



Sustainable construction and engineering details behind the Brock Environmental Center

Chesapeake Bay Foundation facility becomes one of the most recent and rare Living Building Challenge certification recipients

Creating one of the most sustainable buildings in the world was no small feat. The Chesapeake Bay Foundation's (CBF) 10,000-square-foot Brock Environmental Center is located on the Lynnhaven River at Pleasure House Point in Virginia Beach, Va. Pre-construction for the Brock Center took one full year prior to construction beginning. Construction began in September 2013 and was completed in October 2014. After the building was completed, training was required for its occupants – CBF and partner organizations - to teach everyone how to properly utilize and maintain the eco-friendly systems.

The Brock Environmental Center has achieved net-zero energy consumption and zero water-use and runoff. The educational facility is the first in Virginia, and one of the only commercial buildings in the world, to be LEED platinum, receive a full Living Building Challenge (LBC) certification, and to create its own drinking water from rainwater.

The Brock Environmental Center had to utilize components of sustainable construction and engineering to meet the requirements of the Living Building Challenge's seven "petals," which include: place, energy, water, health, materials, equity and beauty.

Place

The Brock Environmental Center sits on the last piece of undeveloped land at Pleasure House Point, a quiet peninsula of beach, marsh, and maritime forest near the Lynnhaven Inlet in Virginia Beach. The forest to the north of the Brock Center (containing loblolly pines), along with a connection to the river's shore to the south and nearby confluence of the Chesapeake Bay, were key influences in the siting of the facility. The site, filled with walking trails, allows visitors to feel a connection to nature simply by sitting on the building's wraparound porch. Site development focused on preservation of the local ecology, and includes a boat pier with floating dock and an open-air education pavilion.

Energy

In addition to being "net-zero," the facility also sends power back to the electrical grid. In order to do this, the building uses renewable technologies include photovoltaic cells, wind turbines, geothermal wells, heating and cooling retention, rainwater usage, and net-zero carbon dioxide emissions. The photovoltaic system converts sunlight into usable electricity, while a geothermal wells system provides "cool groundwater" to the mechanical units inside the building for conditioning of interior spaces, generally saving upwards of 80 percent of energy over conventional HVAC systems. The two Bergey wind turbines provide approximately 40 percent of the renewable energy for the entire facility and the photovoltaics provide the other 60 percent.

Water

All of a Living Building project's water needs must be supplied by captured precipitation or other natural closed-loop water systems, then treated and recycled on-site. In addition, purified water



suitable for washing and showering must also be created without the use of chemicals. The Brock Environmental Center is also believed to be the first commercial building with an LBC certification in the continental U.S. to create its own drinking water from rainwater.

The components of Brock's sustainable water technologies include:

- **Rainwater collection and treatment:** rainwater is collected in a continuous gutter system on the sloped roof and diverted into a large wooden cistern. After moving through a whirlwind-like "vortex filter," clean rainwater is separated from large particulates and debris. Rainwater containing debris is sent to rainwater gardens, while filtered rainwater is sent to two separate storage tanks and purified to make it suitable for hand washing and showering.
- **Rainwater gardens:** unfiltered water containing debris is collected in multiple rainwater gardens located around the perimeter of the building. The gardens are comprised of native and natural vegetation and serve as a collection point for excess rainwater to pool and evaporate back into the atmosphere.
- **Composting toilets (blackwater):** these self-contained units transform human waste into usable compost; the only byproduct is a leachate material that is held in an underground tank until it is drained and shipped to a struvite reactor, which transforms the liquid into fertilizer which is used by the Brock Center for the natural plants surrounding the facility.
- **Sinks and showers (greywater):** this water is diverted to an underground storage tank where it is pumped to an elevated infiltration garden. Resembling an elevated flower and grass bed, the garden is filled with multiple layers of stone and soils. As the water filters through, it is cleaned to the point where it can re-enter the ground to go through the normal groundwater filtering system that nature has provided.
- **Stormwater:** Water collected from the building and not treated to be drinking water is diverted to sunken rain gardens, planted with natural vegetation to allow water to recharge the groundwater without runoff into unprotected areas. Hard surfaces on the site such as paths, roads, and parking lots are constructed of permeable materials such as gravel or pavers, which allow the water to infiltrate the ground without the use of traditional stormwater structures. Any runoff is captured by vegetative swales, wide shallow ditches planted with perennial grasses, which hold the water until it can naturally filter back into the ground.

Pre-construction and planning took one year to uncover materials and technologies that could be used to meet the water demands. Many of the systems installed were new or previously unused by Hourigan or its partners. The result is both low-tech and state-of-the-art materials and technologies that manage water at the Brock Center.

Materials

When targeting LBC certification, as many design elements as possible are to be composed of recycled, reclaimed or salvaged materials, minimizing the carbon footprint and maximizing the retention of natural resources. The team also avoided building with the LBC red-list materials that contained chemicals harmful to humans and the surrounding environment.



Exterior

The chocolate brown, sleek wooden exterior siding of the Brock Center is harvested and reclaimed sinker cypress, known for its durability and longevity. Over a century ago, cypress timbers were floated downriver to lumber mills across the Southeast. But many timbers sank, and over time formed a natural preservative oil - cypresseine - that resists rot and insects. Sinker cypress typically lasts over 150 years without severe deterioration, making it a perfect choice for the exterior siding of the Brock Environmental Center. The roof of the conference room and the exterior educational area, made of 100 percent zinc, will last for 50 years. Fallen oak trees are used as benches.

Interior

Old school gym bleachers were salvaged for the Brock Center's interior wood trim, while reclaimed maple wood flooring was pulled from a Virginia Beach middle school gymnasium and used throughout the entire facility. Salvaged ceramic tile is used in restrooms, and old champagne corks are repurposed as knobs.

Windows

Sourced from a factory in Lithuania, windows in the facility are triple-glazed with three panes of glass, each separated by a half-inch air space, giving them an insulating capacity (known as an R-Value rating) of 6 - very high for a window system. The 100 percent FSC-certified wooden frame and aluminum cladding reduce thermal conductivity and are Category I hurricane-wind resistant and were the only windows in the world that met the specific R-value required for the building envelope.

Architecture

The building rests on an elevated concrete superstructure 8-feet above ground level (to satisfy the 100-year flood plain), serving as the primary occupancy floor for the Chesapeake Bay Foundation's office and conference room functions. Straight lines do not exist in nature, therefore natural shapes and boundaries were used to blend the structure of the facility with the natural surroundings.

Access

Project teams were challenged to design a site that promoted pedestrian travel and reduced vehicular traffic without restricting access (the LBC's "car-free environment"). Three ADA parking spaces were created adjacent to the building, the only permanent parking spaces on-site. Deliveries and drop-off access is accomplished with a permeable, minimum-width road that makes a circle at the western end of the building, providing an area for short-term parking. Staff and visitors park nearly 600 feet from the building in a lot constructed with a permeable paver system, then walk along a footpath. New trails on the site allow travel by foot or bicycle.

Project Team

Owner: Chesapeake Bay Foundation
Owner's Representative: Skanska USA
Architect/MEP Engineer: SmithGroupJJR
General Contractor: Hourigan Construction
Structural Engineer: A+F Engineers

Civil Engineers: WPL and Kimley-Horn & Associates
Landscape Architect: WPL
Concrete: Bayside Concrete
Mechanical: Warwick Plumbing & Heating
Electrical: IES Commercial