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B. ACKNOWLEDGEMENTS

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Faculty, staff, and students from multiple Western Kentucky University departments contributed time, expertise, resources, and enthusiasm to the project, specifically:

- The WKU Center for Environmental Education and Sustainability (CEES) administered the grant, with assistance from the Office of Sponsored Programs and Grants Accounting Office, and coordinated the education and media outreach activities. Recognition is given to Dr. Terry Wilson, Director; Nancy Givens, Principle Investigator; Robin Hume, Education Committee Chair. Each of these individuals served on the Advisory Council. Trish Sowell, Office Associate, contributed photography and coordinated the vernal pond installation beyond her usual job responsibilities.

- Planning, Design and Construction, under the direction of Dan Chaney, Project Manager of Capital Construction, provided project management support and contractors' oversight; Doris Hayes assisted with budget matters. Dan, who is also a HFH BG-WC Board member, served on the Advisory Council and was integral to all aspects of project implementation..

- Grounds and Landscaping trained and licensed personnel assisted with the plantings and signs installation, under the direction of Helen Siewers, Landscape Architect; Josh Twardowski, acting as interim head Landscaper, developed the Landscaping Plan. Helen also served on the Advisory Council.

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- Dr. Warren Campbell, Professor, Geography and Geology, for working with students to develop a project site flood map.

- Christian Ryan-Downing, Sustainability Coordinator, and students from the campus Office of Sustainability, for assisting with educational and volunteer activities

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Arnold Consulting and Engineering Services (A-CES) provided the engineering and architectural design drawings and specifications plus construction oversight. Aaron Arnold acted as chief engineer and did an excellent job accommodating numerous obstacles to master plan implementation that were encountered at the site and being responsive to addressing issues quickly. Thanks also to Jeff Arnold, Owner and CEO, and Daniel Whitley and Brian Shirley, Engineers, for their early involvement in the project. Each served at various times on the Advisory Council.

Roundstone Native Seed, LLC, is recognized for its extreme generosity in donating all products and services for the native plantings at the site. A huge thanks is given to John Seymour and all of his staff, who spent countless hours visiting the site to monitor progress, seeding and reseeding, planting plugs, and participating in educational and training events at no cost to the project.

The Bowling Green Division of Stormwater Management provided consultation services plus onsite MS-4 training for area contractors and operators, in conjunction with the KyHFH state affiliate chapters. Matt Powell, Coordinator Erosion Prevention and Sediment Control, and Tim Slattery, City Hydrologist, served on the Advisory Council and put together the MS-4 onsite training for area contractors and Habitat affiliate chapters toward the end of the grant. Matt and Tim both served on the Advisory Council.

Special thanks is also given to Mary Shearer, Executive Director, Kentucky Habitat for Humanity, for her tireless and enthusiastic support in linking with the project, linking the project with International Habitat, and providing education and training opportunities related to the Durbin project to Habitat affiliates. Mary

has provided critical and inspirational leadership in supporting all aspects of the project and served on the Advisory Council. Also to Ginger Watkins, Sustainabile Buildings Specialist, in Years 1 and 2, and Holly Todd, in Year 3, for their contributions; Ginger also served on the Advisory Council and conducted the design charrette.

Scott and Ritter, LLC, served as General Contractor, for the Phase I road and utilities construction. They did an excellent job keeping the project under budget, on schedule, and were responsive to addressing issues quickly.

Other partners to acknowledge include:

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- Andrew Stoeckinger, with Bluegrass PRIDE, for his active service on and providing education on other green infrastructure initiatives around the state to the Advisory Council.
- Kevin Brooks, Attorney at Bell, Orr, Ayers and Moore, for developing the Binding Elements for the Durbin site and serving on the Advisory Council.
- Tom Biebighouser, with the Center for Wetlands and Stream Restoration, for his directing and donation of materials for the vernal pond installation.
- Lee Brick and Block for their donation of all materials and labor for installing the permeable parking lanes for Phase II of the project.
- To Gather BG, a community nonprofit, and David Givens, its Director, for introducing composting and a greenhouse to the site;

Thanks are also extended to the many community members from BGGreen Partnership for a Sustainable Community, including Cynthia Mason who served on the Advisory Council, and others who volunteered for cleanups and planting days, and to all others unnamed here who assisted with this project.

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K. APPENDICES (Attached and tabbed in order)

D. EXECUTIVE SUMMARY

The goal of the Habitat for Humanity Green Infrastructure Demonstration Extended project is to demonstrate an integrated green infrastructure model for community development that can be broadly replicated to reduce NPS pollution, educate the public, and improve quality of life for communities. This is a FFY 2010 project and the contract expires 12/31/2017.

The site is a 14.3-acre parcel owned by Habitat for Humanity Bowling Green-Warren County (HFH BG-WC) within the Jennings Creek watershed. The entire area has significant karst features. A large retention basin created on the site in the 1980's as part of an urban renewal project directs and discharges stormwater through a storm sewer into the basin from a 270-acre offsite drainage area. Prior to when the retention basin was created, stormwater drainage flowed across the property and emptied into Limestone Lake. Heavy blasting used to create the basin likely fractured the basin floor, which caused a rapid infiltration of the inflow and its by-passing of the dry wells and disappearance into the basin floor. A lack of trees and landscaping throughout the property contributed to the heavy water runoff during storm events and the velocity of the flow discharging on the site was highly erosive.

In collaboration with WKU and many community partners, HFH BG WC identified the site as an optimal opportunity to develop a model green community that demonstrates an integrated green infrastructure and green building techniques for water quality improvement. The site will eventually comprise up to forty-three residential units with shared green space, community building features, and some shared-use functions. The concentration of residences and paved areas at the perimeter of the property permits the core area to be used to create a park-like outdoor learning, human interactions, and recreational environment.

Specific improvements constructed as part of this project include the following:

- Drainage channels were modified and planted to slow and absorb runoff
- J-hooks and sediment pools were added to decrease sedimentary deposits in the basin
- Rock dam was installed between drainage channel and basin to catch litter and sediment
- Bio-infiltration basin was installed and planted with bald cypress to increase absorption and filtration
- Injection wells were reconstructed and connected through French drains from the bio-infiltration basin
- Native flowers/grasses were planted throughout site to reduce water need, slow runoff
- Increased tree cover and edible trees were planted to add food, cover, and shading
- Addition of 0.7 acre vernal pond with an impermeable liner and wetland features
- Installation of permeable pavers in parking lane
- Bioswale was constructed and planted along the road to reduce runoff, increase filtration
- Educational signage, translated into 5 languages, was installed to aid in public education

Community building activities included a design charette open to the public, town hall meeting about the project for area residents, outreach to schools and new partners, and regular press releases to keep the public informed about on-going developments at the project site.
Educational activities to build awareness and understanding of NPS pollution and protecting water quality included:

- Educational presentations made at Advisory Council meetings, KY Habitat for Humanity Green Summits for affiliate chapters, and at national and international conferences
- Professional on-site MS-4 training for >130 contractors and operators
- Site tours for outdoor learning about green infrastructure, karst environments, and habitat protection for eight classes, 140 students, from two schools

- Educational signage along trails with translations in five languages
- Durbin Project web page with history of project, special project updates, photo gallery, green features descriptions, instructional sign translations, and other resources
- PreK-12 water quality Educator Resources webpage
- 30-minute on-air broadcast about project by WKYU-PBS
- Dissemination of project results through regional/national conference presentations, media, Facebook page, and web site

Many public involvement and educational components were incorporated into this project. A design charrette and town meeting were held to inform and get input from the public. Interpretive signage was designed and installed and translated into five languages, to educate site visitors and students about green infrastructure and water quality. On-site classes and professional trainings were held to educate students, educators, Habitat affiliates, contractors and operators about important concepts and features of the project. On-site teaching by the city and school system will continue into the foreseeable future. Lessons learned during implementation will be used in planning for future water quality projects for the city and Habitat for Humanity.

Broad and committed partnerships with state and local government agencies, nonprofits, area businesses, community groups, schools and the university were essential to the success of the project. The River Basin Coordinator and River Basin Team in the project area worked closely with an Advisory Council to the project that included representation from each of the principle partner groups.

E. INTRODUCTION & BACKGROUND

In 2006, Habitat for Humanity Bowling Green-Warren County (HFH BG-WC) purchased a 14.3-acre site near Durbin Street for future building projects. The site is within the Jennings Creek watershed and Bowling Green city limits. In 2007, members of BGGreen Partnership for a Sustainable Community and HFH BG-WC developed a concept for the site to be used to establish a mixed-income, mixed-use, green, affordable housing community with an integrated green infrastructure that could be a model to the larger community. This integrated systems approach would reduce NPS pollution and improve water quality. The site could also be used to train professionals and educate the public, plus build community and improve the quality of life for residents. In 2010, a WKU class generated a concept mapping for the community that was later refined by Arnold Consulting and Engineering, the engineering firm used for the project. A 319(h) grant was pursued to assist in financing, and a grant was approved in 2009, to begin in January, 2010.

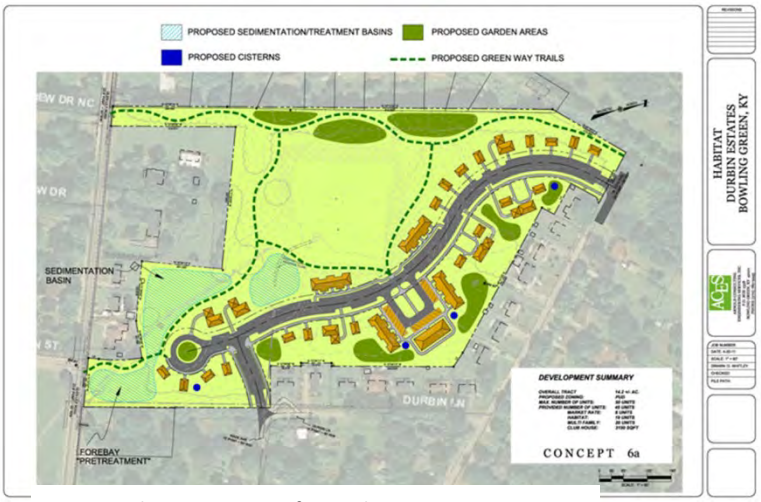


Fig.1: Early concept map for Durbin Estates

After several iterations and modifications based on site constraints, as it is now planned, the Durbin Project community will eventually comprise up to forty-three high performance or passive homes, walking trails and shared green space, perimeter roads with on-street parking, community gardens, community-scale renewable energy, a community center, and other shared use functions (e.g., public transit.) Green community models similar to this have been implemented by other communities and by HFH in other states, but this would be the first HFH community with integrated green infrastructure to be implemented in Kentucky.

A large retention basin that existed at the center of the site was created in the 1980's as part of an urban renewal project. It directed stormwater from a 270-acre offsite drainage area and discharge it through a storm sewer into the basin. The drainage area to the site is highly urbanized with industrial, commercial, and residential land uses. Prior to the improvements, trash, large debris, sediment and other pollutants entered the site and passed essentially unfiltered into the underground water system. Construction of the basin was accomplished by drilling and shooting about 15 feet into the bedrock, with the excavated rock becoming the core of the basin walls. Prior to its creation, the stormwater drainage that entered the property from the east and southeast had flowed across the property and emptied into Limestone Lake. Once the basin was built boreholes were drilled and developed into dry wells with stand pipes. However, the basin floor was heavily fractured from the blasting and provided for rapid infiltration of any inflow, by-passing the dry wells and disappearing into the basin floor. The velocity of the flow discharging onto the site was very erosive. The lack of vegetative cover throughout the property contributed to the heavy water runoff during storm events. The retention basin filled with sediment and would frequently flood with several feet of standing water after storm events.


Fig. 2: Images from undeveloped site showing lack of vegetative cover

Fig.3: Images showing erosion from velocity and heavy discharge onto site

Fig. 4: Flooding following a storm event

The site for this project created many opportunities and challenges when it comes to site layout. With the large but shallow stormwater retention basin located in the center of the site,
there was an opportunity to use this facility not only for its intended use of collecting stormwater runoff, but also to create a park-like area for passive recreation for residents when the site is dry, which is a majority of the time. Using this land area for multiple uses could improve the overall efficiency of this valuable resource. Proposed low impact development (LID) stormwater techniques could be expected to control water flow to the basin, and improve infiltration and filtering out of pollutants to improve water quality.

In addition to controlling runoff and erosion caused by inflow from the 270 acre off-site catchment area, the project also had a goal to decrease the amount of stormwater generated from any onsite improvements that would then flow into the basin. Planned strategies to help achieve this goal included minimizing pavement and locating it toward the perimeter of the project, using on-street parking and permable pavers for the parking lanes, installing bioswales and rain gardens along the roads and dispersed throughout the housing areas, and using rain barrels and underground cisterns to collect roof water runoff, for re-use to irrigate plants. Increasing the trees and plant cover could improve the water filtration and absorption, create habitat, and beautify the site. Using native and drought resistant plant species for the majority of the landscaping could reduce water needs and long term maintenance costs. Native plants incorporated into the basin could act as natural water pumps to help dry out the basin, while being able to survive long dry periods. Organic growing methods would be used to reduce water requirements, and also pesticide and synthetic fertilizer use that can contaminate groundwater.

Beyond the potential water quality benefits, the Durbin Project site was identified as an excellent platform for providing educational opportunities related to sustainable practices, water quality, habitat protection, and environmental issues in general. The site could be used to demonstrate the value of natural ecosystem services and the contrast between traditional vs. LID, where traditional practices increase runoff and reduce infiltration and soil activity through soil compaction, reduced vegetative cover, and erosion while LID does the reverse and improves air and water quality and soil health. Education and outreach would be needed to advance the public's understanding of the causes of NPS pollution and benefits of LID, plus how individual and community practices contribute to water/ environmental quality or contamination, and how individuals and groups can inform themselves to more effectively participate in creating solutions. Professional training would advance the knowledge, skills, and familiarity with new techniques and materials necessary to encourage more widespread adoption of the low impact development stormwater techniques advocated by this project.

Broad dissemination of project results through the media, social networking and conferences was used to increase the visibility and educational penetration of the project. The emphasis on training for HFH affiliate chapters, builders, and local government, plus education and outreach to educators, school groups,

residents, and the public was intentional to extending the project's impact to the larger public. In addition to improved water and air quality and reduced water treatment savings, the benefits of sustainable sites to be emphasized include energy savings, climate control, reduced greenhouse gas emissions, habitat protection, and physical and psychological health and productivity.

The project design planned for residents and the community to be involved in every stage of implementation, from town meeting and design charrette input, to the "sweat equity" requirement for HFH families; participation by volunteer groups and individuals in plantings, trail construction, and building activities; and creating a homeowners association to assist with site planning and maintenance. Such involvement contributes to building a sense of pride and a personal stake in the community; it creates a sense of shared responsibility for "stewardship of place" among site residents and the community. Through shared activities and education, this project will move its partners and participants beyond the physical action of building a green infrastructure to constructing an ethic of understanding and action that connects personal lifestyle and community practice with environmental quality.

This project also exemplified a spirit of true partnership, where the project partners shared not only in the vision, but they "rolled up their sleeves" to do the work to ensure positive outcomes and project success. The environmental and social benefits of the project were anticipated to have lasting impact by encouraging innovative technologies for water quality improvement, applied on a community scale. The principles of demonstration, education and outreach; cooperation among agencies, community involvement; and seeking building policy revisions were utilized. Unanticipated obstacles, e.g., the high rock table and higher-than-budgeted bids led to the engineering plans needing to be re-drawn repeatedly, cost overruns, and additional fundraising. Currently, Phases 1 (green infrastructure) and 2 (first road & utility structure) have been completed, and funding has been raised for Phase 3 (extending the road and utility structure.) The first two energy efficient homes are being constructed and a passive house will be the third house to be constructed.

F. MATERIALS & METHODS

During project planning, specific goals, objectives and activities were identified to ensure a successful project. The project was part of a larger mixed income affordable housing green neighborhood being developed in partnership with Habitat for Humanity. The Durbin Project was administered by the Center for Environmental Education and Sustainability at Western Kentucky University (WKU), in close coordination with the Bowling Green-Warren County Habitat for Humanity (BGWC HFH) office and its Board; various departments at WKU, most importantly Planning, Design and Construction, Landscaping, and WKYU-PBS; and a large grouping of state and local government and community partners. The WKU Grants Accounting and Sponsored Programs offices provided support for budget accounting and filing the quarterly and annual reports. The College of Education and Behavioral Sciences' Grants Specialist worked directly with the Principle Investigator in budget planning.

An Advisory Council comprised of representatives from each of the major partnership groups convened quarterly, or more often when needed, and many of the project partners contributed substantively to the project in materials and labor in addition to their time. The Advisory Council also created subcommittees to focus on specific functions, i.e., site plan/street design, stormwater management, education and outreach, landscaping, fundraising, and maintenance. The Advisory Council meetings were also used as a forum to educate the members about many aspects of the project, e.g. green infrastructure, liveable neighborhoods, and passive homes. Committee members created presentation to share information, and in addition, some committee members were sponsored for additional training using grant funding. Aaron Arnold, the chief engineer for the site master plan and revisions, was sent to a Green Infrastructure training; Charlie Gries, Engineer, and Ryan Smith, Construction Manager for BGWC HFH, were sent for Passive Home construction training.

Project Goal: Demonstrate an integrated green infrastructure model for community development that can be broadly replicated to reduce NPS pollution, educate the public, and improve quality of life for communities.

Objective 1: Create an integrated green infrastructure that retains, filters, and reuses all stormwater at the site

Activities related to this objective included working with partners to develop a design for green infrastructure for the site and developing and implementing, after approval by KDOW, a Best Management Practice Implementation Plan (BMP IP) based on the design.

The BMP Implementation Plan laid out the "treatment train" or series of BMPs to be constructed. The BMP Implementation Plan approved by KDOW is provided in Appendix C and lists the following BMP technologies to be installed:

- Stormwater Injections Wells: rehabilitate existing structures; add French drains from the bio-infiltration basin to return pre-filtered water
- Drainage Channels: reconfigure and stabilize existing drainage channels; remove concrete channels, broaden path and create meandering configuration; add J-hook structures and rock check dam
- Broad Outlet Structure: this planned feature was replaced with J-hook structures in drainage channels, to settle out sediment, and a rock check dam, placed across the pre-treatment basin flow path to reduce velocity and allow further settling of solids and trash.
- Side Slope Buffer Strip: plant drainage channels and slopes with sedge and native grasses plugs to stabilize soil and prevent erosion, plus slow and absorb stormwater runoff

- Bio-infiltration Basin: install large pre-treatment bio-infiltration basin on far side of detention basin, graded to maximize inflow and plant with 40 bald cypress trees, to absorb and filter water
- Rain Gardens/Bioswales: Construct throughout residential areas and along roadways to slow and absorb stormwater runoff, filter pollutants, and beautify the neighborhood
- Underground Cisterns with Automatic Overflow Valve and Piping: Install near or under rain gardens, to collect water from rooftops and use to irrigate gardens
- Onstreet Parking/Pervious Pavers: for parking areas, with underlying drainage.
- Native Plantings: provide diverse groupings of native and water tolerant plants that will provide water quality and filtering benefits; reduce pesticide use; and create habitat
- Increase Tree Cover: to improve absorption and reduce runoff; increase shade, and build habitat. Include edible plantings, e.g., persimmon and nut trees and site for future orchard
- Walking Paths: with educational signage
- Vernal Pond: shallow, seasonal native wetland and aquatic plant material to provide filtering and nutrient uptake and build habitat.

Each of these objectives was or will be accomplished with the exception that the final engineering plan did not include the planned stilling basin and broad outlet structure. These functions were met alternatively by broadening and creating a meandering configuration for the drainage channels, plus installing J-hook structures and planting along the channels to slow flow and settle out sediment and a rock check dam to further slow flow and capture trash. Due to major delays in construction, explained further below, no rain gardens, cisterns or piping were installed by the completion date for the grant project; these will be installed with additional funding required to complete construction in the residential areas.

