PHASE ONE
ADAPTIVE REUSE OF HOUSE AND BARN
GREAT SMOKY MOUNTAINS INSTITUTE SECOND CAMPUS

12 OCTOBER 2021
Phase One, Adaptive use of Brick Home & Barn

Great Smoky Mountain Institute at Tremont seeks funding for phase one development of our second campus as a Living Building project. LBC is a certification program that provides a “framework for planning, design, and construction and the symbiotic relationship between people and the built environment”. Its holistic projects pursue the most advanced measures of sustainability in built communities. It asks us to “imagine that a community is as connected as a forest ecosystem.”

For over 50 years, Tremont has brought youth and adult learners alike to Great Smoky Mountains National Park. Our mission’s work of “connecting people to nature” is traditionally done in the streams and forests of our outdoor classroom. Students are transformed as they experience joy and discovery in nature. We know time spent outdoors is key for health, wellness, and mental wellbeing. Yet, we recognize many barriers prevent equitable access to the benefits of nature. This includes the increasing amount of time spent indoors. We believe that by connecting the built environment to the natural world, through thoughtful design and holistic solutions, we can improve health outcomes. We can realign our understanding of and impact on the natural environment. With the collective knowledge gained, we will help shape our community’s understanding that our well-being is tied to the well-being of our environment. Together with our partners, we will model what a more equitable and resilient future looks like.

Phase one will adapt a brick home and barn into an education center that showcases sustainable, technology-driven solutions for residential and commercial applications. We’ll create hands-on learning experiences for a wide regional audience, offering long-term impacts in workforce development and transformational learning for all ages. Our emphasis on equity and net-positive energy significantly exceeds strategic alignment expectations of energy and environmental justice. It will be the first of its kind in Tennessee. Currently, no LBCs exist in Tennessee, and few are proposed or in planning. Worldwide, roughly 30 certified LBC projects exist, yet only a handful are renovations or adaptive reuses.

The pilot project builds placed-based partnerships and generates new knowledge for industry, planners, architects, and contractors, allowing replication of future LBC projects. It will generate learning opportunities for local colleges and universities, building new skills for our community’s next generation of leaders. Additionally, the pilot will mobilize Tremont toward Phase 2, a 220-bed educational LBC facility. It will have a long-term transformative impact on how people in our region interact with renewable energy and the natural world.

