

Team Compositive

Eco-Park Learning Center



Project Introduction

The Eco-Park Learning Center is a future municipal office building and community center owned and operated by Prince William County, VA. The project site borders the woodland buffer of the county's operational landfill, currently designated as an Extraordinary Environmental Enterprise (E4) participant in the Virginia Environmental Excellence Program (VEEP). The Learning Center develops the County's vision of the landfill as an eco-park – a nexus for interactive STEM education, community and professional engagement, and the demonstration of cutting-edge waste management technologies of global significance. Once built, it will house the county's municipal administrators while providing ample space to host school groups, professional meetings, and larger community events.



Design Strategy

The design strategies approached within this project are inspired by the various petals of the Living Building Challenge, which will help establish the office building as a keystone of Prince William County's community development. The goal is to seamlessly integrate the Eco-Park Learning Center with its environmental and cultural fabric. Therefore, our values are reflected in a macro strategy concerning the Learning Center's position relative to the sensitive ecological habitat, connections to walking/biking trails, relationships with local schools, and cutting-edge waste management facilities. At the micro scale, we make use of environmentally responsible materials such as structural CLT panels and engineered wood beams/columns. Recycled glass appears as paver blocks, ground filter sand, and as aggregate within sustainable concrete. Efficient building systems and a high-performance enclosure will reduce the building's emissions over its life-cycle. Our multi-tiered design team spanning the domains of architecture, landscape, engineering, and construction, will carefully evaluate the financial implications of our cutting-edge design aspects through detailed budgeting and cost-benefit analyses.

Project Data

Location	Prince William County Virginia, USA
Climate Zone	4A
Lot Size	3 acres
Building Size	31,000 ft ² , 2 stories
Occupancy	100 people, 310 ft ² /person
Target Source EUI	70 kBtu/ft ² /year
Average Utility Cost	\$4,500/month
Construction Cost	\$350/ft ²

Technical Specifications

R-Value(s)	Wall (20), Foundation (10), Roof (40), Windows (4)
HVAC	Displacement system in large assembly area for minimized conditioning volume/loads; Hydronic heat pumps and perimeter radiators in all other spaces
Lighting	High performance LEDs controlled by smart daylighting and occupancy sensors
Power Generation	180kW roof mounted PV

Project Highlights

Energy Performance: The Eco-Park Learning Center's energy performance is achieved through a high-performance building enclosure paired with efficient mechanical and electrical systems. Energy recovery ventilation coupled with smart lighting and plug load controls will minimize the building's major energy consumption sources. An energy-saving vegetation strategy informed by i-Tree Design tools coupled with construction elements such as a Kalwall glazing system will help the building to passively reduce energy consumption before employing active strategies.

Engineering: The building's CLT enclosure creates a structurally stable building shell that can become cost competitive when effective prefabrication is employed. Photovoltaic Panels located on the roof will provide active solar energy collection to support the net-positive ambitions of the building. For the HVAC system design, a displacement ventilation system is currently being evaluated for the large assembly hall, which will decrease the energy consumption by strategically conditioning only the occupied portion of the space. The rest of the building is envisioned to have highly efficient heat pumps to accommodate individual needs of other spaces.

Financial Feasibility & Affordability: As a public project, special emphasis will be put on our cost analysis. A detailed construction budget has been developed and will be continuously updated with each design iteration throughout the project, where each design element will be examined on a cost-benefit basis. This budget is developed with subcontractor/vendor input and industry partner feedback for more concrete numbers that can be evaluated by county officials.

Resilience: The building is sited on a hill in FEMA Zone X for minimal flooding hazard, and within FEMA seismic zone B where earthquake damage potential is small. Special attention will be put into studying the building's enclosure and durability and hygro-thermal performance with analytical software tools.

Architecture: At the Eco-Park Learning center, architecture and landscape wrap around each other in a seamless expression of biophilic design. To the approaching visitor, the building is simply a grassy hill clad in Photovoltaic panels. To the office worker, the building is a naturally luminous space featuring organic materials and excellent views. Privacy for workers is maintained through a vertical separation of community and office space, with a wing hosting only office and laboratory facilities. Our programming encourages healthy outdoor living and educational interaction, featuring an accessible central courtyard with an amphitheater and outdoor seating, walking trails, a wetland boardwalk, and organic growing beds.

Operation: Building operations are facilitated through the use of automated sensors and controls that regulate lighting, temperature, and plug loads from appliances/workstations. Additionally, durable finishes and construction materials will be selected to increase the longevity of the building and minimize capital costs.

Market Potential: The building fulfills the need for administrative municipal office space and educational gathering areas, as a showpiece building that highlights unique design innovation. Beyond the intended public use of the building, a market analysis has been put together by our real estate team to examine the opportunity for a public-private partnership on this project, and the possibility of research/office space rental in sections of the building.

Comfort & Environmental Quality: Daylight is prioritized for a natural feeling in the space, but is also carefully analyzed to reduce discomforting computer glare at desks. A make-up air unit provides ample fresh and clean air to the building to ensure occupant comfort throughout.

Innovation: The creative use of recycled and reclaimed materials including crushed glass and aggregate in masonry, and reclaimed wood that will be CNC-routed for architectural elements, creates a tangible benefit to the environment. Conversely, the incorporation of community made earthen bricks in the project's growing landscape provides an intangible learning experience which situates the building as a living laboratory to be used for discussing sustainable living. Additionally, concepts such as pumped-storage will be evaluated and explored as an educational energy storage/load balancing strategy to be showcased within the project's landscape.