Prior to designing the green infrastructure, WKU professor of Geography and Geology, Dr. Warren Campbell, Professor, worked with students to assess peak discharge and the 100-year flood stage at the site. WKU professor Dr. John All's master's class in Urban Design developed projects to recommend green features to incorporate into the new neighborhood. Meetings were held with Limestone Lake owners John and Sheryl Payne, the BG WC Habitat for Humanity Board, Mayor of Bowling Green, and City Arborist to discuss the proposed changes at the site and gain their input and support for the project. Meetings were held with the City's Greenways Commission to encourage their involvement in the back corridor trail on the property that would connect two neighborhoods and existing City parks.

Photos from Before the Re-construction:


Fig. 5 Concrete drainage channel

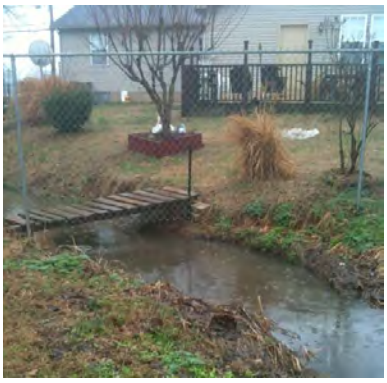


Fig. 6 Drainage channel in yard


Fig. 7 Original injection wells

The architecture and site engineering consulting firm Arnold Consulting and Engineering Services (ACES) was contracted with to perform planning and design for the project and to perform oversight services for construction of the green infrastructure features designed for the site. The engineering plan (see Fig. 13) had to be revised several times to accommodate partner and zoning identified needs in accordance with the BMP-IP.

Photos from during the Construction Process:

Fig. 8: Constructing bio-infiltration basin

Fig. 9: New injection well with French drain

Fig. 10: Preparation for permeable pavers

Fig. 11: Permeable pavers parking lane

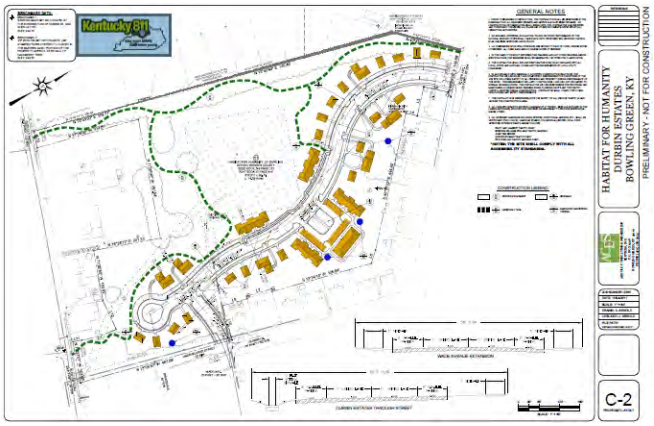


Fig. 12: Preliminary Site Master Plan

Once it was determined that a PUD was needed, the document and binding elements (see Appendix D) were developed by Bell, Orr, Ayers and Moore, in accordance with City requirements and the BMP-IP. These were submitted to the Planning and Zoning Commission for review Sept 8, 2011. Once approved, on Oct. 6, the PUD was then presented and approved at two sequential City Commissioners meetings on November 1 and 15, 2011. After the site plans were fully approved by the City, a request for bids for Phase

1, constructing the green infrastructure, was written and put out for 30 days through the WKU Planning, Design, and Construction office. Scott and Ritter, Inc., was awarded the bid with instructions that construction must begin within sixty days.

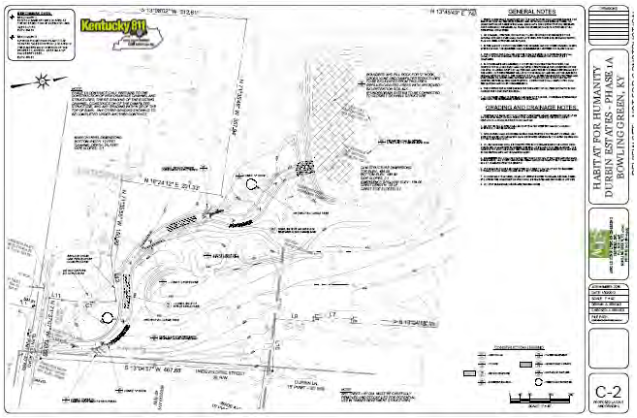


Fig. 13: Green Infrastructure Engineering Plan

Cost overruns from unforeseen contingencies, such as an unexpectedly high surface rock encountered at the site, were high and construction delays due to heavy rains from storm events were frequent so the engineered site plans and what could be completed under the grant had to be revised more than once, and these revision to engineering plans resulted in additional cost overruns and time delays. Eventually, Phase 1 was designated as the new and revised green infrastructure features related to the drainage channels, detention basin, and native and tree cover plantings, and Phase 2a was designated as the road and utility infrastructure for the first three homes to be built only. The permeable pavers used for on street parking and labor to install them were fully donated by Lee Block and Brick, as a demonstration site to the community.

Construction for Phase 1, the green infrastructure, was started May and completed in early October, 2013. Phase 2a for utility and road construction onto the site and for the first three homes was started in mid-Oct. and completed in November, 2013. Construction of the first energy efficient home began in mid-March, 2014. Funding for Phase 2b, to extend utility and road construction for eight to ten more homes, was acquired through many twists related to gaining Community Development Block Grant (CDBG) funding from City government. The first awarded grant in 2013 was rescinded due to a conflict with funding and federal regulations; when bids were opened for the second grant awarded in 2014, the initial bids received were over budget and the bidding process had to be reopened. A final bid was awarded in May 2014 with construction on Phase 2b set to begin in late summer or early fall 2014.

The site landscaping plan was designed by Josh Twardowski, Landscaper for WKU, to emphasize water filtration and absorption as well as habitat creation and low maintenance. Helen Siewers, Head Landscaper, provided 5% of her time to oversee the landscaping aspects of the project. The stream bed and basin area were to be planted in a rush and sedge mix that is evergreen and more rigid, to slow water flow and encourage filtration. A large grove of bald cypress trees was selected for the bio-filtration basin, selected because each tree can absorb hundreds of gallons of water per day, they can grow in standing water and also are drought tolerant, and their leaves do not create a lot of biomass when shed in the fall. White pines were to be planted along the streambed and back property trail, serve as a screen and provide food for wildlife. Rain garden areas were to be planted in a wetland/wildflower mix around the injection wells and on the slopes near to housing areas. A tall prairie mix was selected for areas away from the detention basin and houses; a benefit is the sound absorption capabilities of tall grasses.

Fig. 14: Landscaping Master Plan

Native and drought resistant plants were emphasized and invasives were not permitted to be planted on the property. Shrubs also were not included in the plan because it was deemed there is no benefit and they are high maintenance. Edible plants were incorporated into the site plans as well as areas for future community gardens. An area above the vernal pond is reserved for eventual planting of an orchard. Native plantings were donated by Roundstone Native Seed and a small amount of additional plants were purchased using ALIVE Center and BGGreen Partnership donated funds. Trees were purchased from Tennessee Tree Nursery, Nolin Nut Tree Farm for edible (persimmon and nut) trees, and Miller's Greenhouse for replacement trees (bald cypress and white pine). Trails around the detention basin were pushed, graded, and mulched in June, 2014, and educational signage installed along the trails for residents and site visitors.

Roundstone Native Seed donated all of the seeds and other plant materials as well as labor to establish the native grasses and plants at the site. The land was initially treated to remove existing grasses and weeks, then cover seeded, then planted with native species. Retreating and reseeding were required on repeated occasions due to failure to get a good stand in various areas. The drainage areas were planted heavily with plugs of sedges and native grasses. A listing of plants used by Roundstone Native Seed is found in Appendix E.

Fig. 15: Donated mixed seed


Fig. 16: Planting native seeds


Fig. 17: Presenting appreciation plaque to John Seymour

The campus Habitat for Humanity chapter constructed a pedestrian bridge over the drainage channel. Volunteer days were organized for: (1) constructing a vernal pond to build animal habitat and an outdoor learning lab for school children on site; (2) planting days for trees and plugs; and (3) site cleanups. Volunteer cleanups were also held on various occasions. These activities are detailed more fully under Objective #3.

Substantial cost overruns in construction costs were encountered, so continued fundraising was and will continue to be needed to keep the project moving forward. The initial Durbin Project grant was sufficient for implementing Phase 1, the green infrastructure, and a grant extension of $300,000 was awarded to permit completion of Phase 2a, the road and utility infrastructure for the first three homes to be built. A Community Development Block Grant (CDBG) was applied for and awarded to the BGWC HFH affiliate by the City of Bowling Green, for Phase 2b to extend the road and utility infrastructure for 8-10 more homes

and incorporate the first rain garden and underground cistern and piping. The initial 2013 CDBG grant, awarded on June 15, 2013, had to be rescinded due to a conflict with the requirement for prevailing wage to be used for all labor, since it was a federal grant, and a mandate not to overlap with the existing KDOW grant which was exempt from using the prevailing wage. When construction under the KDOW grant was completed, BGWC HFH was able to resubmit for the 2014 CDBG grant cycle, and this time when funding was awarded it was able to be used for Phase 2b.

Habitat for Humanity has also been successful in raising funds to permit house building to begin on the site. Construction on the first home began in March, 2014, using funds from an $80,000 GM Foundation grant (see http://www.bgdailynews.com/news/gm-donates-volunteers-for-habitat-for-humanity-development/article_2a7e8c78-0d2f-5a0d-8fb9-1527a4e82d98.html) and construction on a second home began in June, 2014. All homes built on the site will be high performance homes that minimize heating, cooling, and water use and thereby positively impact water use and quality and climate change. The third home is slated to be a passive home that uses 80% less energy than a conventional home, the first to be built in South Central Kentucky. $30,000 in funds have been raised from a local bank toward construction of this home.

Objective 2: Provide professional training and community education and outreach on the features of this system and how they reduce NPS pollution and benefit the community and environment.

An education subcommittee was formed to develop an overall plan and Education/Outreach Checklist for professional, community, and public education activities. Areas of emphasis included community, media, web, and social media outreach; working with classes and students in the school and university; conference presentations, and other training opportunities. A pre-post test was developed to assess learning by classes for onsite instruction. These documents are found in Appendix F. Specific accomplishments included:

<u>Community Outreach</u>

- A design Charette was held at LC Curry School on February 18, 2011, open to the public. Presentations were made about green streets, infrastructure, and communities, and attendees offered ideas and feedback on the plans. Over thirty people attended this half-day session including project partners, community members, and the City's Mayor.
- A *New Look at Community* luncheon was held in honor of Larry Gluth, Senior Vice President, U.S. and Canada Habitat for Humanity International, on June 30, 2011, at WKU. The event was attended by over thirty WKU administrators, and others from the Kentucky Department of Energy Development and Independence (DEDI) and Tennessee Valley Authority (TVA), along with Durbin Project partners.
- A town hall meeting was held on Sept. 29, 2011 with nearby residents to inform them about plans for the site and address questions and concerns, with presentations made. About forty people attended. Concerns raised especially related to lighting and safety, but by the meeting's end the attendees felt the concerns were being satisfactorily addressed.
- Tim Slattery, City Hydrologist, worked with WKYU and the Keep it Clean BG Campaign to develop a Red is Green 30-sec. spot on trash-littering-recycling, using the Durbin property. The spot produced aired on the football scoreboard during the WKU Homecoming game against LA-Lafayette on Oct. 22, 2011.
- The Bowling Green Human Rights Commission featured Durbin in its "Get on the Bus" tour for energy efficiency on April 26, 2012.

<u>Collaboration with City schools</u>

- On March 15, 2012 , a hands-on rain barrel construction workshop was held at the former LC Curry school across from Durbin (site of the new Dishman McGinnis school being built). Forty students, parents, and teachers participated.


Fig. 19: Working to construct a rain barrel


Fig. 20: Parents, students, and teachers in rain barrel workshop

- On May 23, 2012, Terry and Robin from the CEES at WKU meet with Vicki Writsel, Assistant Superintendent with BG City Schools, about various collaborations with the schools as a result of the Durbin Project: science students, community gardens, rain barrel workshops for families, web catalog school projects
- On Oct 9, 2012, a draft script and activities plan for Durbin school tours was conditionally approved by KDOW.
- On Nov 12, 2012, Dishman McGinnis 4th graders came to the Durbin site to learn. Topics emphasized included non-point source pollution and watershed protection, karst environments, and habitat protection/vernal ponds. 50 students participated.
- On May 16, 2014, Students from five classes of Parker Bennett Curry 4th graders came to Durbin for onsite instruction. Topics included those listed above. 50 students participated.


Fig. 21: Dishman McGinnis students learn about habitat


Fig. 22: Parker Bennett Curry students learn about stormwater management

- An online Durbin Estates Educational Resources curriculum was developed to provide educator resources for preK-12 teachers. This curriculum includes lesson plans/activities by grade level with a description and web-linked source, plus additional resources by grade level with source links. More information and the web address are in Appendix G.
- BG City Schools identified the five most common foreign first languages in their schools (Albanian, Bosnian, Burmese, Spanish, Swahili) and provided language translations for the educational signage being developed for the site. These translations were then uploaded to the Durbin Project web site, as found under each sign, and may be viewed at http://www.wku.edu/cees/signs_multi_language_translation.php.

<u>Educational Signage</u>

Educational signage was developed to explain green infrastructure features and functions and placed along walking trails for on-site education with school groups and visitors. WKU contracted with the Hoffman Environmental Research Institute (also WKU) to design the graphical template and assist the CEES in developing text and identifying graphics.. KDOW provided input throughout, and following their final approval, electronic versions of the signs were uploaded to the project web site in June, 2013 and the printed signs installed onsite on April 1, 2014. Images of the \signs produced are found in Appendix H.

Media Coverage

- Project events and milestones were disseminated through regular press releases, which were then published in The Daily News and other regional newspapers. These are found in Appendix I.
- The WKU ALIVE Center for Community Partnerships conducted interviews with Principle Investigator, Nancy Givens, and the local Habitat for Humanity Executive Director, Rodney Goodman, for article published in their Sept. 2011 magazine. View it at http://www.wku.edu/alive/news_publications/progression_through_partnerships.php
- WBKO-TV coverage and videos:
  - "View from the Hill", on the Parker Bennett Elementary students visiting the Durbin site. It can be viewed at https://www.youtube.com/watch?v=8VHYJncmS9o
  - Article and video, *Bowling Green's Habitat for Humanity Builds Eco Friendly Community*, about the GM Foundation's funding contribution to permit construction of the first house at Durbin, at http://www.wbko.com/news/headlines/Bowling-Greens-Habitat-for-Humanity-Builds-Eco-Friendly-Community-252344681.html
- Sample *BG Daily News* article: *GM donates, volunteers for Habitat for Humanity development*. View it at http://www.bgdailynews.com/news/gm-donates-volunteers-for-habitat-for-humanity-development/article_2a7e8c78-0d2f-5a0d-8fb9-1527a4e82d98.html

WKYU-PBS documentary

WKYU-PBS produced a 30-minute documentary on the Durbin Project that featured its green infrastructure and green buildings, including passive homes, for professional training and public education. Staff and interns collected footage to document each step of the project, from start to finish. The CEES developed a preliminary script line and WKYU-PBS modified this to create the final product. On Feb. 20, 2014, interviews with key partners were scheduled, and there were held in March. The draft documentary was sent to key partners and KDOW for final revisions in March, 2014, and approved for showing in April, 2014. A DVD copy of the documentary is provided in Appendix M.

Web/Social Media

- Project event announcements and photos and information on accomplishments were disseminated through web site and Facebook updates. Information about and screen shots of these web pages are found in Appendix J.
- The project web site was created to catalog and document the various aspects and phases of the project–providing background information on the project, a timeline, special projects updates, photo gallery, green features, the instructional signs with multi-language translations and resource links, the Educator Resources curriculum guide, and other information–at http://www.wku.edu/cees/ee_programs_durbin_estate_project.php.
- The Facebook page announced upcoming events and established an interactive online presence. The web address is https://www.facebook.com/durbinproject

Conference/Class Presentations

Project accomplishments and milestones were regularly disseminated through presentations made at local, regional, national and international conferences,in WKU classes, and other forums. Some of the conference proposals and abstracts are found in Appendix L and a CD of sample PowerPoint presentation, in Appendix N.

Some examples of presentations made are listed:

- Green Housing Summits hosted by KY HFH, in Lexington, KY, 2010 and 2011, 25 + 20
- Teacher Education Summer Conference, WKU, June 2011, 20 people
- Education for Sustainability Summer Institute, WKU, July 2011, 25 people
- Association for the Advancement of Sustainability in Higher Education (AASHE) Annual Conference, Pittsburgh, PA, Oct. 2011, 6 people
- KY Water Resources Research Institute Symposium, Lexington, KY, Mar. 2012, 30
- North American Association for Environmental Education (NAAEE) Annual Conference, Oakland, CA, Oct. 2012, 8 people
- Campus-Community Partnerships for Sustainability annual conference, WKU, Nov. 2012, 12 people
- Glasgow Rotary Club and Benton KY HFH chapter meetings, Apr.-May 2012, 60 people
- Dr. John All's Geography & Geology class, WKU, on presentations about developing a green community, Feb. 2011, 20 students
- Dr. Warren Campbell's Geography & Geology class, WKU, about monitoring and producing a flood stage analysis report, Mar. 2011, 15 students
- Dr. Martin Stone's Horticulture class, WKU, about the project and potential for student involvement in growing plants for the bioinfiltration basin, Jan. 2012, 15 students
- Meeting with Agriculture dept. faculty to enlist support for student engagement and research projects with Durbin, Feb. 2012, 12 faculty

<u>Conferences and Trainings</u>

- Onsite training about wetlands and habitat restoration was held in conjunction with the one-day volunteer vernal pond construction on Aug. 3, 2012, by Tom Biebighauser. Mr. Biebighauser is a wildlife biologist, wetland ecologist, author, and faculty member with decades of experience in wetland and stream restoration.

Fig, 23: Verbal pond in spring

Fig. 24: Dragonfly resting beside pond

- KY Habitat for Humanity's annual Green Housing Summit was held at WKU in April, 2013 for its 55 chapter affiliates, with over 100 attending. This two-day conference included sessions on green infrastructure in residential settings and a Durbin site tour.
- The City of Bowling Green's Public Works and HFH BG-WC hosted an all day MS-4 on April 23, 2014. The training included morning educational sessions, lunch at Durbin, and afternoon tour and training at the Durbin site for over 100 local-regional building trades professionals and state HFH chapter affiliates. See Appendix K for documents.

Objective 3: Involve residents and the community in hands-on activities to build a sense of pride and ownership in the project and shared responsibility for stewarding the environment

Activities:

1. New Habitat for Humanity (HFH) homeowners will contribute a portion of their required "sweat equity" to assisting with plantings, trail construction, education, and site maintenance

This activity was not accomplished due to the long construction delays having pushed back the timetable for houses to be constructed on site past the grant period. However, homeowners from existing HFH homes bordering the property frequently participated in the volunteer days held, as detailed below, and plans are in place for this requirement for "sweat equity" by homeowners to be made in maintaining the property and trails.

2. WKU classes will engage students in volunteer work and action-research

Classes and students from Geography & Geology, Agriculture, Community & Diversity Studies, and Broadcasting have been involved in class projects, individual engagement, and action research. Students helped to:

- design features of the community that were built into the site plan
- assess peak discharge and the 100-year flood stage at the site help to prepare the report
- assisted in cleanups and the planting, vernal pond construction, and brush clearing volunteer days
- assisted with community gardens education and planning for the onsite gardens
- collected footage for the WKYU-PBS documentary

Students with the Campus Habitat for Humanity chapter have had instrumental involvement in helping to plan and volunteer for many activities and events. They designed and built the pedestrian bridge across the drainage channel that connects the trails encircling the detention basin to creates a pathway to the vernal pond and connect the educational signage; details are provided below. They also have been involved in the recent home building on the site.

3. BGGreen Partnership and other community groups' members will contribute time, effort, and materials toward meeting project goals

Community individuals and groups participated in a great many ways toward project success. Some of the more notable volunteer efforts are detailed below.