Simply, visitors won’t need to imagine a connected community nor a forest ecosystem - they will experience both firsthand.
<table>
<thead>
<tr>
<th>PETAL</th>
<th>IMPERATIVE</th>
<th>INTENT</th>
<th>TARGET PARTNERSHIPS</th>
<th>RESEARCH</th>
<th>COMMUNITY IMPACT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLACE</td>
<td>The Ecology of a Place</td>
<td>Realign understanding &amp; relationship to the natural environment</td>
<td>INDUSTRY PARTNERS</td>
<td>Fertilizers, pesticides, substrates, carbon sequestration across soils, habitat management / preservation, community science</td>
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<td></td>
<td>Urban Agriculture</td>
<td>Grow and provide food access / sustainable practices - harvesting, irrigation, forest farms / resilient storage</td>
<td>INDUSTRY PARTNERS</td>
<td>Advanced refrigerants (food storage) / forest farming, sustainable harvesting and ag practices / food systems</td>
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<tr>
<td></td>
<td>Habitat Exchange</td>
<td>Conserve lands in perpetuity</td>
<td>Local or regional Land trust</td>
<td>EV charging stations, pervious surface parking materials, Hybrid/EV fleet</td>
<td>🟢 🟢 🟢 🟢 🟢</td>
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<tr>
<td></td>
<td>Human Sealed Living</td>
<td>Walkable / EV and human powered transportation onsite</td>
<td>INDUSTRY PARTNERS</td>
<td>🟢 🟢 🟢 🟢 🟢 🟢</td>
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<tr>
<td>WATER</td>
<td>Responsible Water Use</td>
<td>Minimize consumption, waste, treat stormwater naturally</td>
<td></td>
<td>Natural &amp; mechanical stormwater treatment and detention, irrigation</td>
<td>🟢 🟢 🟢 🟢 🟢 🟢</td>
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<td></td>
<td>Net Positive Water</td>
<td>Recycled water use, onsite treatment, resilient water storage, impacts of human behavior on fresh water supplies</td>
<td>INDUSTRY PARTNERS</td>
<td>Chemical-free treatment, closed-loop systems, grey/black to potable, composting toilet systems</td>
<td>🟢 🟢 🟢 🟢 🟢 🟢 🟢</td>
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<tr>
<td>ENERGY</td>
<td>Energy and Carbon Reduction</td>
<td>Minimize energy consumption, meter usage, high efficiency building, appliances</td>
<td>INDUSTRY PARTNERS</td>
<td>Modeling demand (pre build), energy meters, low carbon materials, behavioral change analysis on consumption</td>
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<td></td>
<td>Net Positive Carbon</td>
<td>Minimum of 10% energy usage generated, carbon offsets, energy storage for disaster response, net metering and return of clean energy to the grid</td>
<td>INDUSTRY PARTNERS</td>
<td>Renewable energy, battery storage, microgrids, inverter / meters, sensors &amp; controls (analysis), transactive elements, HE appliances, building envelope efficiency, resilient food storage system</td>
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<tr>
<td>HEALTH</td>
<td>Healthy Interior</td>
<td>Improved Indoor Air quality / plan and monitoring &amp; filtration</td>
<td>INDUSTRY PARTNERS</td>
<td>Exhaust systems, IAQ monitoring and filtration technologies</td>
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<tr>
<td>+ HAPPINESS</td>
<td>Healthy Interior Performance</td>
<td>VOC alternatives, individual airflow/temp controls across campus</td>
<td>INDUSTRY PARTNERS</td>
<td>No VOC products, local airflow/temp controls and sensors, active and variable workspace on productivity, advanced AC &amp; heating technologies</td>
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<tr>
<td></td>
<td>Access to Nature</td>
<td>Connection to nature through design, evaluation of health benefits</td>
<td>INDUSTRY PARTNERS</td>
<td>Evaluation and projection models on behavioral changes and effect on health</td>
<td>🟢 🟢 🟢</td>
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<tr>
<td>MATERIALS</td>
<td>Responsible Materials</td>
<td>Prioritize locally sourced materials, with transparent ingredient labels, diversion of construction waste, composting, recycling</td>
<td>INDUSTRY PARTNERS</td>
<td>Transparency / ingredient analysis, advanced manufacturing - low waste and low carbon materials, locally sourced material availability</td>
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<td></td>
<td>Red List</td>
<td>Avoidance of chemicals and materials that pose serious risk to human health and the environment, including building occupants, and the health and safety of those who produce and install materials and products</td>
<td>INDUSTRY PARTNERS</td>
<td>Toxic free materials, computational analysis of “downstream” impacts on global scale / fenceline community benefits</td>
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<td>Responsible Sourcing</td>
<td>FSC, salvaged, onsite harvested wood (50%) / advocacy for sustainable resource extraction</td>
<td>INDUSTRY PARTNERS</td>
<td>Sustainable resource extraction practices, wood salvage and harvesting practices</td>
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<td></td>
<td>Living Economy Sourcing</td>
<td>Place-based solutions for materials economy in sustainable practices, products and services</td>
<td>INDUSTRY PARTNERS</td>
<td>w/ industry: local access of materials, their use and installation needs, durability in practice (not just lab)</td>
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<td></td>
<td>Net Positive Waste</td>
<td>waste reduction through reuse/salvaged materials in all phases of building (incl. end of life)</td>
<td>INDUSTRY PARTNERS</td>
<td>Material breakdown / deconstruction and life cycle, adaptable reuse and recycled materials</td>
<td>🟢 🟢 🟢</td>
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<tr>
<td>EQUITY</td>
<td>Universal Access</td>
<td>Equitable access for all regardless of ability (ADA+) on main campus trails and pathways</td>
<td>INDUSTRY PARTNERS</td>
<td>Resilient and accessible trails</td>
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<tr>
<td></td>
<td>Inclusion</td>
<td>High paying job creation, supporting diverse businesses, Just() Label, EDI priority, “downstream” impacts</td>
<td>INDUSTRY PARTNERS</td>
<td>Analysis on workforce development / economic impact</td>
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<tr>
<td>BEAUTY</td>
<td>Beauty and Biophilia</td>
<td>Inspire stewardship and access to benefits of time spent in nature, use design to foster stress reduction, rejuvenation / mental, social &amp; emotional health benefits</td>
<td>INDUSTRY PARTNERS</td>
<td>Behavioral research of design impact - stress, connection, inspiration, attention, retention, etc. in learning habits / stewardship impacts</td>
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<tr>
<td></td>
<td>Education</td>
<td>Teach people why and what we are doing, share successful solutions, catalyze broader change to make the world a better place, Build problem solvers for the problems of our next generation. LBC is open source community of best practices, and opportunity to share what we learn along the way to broaden our reach</td>
<td>INDUSTRY PARTNERS</td>
<td>Economic impact to region: workforce development, materials economy, industry knowledge in green sector, collaborative implementation and impact across sectors, tourism revenue / natural spaces and engineered wetlands as classrooms</td>
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</tbody>
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Catey McClary, President and CEO
Great Smoky Mountains Institute at Tremont
catey@gsmi.org / 865-448-6709 / www.gsmi.org
FOR MORE INFORMATION ON LIVING BUILDINGS, VISIT WWW.LIVING-FUTURE.ORG
2019 SECOND CAMPUS MASTER PLAN