Institution Profile

Virginia Tech is the Commonwealth of Virginia's most comprehensive university. As a land-grant university, our institution strives to fulfill its mission in transforming knowledge to practice through technological leadership and by fueling economic growth and job creation locally, regionally, and across Virginia.

The College of Architecture and Urban Studies has the most direct impact on moving towards a more sustainable future for buildings. It is home to the School of Architecture+Design, which offers undergraduate and graduate degrees in architecture, among other design fields, and the Myers-Lawson School of Construction, which offers degrees in building construction, construction engineering management, and environmental design and planning. Furthermore, the Building Construction program offers a Sustainable Building Performance track with a heavy emphasis on applied building sciences. Additionally, the Colleges of Business, Engineering, and Science all function to support our project in innovative ways as the university approaches the current environmental crisis with a more holistic mentality.

Industry Partners

Prince William County: As the client for this project, Prince William County plays a primary role in supporting and evaluating our design decisions. Access to the site and county resources facilitates our design process and direction. Progress reports and meetings with the county allow for an open dialogue that grounds the decisions made in the reality of the buildings intended use/the county's needs.

DPR & Hourigan Construction: DPR has built four International Living Future Institute (ILFI) net-zero certified projects and is a long-standing industry partner of Virginia Tech. Hourigan Construction has built one of the ILFI's fully Living Building Challenge certified buildings, the Brock Environmental Center in Virginia Beach VA, and is also a primary industry partner of Virginia Tech. Both DPR and Hourigan play a key role in supporting the project with real cost data, as well as providing feedback to our design ideas based on their previous challenges and experiences.



Team Members

Student Team Lead: Dominick DeLeone*



Marketing

Chiravi Patel
Christian Schroeder
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Hayley Stout
Rosalie Siegel
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Landscape

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Engineering

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Faculty

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* Graduate Standing

com _____.
 comfort
 community
 communication
 complexity
 compassion
 comprehensive
 compositive.

Building Team Compositive

In order to provide a holistic design approach, our team is composed of a variety of backgrounds, ranging from architecture and building construction to macromolecular science and civil engineering. As a team, we intend to positively impact the surrounding community with our design. Developing a community within our team is crucial to our success. Team members are encouraged to participate in all design charrettes, as well as individual research, which allows our comprehensive design for the Eco-Park Learning Center to integrate all aspects of life and community.

Vision Statement

"To leverage our team's diverse backgrounds and experiences in a manner that positively impacts the future of the built environment"

Team Experience

What makes Virginia Tech unique is the heavy emphasis on hands-on learning. All students are encouraged to participate in study abroad and/or internship opportunities. Having the ability to apply what is learned in the classroom, is an incredibly valuable experience that our team values. Collectively with over 30 students, we have gained real world experience from over 20 companies and many study abroad experiences. This combined knowledge allows our team to work collaboratively in a team, and sets us up to successfully design the Eco-Park Learning Center.



Living Building Challenge

As a part of our design process, the team has been researching buildings that exemplify strategies we intend to use in our building. Many of these buildings have attained various petals of the Living Building Challenge. This allows our team to further understand the dynamic systems and meticulous design choices implemented in these existing buildings:

Brock Environmental Center
Virginia Beach, VA



Hitchcock Center for the Environment
Amherst, MA



Sonoma Academy
Santa Rosa, CA

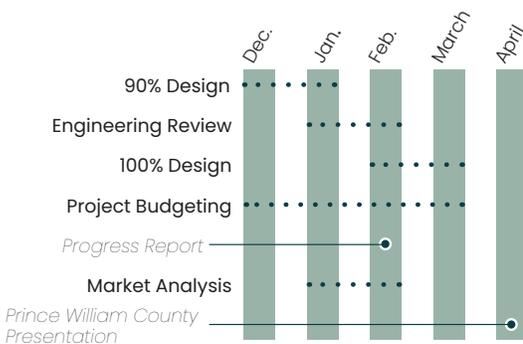
Bullitt Center
Seattle, WA

- The **Brock Environmental Center** allows students to further understand the complexities of the living systems located in the Chesapeake Bay. Many materials in this building were donated by the neighboring community to be re-purposed in the construction of this project.
- The external landscape of the **Sonoma Academy** is carefully cultivated in order allow young children to engage the outdoors. The living roof on this building allows for greywater collection, as well as energy generation.
- Leading environmental literacy, the **Hitchcock Center for the Environment** provides the neighboring community a place to learn about the living systems in their community. The grounds of the center are cultivating shrubbery, used as teaching gardens, in addition to achieving Net-Zero Water.
- A six-story net positive office building, the **Bullitt Center** implemented a ground-source heat exchange system to condition the building, while using a 244kW array to generate more than enough energy.

Mission Statement

“To provide Prince William County with a building that supports the functional needs of its occupants and stimulates the community’s engagement with the environment we live in”

Projected Timeline



A major goal for the Eco-Park Learning Center is to provide Prince William County with a municipal office building and community center. Part of our process while designing the building will be meeting with the county to show them the prospects of this project. This collaboration allows our team to provide this community with a building that respects their needs, while following their community values.