- A volunteer day was organized to construct a vernal pond onsite that would build habitat, add visual appeal, and create an outdoor learning center onsite. Over thirty people participated in this event. Trish Sowell, who has organized vernal pond construction projects for both the BG City and Warren Co. school systems, made the arrangements. Tom Biebighauser, an expert in wetland restoration and vernal ponds construction who has supervised construction of 1,500 vernal ponds, supervised the effort and trained the volunteers; he donated his time and a portion of the supplies. Scott and Ritter, Inc. donated the construction equipment and labor needed for heavy moving of soil and rocks.

Fig, 25: Volunteers gather under tent

Fig. 26: Heavy equipment digs for vernal pond

Fig, 27: Volunteers lay the pond liner

Fig. 28: Completed vernal pond in late fall-winter

Other volunteer days were organized for: (a) planting 40 bald cypress trees in the bioinfiltration basin and 40 white pine to create a boundary border and build bird habitat, on Nov 30, 2012; (b) planting sedge and grass plugs along the drainage channels to slow, filter, and absorb water, on June 3, 2012; and (c) installing picnic tables and clearing brush, in Nov, 2013. Volunteer site cleanups were held at various times, including by a large group of students arranged by City Hydrologist Tim Slattery, during Commonwealth Cleanup Week each year, and by the campus Habitat for Humanity chapter.

Fig. 29 Planting white pines on Tree planting day

Fig. 30 Planting plugs on “Plugs” planting day

Fig. 31 Volunteers collect trash

Fig. 32 Volunteer group installs picnic tables and clears brush by vernal pond

The campus chapter of Habitat for Humanity constructed the pedestrian bridge across the drainage channel in April-May 2014. It connects the trails around the drainage basin along which the educational signs explaining the project and green infrastructure were placed.

Fig. 33 Campus Habitat for Humanity students work on constructing pedestrian bridge

4. A site maintenance program will be developed and implemented that includes a Homeowners Association, educational and training materials for site maintenance, and training of volunteers and City personnel responsible for future maintenance.

Due to the major construction delays already noted, and the fact that no houses had been constructed on the property by the end of the grant period, this activity was correspondingly delayed and hence has been transferred to the local Habitat for Humanity, the organization that will be fully responsible for the project henceforth.

Current plans are to incorporate a $50 monthly fee into the house mortgage structure that would be designated to create funds for ongoing maintenance, to form a Homeowners Association comprised of interested site residents, and to provide education and training for residents, volunteers, and City personnel responsible for future maintenance.

Objective 4: Seek building policy revisions for Kentucky Habitat for Humanity (KyHFH) that will potentially impact international HFH

Activities:

1. The local and state HFH offices will review their current building codes as relates to green building and infrastructure
2. The KyHFH green building specialist and Durbin Project Advisory Council will consult to recommend code revisions to incorporate green building and infrastructure in all future building activities.
3. All state affiliate chapters will be trained to any Ky HFH code revisions adopted.

Some progress was made toward this objective although it is not formalized into code at this time. KyHFH has provided extensive trainings on green infrastructure, the Durbin project, green building, and passive home building to its 55 chapter affiliates at each of its annual Green Housing Summits from 2010 to 2012. In 2014, the Green Housing Summit was hosted at WKU so that a tour of Durbin could be included in the event. Over 100 KyHFH affiliate directors and staff participated. In the last two years, KyHFH has built two passive houses and it promotes this as a model to strive for in all future building by affiliate chapters.

The construction engineer and manager for Bowling Green Warren County Habitat for Humanity (BGWC HFH) were sponsored under the grant to attend training provided by the U.S. Passive Home Institute in passive home design and building techniques. These principles have subsequently been integrated into all house design and building for BGWC HFH and the agency has committed itself to building the first passive home in south central Kentucky at Durbin Estates, as the third house to be built. The project engineer from ACES was also sponsored, using grant funding, to attend a conference on Green Infrastructure Research at Villanova University, to learn state-of-the-art techniques to bring back and incorporate into the project. This expertise will permeate all future ACES work projects relating to green infrastructure.

The luncheon held with Senior Vice President of Habitat for Humanity International (HFHI) at WKU provided an opportunity to educate about the Durbin Project as a model to HFHI in green infrastructure and passive home building. Other attendees at the event, including WKU administrators, the KY Department of Energy Development and Independence (DEDI), and Tennessee Valley Authority (TVA), also were introduced to the commitment being made by HFH to require high performance buildings and communities in all future construction activities.

The City of Bowling Green and Planning and Zoning Commission were introduced to the green infrastructure and buildings concepts being integrated into the Durbin community through presentations and discussions that occurred throughout the planning and zoning process. Some zoning requirements were amended to permit, for example, permeable pavers in the parking lanes, curbless streets, and bioswales along the full length of the streets.

The full-day MS4 training arranged by the City of Bowling Green's Public Works department provided training in green infrastructure and an onsite tour at Durbin for 200+ local-regional building trades professionals and operators along with state HFH chapter affiliates.

G. RESULTS & DISCUSSION

The qualitative and quantitative Measures of Success identified in the original proposal relating to the overall project goals and objectives were adapted to reflect the changes approved and delays encountered during the grant period. With these modifications noted, the success measures have been largely achieved.

Quantitative data was collected on participation numbers for professional trainings, classes, and and education workshops. Completion of the milestones for construction and education were a measure of success as documented in the quarterly reports and in the photo log and on the web site and Facebook pages. Viewing rates for the PBS on-air broadcast and resident and public use of the walking trails were not assessed since both were not completed until near the end of the grant so they could not be monitored over time as indicators of success.

Measures of success for education activities include the number of students and others who participate; the number of elected officials, building trades professionals, and Habitat affiliates who attend trainings to learn about BMPs and their implementation, and the amount of media coverage that results. Pre and post-tests administered to students in classes visiting the site measured changes in attitudes and knowledge. Beyond the grant term, measures of success will include the number of classes/students to use the site as an outdoor classroom and the number of site visitors who use the walking trails and read the educational signs.

The education programs and outreach have targeted a variety of groups and audiences. In general, the programs have provided basic information about the Durbin Project, its importance and what it seeks to accomplish, and its benefits to the community as well as to water quality in the Jennings Creek Watershed. Education programs have included onsite and offsite classes in schools and at the University; conference and meeting presentations; training events; community outreach events and indirect; volunteer events; and university student engagement/research projects; These programs and numbers of participants have been cited elsewhere but a summary is listed below, and followed by a compiling of the total number of participants by category:

- BG City Schools classes: included a rain barrel workshop (40 participants), plus onsite, with students from Dishman McGinnis (5 classes, 60 participants) and Parker Bennett Curry (5 classes, 50 participants) impacted 150 students. Pre- and post-tests were administrated and demonstrated that learning occurred.
- Presentations: on the Durbin project, low impact development techniques, and green infrastructure were made in five WKU classes and one WKU meeting (80 students + 15 faculty), three community meetings (110 people), and at six in-state (230 participants) and two international (20 participants) conferences.
- Trainings: included the Green Housing Summit, with green infrastructure class and onsite tour to Durbin (103 participants), and the MS-4 training on BMPs and LID offered to city employees, building trades professionals and KyHFH state affiliates (106 participants).
- Community outreach events: included a design charette (40 participants), town meeting (30 participants), Habitat for Humanity International luncheon (35 participants), and ‘Get on the Bus’ tour for energy efficiency that featured the Durbin site (25 participants). Indirectly, a ‘Red is Green’ 30-sec. spot potentially impacted 1,000s.
- Volunteer events: included vernal pond construction (40 participants), trees planting day (25 participants), plugs planting day (10 participants), brush clearing day (20 participants), and four site cleanups (55 participants).
- University student engagement/research projects: included 1 group (12 students) and 3 individual projects (3 students)

- Media coverage: included over 12 news releases; resultant articles by *The Bowling Green Daily News* and occasionally in other publications in Louisville and Lexington; three videos and corresponding coverage from WBKO-TV; and a Durbin Project profile article in the WKU ALIVE Center magazine
- Other outreach: vehicles included the educational signs installed onsite with multi-language translations, web site and Facebook pages, and WKYU-PBS documentary

Total number of participants, by category:

- BG City Schools classes, on- and off-site (1/5/5) – 150 students
- University classes/meetings (5) – 80 students + 15 faculty
- Trainings (2) – 209 people
- Conference presentations (8) – 250 people
- Community meetings (3) – 110 people
- Community outreach events, direct (4) – 130 people
- University student engagement/research projects (1/3) – 15 students
- Volunteers events (8) – 150 people
- Community outreach, indirect (4) – potentially 1,000's

Project delays meant there were limited site tours, and no open houses or annual field days were held as anticipated. The MS-4 training satisfied a similar need, where training in BMPs and LID and an onsite tour were provided to over 100 city employees, professional contractors, and Habitat affiliates. Evaluations administered at each of the two training events indicated a high level of satisfaction with the events and meeting the goals set for each event.
Since WKU project staff are no longer employed at WKU, on-going education will be picked up by the local Habitat for Humanity and BG City Schools, which has designated the Durbin site as an outdoor learning laboratory for the new school built just across the street.

The **print product measures of success** listed in the grant proposal were demonstrated in good measure. These include:

- eight educational signs produced and translated into five languages (Appendix H)
- multi-page web site and Facebook page to document achievements (Appendix J)
- photo log kept to document all stages of construction and the LID features;
- 30-mins. WKYU-PBS documentary (DVD for Appendix M)
- PowerPoints prepared for conference and meeting presentations about the project, its BMP features, and functions of LID stormwater techniques (CD for Appendix N)
- twelve news releases and updates posted to the web site and social media announcing events and the accomplishment of milestones
- Development of Durbin Estates Educational Resources curriculum for K-12 teachers.

The **qualitative measures of success** initially set forth in the Memorandum of Agreement had to be modified to address changes made and approved to the grant's objectives and timeline. For example, the repeated construction delays greatly restricted the number of site visitors so it became impossible to use visitor surveys to demonstrate changes in attitudes/knowledge as a qualitative measure of success. Similarly, with the MS-4 training being held at the end of the grant term, evaluating for evidence of changes in local-state building practices as a result of this training was impractical.

Qualitative measures of success will determine how well the project met the four main objectives for the project: (a) creating an integrated green infrastructure that retains, filters, and reuses all stormwater at the site; (b) providing professional training and community education and outreach on the features of this system and how they reduce NPS pollution and benefit the community and environment; (c) involving residents and the community in hands-on activities to build a sense of pride and ownership in the project and shared

responsibility for stewarding the environment; and, (d) seeking building policy revisions for KyHFH and potentially state and local governments. Each of these are addressed separately below.

(A) Creating an integrated green infrastructure that retains, filters, and reuses all stormwater at the site;

One qualitative measure of success is the use of Best Management Practices (BMPs) and Low Impact Development (LID) techniques to reduce/prevent Nonpoint Source (NPS) pollution from entering the Jennings Creek Watershed, and corollary to this, the ability to demonstrate improved water quality and reduced sedimentation, stormwater flow, and amounts of runoff, trash, and pollution entering the basin. This measure of success is determined by the removal of accumulated sediment in the basin, the amount of sediment being deposited prior to its entering the basin, the amount of trash and debris blocked before it enters the basin, and water levels in the basin and how quickly these drop following stormwater events.

Prior to the project, the drainage channels that brought water from a 270-acre catchment area were narrow, straight, and one was lined in concrete, so stormwater from off-site carrying sediment, trash, and other pollutants was delivered quickly, and unfiltered, to the basin. Restoration methods included broadening the channels with a meandering configuration to slow the flow and permit infiltration; planting the channels and side slopes with native sedges and grasses, to slow the flow, permit sedimentation, and increase filtration and infiltration; introducing J-hook structures for sedimentation deposits; and adding a rock check dam to block solids and trash from entering the basin. The three existing 12-inch and partially blocked injection wells were upgraded to two 24-inch reinforced concrete pipes and the basin floor graded away from the rock check dam. A large bio-infiltration basin was constructed on the far side of the basin and planted with 40 bald cypress trees due to their capacity to absorb and filter water and pollutants. French drains were constructed to carry filtered water coming from beneath the bio-infiltration basin to the injection wells. The graded basin floor directed water coming into the detention basin to the bio-infiltration basin where it could be filtered or absorbed.

Several restoration methods were applied also to reduce the pollution from onsite sources and further improve water quality. The existing grass cover was replaced with native grasses and flowers across the property in order to decrease the need for mowing and for pesticide, energy, and water inputs, all of which contribute to improving water quality. An increased the tree cover helped to slow and decrease runoff and to increase filtration while also adding shade and aesthetic appeal to the site. Planting edible trees added nutritive value.

Observable changes in stormwater management following this implementation of BMPs and LID techniques included large amounts of sediment depositing at the J-hook structures before entering the detention basin; trash accumulation in front of the rock check dam before entering the detention basin; more rapid decreases in the water level in the detention basin following storm events; and water in the detention basin moving rapidly to the bio-infiltration basin where it could be filtered and absorbed.

The BMPs and LID techniques implemented to create an integrated green infrastructure are evidence of success. All new landscaping–trees, grasses, shrubs, plants–is native and drought resistant, and therefore irrigation and pesticide use and site maintenance input needs are reduced. Collection of water from storm events in rain barrels and cisterns for distribution through installed piping to irrigate rain gardens and community gardens, however, was not achieved, and rain garden construction was delayed, so these measures of success were not evaluated.

(B) Providing professional training and community education and outreach on the features of this system and how they reduce NPS pollution and benefit the community and environment.

The degree of professional training and community education and outreach on the BMPs and LID techniques used and how they reduce NPS pollution and benefit the community and environment is another qualitative measure of success. This measure of success is determined by the number of community members, students, elected officials, buildings trades professionals, and others who participate in the education and outreach activities; the types of education and trainings offered; and participant evaluations on the quality of education and outreach activities and what was learned.

The quantitative measures of success are addressed above and will not be restated here. The pre- and post- tests used with students from schools all demonstrated learning had occurred. Participant evaluations used at the trainings offered and conference presentation events all demonstrated satisfaction with the content and delivery methods used and that learning had occurred.

(C) Involving residents and the community in hands-on activities to build a sense of pride and ownership in the project and shared responsibility for stewarding the environment.

The degree of public involvement in the planning and implementation process is another qualitative measure of success. This measure of success is determined by the number of community members, students, residents, organizations, and others to participate in the education and outreach efforts.

- Fifteen state and local community, government, and nonprofit groups were involved as project partners. Many of these contributed substantively in materials and labor as project match in addition to the time and expertise invested.

- Public engagement in planning events included the design charette and town meeting. The seventy participants in these two events included nearby residents, city officials, representatives of various organizations, community members, and project partners. These events helped to inform the public about the project and gain support for the project, but also to learn about the questions and concerns of community stakeholders.

- Volunteer engagement in restoration events included the vernal pond construction, tree planting day, plugs planting day, and picnic tables installation-brush clearing day, in addition to multiple cleanup efforts. These events served a secondary purpose of educating participants about the project and its LID features; its primary purpose was to gain the public's buy-in and support through their hands-on engagement in the project and the demonstration of shared interests among the volunteers.

(D) Seeking building policy revisions for KyHFH and potentially state and local governments.

Building policy revisions by Kentucky Habitat for Humanity and state and local government are not formalized; nonetheless, gains have been achieved. KyHFH affiliates from across the state have received training in green infrastructure in more than one format, and encouraged by the Executive Director to find ways to integrate LID techniques into future building projects. KyHFH has also been a leader in the state in encouraging the building of passive homes; two have been built in northern Kentucky and the third is scheduled to be built at Durbin Estates in south central Kentucky.

Meetings held with the City's Planning and Zoning Commission, Public Works, and Greenways Commission have built visibility to BMPs and LID techniques for stormwater management and planning and zoning issues related to the project. Regular contact with City officials has helped to raise their willingness to

adapt existing rules to unique needs of the project. For example, the City modified its existing rules to permit a street design being used with an on street parking lane, permeable pavers, curbless street, and bioswale. The close relationships amount the engineering and construction professionals working on the project and City and Habitat officials has fostered flexibility in addressing recurring challenges presented by the project. Involving Public Works officials on the Durbin Advisory Council has also been a way to further the city's commitment to BMPs and LID methods for stormwater management.

H. CONCLUSIONS

The Habitat for Humanity Green Infrastructure Demonstration project successfully met the main goal established for the grant. The project goal was to demonstrate an integrated green infrastructure model for community development that can be broadly replicated to reduce NPS pollution, educate the public, and improve quality of life for communities. The Durbin Project model has been used to educate diversely through conference presentations, onsite training, classes, media releases, and a WKYU-PBS documentary.

The Demonstration project has also successfully met the four main objectives defined for the project, which were to: (a) create an integrated green infrastructure that retains, filters, and reuses all stormwater at the site; (b) provide professional training and community education and outreach on the features of this system and how they reduce NPS pollution and benefit the community and environment; (c) involve residents and the community in hands-on activities to build a sense of pride and ownership in the project and shared responsibility for stewarding the environment; and (d) seek building policy revisions for KyHFH and potentially state and local governments. Major construction delays and cost overruns resulted having to adapt and push back the timeline to accomplish various objectives, but by the grant term's end the major components of the green infrastructure were in place, education and training activities were under way, and home construction had begun on the first two high performance homes at the Durbin site.

The value of partnerships on this project cannot be overemphasized. Partners included state and local government agencies, local and regional businesses, local contractors, Bowling Green City Schools, university classes, nonprofits, and community individuals and groups. Partners contributed time and expertise as well as contributing generously in materials, supplies, and labor. Volunteer days were essential in constructing important site features, for example the vernal pond and the planting of trees in the bio-infiltration basin. The volunteer days were also used as educational opportunities for the participants.

Major construction cost overruns and site conditions requiring major engineering revisions were encountered. There resulted in a need to secure additional funds to accomplish the major outputs required in the grant. The rock layer where the road and utility infrastructure was to be laid was close to the surface, so the proposed entry onto the site had to be moved and fill added to elevate the land grade enough to permit the necessary sewage gradient, for example. The initial plans to build Phase 2a on the southeast part of property near the new school and off of Wade Ave. were reengineered for the road and utility infrastructure to come off the northwest corner of the property, off of W 12th Ave. Even with the grant extension, the additional funds only permitted construction to create access onto the site and for a distance for only three homes to be built. A Community Development Block Grant was then secured to permit road and utility construction for an additional 8-10 homes.

A budget extension of $297,000 was granted by KDOW and added to the original project budget of $652,008 on May 20, 2012, creating a total revised budget of $949,008. It was originally planned that some of this extension would go toward salary but this was revised and most was added to the Contractual portion of the budget and applied to construction and materials/supplies costs; a tiny portion went to travel.

The project schedule was originally set for completion on January 30, 2014. This date was also extended, due to the major unforeseen delays in construction approvals and work, to January 30, 2017. Most work on the grant terminated on May 30, 2015, however, when the contracts with all key personnel were ended. Following this, all that remained was an end-or-grant recognition celebration and the final report.

A few issues came up during project implementation that serve as "lessons learned" for future projects. Firstly, it is difficult to plan a realistic budget prior to obtaining construction bids so it is highly recommended to seek provisional bids before the grant budget is developed and submitted. Another related issue was the number of heavy rainfall events experienced during construction. Frequent rainfall events during the fall of 2009 caused significant delays in construction due to the time it took for the site to dry sufficiently before equipment could resume work. For projects that include work in wetland and low-lying areas, it is recommended to include additional construction time into the schedule to allow for this contingency. In the Durbin Project case, Scott and Ritter did an excellent returning to the job as quickly as possible when weather permitted to prevent further delays in meeting the schedule, while maintaining product quality under challenging conditions. A final issue to note is that, due to the multiple and varied objectives for this project that included construction, education, outreach and impact milestones, it is recommended to keep a daily or weekly log of all activities and develop spreadsheets to record all activities, with dates, numbers attending, and outcomes or what was accomplished, for purposes of future reporting.

This project could not have been completed without the funding through the EPA's 319(h) grant program and the assistance of the Kentucky Division of Water. Overall, WKU and its project partners consider the Habitat for Humanity Green Infrastructure Demonstration project a success that has produced many future positive outcomes for our community and been a model for the state.