LEGEND:
1. campus entry
2. entry pavilion
3. education + admin building
4. dining + gathering building
5. service + water infrastructure
6. open-air council house
7. open-air pavilion
8. open-air spiritual space
9. residential buildings
10. staff housing
11. in-residence housing
12. demonstration kitchen
13. farm
14. universal access path
15. mown path
16. parking (~100 spaces)
17. small gathering space
18. trail
19. bus parking
20. deliveries/loading
21. water treatment wetland
PHASE 1  ENTRY, DEVELOPMENT OFFICE / HOUSING, OPEN AIR CLASSROOM

PHASE 2  FULL CAMPUS BUILD-OUT

LEGEND:
1. campus entry
2. entry pavilion
3. education + admin building
4. dining + gathering building
5. service + water infrastructure
6. open-air council house
7. open-air pavilion
8. open-air spiritual space
9. residential buildings
10. staff housing
11. in-residence housing
12. demonstration kitchen
13. farm
14. universal access path
15. mown path
16. parking (~100 spaces)
17. small gathering space
18. trail
19. bus parking
20. existing barn location
21. water treatment wetland
22. relocated barn classroom
23. remodeled house
24. EV parking
CONCEPTUAL PROJECT SCHEDULE

CODES & PERMITTING:

The pilot project is not anticipated to be impacted by any local, state, or federal ordinances. Primary permitting will be through Blount County and the electrical permitting will be a state permit through the Sevier County Electric System. The most complex permitting is likely to be associated with water and wastewater, but no issues are anticipated. The system will be permitted though the Blount County Health Department and will be designed in alignment with the Tennessee Code. The inclusion of greywater reuse and rainwater harvesting may require additional regulatory review as it is not a common practice in the region. It is anticipated that all permitting will be completed in two to four months.
For the purposes of planning, a Rough Order of Magnitude estimate has been developed. This estimate is based on cost per square foot assumptions and includes a cost premium for meeting the Living Building Challenge. Due to the preliminary nature of the design work, the ranges established include additional contingencies of 5% for the low end and 20% for the high end.

<table>
<thead>
<tr>
<th>Estimated Project Cost Range</th>
<th>Low End</th>
<th>High End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated Pilot Project Required Sitework Cost</td>
<td>$138,000</td>
<td>$159,000</td>
</tr>
<tr>
<td>Estimated Entry Drive and Additional Parking Cost</td>
<td>$552,000</td>
<td>$636,000</td>
</tr>
<tr>
<td>Estimated House Renovation Cost</td>
<td>$1,032,000</td>
<td>$1,189,000</td>
</tr>
<tr>
<td>Estimated Barn Relocation and Renovation Cost</td>
<td>$536,000</td>
<td>$617,000</td>
</tr>
<tr>
<td>Estimated Net Positive Energy/Water Systems Cost</td>
<td>$552,000</td>
<td>$637,000</td>
</tr>
<tr>
<td>Estimated Building &amp; Site Total Cost(^1)</td>
<td>$2,810,000</td>
<td>$3,238,000</td>
</tr>
<tr>
<td>Estimated Architecture &amp; Engineering Services(^2,3)</td>
<td>$393,000</td>
<td>$453,000</td>
</tr>
</tbody>
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1 Excludes furnishing.
2 Typically professional services are in the range of 8%-16% of project cost.
3 Assumed to include architecture, structural engineering, mechanical & electrical engineering, plumbing design, landscape architecture, civil engineering, water & wastewater systems.
LONG-TERM TRANSFORMATIVE IMPACT

The Living Building Challenge's holistic approach to building planning, design, and operations make it an ideal certification goal for environmental education facilities. This approach provides clear and objective metrics for projects to target and requires 12-months of operational data proving results, prior to certification. With an emphasis on equity and net-positive energy, the Living Building Challenge is also in alignment with TVA's Connected Communities program. Despite nearly 15 years of LBC projects, there have been no certified living buildings completed in Tennessee, and few have been proposed or are in planning. Of the roughly 30 fully certified LBC projects in the world, only a handful are renovations or adaptive reuses.

