecture and Design, new ground was broken daily and the project team is very grateful to all those listed here who desired to participate in this learning experience. Thank you for your support.

Awards

Winner, 2011 NCARB Prize for Creative Integration of Research and Practice

Awarded, 2011 Faculty Letters of Excellence, UTK School of Architecture Project Team

Winner, 2009 US EPA P3 Sustainable Design Competition, Phase I

Winner, 2009 US EPA P3 Sustainable Design Competition, Phase II

Winner, 2009 Office of Research Top Award, The University of Tennessee Knoxville Eureca EURCA

Awarded, 2009 Faculty Letters of Excellence, UTK School of Architecture Project Team

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History

p.4 Ken McCown; p.9 courtsey of General Shale Corporation; p.13 TVA.....; p.17 Ken McCown

NNH User's Manual

p.4 Mitsubishi Electric; p.9 Fantech; p.13 (lighting) Ken McCown; p.17 (washer/dryer) Ikea and Ken McCown; p.13 (plumbing) Ken McCown; p.13 (deck) Ken McCown, (elevation) TVA; p.13 (siding) Ken McCown, photo (TVA); p.13 (window frames) (dining table) Ken McCown; p.13 (doors) Ken McCown; p.13 (countertop) Ken McCown; p.13 (cabinets) Ken McCown; p.13 (floors) Ken McCown; p.13 (shutter) (interior) Ken McCown; p.13 (IAQ) (skylight) Ken McCown; p.13 (chair) Ken McCown;

NNH + LEED for Homes

p.83 (Trim and Cabinets) Ken McCown; p.99 (Sewer map) courtsey of ???;

Appendix

p.4 Ken McCown; p.9 courtsey of General Shale Corporation; p.13 TVA.....; p.17 Ken McCown