LITERATURE CITED

1. Low Impact Development: A Guidebook for North Carolina, North Carolina State University, June 2009, Published by North Carolina Cooperative Extension.
2. The Case for Sustainable Landscapes, 2009, Published by The Sustainable Sites Initiative.
3. University of New Hampshire Stormwater Center, 2009 Biannual Report.

K APPENDICES

APPENDIX A: FINANCIAL & ADMINISTRATIVE CLOSEOUT

a. Application Outputs
b. Budget Summary
c. Equipment Summary
d. Special Grant Conditions

A. Application Outputs

A summary of application outputs accomplished is listed below:

Partnerships and Collaboration

1. Fifteen state and local community, government, and nonprofit groups were involved as project partners. Many contributed substantively in materials and labor as project match in addition to the time and expertise invested.

2. An Advisory Council representing diverse interests was formed and met three times per year, and additional meetings were held as needed.

3. A collaborative process was used to link government, business, nonprofit, and community groups in developing this demonstration model and to encourage policy revisions related to green infrastructure for neighborhood development by city, state, and Habitat for Humanity.

4. Project staff worked with WKU faculty and classes to engage students in volunteer work and action research

5. Prospective vendors and contractors were contacted for potential partnerships/pricing breaks.

Green Infrastructure Implementation

6. A BMP-IP was developed in collaboration with

project partners and approved by KDOW to guide the green infrastructure implementation.

7. Drainage studies and a preliminary master site plan and utility layout were developed and approved by KDOW.

8. A species list for trees and native plants to use on site was created and approved by KDOW.

9. Phase 1 green infrastructure was designed and approved by KDOW for implementation in the detention basin area, to include: redesigned drainage channels with j-hook structures; rock check dam; sloped detention basin; bio-infiltration basin in low area with drainage layers, French drains, and planted with bald cypress trees; rebuilt injection wells. Tree cover and native plants were planted throughout site. Trails and educational signs were installed.

10. Phase 2 green infrastructure was designed and approved by KDOW for implementation in the residential areas, to include: permeable pavers for onstreet parking; bioswale along length of road; native plants, rain gardens, rain barrels, and cisterns with automatic overflow valve and irrigation piping were delayed due to construction delays but are still planned.

11. NPS load reductions for implementation activities were calculated and reported to KDOW.

Involvement of Residents and the Community

12. Project staff met with community groups, educators, and the public to inform and build interest in the project, and secondarily, gain volunteers: design charette (2/18/11); *A New Look at Community luncheon*, with International, state and local Habitat for Humanity, government representatives, and WKU administrators (6/30/11); town hall

meeting (9/29/11)

13. Volunteers participated in various work days to contribute to activities and accomplish project milestones: site cleanups (4); tree planting day; vernal pond construction and planting days; drainage channel plugs planting day; brush clearing-picnic tables installation day.

14. The Bowling Green Human Rights Commission featured Durbin in its “Get on the Bus” tour for energy efficiency on April 26, 2012.

15. The Campus Chapter of Habitat for Humanity constructed a pedestrian bridge across the drainage channel to connect the trails with the educational signs (Apr-May, 2014).

Educational Outreach

16. An Education/Outreach Checklist was developed and approved by KDOW to guide the implementation of educational activities throughout the grant term.

17. A pre-post test assessment tool for school class site visits was developed and approved by KDOW then used with classes that visited the site.

18. Presentations were developed and approved by KDOW then made in WKU classes; at local, national, and international conferences; and in other forums (e.g., Rotary Club) to disseminate information on NPS and green infrastructure and the Durbin Project.

19. Professional onsite trainings were developed and approved by KDOW then implemented: KY Habitat for Humanity annual Green Housing Summit (2013; 100+ attendees); MS4 training for building and city professionals and HFH chapter affiliates (2014, 100+ attendees)

20. School groups trainings and site educational visits were coordinated and approved by KDOW then conducted: rain barrel workshop for students, parents, and teachers (3/16/12); 4th grade classes from Dishman McGinnis (4 classes, 11/12/12); 4th grade classes from Parker Bennett Curry (5 classes, 5/16/14).

21. An onsite training about wetlands and habitat restoration was held in conjunction with the one-day volunteer vernal pond construction, with Tom Biebighauser (8/3/12).

22. An online Durbin Estates Educational Resources Curriculum for preK-12 teachers was developed and approved by KDOW then placed on the BG City Schools internal web site.

23. Educational signage (8) was developed and approved by KDOW, then placed along trails at the Durbin site was developed; the signs are also available on the Durbin Project web site.

24. The education signage was translated into the five most common foreign languages identified by the BG City Schools system; the translations are available through QR code on the signs and also on the Durbin web site.

Project Results Dissemination

25. Project events and milestones were disseminated through regular press releases (12) that were written and approved by KDOW then sent to local and state media agencies.

26. Durbin project was featured in other media venues: article in The WKU Alive Center magazine (Sept., 2011); “View from the Hill” WBKO coverage on Parker Bennett Curry students’ site visit and GM Foundation’s funding for first house build at Durbin; a ‘Red is Green’ 30-sec. spot on trash-littering-

recycling using the Durbin property, was developed and aired during WKUs Homecoming (Oct., 2011);

27. An extensive web site and Facebook page were developed and approved by KDOW to log activities and milestones achieved and to catalog and document all aspects of the project.

28. A 30-mins. WKYU-PBS documentary was developed on the green infrastructure at the Durbin Project and approved by KDOW, to be aired in spring, 2015.

Record-keeping and Administration

29. All site construction, cleanup, and volunteer activities were documented in a photo log and video footage was obtained to be incorporated into the WKYU-PBS documentary.

30. Quarterly reports were filed regularly; annual reports were filed upon request.

B. Budget Summary **THIS SECTION IS NOT COMPLETED PENDING INFO NEEDED FROM WKU

The detailed budget from the original grant proposal is listed below:

25. Detailed Budget			
Budget Categories (Itemize all Categories)	§319(h) (60% of funds)	Non-Federal Match (40% of funds)	TOTAL
Personnel	124,727	99,730	224,457
Supplies	10,500	585	11,085
Equipment	-	-	-
Travel	2,500	11,827	14,327
Contractual	224,500	46,000	270,500
Operating Cost	28,978	68,044	97,022
Other		34,617	34,617
TOTAL	391,205	260,803	652,008

Due to major construction cost overruns, a budget extension of $297,000 was offered by KDOW, then requested and approved. This new agreement was approved in May, 2012.

The new detailed budget appears below.

25. Detailed Budget			
Budget Categories (Itemize all Categories)	§319(h) (60% of funds)	Non-Federal Match (40% of funds)	TOTAL
Personnel	124,727	99,730	224,457
Supplies	10,500	585	11,085
Equipment	-	-	-
Travel	2,500	11,827	14,327
Contractual	389,500	46,733	436,233
Operating Cost	42,178	186,111	228,289
Other		34,617	34,617
TOTAL	569,405	379,603	949,008

Personal, supplies, travel, and other costs remained essentially the same. Construction costs were increased from the original budget of $210,000, by $165,000, to a total of $389,500. Operating costs and non-federal match were correspondingly increased. Additional match under Contractual in the amount of $733 was contributed by Habitat for Humanity. Additional Operating Costs were identified due to an error in how the cost calculation used in the original budget, where the 40% match figure had been calculated based on the total match rather than on the total federal cost figure.

The additional money was applied to costs related to Phase 2a, to build the utility and road infrastructure onto the site and for the first three homes to be built. Due to construction costs overruns and long delays, the cistern, rain garden, rain barrels, automatic overflow, and piping features of the green infrastructure and water collection systems have been delayed and these required features will be added to the subsequent CDBG grant already awarded.

First, list your original detailed budget as it appears in your application.

* Secondly, list all DOW approved revised budgets, if any, using the same format. Below each revised budget table, explain why the revision was needed and that the DOW approved the revision.
* Lastly, add an additional column to the last budget revision table or to the original budget table (if no budget revisions apply) and label this new column "Final Expenditures". When filling out this column, list what was truly spent for each line item. Use total (federal + nonfederal match) dollars only for this column.
* If the project did not spend all of the monies originally budgeted and had additional funds left over, add the following statement below the budget table: "*(insert name of your organization here)* was reimbursed $*(insert dollar amount that your organization will be reimbursed by DOW after all billings, including the final invoice, have been paid)*. A total of $*(insert the difference between the original 319(h) budget amount and the dollar amount that KDOW will be reimbursing your organization)* federal funds remain unspent." Also, give an explanation of why the excess project funds were not spent.
* If the project spent the exact amount of monies originally budgeted, add the following statement below the budget table: "*(insert name of your organization here)* was reimbursed $*(insert dollar amount that your organization will be reimbursed by DOW after all billings, including the final invoice, have been paid)*. All dollars were spent; there were no excess project funds to reallocate."
* If the project spent more dollars than was originally budgeted, add the following statement below the budget table: "*(insert name of your organization here)* was reimbursed $*(insert dollar amount that your organization will be reimbursed by DOW after all billings, including the final invoice, have been paid)*. All dollars were spent; there were no excess project funds to reallocate. This project did generate overmatch provided by *(insert name of your organization here)*. This overmatch was not posted to the Grant."

C. Equipment Summary

No equipment, and especially no equipment having a current per-unit fair market value exceeding $5,000, has been purchased for this grant.

D. Special Grant Conditions

No special grant conditions were placed on this project by the U.S. EPA.

APPENDIX B: QA/QC FOR WATER QUALITY MONITORING *(Not applicable to this project)*

APPENDIX C: BMP IMPLEMENTATION PLAN

Project Name: Habitat for Humanity Green Infrastructure, Project No. 10-06
Contractor: WKU Center for Environmental Education & Sustainability

1) List of technologies to be installed:

Stormwater management for water from off site

Pre-treatment stilling (sedimentation) basin
Trash filtration mechanism
Broad outlet structure
Modification of drainage channels to more closely resemble a rock bed meandering stream
Large pretreatment bio-retention basin
Rehabilitated injection wells with risers in existing detention basin
Native vegetation plantings in detention basin and upland shared green space areas

Stormwater management for water from on site

Permeable asphalt for parking areas
Permeable pavers or porous concrete for sidewalks, walkways
Vegetated bioswales along both sides of road
Rain gardens regularly spaced in built areas
Rooftop rain collection into rain barrels or subsurvace cisterns
Subsurface cisterns and/or RainXchange water harvest system(s)
Grated tree wells or similar water absorption features in sidewalks
Lip curb or no curb along bioswales
Road crown/crest to direct water to bioswales

NCRS Practices and Codes

Conservation Cover	327
Tree/Shrub Planting	612

2) **Describe the selection process**

The source for impairments is the detention basin that is sized sufficiently to collect water from a 270 acre city-street catchment area. The large volume of water flowing onto the property during major storm events carries trash, pollution and sedimentation to the site. The property has been unused for neighborhood development to date. This project plans to restore the property to full-use capacity.

A 23-member Advisory Council comprised of principle partners and community members interested in the project was formed. The Council incorporates a wide representation of expertise (engineers, attorney, planners, educators, etc.) It will meet a minimum of three times per year; it has been meeting more frequently for the startup of the grant. Subcommittees were formed in the following areas: site plan/street design; stormwater management; education/outreach; fundraising; landscaping; and maintenance to focus each person's contributions toward design and implementation. The Council has received presentations on methods, cost-effectiveness, and implementation design of Low Impact Development and Light

Imprint techniques and supplemental education materials have been provided. These have guided the selection process for BMPs.

In making these selections, preference was given based on the factors below:

- improve natural drainage and filtration
- improve water quality
- have lower initial costs
- have lower maintenance requirements and costs
- have a long lifespan
- minimize disruption of existing terrain
- increase vegetative and tree cover
- emphasize drought resistant and native plants
- amplify green space and recreation areas
- improve neighborhood quality of life
- have high demonstration value for public education and outreach

An overall goal of the project is that all features will be designed for ease of long-term maintenance (see #5 below).

This is the first large scale green infrastructure community development project in the City and County, and many ordinances will need to be reviewed and potentially modified. We are fortunate to have on the Advisory Council the City Coordinator for Public Works who is responsible for Stormwater Management. Two of the people working closely with the project, i.e., the Chief Engineer of the Engineering firm who is contracted with to do the site survey, concept map, and Planned Unit Development (PUD), and the Attorney who is volunteering his services to work with the project, work regularly with the Planning and Zoning Commission and have great familiarity with their permitting and zoning change processes. The Director of Public Works has been contacted about the street entrances to the site, and basic consent has been given to the proposed design.

Due to the number of variations on traditional zoning plans, the city determined that it was necessary to submit a PUD to the Planning and Zoning Commission for site development.
All applicable city and county permits will be acquired prior to any BMP implementation.

3) **Describe how selected BMPs will be targeted to specific locations**

The property is owned by the Bowling Green Warren County Habitat for Humanity, which is a full partner to the project. All planned modifications to the property and infrastructure must first be approved by the Habitat Board and the City and County governments, before they are forwarded to the State for review and approval. Three of the Habitat for Humanity Board members as well as the two people responsible for stormwater management for the City of Bowling Green are on the Advisory Council for the project, so they are involved in all stages of design, review, and implementation.

All BMPs will be targeted to areas where they will have the highest likelihood of improving water quality and providing education and outreach opportunities. Locations will also be selected based on appropriate conditions for the particular BMPs (e.g. correct slope, proper soils, etc.)

The project will be developed in several phases. Phase I, that will be completed under the grant, will include full implementation of the techniques to manage the off-site stormwater coming onto the site, as detailed in section #1 above. It also includes a section of road off of Wade Ave. that includes the cul-de-sac area with turnaround and six houses near the Wade St. entrance on the concept map, plus the

corresponding bioswales, porous pavement, rain gardens, underground cistern, etc. All of the on-site stormwater management LID techniques detailed in #1 above will be demonstrated in this area.

The final concept plan identifying the locations of the BMPs will be submitted to KDOW for review and approval prior to implementation. The engineered drawings for the individual BMPs will be submitted to KDOW for review and approval as well.

Appropriate/designated individual(s) will be on site to ensure proper installation of BMPs during implementation.

4) **Explain the financial plan of action**

Total funds for the grant (match and federal) for design and implementation, not including indirects, are $552,485; the amount of match is $192,759; and the percentage of match is 34.9%. When indirects are included, total funds for the grant is $652,008; the amount of match is $260,803; and the percentage of match is 40%.

Cost-share and in-kind match will come from:

1. Professional time (Co-PI, 35% time, Years 2 & 3; 5% time for (a) Planning and Construction Consultant and (b) Landscape Engineer, Years 1-3)
2. In-kind for public broadcasting production from WKYU-PBS, Yr. 3
3. In-kind services from Public Works, Years 1-3
4. In-kind volunteer services from community groups, Years 1-3
5. Administrative assistance and in-kind supplies from BG-WC HFH, Years 1-3
6. Travel, honorarium, and consulting services from KY HFH, Years 1-3
7. Donated products and services from Roundstone Native Seed, Years 1-3
8. Donated consulting and training time from professionals, Years 1-3
9. Volunteer time from students and community members, Years 1-3

5) **Describe the maintenance plan of action**

On-going maintenance plans are tiered to correspond with the timeline for implementation. Before the site plans are finalized and implementation begins, site maintenance will continue to be done by the local Habitat for Humanity and through coordination of volunteer groups (e.g., site cleanups). After implementation begins, a “Friends of Durbin Estate” group will be developed to offer additional assistance to what is being maintained by the local Habitat for Humanity. In addition, as homes are constructed the Habitat homeowners will contribute a portion of their required “sweat equity” toward maintenance functions. When sufficient housing is constructed and families are in residence a Homeowners Association will be created for long-term required maintenance. Homeowners association members and city employees responsible for site maintenance will be trained.

The Public Works department of the City of Bowling Green will do regular vacuuming and trash removal from the stilling/sedimentation basin and trash filtration fence.

Roundstone Native Seed will implement the native plants conservation cover and monitor and perform the 3-year burns required to reseed and regenerate the large planted areas at the site. They have been doing this type of work for over fifteen years, and have implemented similar projects at Bernheim Forest, Mammoth Cave, and other sites throughout the southeast and Midwest regions and beyond.

A maintenance subcommittee of the Advisory Council has been formed to develop more detailed

schedules and plans for maintenance. These maintenance plans will be submitted to KDOW for review and approval. The ultimate responsibility for coordinating, supervising, and monitoring the on-going maintenance functions will fall to the Executive Director for the BG-WC Habitat for Humanity and the PI for the grant, who will, together, certify plans to ensure these functions are met for the lifespan of the BMPs.

6) **Describe the notification process to DOW**

The KY DOW, NPS Section Technical Advisor must be advised of the selected BMP before implementation begins. This may take the form of a letter or an electronic notification to the TA describing the chosen BMP, location where the BMP will be installed and the expected date of implementation. In projects which involve multiple BMPs being phased in overtime, the TA may request batch notification.

All design plans, press releases, educational materials, contract specifications, etc. are first discussed and approved by the Advisory Council. They will then be sent to Deb Day and Brooke Shireman for review and approval prior to the work being done. Requests for budget adjustments will also be sent to KDOW for review and approval prior to shifts among categories being made. All requested budget expenditures are reviewed internally twice: by the College of Education and Behavioral Services grants specialist and by Grants Accounting to make sure all expenditures are made within University policy and according to the guidelines for the grant.

7) **Provide a statement at minimum, agricultural and forestry BMPs will comply with KY Ag Water Quality Act or the Forest Conservation Act.**

This is not an agricultural or forestry project so this question does not apply.

APPENDIX D: BINDING ELEMENTS

STATEMENT OF BINDING ELEMENTS

This Statement of Binding Elements is filed pursuant to Sections 3.10 and 3.11 of the Warren County Zoning Ordinance.

PROPERTY OWNERS: Habitat for Humanity of Bowling Green/Warren Co., Inc.

PVA TAX PARCEL NUMBER: 039B-13A-011

DESCRIPTION OF AFFECTED PROPERTY AND SOURCE OF TITLE: See Exhibit "A" attached hereto and incorporated herein by reference (the "Property").

BINDING ELEMENTS

I

The Property will be developed with sufficient water supply and fire hydrants to meet the fire control standards of the City of Bowling Green, Kentucky.

II

All improvements on the Property shall be connected to sanitary sewer.

III

Each building on the property will be constructed with a maximum of fifty percent (50%) vinyl siding. Other permissible building materials include wood, brick, stone, cementitious materials such as "hardiboard" and other modern masonry materials, stucco or EFIS.

IV

Utilities shall be located underground.

V

Minimum setbacks shall be as follows: front setback for all structures (except garages), ten (10) feet; front setback for garage twenty (20) feet; side setback seven and a half (7.5) feet; and rear setback ten (10) feet.

VI

Property will be developed with access points to adjacent streets as shown on Exhibit "B" and with an interior street system as generally shown on Exhibit "B".

VII

Parking requirements for individual residential lots may be satisfied by onstreet parking, subject to approval of the City of Bowling Green Public Works Department, and as generally shown on Exhibit "B".

VIII

Streets will be developed with five (5) foot sidewalks on at least one (1) side of each street.

IX

No more than forty-nine (49) dwelling units shall be developed on the Property.

X

The Property will be developed with uniform street light poles of fiberglass composite or metal materials.

XI

Lighting for common parking areas and for commercial and office areas shall be designed to focus downward and to minimize light trespass onto adjacent residential properties.

XII

All property owners will be required to become members of a property owners association to be organized by the developer. The developer will be responsible for the maintenance and upkeep of the common areas until at least thirty (30) individual dwelling units shall have been sold to third parties.

XIII

No single-family dwelling unit shall be smaller than one thousand (1,000) square feet of heated interior living space nor any larger than two thousand (2,000) square feet of heated interior living space.

XIV

The Property may be developed with up to ten thousand (10,000) square feet of building for non-residential use.

XV

The following uses shall be permitted: single-family or multi-family residential, OP-R uses as defined in the Zoning Ordinance, limited retail and child care facility, and a community building.

XVI

The Property will be developed with at least fifty percent (50%) open space.

XVII

Any buildings which are not residential structures or structures ancillary to a residential structure, including retail uses, office uses, and community buildings, will be landscaped consistent with the landscape provisions of the Zoning Ordinance of Warren County, Kentucky.