The completion of this pilot project will raise the bar on sustainable design and construction, equity, and renewable energy in the region. It also has the potential to be a catalyst for the Great Smoky Mountains Institute's second campus vision – a facility that will expand the organization's reach significantly and will have a long-term transformative impact on how people in the region interact with renewable energy and the natural world.

ALIGNMENT TO EQUITY

Through the design and implementation phase, the project team will emphasize equity through the composition of the team, an open design process that includes the community, and operationally by providing the local community with future access to the completed pilot project. Project planning and design will incorporate principals of universal design, ensuring that all persons may use the site equitably, regardless of race, color, national origin, ethnicity, gender, ability/disability, sexual orientation, religion, age and personality.

ADVANCING ENERGY IN OUR COMMUNITIES

The Second Campus Pilot Project will allow the Great Smoky Mountains Institute to incorporate renewable energy and the environmental impacts of carbon more directly into their curriculum. Additionally, by telling this story through the adaptive reuse of the existing house and barn, the information will be more approachable and equitable – allowing visitors to envision implementing similar strategies at home.
Raise the existing floor and roof approximately 4’ to create a full-height first floor for staff housing and vaulted second floor for the development office.
PROPOSED BARN RENOVATION FLOOR PLAN
Interior of barn.

East side of house.

West side of house.
ENERGY AND PV ANALYSIS

SUSTAINABLE DESIGN STRATEGIES:

To meet the aggressive energy savings goal of the project, several strategies will be considered. These will be studied with energy modeling and cost analysis to identify an approach that balances all project criteria. Some initial considerations include:

- Geothermal heating & cooling
- High performance building enclosure
- High performance windows and doors
- Seasonally balanced solar shading/heat gain
- Heat/energy recovery ventilation

ENERGY DEMAND:

<table>
<thead>
<tr>
<th>Building</th>
<th>Area ft²</th>
<th>Design EUI</th>
<th>kWh/yr needed*</th>
</tr>
</thead>
<tbody>
<tr>
<td>House</td>
<td>2,600</td>
<td>25</td>
<td>19,203</td>
</tr>
<tr>
<td>Barn</td>
<td>2,700</td>
<td>5</td>
<td>3,957</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>23,160</strong></td>
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</tbody>
</table>

*15% contingency

PV ENERGY PRODUCTION:

<table>
<thead>
<tr>
<th>Roof</th>
<th>kWh/yr* produced</th>
<th>Panel efficiency compared to average</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22,673</td>
<td>+2.29%</td>
</tr>
<tr>
<td>2</td>
<td>8,100</td>
<td>+5.48%</td>
</tr>
<tr>
<td>3</td>
<td>6,575</td>
<td>-10.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>37,348</strong></td>
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*given 80% coverage, 16% efficiency, 25% reduction for shading

PV ENERGY POTENTIAL* & USE BY MONTH IN KWH

*assuming roof 1 & 2 only
ORG CHART AND LOCAL PARTNERING PLAN

GREAT SMOKY MOUNTAINS INSTITUTE AT TREMONT
Catey McClary  GSMIT Second Campus Committee

ARCHITECTURAL TEAM
Will Ives  AIA, LFA, CPHC, LEED  Principal / Architectural Lead
Hennebery Eddy Architects
Local Partner Firm

CORE CONSULTANTS TEAM
Pete Munoz  PE, LEED AP  BioHabitats  Water and Waste Water Engineers
Local Mechanical/Electrical/Plumbing Engineers
Local Structural Engineers
Local Civil Engineer

Additional Specialty Consultants
Enclosure Consultant  Net-Zero Energy Analysis  Cost Estimating

LOCAL PARTNER SELECTION

An initial step of this project will be to select a local architecture firm as a project partner through the following process.

- January 14, 2022: Identify 4-6 potential partner firms.
- January 22, 2022: Issue a request for qualifications (RFQ) to interested firms outlining the project goals and submittal requirements. Responses will be limited to 5 pages.
- February 9, 2022: Selection committee meets to review and rank firm responses and identify up to two firms for interviews.
- February 16, 2022: Finalist interviews.
- February 17, 2022: Selection and notification.

Following the selection of a local architecture firm the team will identify additional consultants included on the organizational chart. These consultants will be selected through an informal process by the team.