XVIII

Signage on the Property will be limited to two (2) entrance signs, and one (1) sign for the community building and retail area, which, for a total of three (3) signs which signs shall be monument-style signs no taller than six (6) feet in height and no larger than thirty (30) square feet on each sign face.

* * * * *

The foregoing Binding Elements shall be binding upon the owners, their heirs, successors, personal representatives, assigns, the Planning Commission, and legislative bodies of Bowling Green and Warren County, as set of the date of adoption unless otherwise amended pursuant to Sections 3.118 of the Warren County Zoning Ordinance.

DATE OF ADOPTION OF BINDING ELEMENTS

These Binding Elements shall be deemed to be adopted and effective as a result of the final approval of the proposed zone change of the Property from RM-3 to PUD contingent upon said final approval.

IN TESTIMONY WHEREOF, witness the hand of the Property owner on this _____ day of _____, 2011.

HABITAT FOR HUMANITY OF BOWLING GREEN/WARREN CO., INC.

By (signed):_____
Name (printed): _____
Title (printed): _____

STATE OF KENTUCKY)
) SCT.
COUNTY OF WARREN)

SUBSCRIBED, SWORN TO AND ACKNOWLEDGED before me by Habitat for Humanity of Bowling Green/Warren Co., Inc., by and through _____, its _____ on this ___ day of _____, 2011.

_____
NOTARY PUBLIC, State of Kentucky at Large
My commission expires: _____

PREPARED BY:
BELL, ORR, AYERS AND MOORE, P.S.C.
P.O. BOX 738
BOWLING GREEN, KENTUCKY 42102-0738
(270) 781-8111

BY:_____
Kevin C. Brooks

APPENDIX E: NATIVE PLANTS SEED MIXES*

*Selected by Roundstone Native Seed

Upland seed mix

Species	Scientific Name	Lbs-oz/Ac	Total
Little Bluestem	Schizachyrium scoparium	1.50	4.50
Virginia Wild Rye	Elymus virginicus	0.50	1.50
Side Oats Gramma	Bouteloua curtipendula	1.00	3.00
Tall Dropseed	Sporobolus compositus	0.25	0.75
Canada Wild Rye	Elymus Canadensis	0.50	1.50
Indian Grass	Sorghastrum nutans	0.25	0.75
Big Bluestem	Andropogen gerardii	0.25	0.75
River Oats	Uniola latifolia	0.50	1.50
Blackeyed Susan	Rudbeckia hirta	2.25	6.75
Bergamot	Monarda fistulosa	2.25	6.75
Greyheaded Coneflower	Ratibida pinnata	3.25	9.75
Illinois Bundleflower	Desmanthus illinoensis	2.75	8.25
Lance-leaf Coreopsis	Coreopsis lanceolata	2.50	7.50
Maximilian Sunflower	Helianthus maximiliani	2.00	6.00
New England Aster	Aster novae-angliae	2.75	8.25
Partridge Pea	Cassia fasciculate	3.50	10.50
Passion Flower	Passiflora incarnate	1.50	4.50
Purple Coneflower	Echinacea purpurea	3.75	11.25
Rattlesnake Master	Eryngium yuccifolium	3.50	10.50
Spiked Blazing Star	Liatris spicata	2.50	7.50
Purple Prairie Clover	Dalea purpurea	2.25	6.75
Wild Quinine	Parthenium integrifolium	2.25	6.75
Common Milkweed	Asclepias syriaca	1.50	4.50
Iron Weed	Vernonia altissima	1.00	3.00

Detention basin seed mix

Item	Scientific Name	Lbs-oz/Ac	Total Lbs
Switchgrass	Panicum virgatum	1.00	2.00
Big Bluestem	Andropogon gerardii	0.50	1.00
Canada Wild Rye	Elymus Canadensis	0.75	1.50
Virginia Wild Rye	Elymus virginicus	0.75	1.50
Eastern Gamma Grass	Tripsacum dactyloides	2.00	4.00
Fall Panicum	Panicum anceps	0.75	1.50
River Oats	Uniola latifolia	0.75	1.50
Browneyed Susan	Rudbeckia triloba	4.00	8.00
Blue Vervain	Verbena hastata	2.00	4.00
Button Bush	Cephalanthus occidentalis	2.00	4.00
Blackeyed Susan	Rudbeckia hirta	4.00	8.00
Illinois Bundleflower	Desmanthus illinoensis	4.00	8.00
Iron Weed	Vernonia altissima	2.00	4.00

Joe Pye Weed	Eupatorium fistulosum	2.00	4.00
New England Aster	Aster novae-angliae	1.00	2.00
Yellow Wingstem	Verbesina alternifolia	2.00	4.00
Virgins Bower	Clematis virginiana	1.00	2.00
Partridge Pea	Cassia fasciculata	8.00	16.00
Seed Box	Ludwigia alternifolia	2.00	4.00
Fox Sedge	Carex vulpinoidea	2.00	4.00
Hop Sedge	Carex lupulina	2.00	4.00

Bank Mix

Specie	Scientific Name	Lbs-oz/Ac	Total
Little Bluestem	Schizachyrium scoparium	2.00	2.00
Virginia Wild Rye	Elymus virginicus	1.00	1.00
Big Bluestem	Andropogon gerardii	0.25	0.25
Side Oats Gramma	Bouteloua curtipendula	1.00	1.00
Indian Grass	Sorghastrum nutans	0.25	0.25
Switchgrass	Panicum virgatum	0.50	0.50
Fall Panicum	Panicum anceps	0.50	0.50
Canada Wild Rye	Elymus canadensis	1.00	1.00
Blackeyed Susan	Rudbeckia hirta	3.00	3.00
Purple Coneflower	Echinacea purpurea	3.50	3.50
Greyheaded Coneflower	Ratibida pinnata	3.50	3.50
False Sunflower	Heliopsis helianthoides	3.00	3.00
Bergamot	Monarda fistulsa	2.00	2.00
Spiked Blazing Star	Liatris spicata	2.50	2.50
Illinois Bundleflower	Desmanthus illinoensis	3.00	3.00
Partridge Pea	Cassia fasciculata	4.00	4.00
Clasping Coneflower	Rudbeckia amplexicaulis	3.00	3.00
Maximilian Sunflower	Helianthus maximiliani	2.00	2.00
New England Aster	Aster novae-angliae	2.00	2.00
Rigid Goldenrod	Solidago rigida	3.00	3.00
Purple Prairie Clover	Dalea purpurea	3.00	3.00
Wild Quinine	Parthenium integrifolium	2.50	2.50

APPENDIX F: EDUCATION SUBCOMMITTEE DOCUMENTS

A) Education and Outreach Checklist
B) Pre/Post Test for Durbin Estates Site Visit

A. EDUCATION AND OUTREACH CHECKLIST

Summary: Educational efforts will focus on transfer of information about the Best Management Practices (BMPs) incorporated in the integrated green infrastructure – features, costs, Nonpoint Source Pollution (NPS) pollution control benefits, installation and maintenance requirements. The site itself will be used as a training facility and will provide an outdoor classroom setting for training on the Low Impact Development (LID) techniques and education about NPS and watershed-water supply protection issues. Educational trail signage and site tours will be designed to engage visitors and school groups in learning about green infrastructure features. Target audiences will include: 1) Habitat for Humanity (HFH) affiliate chapters; 2) contractors and building trades professionals; 3) educators, school groups, residents, and site visitors; and 4) the community-at-large and general public. All education and training materials will be submitted to KDOW for review and approval prior to use.

PUBLIC EDUCATION – for school and community groups and the general public

- ☐ Develop sessions for use with school and community groups for education and outreach about the Durbin project, and on LID techniques, e.g., rain barrels and rain gardens
- ☐ Submit developed sessions to KDOW for review/approval prior to use.
- ☐ Develop pre-test and post-test for education sessions
- ☐ Administer pre-test at start and post-test at conclusion of all education sessions
- ☐ Contact community and school groups to schedule education sessions about the project [5 groups/classes, 15 people/students each]
- ☐ Offer community education sessions on building your own rain barrels and rain gardens
- ☐ Conduct and evaluate sessions
- ☐ Keep log of sessions and compile pre- and post-test results for quarterly reporting

PROFESSIONAL TRAINING – for HFH chapter affiliates, City workers, and contractors

- ☐ Develop sessions for professional trainings with HFH affiliate chapters, City maintenance workers, and building contractors
- ☐ Develop evaluation forms for each training session
- ☐ Submit developed sessions and evaluation forms to KDOW for review/approval prior to use.
- ☐ Schedule, conduct, and evaluate half-day training for all 55 state chapter affiliates sponsored at KyHFH annual conference [100 affiliate chapter representatives plus builders]
- ☐ Schedule, conduct, and evaluate on-site training for state chapter affiliates and contractors on LID techniques implemented, e.g., bioretention basin, bioswales, rain gardens, and cisterns [2x, 20 attendees each]
- ☐ Schedule, conduct, and evaluate training for "Friends of Durbin Estates" group, Homeowners Association and City employees responsible for maintenance
- ☐ Schedule, conduct, and evaluate professional training on LID techniques for builders (Builders Association of Bowling Green) and city/co. employees [2x, 15 attendees each]
- ☐ Keep log of sessions and compile evaluations for quarterly reports

ON-SITE TOURS – for educators, school groups, and visitors

- ☐ Contact area schools to inform them about the project and schedule class visits to the site
- ☐ Develop script for guided onsite class tours

- ☐ Develop and produce pamphlet for self-guided tours for visitors
- ☐ Develop brief pre-test and post-test to use for on-site tours.
- ☐ Submit developed materials and pre-/post-tests to KDOW for review/approval prior to use.
- ☐ Conduct Open House and on-site tours; administer pre-test and post-test [50 site visitors]
- ☐ Incorporate on-site tours as a part of field trips for the Education for Sustainability Summer Institute for Educators hosted at WKU
- ☐ Keep log of tour groups and compile pre- and post-test results for quarterly reports

WKYU-PBS – documentary for public education and DVD for professional training

- ☐ WKYU-PBS is notified in advance and shoots footage at each stage of the process
- ☐ Script for WKYU-PBS instructional DVD and 30-minute documentary is developed
- ☐ WKYU-PBS instructional DVD and 30-minute on-air broadcast produced
- ☐ WKYU-PBS 30-minute on-air production is scheduled for broadcast
- ☐ WKYU-PBS 30-minute on-air production is broadcast

TRAIL SIGNAGE – to explain green infrastructure features and functions

- ☐ Appropriate locations/LID features for signage are identified, e.g., sedimentation basin, trash filter, bioretention basin, native plantings, bioswales, rain gardens, cisterns.
- ☐ Language and graphics for signs are developed
- ☐ Options and costs for sign production are examined and sign to use is selected
- ☐ Signs are contracted and produced
- ☐ Signs are installed at designated locations

DISSEMINATION OF PROJECT RESULTS – to build awareness and document successes

- ☐ Write press releases for key project steps and submit to KDOW for review/approval [4 releases on major milestone achievements]
- ☐ Send approved press releases to WKU Public Affairs for regional dissemination to television and radio and to partner listservs
- ☐ Note regular updates on project on Center for Environmental Education and Sustainability web site
- ☐ Set up social networking site on Facebook and post regular project updates
- ☐ Develop conference presentations and submit to KDOW for review/approval
- ☐ Present to KyHFH annual conference and 2 national and 1 international conferences, plus for community groups and other informational meetings

PRE/POST TEST FOR DURBIN ESTATES SITE VISIT (4th grade)

1) Does green infrastructure help to *prevent* flooding or does it *cause* flooding?

   _____

2) Name one way that water could become polluted.

   _____

3) What is the difference between point source pollution and non-point source pollution?

   _____
   _____
   _____

4) Name one example of an "ecosystem service".

   _____
   _____
   _____

5) Name one plant or animal that might use a vernal pond as its habitat.

   _____

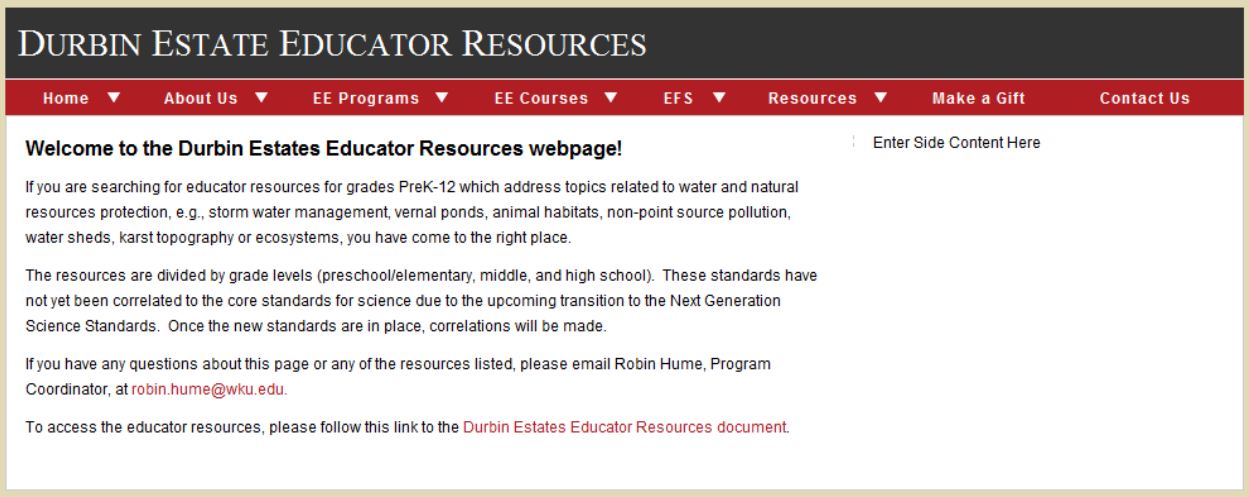
6) What is one thing you can do to help prevent water pollution?

7) _____
   _____
   _____

APPENDIX G: EDUCATIONAL CURRICULUM

An Educator Resources web page was developed to provide educator resources for preK-12 on the following topics: natural stormwater management, vernal ponds/wetlands, animal habitats, Nonpoint Source Pollution, watersheds, karst topography, and ecosystems. This curriculum includes lesson plans/activities by grade level with a description and web-linked source, plus additional resources by grade level with source links.

The web page address for this tool is http://www.wku.edu/cees/hfh_educator_resources.php. The curriculum is accessed by a link on this page. A screen shot of the page is below.



APPENDIX H: INSTRUCTIONAL SIGNAGE

A) Signs Placement Map
B) Durbin Estates
C) Karst Landscapes and Nonpoint Source Pollution
D) Natural Infiltration
E) Rainwater Harvesting
F) Sustainable Communities
G) Sustainable Landscaping
H) Sustainable Sites
I) Wetlands and Watersheds

A. SIGNS PLACEMENT MAP

B.


Durbin Estates
Key Features
Durbin Estates Project
Durbin Project Goals
What is Green Infrastructure?

C.


Karst Landscapes & Nonpoint Source Pollution
What is Karst?
Caves
Streams
Springs
What is Nonpoint Source (NPS) Pollution?
Connected Karst Landscapes
Durbin Estates
Springs
Sinkholes
Aquifers
Above and Below
What Can You Do to Prevent NPS Pollution?

D.


Natural Infiltration
What is Natural Infiltration?
Stormwater runoff is the water that flows across a land surface during and after a rain event before it reaches a natural body of water. It occurs largely because of impervious surfaces which prevent the rainfall from soaking into the soil. It may also occur when the rate of rainfall is too high and the soil is already saturated, or filled, with water. Stormwater discharges are a significant source of nonpoint source pollution and impact water quality. They flow into streams, rivers and eventualy large bodies such as lakes or the ocean, and carry with them any untreated pollutants such as sediment, nutrients, pesticides and trash. Stormwater movement over the land surface also causes soil erosion.
Natural infiltration is the beneficial process by which rainwater and snowmelt soaks into the ground and filters out some pollutants. It replenishes groundwater supplies, provides water for plants and grass, decreases soil erosion and reduces flooding from stormwater runoff. Impervious surfaces such as driveways, sidewalks, street and compacted soil block rainfall and other precipitation from infiltrating naturally into the ground, which leads to more stormwater runoff and pollution.
Bioinfiltration Basins
Bioinfiltration basins are used to filter stormwater runoff and improve the water's quality before it enters the groundwater table. A shallow depression with gravel and sand layers under the soil is constructed and deep-rooted native plants that can be intermittently submerged are used. The depression collects runoff and the plants absorb water and remove various pollutants.
Rain Gardens
Rain gardens are very similar to bioinfiltration basins in how they are structured, but smaller. They are usually located near a runoff source such as a downspout, driveway or street to capture and filter the runoff. They are planted with native plants that have much deeper root systems than lawn grasses, in order to increase water penetration into the soil.
Pervious Pavers
Pervious pavers allow water to pass through the pavement into a sand and gravel layer and then soak into the ground. By permitting infiltration, pavers help to reduce stormwater runoff. They also allow natural infiltration to occur, which decreases the amount of oil, gas and other pollutants that reaches the groundwater.
What features at Durbin Estates mimic natural infiltration?
At Durbin Estates natural infiltration is aided with green infrastructure installations, including the variety of low impact development (LID) best management practices discussed here. These techniques are designed to increase the rate and amount of infiltration, reduce the pollutants reaching the groundwater and ensure the health of the ecosystem and community.
Drainage Channels
The size and shape of drainage channels are designed to be broad and shallow and meandering like a natural stream. This design and the native plantings on the banks help reduce the speed of stormwater entering Durbin Estates and minimizes the erosion of the stream banks.

E.


Rainwater Harvesting
What is Rainwater Harvesting?
Rainwater harvesting refers to a variety of methods that are used to capture, collect and store rainwater. Collecting and storing rainwater reduces demand on the existing water supply and protects the environment.
As periods of drought increase and human population grows larger, public water supplies are reduced. Rainwater harvesting offers another water source that benefits everyone and the environment. The community benefits by being able to use the stored rainwater to irrigate gardens for landscaping. This reduces the need to use treated drinking water for irrigation, saves the community and individuals money and benefits the environment.
Rainwater harvesting also helps to reduce stormwater runoff and problems of flooding, soil erosion and surface water pollution. The captured and stored rainwater is released slowly back into the soil through irrigation and open valves, so it can soak into the soil. This helps to filter out pollutants the water may carry, which protects the quality of water.
How is rainwater harvesting used at Durbin Estates?
Durbin Estates uses rooftop rainwater harvesting to collect rainwater. Gutters and downspouts channel the water to rain barrels and underground cisterns for storage. Debris screens and first-flush diverters are used to filter out large contaminants before they enter the storage container.
When using rainwater for irrigation it is important to be as efficient as possible. Drip irrigation is used to limit the flow and apply only the amount of water that the plants need. Automatic overflow valves slowly release the captured water to permit natural infiltration into the soil when the storage containers are full.
Rain Collection Barrel and Cistern
Rain that falls on rooftops is collected in gutters and channeled through downspouts and hoses into rain barrels and underground cisterns for storage. This water is used to irrigate gardens and yards and for other purposes. Rainwater harvesting reduces demand for treated water.
What about mosquitoes?
Rainwater harvesting vessels, i.e., rain barrels and cisterns, are covered and they deter mosquito larvae. Homeowners too can help prevent mosquitoes from breeding by regularly cleaning gutters to avoid standing water.

F.


Sustainable Communities
Scan this QR code with your smart device for more info
What are Sustainable Communities?
Sustainable communities are communities that integrate economic, social and environmental goals and sustainability principles into their planning and design. They strive to reduce their use of nonrenewable resources, such as fossil fuels, and increase their use of renewable resources, such as solar, wind and geothermal energy and sustainably harvested wood. By shifting away from fossil fuels (coal, oil and gas) they can enhance air and water quality, improve health and decrease the amount of carbon produced that contributes to climate change.
Sustainable communities minimize waste by reducing, reusing and recycling materials. They utilize green building practices and green infrastructure to manage stormwater. In addition, they boost the local economy by promoting community-based businesses and local sustainable food systems. Sustainable communities increase green space and add recreational opportunities in order to restore a healthy environment and contribute to improving human health. They increase transportation options with walking and bike pathways and public transportation so people have an alternative to the private car. They are located near jobs, schools, businesses and cultural activities to cut commuting distances. This can save residents time, money and stress. In short, sustainable communities are safer, greener, healthier and more livable.
What is Livability?
Livability refers to the part of sustainability that affects how it feels to live in a place. It is the sum of factors that add up to a community's quality of life. These include an area's built and natural environments and its affordability, economic prosperity, public health and safety, diversity, equity and positive relationships among neighbors. Amenities also include ease of access to community features and services like education, health care, healthy food options and entertainment. Livable communities have a small-town feel, even when they are part of a larger city. They are friendly, easy to get around and provide many amenities. In short, residents enjoy living in them.
Community Features
Additional sustainable community features at Durbin Estates include:
Green buildings (energy and water)
Integrated green infrastructure
Renewable energy
Native plants and edible landscaping
Green space
Habitat restoration and a vernal pond
Nearby schools, services and cultural amenities

G.


Sustainable Landscaping
What is Sustainable Landscaping?
Sustainable landscaping mimics natural ecosystems. Organic growing methods are emphasized to eliminate the need for chemical inputs and therefore reduce air, water and soil pollution. Sustainable landscapes are both attractive and beneficial to native pollinators. In addition, xeriscaping* reduces the need to use supplemental water for irrigation. Use of compost as a fertilizer recycles nutrients back into the soil.
Traditional landscaping practices can have long-term damaging effects on the environment, such as loss of habitat for native species and loss of biodiversity. Other damaging effects include persistent toxic chemicals in the soil from fertilizer and pesticide use, degrading effects on surrounding ecosystems and waterways, harm to human health resulting from chemical use and invasive species that disrupt native plant communities. Reliance on fossil fuel powered landscaping tools, such as mowers, blowers and weed eaters, also can contribute to climate change from the carbon emissions produced during their use.
Sustainable landscaping can reverse these damaging effects and it provides a beneficial alternative to traditional landscaping methods. By using plants in the most ideal locations, plants grow better, wildlife is benefited, costs and maintenance are reduced and enjoyment is increased for everyone living in the community.
Native Plants
Native plants and grasses are well adapted to Kentucky's climate. They require less water and fertilizers and are more productive at filtering pollutants out of stormwater.
Organic Methods
Organic methods limit the use of pesticides, herbicides and fertilizers. They build community sustainability and soil health and protect the environment.
Community Gardens
Community gardens provide fresh produce, a sense of community through sharing among neighbors and a connection to the environment.
How is Sustainable Landscaping used at Durbin Estates?
Sustainable landscaping practices are used throughout Durbin Estates. They contribute to a healthier environment for residents, reduce the resource inputs needed and reduce costs. Native plants and drought resistant species are adapted to the local growing seasons and require less water and maintenance. The increased tree cover and plantings absorb water, reduce runoff, create habitat and also beautify the site. Community gardens and edible landscaping provide fresh food as well as a sense of community and a connection to the environment. Organic methods, composting and mulching minimize the need for synthetic fertilizers and toxic yard chemicals. They also build soil health and improve peoples health and the environment.
The Bald Cypress trees planted in the bioinfiltration basin were specially selected because each can "drink" 100 gallons of water a day. They act as natural water pumps to dry out the basin and filter out pollutants, while also surviving long dry
Tree Cover
Trees affect energy consumption by shading buildings and blocking winter winds. Tree canopy helps to mitigate stormwater runoff and helps increase air quality.
*Xeriscaping
Xeriscaping refers to landscaping designed to reduce the need for supplemental water from irrigation or landscaping that uses native and drought tolerant plants to reduce water consumption.

H.


Sustainable Sites
What are Sustainable Sites?
Sustainable sites, like green buildings, are a way to improve the local and global environment. They are designed to use less energy, water and other resources and to produce less waste. Sustainable sites are a solution for addressing global problems such as climate change, loss of plant and animal life and overuse of natural resources. By combining practices used to develop and manage the land with features of healthy ecosystems, sustainable sites can:
restore or enhance natural ecosystem services
protect watersheds
enhance health and well-being
maximize beauty and encourage use of outdoors areas
save money, so funds can be redirected into other community needs
Stewardship
improved air and water quality
lowered urban heat island effects
increased soil health
increased evapotranspiration
increased vegetative cover
increased infiltration
improved soil conditions
reduced vegetation cover
compaction of soil
reduced infiltration
increased runoff
decreased soil activity
decreased soil organic matter
impaired water and air quality
Degradation
What are Ecosystem Services?
Most of us don't think about, or even realize, the services and benefits nature provides to us every day. These numerous natural benefits on which we depend are called ecosystem services. Many people view them as free to society. As a result, the benefits they provide are often discounted. For example, when you enjoy picnicking by a clear stream, do you think about how it may have been cleaned by the environment upstream? Or, when you eat fresh fruits or grains, do you think about the many species--like bats, bees, birds and butterflies--that are involved in pollinating them? Some other ecosystem services include flood control from wetlands and flood plains, the food we consume, renewable energy sources, shade from trees and the paper and building products they provide, plant substances used to create medical products and recreational opportunities in nature.
Because ecosystem services are undervalued people often do not consider them in making land-use decisions. Many communities learn how difficult, costly or even impossible these services are to duplicate only after they are destroyed.
What are Economic Benefits of Sustainable Sites?
Sustainable sites are good for the environment, community and people's health. They also produce important economic benefits. These include:
Use less energy and water
Help control climate (heating and cooling)
Reduce greenhouse gas emissions
Save money on water treatment
Clean the air
Protect habitat and species
Improve health
Why Low Impact Development (LID)?
LID is a way to develop land that works with nature and maximizes the use of natural ecosystem services. Conventional development practices hurt the environment over time and can lead to compacted soil, excess stormwater runoff and flooding, decreased water and air quality and less vegetation. LID reverses these negative impacts and improves the environment: it cleans the air and water, improves soil health, reduces flooding, protects and enhances habitat and increases beauty and recreation.
Having natural spaces in communities also encourages people to spend more time outdoors and with each other. This improves the health and quality of life for the residents.

I.


Wetlands & Watersheds
What are Wetlands?
Wetlands are lands where water is a dominant feature, such as marshes, swamps and vernal ponds. They support productive and diverse natural communities and provide vital ecosystem services such as recharging groundwater and providing habitat for wildlife populations. They protect land areas from storm damage and flooding and creating opportunities for bird and wildlife viewing and other outdoor recreation. Wetlands also act as sponges absorbing pollutants and transforming many toxic substances into harmless materials. Because of their positive effects on water quality and flood control they play an important role in protecting watersheds* and ensuring ecosystem health and biodiversity.
Wetlands have been drained for decades, initially due to agriculture, and more recently due to urban and suburban sprawl. Their disappearance marks the loss of important habitat for associated plants and animals. Protecting them offers numerous benefits to wildlife and watersheds*. Efforts are being made to protect and restore them and return the vitality of these natural communities to lands and schoolyards. By providing the four basic elements that all wildlife need--food, water, shelter and space--communities can foster healthy populations of wildlife. It is a myth that wetlands breed more mosquitoes. In fact, predator species that live in the ecosystems, like frogs and dragonflies, keep the mosquito population down.
How is it used at Durbin Estates?
The vernal pond you see in front of you serves many functions. It attracts wildlife and protects habitat. It offers a pleasant place for residents to relax and enjoy the outdoors and provides a learning laboratory for area schools where students can learn about wildlife, ecosystems and habitat protection. Other methods used to expand habitat at Durbin Estates include increased tree cover and native plantings.
Roundstone Native Seed, which is located in Upton, Kentucky, is an important partner to the project and they have donated all of the native plantings you see at the site.
*What is a Watershed?
A watershed is the area of land that drains rainfall and other precipitation to a common point like a stream or lake. The word watershed is sometimes used interchangeably with drainage basin or catchment.
Small watersheds link together to form larger watersheds, draining land area and small bodies of water into larger rivers and lakes, eventually leading to the ocean. Some watersheds connect to karst areas and drain underground.
Because all of our water comes from within a watershed area, it is important to reduce pollution and work together to clean up our watersheds for clean water. Remember wherever you are, you are always in a watershed!
What is a Vernal Pond?
A vernal pond is a seasonal wetland or temporary pool of water that adds habitat for plants and animals. Seasonal weather changes cause fluctuating water levels and dramatic changes in the appearance of flora and fauna associated with vernal ponds. Despite being dry at times, when they are filled, vernal ponds teem with life both in the water and around the shore. Common animals seen at vernal ponds include toads, frogs, salamanders and dragon flies. A variety of bird life is attracted to the pools which are used as a seasonal source of food and water.

APPENDIX I: NEWS RELEASES

a) WKU Receives Grant to Develop Green Infrastructure for Planned Habitat for Humanity Community, *8/25/2010*
b) Plans for green housing in works: WKU, Habitat for Humanity teaming up for subdivision to be built on Glen Lily Road, By LIZ SWITZER, *The Daily News, 8/27/2010*
c) Public Invited to Design Charrette for WKU-Habitat for Humanity Statewiude Demonstration Project on 2/18, *2/14/2011*
d) WKU and HFH to Sponsor Trash Pickup for Commonwealth Cleanup Week, *3/23/2011*
e) Hoffman Environmental Research Institute is Newest Partner for WKU-HFH Durbin Statewide Demonstration Project, *5/25/2012*
f) WKU-HFH Durbin Project Installs Vernal Pond as Link to New School, *8/3/2012*
g) WKU College of Education Hosts Kentucky Habitat for Humanity Green Buildings Summit, April 19-20, 2013, *4/1/2013*
h) Parker Bennett Curry 4th Graders Visit Durbin Project to learn about Water, *10/16/2013*
i) Campus Habitat for Humanity Chapter Constructs Bridge for Durbin Estates Statewide Demonstration Project, *5/13/2014*
j) Public Invited to Celebration Event for WKU-HFH Durbin Statewide Demonstration Project, *6/15/2014*

A.

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August 25, 2010

Contact Nancy Givens at (270) 745-2842 or Terry Wilson at (270) 745-4671.

WKU RECEIVES GRANT TO DEVELOP GREEN INFRASTRUCTURE FOR PLANNED HABITAT FOR HUMANITY COMMUNITY

BOWLING GREEN, Ky. –WKU has received a $655,000 grant from the Kentucky Division of Water to create an integrated green infrastructure at a 16-acre site owned by Habitat for Humanity called Durbin Estates located just off Glen Lily Rd. WKU will work with the local and state Habitat for Humanity and several partners to demonstrate low impact development (LID) techniques including use of natural ecosystem services, and to provide education and training to professionals and the public on ways to reduce nonpoint source pollution and improve quality of life for communities.

Under Section 319 of the Clean Water Act states receive funding to support nonpoint source management (NPS) programs. NPS is water pollution that affects bodies of water from diffuse sources including stormwater runoff, drainage, or seepage from agricultural and urban areas. It is the leading cause of water pollution in the U.S. today. Because it comes from diffuse sources it is difficult to manage.

Over the next few years, the 16-acre site will include up to 50 housing units, a community center, outdoor amphitheater, walking trails, community gardens, rain gardens, edible landscaping, native species plantings and increased tree cover.

"The project will address quality of environment and economic issues as well as have a positive impact on carbon emissions and the larger concern of global climate change," said Nancy Givens, WKU Sustainability Programs Development Coordinator and Principle Investigator for the grant.

Mechanisms to be included in the infrastructure design and examples of LID techniques include use of modified drainage channels and pervious pavement to reduce stormwater runoff; cisterns, rain barrels, and irrigation piping to collect and recycle rainwater; rain gardens and landscaping to slow water flow and improve natural absorption and filtration; and drought tolerant native plants and organic treatment methods to reduce chemical use and irrigation needs and also beautify the site.

The key partners for the project are WKU and the state and local Habitat for Humanity affilates. Other partners include WKYU-PBS that will produce a 30-minute documentary on the project, Bowling Green mayor's office and department of Public Works, Bowling Green City Schools, BGGreen Partnership for a Sustainable Community, and Bluegrass PRIDE. Dale Reynolds, the regional representative of the Kentucky Division of Water, has lent great encouragement and support to the project.

WKU students from various departments and academic programs will have opportunities to participate in the design, testing and development of the green infrastructure as well as the education and outreach efforts. Area schools will be invited to bring school groups to the site for education. Community organizations, individuals, and residents will also have volunteer opportunities to be involved.

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B. Plans for green housing in works

WKU, Habitat for Humanity teaming up for subdivision to be built on Glen Lily Road

By LIZ SWITZER, The Daily News, lswitzer@bgdailynews.com/783-3240
Friday, August 27, 2010 11:07 AM CDT

Bowling Green is about to get greener.

Western Kentucky University and Habitat for Humanity announced Thursday they will partner to create a new 16-acre, 50-unit green housing community using low-impact development techniques.

Site development for the project - the first of its kind in the state - will begin by the end of the year, funded with a $655,000 grant to WKU from the Kentucky Division of Water, according to Nancy Givens, WKU's Sustainability Programs Development Coordinator with the Center for Environmental Education and Sustainability.

The community, called Durbin Estates, will be just off Glen Lily Road near the former L.C. Curry Elementary School on land owned by Habitat for Humanity. Plans call for it to be a mixed-income subdivision of both single and multifamily dwellings such as condos, said Rodney Goodman, executive director of Habitat for Humanity of Bowling Green-Warren County Inc. Some of the homes will be built by Habitat for Humanity while other lots may be sold to the public, with restrictions.

"It's going to be about more than building homes, it is going to be about building a decent, safe community for people to live in where there are community gardens, community interaction and community associations," Goodman said.

The development is unique among Habitat for Humanity projects because it combines the elements of multiple housing units with green infrastructure, said Terry Wilson, director of WKU's Center for Environmental Education and Sustainability. "We feel like the project will provide a strong sense of community for the folks that end up living there because that is what we are trying to do from the start is create a real community," Wilson said.

The plan has been in the works for some time but has been held back by funding, according to Goodman. "We have been waiting for funding for infrastructure and now we've got it," Goodman said. "Right now we can go in and build one or two homes in a community, but we can't go in and make a large change, so this gives us a chance to make a huge impact."

The project addresses environmental and economic issues, including the larger concern of global climate change, according to Givens. It also will serve as a model of infrastructure that uses natural methods of reducing the cost to communities of treating water, protecting waterways and restoring the environment.

Storm runoff, drainage and seepage from agricultural and urban areas is the leading cause of water pollution in the United States today - and because it all comes from different sources, it is difficult to manage, according to Givens.

WKU students will also play an integral role in the design aspects of the project, such as a major retention

basin that drains runoff so it can be returned as pure ground and river water. Students may also be involved in keeping data to validate the cost and benefits of the sustainable features.

Other mechanisms to be included in the green infrastructure include pervious pavement, cisterns, rain barrels, irrigation piping to collect and recycle rainwater, rain gardens, landscaping that slows water flow and provides natural filtration, drought-tolerant native plants and organic alternatives to the use of chemicals.

Plans also call for a community center, outdoor amphitheater, walking trails, community gardens, rain gardens, edible landscaping - such as fruit and nut trees as well as berry bushes - landscaping with native plants, walking trails and mass transit stops.

WKU and Habitat for Humanity are also considering the use of a passive home model - which uses 90 percent less energy than a standard home - as a construction prototype, Givens said, adding that the development “returns money to families.”

“This will show that if we can develop housing that is environmentally friendly, sustainable for its homeowners and we can do it in a low-income setting, then it sets a precedent for the entire community,” said Goodman. “The other thing is - for our families - being able to produce a setting with lower energy bills means we are making a sustainable, affordable situation for them.”

The project will also be used as a training model on how to use natural ecosystems and technologies. Habitat for Humanity affiliates from all over the state will use the building project for on-site training, according to Goodman. “We see this as a model for the future to be replicated by all communities,” Givens said. “We are definitely going to be setting a model for our region and state.”

Durbin Estates will also serve as an educational model for the community and organizations, and for individuals, who will be able to volunteer and get involved, Givens said. WKYU-TV will be make a 30-minute documentary on the project.

“We have already developed a broad coalition on the project and we only see that expanding,” Goodman said. “We are building a community for people to live in and it is also going to be an on-going educational facility for WKU. The short term is about the infrastructure but the long term is about the community.”

C.

FOR IMMEDIATE RELEASE

February 14, 2011
Contact: Nancy Givens (WKU), 270/745-2842, or Rodney Goodman (HFH) 270/843-6027

PUBLIC INVITED TO DESIGN CHARRETTE FOR WKU-HABITAT FOR HUMANITY STATEWIDE DEMONSTRATION PROJECT ON 2/18

BOWLING GREEN, Ky. –This Friday, February 18, community members are invited to participate in a design charrette for the WKU-Habitat for Humanity (HFH) green infrastructure statewide demonstration. This project is part of a larger plan to construct a green affordable housing community at a fourteen acre site owned by BG-WC Habitat for Humanity known as Durbin Estates. The charrette will begin with a site tour at 9:30 am, and be followed by an interactive period for public comment during which citizens, planners, designers, and project staff may share ideas for the project's design. It will take place at the former LC Curry Elementary School, at 1350 Durbin Drive. Community members may come and go during the public comment period, until 12:00 noon; the project's Advisory Council will stay after to complete the design process. All participants should park at the far end of the parking lot.

"This project is a wonderful opportunity to come together as a community to do something that is good for our environment, creates affordable, sustainable homes, and strengthens our community," says Rodney Goodman, Executive Director of BG-WC Habitat for Humanity. "Bowling Green is a great community and we recognize that there are many in our community who have ideas which will strengthen this project and we would love to hear from you at the design charrette." "We seek to demonstrate the value of natural ecosystem services and, optimally, to influence policy regulations for green infrastructure in community development," added Nancy Givens, Principle Investigator for the grant project. The statewide demonstration project is funded by the Kentucky Division of Water through a grant to the Environmental Protection Agency and will be administered by WKU's Center for Environmental Education and Sustainability.

Design charrettes are a way to engage the community in building a new or alternative vision for an area or site through a productive team process. Their goal is to capture the values, ideas and creativity of the community, while designers are sketching to integrate alternatives and ideas into design plans as fast as they can be generated by the participants. The charrette will be facilitated by Ginger Watkins, Green Building Specialist with the Kentucky Habitat for Humanity. The designers for the project are from Arnold Consulting, Engineering, and Surveying (ACES), Inc., a local agency with over thirty-three years experience in engineering, landscaping, surveying, and project management. Other key partners for the project include WKU departments and WKYU-PBS, Bowling Green City Schools, Bowling Green Public Works, Green River-Tradewater Basin Team, BGGreen Partnership, and Bluegrass PRIDE.

Initial plans are for the site are to comprise up to fifty housing units, a community center, outdoor amphitheater, community gardens, and walking trails. Low Impact Development techniques that may be included in the green infrastructure design include modified drainage channels, pervious pavement, cisterns, rain barrels, irrigation piping, rain gardens, native plants and increased tree cover, including edible plants.

D.

FOR IMMEDIATE RELEASE

March 23, 2011

Contact: Nancy Givens
nancy.givens@wku.edu, 270-745-2842

WKU and HFH to Sponsor Trash Pickup for Commonwealth Cleanup Week

Bowling Green, KY. — Western Kentucky University (WKU) and the Bowling Green Warren County Habitat for Humanity (HFH) will sponsor a community trash pickup on Saturday, March 26 at 2:00-5:00 pm as part of Commonwealth Cleanup Week.

The trash pickup will occur at Habitat's Durbin Estate site, located between Glen Lily Road, Durbin Lane, and 12th Avenue West. Durbin Estate is being developed into a green infrastructure and affordable green housing community that will eventually comprise forty-five residences plus green space and community gardens.

Trash bags and gloves will be provided for participants. T-shirts will be given to the first ten to arrive.

Participants may park at the former LC Curry Elementary School on Durbin Drive off of Glen Lily Road or there is limited parking at the end of 12th Ave. W.

Commonwealth Cleanup Week is March 20-26, 2011. This year marks the 13th anniversary of this annual event that is implemented by the Kentucky Energy and Environment Cabinet and gives communities an opportunity to "spring clean", recycle, and promote community service.
For more information about the cleanup or the Durbin Estate project contact Nancy at 270-745-2842 or nancy.givens@wku.edu.