DESIGN TEAM ORGANIZATION

One of the most critical factors in achieving the pilot project goals is bringing together the right team. Hennebery Eddy Architects will lead the overall planning and design in partnership with a local architecture firm, to be selected early in the process. The only additional team member currently identified is Biohabitats, an ecological and wastewater engineering firm with specialization in Living Building Challenge projects. This organization will provide the ideal balance of relevant project expertise, local knowledge, and the potential to expand the sustainable design knowledge basis of the local design and engineering community. In a practical sense, it is anticipated that a minimum of 50% of project professional services fees will go to local firms.
Hennebery Eddy is an architecture and planning firm with a focus on net-positive and site responsive design. With offices in Portland, Oregon, and Bozeman, Montana, the firm serves clients throughout the country. They have completed dozens of academic, civic, and cultural projects, including highly sustainable and net-zero energy projects. The firm promotes equity through these projects and is a JUST organization, a certification recognizing equitable business practices.

Hennebery Eddy is a signatory to the American Institute of Architects 2030 Commitment and multiple firm projects have been recognized with the Oregon AIA 2030 Challenge award. The firm was named the 2018 firm of the year by the AIA Northwest & Pacific Region, and in 2018 and 2019, were named by Architect Magazine as one of the country’s top 50 architecture firms based on design, sustainability, and business practices.

Will leads design and planning for complex projects with an emphasis on education environments, projects in national parks, and aspirational sustainable design goals. He is a Certified Passive House Consultant (CPHC) through the Passive House Institute US, holds a Living Future Accreditation (LFA) through the International Living Future Institute, and has led the planning and design for four projects with Living Building Challenge goals. He has presented on sustainable design at national conferences including Greenbuild and the Passive House Institute Conference and has taught graduate-level net-zero design studios at the University of Oregon.

In addition to his previous work with the Great Smoky Mountains Institute he has collaborated with the Mount St. Helens Institute, Denali Education Center, and Yellowstone Forever on various scales of planning and design for their environmental education campuses. Will has also worked on nearly a dozen projects with the National Park Service.
Biohabitats applies the science of ecology to restoring ecosystems, conserving habitat, and regenerating the natural systems through engagement, assessment, planning, engineering & design, construction, and monitoring. The Biohabitats team operates in eight bioregions in the United States to focus on local values and concerns, specific ecological and biophysical processes, and place-based solutions. They specialize in providing ecological analysis to inform building site selection and water systems design. They have expertise in a wide range of water supply, wastewater treatment, and greywater reuse systems and understand which systems are ideal for specific regions and climates.

Pete is Senior Engineer and Practice Lead at Biohabitats and works around the globe helping to implement nature-based solutions that promote healthy communities, resilient infrastructure, and ecological complexity. He has been involved in hundreds of projects involving wastewater treatment, stormwater management, rain harvesting, environmental remediation, and watershed restoration including SITES, LEED, and seven fully certified Living Buildings.

Pete has advised the International Living Future Institute on multiple versions of the Living Building Challenge, by helping with the integration and criteria of the water requirements. He is a Living Building Ambassador, volunteer, and Living Building Hero Award recipient (2017). Pete’s collaborations with Hennebery Eddy include planning wastewater strategies for the Yellowstone Youth Campus, Great Smoky Mountains Institute’s second campus, and Mount St. Helens Institute’s new outdoor school.
October 20, 2021

Catey McClary
President and CEO
Great Smoky Mountains Institute at Tremont
9275 Tremont Rd
Townsend, TN 37882

Re: Letter of Support

Dear Sir or Madam,

As Superintendent of Great Smoky Mountains National Park, it is my honor to work with special partners that help to serve our mission that support our precious cultural and natural resources. Great Smoky Mountains Institute at Tremont is no exception. I have had the privilege of experiencing firsthand, several of the unique educational programs provided by Tremont. These immersive programs are an integral part of the park’s overall Resource Education mission. They help to weave together the many varied natural and cultural strands of past and present.

The pandemic delivered a serious blow to the enrollment of their programs, at a time when park visitation was at record heights. I witnessed as they endured, finding novel ways to achieve their mission, and providing new opportunities to deepen the connections between our precious resources and diverse audiences.

We are proud to work with Great Smoky Mountains Institute at Tremont to broaden our audiences and strengthen our outreach in nearby communities. We are particularly excited about Tremont’s focus on using relevant and innovative technology to spark interest and engage a new generation of environmental stewards. Their pursuit to make the world a better place through the development of their second campus strengthens our community and the stewardship of our beloved National Park.

My wish is that more people will build a personal connection to nature and to our park through programs like Tremont.

Sincerely,

Cassius M. Cash
Superintendent

Interior Region 2 • South Atlantic-Gulf
Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi
North Carolina, Puerto Rico, South Carolina, Tennessee, U.S. Virgin Islands