E.

FOR IMMEDIATE RELEASE
May 25, 2012

Contact: Nancy Givens, Principle Investigator, at nancy.givens@wku.edu or 270/745-2842

Hoffman Environmental Research Institute is Newest Partner for WKU-HFH Durbin Statewide Demonstration Project

BOWLING GREEN, Ky. – The Hoffman Environmental Research Institute is the newest partner to join the Western Kentucky University (WKU)-Habitat for Humanity (HFH) Durbin Project. This project will develop an integrated green infrastructure, green building, mixed-income, mixed-use neighborhood on a 14.3 acre site owned by the Bowling Green-Warren County Habitat for Humanity as a statewide demonstration. Initial funding for the Durbin Project was awarded by the Kentucky Division of Water through a grant from the Environmental Protection Agency. The grant is administered by the WKU Center for Environmental Education and Sustainability, which has the mission to work with a broad set of stakeholders to provide resources and leadership to advance education for a sustainable future through educational programs, professional development, community service, and research.

A key goal for the project is providing community education and professional training on stormwater management and nonpoint source pollution reduction in a karst environment. Much of Bowling Green and Warren County is situated on a karst plain that has special requirements for groundwater protection. The Hoffman Institute will develop educational signage that will be posted along walking trails and around the community to explain the low impact development (LID) features of the site and how they benefit stormwater management and water quality in a karst environment. Demonstrated LID techniques will include: drainage channel modifications to a more natural meandering configuration that slows and pre-filters stormwater entering the site; primary use of native plants, edible plants, and increased tree cover that absorb and filter water and reduce irrigation needs; trash collection and sedimentation mechanisms designed to improve water quality; a bio-retention basin that pre-treats water and removes pollutants before water enters the water table; use of bioswales, rain gardens, rain barrels, and underground cisterns that slow, pre-treat, and capture rainwater for reuse; and use of pervious pavers that reduce and slow runoff. The Hoffman Institute is a part of the Department of Geology and Geography at WKU.

The Durbin site will also be used as a learning laboratory for area schools, being located just across the street from the former LC Curry Elementary School, on Glen Lily Road. Plans are underway to rebuild the school as a high performance school that reduces energy use, water use, and costs, with expected completion in August, 2014. “We are proud to be a partner on this project that will benefit our students, families, and the community” says Vicki Writsel, Assistant Superintendent of the Bowling Green Independent Schools and an Advisory Council member for the Durbin Project. Personnel at the Bowling Green Independent Schools will translate the text of the signs into multiple languages, to reflect the primary languages of students in the school system and other local community members. The translations, along with supplemental information on LID techniques and learning activities, will be accessible by QR codes on the signs that direct people to associated websites.

The Hoffman Institute team brings extensive experience in researching and addressing local and international water resource issues in karst environments to the project. They also work with communities through student engagement projects and develop learning materials through informal education research. “We are very excited to be a part of this project,” said Dr. Leslie North, the Hoffman Institute’s Associate Director of Education. “It is a perfect example of how diverse groups within the community can work together to provide a site for living, learning, and community engagement regarding crucial issues like water resource protection and sustainable development.”

“A growing mix of partners have come together on this project, reaching across the university, local businesses, schools, and government; these partnerships are transformational and vital to the project’s success.” said Nancy Givens, Principle Investigator for the project and Program Coordinator for the Center for Environmental Education and Sustainability at WKU. Other key partners on the project include WKU departments including Planning, Construction and Design, and Landscaping; WKYU-PBS, which will do a public documentary on the project; Kentucky Habitat for Humanity, the Public Works Department of the City of Bowling Green; Arnold Consulting, Engineering, and Surveying, Inc.; Service One Credit Union; the Green River-Tradewater Basin Team; Roundstone Native Seed, LLC; and Bluegrass PRIDE.

For more information contact Nancy Givens, Sustainability Programs Development Coordinator with the WKU Center for Environmental Education and Sustainability and Principle Investigator for the grant, at nancy.givens@wku.edu or (270) 745-2842.

F.

FOR IMMEDIATE RELEASE
August 3, 2012

WKU-HFH Durbin Project Installs Vernal Pond as Link to New School

After more than a year of planning, the WKU-Habitat for Humanity (HFH) Durbin Project broke ground today with the installation of a vernal pond. Community volunteers and project partners participated with Tom Biebighauser, wildlife biologist and wetland ecologist with the Center for Wetland and Stream Restoration, supervising the effort and Scott and Ritter, Inc. operating the equipment. The WKU Center for Environmental Education and Sustainability (CEES) planned the day, as part of a grant project funded by the Kentucky Division of Water. Brooke Shireman, Angie Wingfield, Stefanie Osterman from the Kentucky Division of Water, participated in the volunteers day. "I have heard wonderful things about Tom and wanted to see an installation first-hand," said Brooke. "I am excited to see how this part of the project is integrated into the entire project."

The vernal pond at Durbin will be an interesting feature for community residents that adds habitat for plants and animals. It will also serve as a natural habitat learning facility for school groups, and in particular, for the new Dishman-McGinness Elementary school that is soon to be built at the former LC Curry Elementary site, located just across Glen Lily road from the Durbin site. Bowling Green Independent Schools is a key partner for the Durbin Project and serves on its Advisory Council. The Durbin community will eventually comprise 43 residences, a community building, an integrated green infrastructure, green buildings, and shared green space with walking trails, community gardens, and edible plantings. The land is owned by Habitat for Humanity of Bowling Green Warren County. The project will be developed over several years.

Vernal ponds are seasonal wetlands that are usually quite small and are covered by shallow water during the wetter part of the year. Climatic changes associated with each season cause dramatic changes in the appearance of and the flora and fauna associated with vernal ponds. Common animals seen at vernal ponds include toads and frogs, salamanders, and dragon flies. A variety of bird life is attracted to the pools which are used as a seasonal source of food and water. In many areas, vernal ponds are disappearing due to sprawl patterns of growth, and efforts are being made to protect and restore them, as their disappearance marks the loss of important habitat for associated plants and animals.

For more information contact Nancy Givens at 745-2842 or nancy.givens@wku.edu or Terry Wilson at 745-4671 or terry.wilson@wku.edu at the WKU Center for Environmental Education and Sustainability.

G.

FOR IMMEDIATE RELEASE

April 1, 2013

Contact: Mary Shearer, Exec. Dir., Kentucky Habitat for Humanity, (502)-608-7041, mary@kyhfh.org

WKU COLLEGE OF EDUCATION HOSTS KENTUCKY HABITAT FOR HUMANITY GREEN BUILDINGS SUMMIT, APRIL 19-20, 2013

Bowling Green, KY–The Kentucky Habitat for Humanity (HFH) Green Housing Summit is a two-day training conference open to Kentucky and neighboring state Habitat for Humanity affiliates, Western Kentucky University (WKU) and other students and staff, building professionals, and the public. The conference dates are Friday and Saturday, April 19-20, 2013.

This is the fourth annual statewide conference and it will be held for the first time in Bowling Green. The conference will be in Gary Ransdell Hall, the first LEED (Leadership in Energy and Environmental Design)-certified building at WKU that houses its College of Education. A tour of Richardsville Elementary School, which is the first net zero energy school in the nation, and information about the WKU-HFH Durbin Project, which is a statewide green infrastructure green building affordable housing community partnership project, are also part of the program–and one reason the conference is being held in Bowling Green.

"The Center for Environmental Education and Sustainability and College of Education are pleased to host this event that will attract HFH affiliates from around Kentucky and surrounding states," said Nancy Givens, Sustainability Programs Development Coordinator and Principle Investigator for the Durbin Project grant. "This will be the 4th year that students from WKU Campus Chapter will be in attendance at the conference. They receive valuable networking opportunities as well as knowledge that will be able to assist them in the future with responsibly assisting the Habitat for Humanity Organization," added Bryan Reaka, Associate Professor of Architecture & Manufacturing Services and Director of WKU's HFH student chapter.

Sessions will include hands-on learning opportunities to help everyone meet ENERGY STAR, the new building code, and Green Standards for 2013 and beyond. The keynote speaker is Sam Rashkin, founder of the Energy Star Program, Chief Architect Energy Building Technologies, U.S. Department of Energy. Other sessions will focus on energy efficient construction, rehabs, repairs, Energy Star, fundraising, social media, mortgage origination and new regulations, and Federal funding.

In addition to the Green Building Summit, a concurrent ENERGY STAR certification course will be offered for HVAC Contractors on Friday, April 19. The EPA requires any builder wishing to certify to ENERGY STAR 3.0 to use a certified HVAC contractor. There are only 14 certified contractors in Kentucky, so contractors are highly encouraged to register for this class.

You may register online by going to the following link: http://www.certain.com/system/profile/web/index.cfm?PKwebID=0x4533606b2d&varPage=home, then clicking on 'Register'. Conference fees are $50 for each participant or $25 for additional attendees from an HFH affiliate; $10 for Students; and $250 for the ENERGY STAR 3.0 certification for HVAC Contractors.

Registration includes the sessions, all materials, hotel, ‘goodie’ bag, tour, and a Friday night BBQ. Registration is open until April 10th.

We hope you can be with us! We look forward to welcoming you!

For more information, please contact: Mary Shearer, Executive Director, Kentucky Habitat for Humanity, mary@kyhfh.org, 502-608-7041

H.

FOR IMMEDIATE RELEASE

October 16, 2013

Contact: Robin Hume WKU Center for Environmental Education and Sustainability, at (270) 745-4424 or robin.hume@wku.edu

PARKER BENNETT CURRY 4TH GRADERS VISIT DURBIN PROJECT TO LEARN ABOUT WATER

On Wed., October 16, 60 students from the fourth grade classes at Parker Bennett Curry Elementary School will visit the WKU-Habitat for Humanity (HFH) Durbin Project site to learn about stormwater management and wetlands. The students will have an opportunity to circulate among on-site learning stations to learn about nonpoint source pollution, karst environments, and wetlands.

Karst is a type of landscape that has soluble rock beneath the ground's surface that is dissolved by carbonic acid that forms when rain and soil react chemically to form sinkholes, sinking streams, caves, and springs. This type of terrain makes the groundwater highly vulnerable to contamination due to the surface water moving quickly underground through sinkholes and sinking streams, thus bypassing the natural filtration processes of the soil.

The Durbin Project receives stormwater runoff from a 270-acre area of surrounding city streets and is part of the city's stormwater management system. As rain falls and flows over the surface, it picks up various types of nonpoint source (NPS) pollution such as trash, yard and auto chemicals, nutrients, and sediments that seep below ground and make their way to nearby Limestone Lake and local springs. NPS is the leading cause of water pollution in the U.S. Because it is widely dispersed it is not possible to identify all of the sources. Nonetheless, individuals can take action to reduce NPS by such simple measures as not littering, reducing the use of yard chemicals, properly disposing of hazardous wastes, and recycling or composting wastes.

The constructed vernal pond at the Durbin Project creates a habitat for plants and animals. It also helps to filter and absorb NPS from stormwater overflow. Vernal ponds are seasonal wetlands that are usually quite small and are covered by shallow water during the wetter part of the year. Climatic changes associated with each season cause dramatic changes in the appearance of and the flora and fauna associated with vernal ponds. A partnership between Bowling Green City Schools and the Durbin Project creates onsite

learning opportunities for young students to learn about the importance and features of green infrastructure to manage stormwater runoff, green buildings to improve energy and waste management practices, and green neighborhoods to encourage carbon dioxide reduction in the atmosphere and community-building among residents. In many areas, vernal ponds are disappearing due to sprawl patterns of growth, and efforts are being made to protect and restore them, as their disappearance marks the loss of important habitat for associated plants and animals.

For more information, contact Robin Hume at (270) 745-4424 or robin.hume@wku.edu at the Center for Environmental Education and Sustainability at Western Kentucky University.

I.

FOR IMMEDIATE RELEASE
May 13, 2014

Contact: Nancy Givens, Principle Investigator, at nancy.givens@wku.edu or 270/745-2842

Campus Habitat for Humanity Chapter Constructs Bridge for Durbin Estates Statewide Demonstration Project

BOWLING GREEN, Ky. – The campus chapter of Habitat for Humanity has engineered and constructed a bridge at Durbin Estates that will traverse the drainage channel and connect trails. The trails provide opportunities for recreation and exercise to community residents, and educational signs placed along the trails explain concepts of stormwater management, green infrastructure, karst environments, and low impact development. A close partnership with Bowling Green Independent Schools means the site also serves as an outdoor learning laboratory for school groups and other site visitors.

Bryan Reaka, Associate Professor in Architectural & Manufacturing Sciences is the Director of the campus chapter. He has guided the project and worked closely with students in its implementation. He notes that students in the campus chapter participate in a variety of service projects, workdays, conferences, and fundraising activities. The campus chapter is quite active and maintains a website to inform the public about its goals and opportunities for involvement at http://www.wku.edu/habitat/.

The Durbin Estates project site is located directly across the road from the new Dishman-McGinnis school that is scheduled to open in fall, 2014. Teachers and students from that school will have easy access to the site for education on topics as diverse as protecting water quality and habitat, to organic gardening methods, to green building, to tips for "living lightly" on the land. The county and other school systems also can use the site for educational purposes. "This project benefits our students, families, and the community and we are proud to be a partner with it," says Vicki Writsel, Assistant Superintendent of the Bowling Green Independent Schools and an active Advisory Council member for the Durbin Project.

Durbin Estates is a partnership project between Habitat for Humanity Bowling Green-Warren County, Western Kentucky University, and a host of other partners, and is designed statewide demonstration and education. Initial grant funding provided by the Kentucky Division of Water through a 319(h) nonpoint source pollution grant from the Environmental Protection Agency terminates soon but the project will go on thanks to new funding obtained from other sources and the on-going commitment by Habitat affiliates to volunteer labor. Nancy Givens, Principle Investigator, from the WKU Center for Environmental Education and Sustainability emphasizes that this is a model project that exemplifies the potential for universities to work in creative partnership with schools, government agencies, businesses, and nonprofits to transform communities toward sustainable development.

Other key partners to the project include WKU departments: Planning, Construction and Design, Landscaping, WKYU-PBS, and Hoffman Institute; Kentucky Habitat for Humanity, Bowling Green Division of Public Works; Arnold Consulting, Engineering, and Surveying, Inc. (ACES); Service One Credit Union; Roundstone Native Seed, LLC; Bluegrass PRIDE; and others.

For more information contact Nancy Givens, Principle Investigator, nancy.givens@wku.edu or (270)745-2842.

J.

FOR IMMEDIATE RELEASE
June 15, 2014

Contact: Nancy Givens, nancy.givens@wku.edu or 270/792-0727

Public Invited to Durbin Project End-of-Grant Celebration on June 30

BOWLING GREEN, Ky. – It has been three-plus years since the Center for Environmental Education and Sustainability(CEES) at WKU received funding from the Kentucky Division of Water, through funding from the Environmental Protection Agency, in partnership with Habitat for Humanity Bowling Green-Warren County (HFH BG-WC), to develop an integrated green infrastructure and green building community as a statewide demonstration. Much has been achieved at Durbin Estates through the efforts of many project partners: a master plan was developed, integrated green infrastructure engineered and implemented; educational signs created and on-site education fostered with area schools and through WKU student engagement projects; and a second green home is under construction. It is time to celebrate!

An end-of-grant celebration event will be held at 9 a.m. Monday (June 30) at the new Dishman-McGinnis Elementary School at 375 Glen Lily Road. The gathering is open to the public and will include remarks, recognition of project partners and refreshments. A brief tour of the Durbin Project site will follow for those who are interested. The school is located directly across from the Durbin Project site. Attendees also will enjoy a preview of Bowling Green City Schools' newest high performance school designed to reduce energy and water use and costs that is set to open in fall 2014.

The Durbin Project is on 14.3 acres of land owned by HFH BG-WC and is a multi-year project that will eventually comprise up to 43 homes, plus shared green space, community gardens, community building and some share-use functions. Phase I to develop an integrated green infrastructure and educational programming is essentially complete with modification of drainage channels; native plantings and increased tree cover; installation of a bio-infiltration basin planted with bald cypress trees, bioswale, and vernal pond for habitat; plus trails, bridge, and educational signage. Phase II to install utilities and road infrastructure for the first three homes is well under way, with construction of a second energy efficient home started and partial funding obtained to construct the first passive home in the region. Phase III to extend the road and utility infrastructure for an additional eight to 10 homes, with funding awarded through a Community Development Block Grant by the City of Bowling Green, will begin in the next month.

The partnerships involved in the project reach across the university, school, government, business and community sectors and are vital to the project's success. Beyond the principal partners, other essential partners include Bowling Green City Schools, City of Bowling Green Public Works, Arnold Consulting and Engineering Services, Kentucky Habitat for Humanity, Green River-Tradewater Basin Team, Roundstone Native Seed, Service One Credit Union and Bluegrass PRIDE. Multiple departments, personnel and students from WKU have been involved, including Planning, Design and Construction; Landscaping; WKU-PBS; Hoffman Environmental Research Institute; Office of Sustainability; Geography and Geology; Agriculture; and Center for Environmental Education and Sustainability, which administered the grant.

For more information contact Nancy Givens, Sustainability Programs Development Coordinator and Principle Investigator for the grant, at nancy.givens@wku.edu or 745-2842.

APPENDIX J: DURBIN ESTATE PROJECT WEB SITE/FACEBOOK PAGE

A Durbin Estate Project web site was created to document the various aspects and accomplishments of the project. The website provides background information about the Durbin Project including partners information, a timeline, special projects updates, a photo gallery, green features information, instructional signs with multi-language translations and resource links, and an Educator Resources curriculum guide.

The web page address is http://www.wku.edu/cees/ee_programs_durbin_estate_project.php. A screen shot of the Durbin Project home page and topics links is below.

A Facebook page was created to announce upcoming events and establish an interactive social media presence that documented various aspects of the project. A screenshot of the heading on the page is below.

The web address for the WKU-HFH (319H) Durbin Project Facebook page is https://www.facebook.com/durbinproject.

APPENDIX K: MS-4 TRAINING INFORMATION

City of Bowling Green

Department of Public Works

1011 College Street ▪ P.O Box 430 ▪ Bowling Green, KY 42102-0430

Phone: 270-393-3628 ▪ Fax: 270-393-3050 ▪ TDD: 1-800-618-0056 ▪ Web Address: www.bgky.org

Attention Erosion Prevention & Sediment Control Services & Supplies Vendors:

This letter is an invitation for your company to participate in this year's Erosion Prevention and Sediment Control (EPSC) Seminar & Field Day event on April 23, 2014. The seminar portion will be held at the Carol Knicley Convention Center followed by a lunch and field demonstrations at the Habitat for Humanity Durbin Estates development, located at 433 Wade Avenue Road just off of Glen Lily Road in Bowling Green. This event promises to bring together local and regional stormwater regulators, builders, contractors, engineers, designers and product and services representatives, as well as Habitat for Humanity associates from across Kentucky.

Jeff Lashlee, P.E.
Public Works Director

Melissa Cansler, P.E.
City Engineer

WM. R. "Bobby" Phelps
Operations Manager

The EPSC contractor certification course has been required for contractors performing land disturbing activities within the city limits since 2003. Contractors must attend an EPSC Field Day Event every three (3) years to maintain certification. The event is an educational tool for contractors to stay abreast of current innovations in the field of construction stormwater management and to establish business relationships with vendors who can provide them with the most effective products available.

Vendors are invited to conduct in-field demonstrations of EPSC products, or to simply man a table at the Field Day portion where they will have the opportunity to converse with attendees regarding their products and services over a lunch.

The morning classroom activities at the WKU Carroll Knicely Center are continuing education courses on recent developments in construction stormwater management. Barry Tonning of TetraTech will be giving the classroom instruction. Vendors are more than welcome to attend this portion of the event to chat with the contracting community.

There is no fee for your firm to participate in this event. Each vendor will be provided table/booth space first come first served, demonstration space, as well lunch at the site, and admission to the Knicely Center. Your participation in this event is vital to its success. If your company is interested in participating please complete the registration form and return by 11 April 2014. If you require more information or have any questions regarding any of the requirements please contact me.

Regards,
Matt Powell
Manager
Environmental Compliance Division

ENC: Registration Form, Event Schedule, Map

For More information:

Tim Slattery 270 393-3097
Tim.slattery@bgky.org
Matt Powell: 270 393-3071
Matt.powell@bgky.org

The City of Bowling Green & Kentucky Habitat For Humanity Inc.

JOINTLY PRESENT THE

2014 LOW IMPACT DEVELOPMENT SEMINAR & FIELD DAY

Green Infrastructure & Low Impact Development
The nature and processes for complying with environmental regulations at construction sites is changing. Are you up to date on the new requirements?

Construction Site Storm-water Management
To comply with state guidelines the site operators must comply with stormwater regulations. Learn How!

Construction: What's Working, What Isn't, and What's Next
Tips, tricks, and helpful hints for more efficient operations and avoiding common pitfalls. Also what can we expect for the future of storm-water regulations.

Habitat for Humanity
This year's cooperative effort will allow local building professionals the opportunity to network with HFH professionals from across the State as well as with local their local counterparts. Our thanks to Habitat for volunteering their construction site for the event.

WITH: BARRY TONNING

Keynote Speaker

Barry is a senior level water resources management consultant with Tetra Tech. Over the past decade, he has conducted storm-water permit training for numerous construction site contractors. He is a principal co-author of the Kentucky Erosion Protection and Sediment Control Field Guide and Technical Manual, and has contributed to dozens of other publications on managing stormwater, wastewater, and watershed planning.

WHEN: April 23, 2014

SEMINAR: KNICELY CONFERENCE CENTER
2355 Nashville Rd. Bowling Green, KY 42101
FIELD DAY: DURBIN BASIN ESTATES
433 Wade Ave. Bowling Green, KY 42101

SIGN IN BEGINS AT 7:30 AM AT THE DOOR
THE SEMINAR BEGINS PROMPTLY AT
8:30 AM AND CONTINUES THROUGH **11:45 AM**
LUNCH SERVED AT THE DURBIN LOCATION FROM 12:00-1:00
FIELD DAY ADJOURNS AT 4:00 PM

Who Should Attend?

Every Certified Contractor must attend at least one recertification seminar (field day) every three years. Contractors who fail to meet this requirement must attend one of the monthly eight-hour classes and retake the test to become recertified.

To register please visit: http://tinyurl.com/bgfieldday14

APPENDIX L: SAMPLE CONFERENCE PROPOSALS

A. 2011 Association for the Advancement of Sustainability in Higher Education (AASHE) Annual Conference: WKU-HFH Integrated Green Infrastructure Statewide Demonstration Project
B. 2012 Kentucky Water Resources Research Institute (KWRRI) Annual Symposium Proposal
C. 2012 Kentucky Engagement Conference: It takes a village: Green neighborhood builds partnerships and sustainability

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A.

2011 Association for the Advancement of Sustainability in Higher Education (AASHE) Annual Conference: WKU-HFH Integrated Green Infrastructure Statewide Demonstration Project

Abstract

This session will demonstrate a grant-funded University partnership statewide demonstration project that will use low impact development (LID) and Light Imprint techniques as part of a planned medium density green affordable housing community. The goal is to demonstrate an integrated green infrastructure model for community development that can be broadly replicated to reduce nonpoint source pollution, educate the public, and improve quality of life for communities. Over a period of years, site development will eventually comprise up to fifty single- and multi-dwelling housing units, a community center with shared uses, outdoor walking trails and community gardens, and an emphasis on community building and green building techniques in addition to the integrated stormwater management approach. The session will discuss key features of the project; the important roles of partnerships, education and outreach; and strategies used to impact policy at the local and state levels.

Learning Outcomes

At the end of the session participants will be able to:

1. Identify key features of Low Impact Development and Light Imprint techniques as applied to this project
2. Describe the key role of partnerships, education, and community/media outreach - and strategies for implementation in each of these areas
3. Discuss policy barriers and strategies to effectively impact policy advances
4. Explain community-building aspects of the project and their importance to the model being developed

B. 2012 Kentucky Water Resources Research Institute (KWRRI) Annual Symposium Proposal

Integrated Green Infrastructure Statewide Demonstration

Principal Investigator(s): Nancy Givens, Terry Wilson

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Preferred format: Platform

Abstract:
In 2009, WKU was funded by the Kentucky Division of Water under a 319(h) Environmental Protection Agency nonpoint source pollution (NPS) grant to create an integrated green infrastructure statewide demonstration project using Low Impact Development (LID) techniques to manage stormwater. The site is a 16-acre parcel owned by Habitat for Humanity Bowling Green-Warren County (HFH BG-WC) and is within the Jennings Creek watershed and Bowling Green city limits. The project will be designed as a mixed income mixed use green affordable house community that will eventually comprise up to 50 residential units, a community building, and LID features throughout. It will promote enhanced water quality and public awareness through Best Management Practices (BMPs), professional and community education and outreach, and cooperation among agencies, citizens, and government. A significant strength of this project is its committed partnerships among WKU; Habitat for Humanity (local and state); city schools; and government, businesses, and community organizations.

In addition to demonstrating reduced stormwater runoff and NPS pollution, an important goal is to build public understanding of NPS pollution and effective approaches to managing stormwater and why this is important. Education, outreach, and professional development are integral to this project. Another goal is to build a sense of stewardship through resident and community involvement in project implementation and on-going maintenance. Students, community volunteers, and residents will assist with construction and plantings plus students will conduct project related action-based research.

C. 2012 Kentucky Engagement Conference Proposal

It takes a village: Green neighborhood builds partnerships and sustainability

Abstract: Western Kentucky University and Habitat for Humanity are partnering to create a mixed-income, mixed use green affordable housing community as a statewide demonstration. A strength of this project is its broad and committed partnerships. Partners include various university departments, the state and local Habitat offices, state and local government, the city school system, an engineering firm, local businesses, and NGO's. Education and training are key goals. Involvement by partners has lead to many interesting offshoots and additional benefits for the community. Session will explore aspects of project design and planning, student engagement and research opportunities, and community benefits.
Description: Western Kentucky University and Habitat for Humanity are partnering to develop an integrated green infrastructure, green building, mixed-income, mixed-use neighborhood as a statewide demonstration. The project will be located on a 14.3 acre site owned by the local Habitat for Humanity affiliate. Initial funding was awarded by the Kentucky Division of Water through a grant from the Environmental Protection Agency under the Clean Water Act. The project will eventually comprise forty-three residential units, a community center with shared uses (e.g., classroom, computer room, guest rooms), shared green space, walking trails, community gardens, and native and edible plantings.

A key goal for the project is providing community and schools education and professional training on stormwater management and nonpoint source pollution reduction in a karst environment. Topics covered will include conservation practices, low impact development techniques, the importance of natural ecosystem services; monitoring for effect, and green building/clean energy techniques.

Many university departments are partnering on the project, including Planning, Design and Construction; Landscaping; Agriculture; Architectural and Manufacturing Sciences; and others. Each department brings opportunities for student engagement and research. The Hoffman Environmental Research Institute, part of the Geography and Geology department, will develop educational signage to place along walking trails and around the community that explain low impact development features and how they effect stormwater management and water quality in the karst environment that typifies Bowling Green, and how they benefit the community. A WKU-PBS production will document the project, with involvement by students.

Other project partners include Kentucky Habitat for Humanity, local government, city schools, local and regional businesses, and NGO's. The WKU Center for Environmental Education and Sustainability will administer the initial grant. The project has received recognition already from the state government and International Habitat for Humanity.

The extent of involvement by partners has led to many interesting offshoots and additional benefits for the community-at-large. For example, an important partnership with Bowling Green Independent Schools continues to evolve. The Assistant Superintendent for the City Schools is on the Durbin Project Advisory Council and, with the site being located just across from a former city elementary school currently being rebuilt as a high performance school, it will be used as a learning laboratory for the school. A multi-lingual rain barrel construction workshop for parents and students, related to the project, was held in Spring, 2012. Personnel from the school will also translate the text of trail signs into multiple languages, to reflect the primary languages of students in the school system and other local community members. Another interesting partnership is developing with Roundstone Native Seed, LLC, which will donate all materials and labor to the project to meet its goal of 90 percent native plants on the site.

This session will explore the project's history and design, how key partnerships have developed and how they contribute to the project, a basic timeline for the project, hurdles encountered, opportunities for student engagement and research; benefits to education, and larger community benefits. There will be a Q&A at the end.

Proposed Conference Track:
Partnerships / Sustainability

APPENDIX M: WKYU-PBS DOCUMENTARY (DVD)

APPENDIX N: DIGITAL COPY OF POWERPOINTS (CD-ROM)

DIGITAL COPY OF FINAL REPORT (CD-ROM)

BENCHMARK DATA:

BENCHMARK 1
EXISTING SANITARY MH LOCATED AT THE INTERSECTION OF DURBIN ST. AND GLEN LILY RD.
ELEV: 494.15

BENCHMARK 2
1/2" IRON PIN SET WITH PLASTIC CAP STAMPED "ACES CONTROL", LOCATED IN THE EASTERN MOST PORTION OF THE PROPERTY, APPROX. 23' FROM A 12" HACKBERRY TREE.
ELEV: 492.52

Kentucky 811
Know what's below. Call before you dig.

NOTE:
PHASE 1A CONTRACT ONLY PERTAINS TO THE CONSTRUCTION OF NEW DRAINAGE CHANNEL AND STRUCTURES, THE RE-GRADING OF THE EXISTING CHANNEL, CONSTRUCTION OF THE DAM/FILTER STRUCTURE, AND ANY GRADING WITHIN 25' OF THE TOP OF BANK. ANY OTHER GRADING SHOWN IS TO BE COMPLETED UNDER ANOTHER CONTRACT.

NOTE:
ANY TREES >16" DIA. MUST BE CAREFULLY REMOVED AND STOCKPILED FOR POTENTIAL USE IN TIMBER REVETMENT STRUCTURES

GENERAL NOTES

1. ALL MEASURES INSTALLED FOR SEDIMENT CONTROL SHALL BE CHECKED AT THE BEGINNING AND END OF EACH DAY WHEN CONSTRUCTION IS OCCURING TO ASCERTAIN THAT THE MEASURES ARE IN PLACE AND FUNCTIONING PROPERLY. ANY DAMAGE OBSERVED WILL BE REPAIRED BY THE END OF THAT WORKING DAY. MEASURES SHALL BE MAINTAINED UNTIL THE ARCHITECT/ENGINEER DETERMINES THAT THEY ARE NO LONGER NEEDED.

2. ALL EROSION AND SEDIMENT CONTROL PRACTICES WILL BE CONSTRUCTED AND MAINTAINED ACCORDING TO THE STANDARDS OF THE LOCAL AUTHORITY AND AS REQUIRED BY STATE AND FEDERAL LAWS.

3. A COPY OF THE APPROVED EPSC (EROSION PREVENTION SEDIMENT CONTROL) PLANS SHALL BE MAINTAINED AT THE PROJECT SITE AT ALL TIMES. THIS COPY SHALL BE PRESENTED TO THE LOCAL AUTHORITY'S REPRESENTATIVES UPON REQUEST.

4. PRIOR TO COMMENCING LAND-DISTURBING ACTIVITIES IN ANY AREA NOT ON THE APPROVED EPSC PLAN, THE CONTRACTOR SHALL SUBMIT A SUPPLEMENTARY EPSC PLAN TO THE LOCAL AUTHORITY FOR APPROVAL.

5. ALL EPSC MEASURES ARE TO BE PLACED PRIOR TO OR AS THE FIRST STEP IN CLEARING AND GRADING. THE CONTRACTOR IS RESPONSIBLE FOR ANY ADDITIONAL EROSION CONTROL MEASURES NECESSARY TO PREVENT EROSION AND SEDIMENTATION AS DETERMINED BY THE LOCAL AUTHORITY. DURING DEWATERING OPERATIONS WATER MUST BE PUMPED THROUGH AN APPROVED FILTERING DEVICE. THE LOCAL AUTHORITY MAY SUSPEND DEWATERING OPERATIONS IF POLLUTION IS OBSERVED.

6. THE CONTRACTOR SHALL INSPECT ALL EROSION AND SEDIMENT CONTROL DEVICES AT LEAST ONCE A WEEK AND AT LEAST ONCE A DAY DURING RAINFALL EVENTS. THE CONTRACTOR SHALL PERFORM ANY REPAIRS OR MAINTENANCE IMMEDIATELY IN ORDER TO ENSURE EFFECTIVE EROSION AND SEDIMENT CONTROL. THE CONTRACTOR SHALL MAINTAIN A RECORD OF ALL INSPECTIONS AND MAINTENANCE ACTIVITIES AT THE PROJECT SITE. THIS RECORD SHALL BE MADE AVAILABLE UPON REQUEST.

7. ALL AREAS DISTURBED SHALL BE STABILIZED ACCORDINGLY. WHEN THE SITE IS BROUGHT TO FINAL GRADE IT MUST BE STABILIZED WITHIN 14 DAYS. DISTURBED AREAS NOT AT FINAL GRADE MUST BE STABILIZED WITHIN 21 DAYS.

SEED AND SOD NOTES

1. ALL DISTURBED AREAS, INCLUDING WASTE AREAS TO BE SEEDED OR SODDED (IF NOT NOTED TO BE RIP-RAPPED, OR HARD SURFACED). THE AREA NOTED ON THE PLAN TO BE SEEDED SHALL BE SPREAD w/ 4" MINIMUM OF TOP SOIL. ALL AREAS TO BE DISKED, LEVELED, AND HAND RAKED. THE TOPSOIL LAYER SHALL BRING ALL TURF AREAS TO FINISH GRADE SURFACE AREA SHALL BE ROLLED TO REMOVE LUMPS. FOREIGN MATERIALS SUCH AS ROCKS, LIMBS, STICKS, ETC. TO BE COLLECTED AND REMOVED DURING CULTIVATION AND RAKING OPERATIONS.

2. INSTALLATION OF SEED SHALL BE BETWEEN MARCH 1 TO JUNE 15 OR SEPTEMBER 1 TO OCTOBER 15. IF SEEDING IS DONE IN BETWEEN OCTOBER 15 TO MARCH 1. A SEED BLEND WILL BE USED CONSISTING OF 20% ANNUAL RYE.

3. GRASS SEED SHALL BE A TYPE WHICH WILL THRIVE IN THIS PROJECT AREA. SUBMIT PROPOSED SEED MIXTURE TO OWNER FOR APPROVAL. FERTILIZER SHALL BE 10-10-10 TYPE I GRADE A. USE APPROXIMATELY 5 LBS. OF GRASS SEED, 10 LBS OF FERTILIZER FOR EACH 1000 SQ. FT. OF GROUND AREA TO BE SEEDED. COVER ALL SEEDED AREAS WITH 3 BALES OF WHEAT STRAW FOR EACH 1000 S.F. WATER DAILY FOR 15 DAYS OR AS REQUIRED BY WEATHER CONDITIONS. AFTER SEED HAS GERMINATED. ALL THIN SPOTS SHALL BE RE-SEEDED.

4. THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR WATERING, MOWING, AND OTHER MAINTENANCE TO SEEDED AREAS UNTIL THE PROJECT IS ACCEPTED BY THE OWNER. A MINIMUM OF 90% COVERAGE OF SOUND, HEALTHY GRASS SHALL BE REQUIRED FOR ACCEPTANCE.

5. EMBANKMENTS/ SLOPES GREATER THAN 3:1 SHALL EITHER BE SEEDED AND COVERED WITH AN EROSION CONTROL MATT (JUTE MESH ENKAMAT) OR INSTALLED WITH SOD FOR PROPER STABILIZATION. SOD TO BE STAKED WITH EITHER WOOD STAKES OR U-SHAPED METAL PINS FLUSH WITH GRADE.

6. SOD SHALL BE REGIONALLY GROWN AND OF A SPECIES THAT WILL THRIVE IN THE PROJECT AREA.

7. MIX SEED, FERTILIZER AND PULVERIZED MULCH WITH WATER, USING EQUIPMENT SPECIFICALLY DESIGNED FOR HYDROSEED APPLICATION.

8. APPLY SLURRY UNIFORMLY TO ALL AREAS TO BE SEEDED. RATE OF APPLICATION AS REQUIRED TO OBTAIN SPECIFIED SEED SOWING RATE.

9. THE SOD SHALL BE RELATIVELY FREE OF DISEASES AND WEEDS. STONES LARGER THAN 1-1/2" IN ANY DIMENSION, PLANT ROOTS AND OTHER MATERIAL DETRIMENTAL TO A HEALTHY STAND OF TURF TO BE REMOVED. DELIVERED SOD THAT HAS BECOME DRY, MOLDY OR YELLOW FROM HEATING, OR HAS IRREGULARLY SHAPED PIECES THAT ARE TORN OR HAVE UNEVEN ENDS SHALL BE REJECTED.

10. THE SOD BED WILL BE LOOSENED TO A DEPTH OF 3" TO A SMOOTH EVEN SURFACE AND SHALL BE GRADED TO SUCH ELEVATION SO THE SOD, WHEN IN PLACE, SHALL BE FLUSH WITH ANY ADJACENT SEEDED TURFED AREA, PAVEMENT, CURB OR OTHER STRUCTURES EXCEPT WHEN OTHERWISE DIRECTED.

11. LAY SOD WITHIN 24 HOURS OF STRIPPING. DO NOT LAY DORMANT SOD OR IF GROUND IS FROZEN. LAY SOD TO FORM A SOLID MASS WITH TIGHTLY FITTED JOINTS. DO NOT OVERLAP.

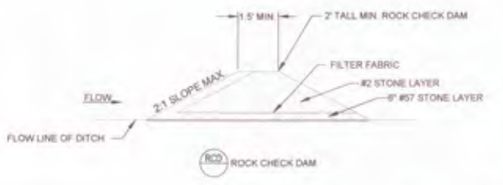
12. WATER SOD WITH FINE SPRAY IMMEDIATELY AFTER PLANTING. DURING FIRST WEEK, WATER DAILY OR MORE FREQUENTLY AS NECESSARY TO MAINTAIN MOIST SOIL TO DEPTH OF 4 INCHES.

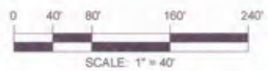
13. PRIOR TO PLACING THE SOD, FERTILIZER 10-10-10 TYPE 1 GRADE A SHALL BE APPLIED UNIFORMLY. SOD SECTIONS SHALL BE HARROWED, RAKED, OR OTHERWISE INCORPORATED INTO THE SOIL. THE SOIL BED, WHEN DRY, SHALL BE MOISTENED TO THE LOOSENED DEPTH.

14. SOD SHALL BE WETTED THOROUGHLY ROLLED AND TAMPED SUFFICIENTLY TO INCORPORATE THE ROOTS INTO THE SOD BED AND TO ENSURE TIGHT JOINTS BETWEEN THE SECTIONS OR STRIPS.

15. ALL SODDED AREAS SHALL BE MAINTAINED (WATERED) AND REPAIRED AS NECESSARY BY THE LANDSCAPE CONTRACTOR UNTIL FINAL ACCEPTANCE OF THE PROJECT.

16. THE LANDSCAPE CONTRACTOR SHALL GUARANTEE ALL SEEDED OR SODDED AREAS FOR A PERIOD OF ONE YEAR FROM THE DATE OF COMPLETION. LANDSCAPE CONTRACTOR IS NOT RESPONSIBLE FOR ACTS OF NATURE THAT MAY CAUSE EROSION, NEGLECT BY THE OWNER OR DAMAGED BY ANIMALS OR MACHINES.





REVISIONS

CONSTRUCTION SET

HABITAT FOR HUMANITY
DURBIN ESTATES - PHASE 1A
BOWLING GREEN, KY

ACES
ARNOLD CONSULTING ENGINEERING SERVICES, INC.
P.O. BOX 1398
BOWLING GREEN, KY 42101
PHONE (270) 780-9445

JOB NUMBER:	2235
DATE:	1/30/2012
SCALE:	1" = 40'
DRAWN:	A. ARNOLD
CHECKED:	J. ARNOLD
FILE PATH:	Z:\SITDEV\C2-PROPOSED LAYOUT

C-3
EROSION CONTROL