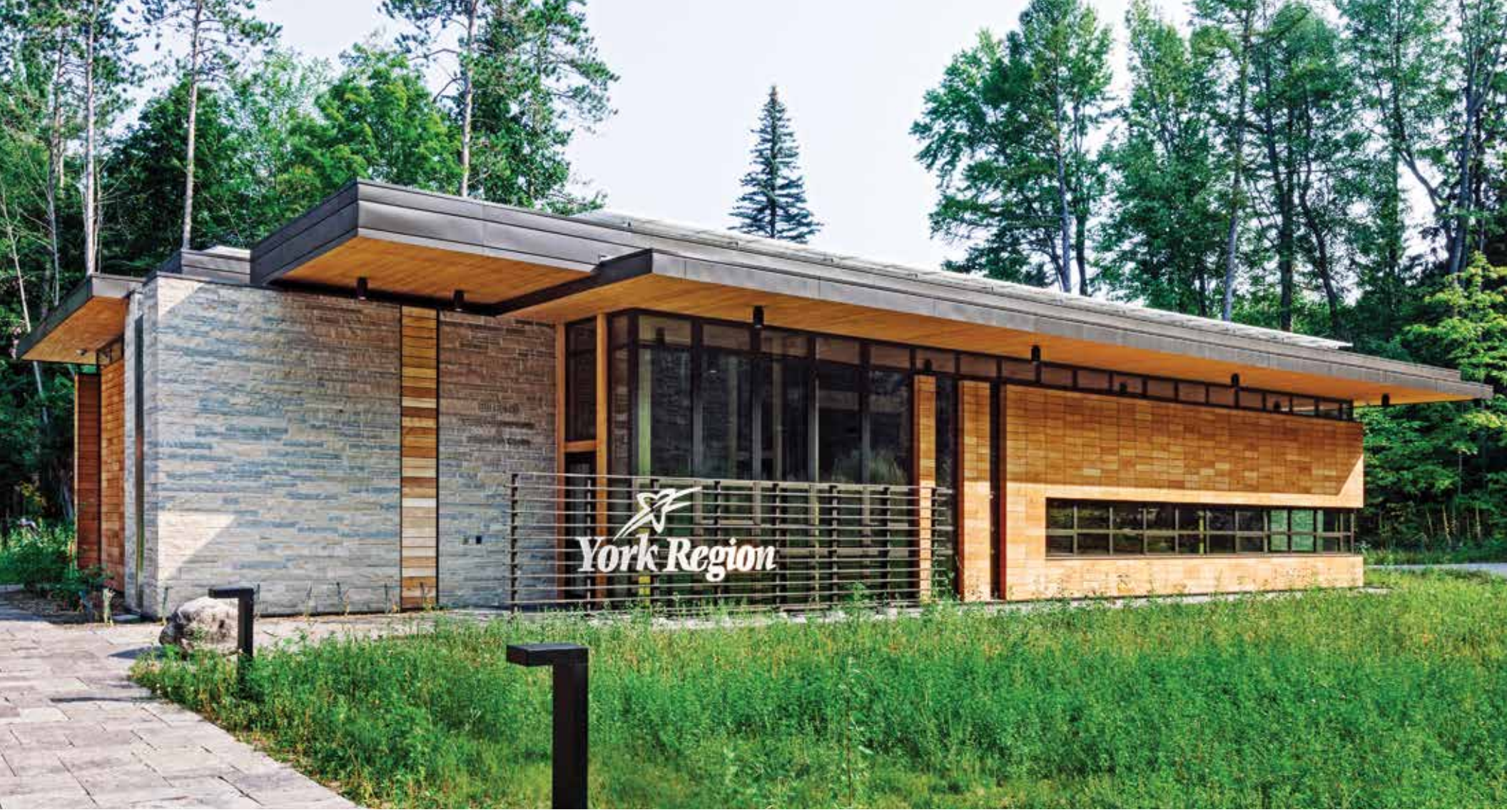

Bill Fisch Forest Stewardship and Education Centre

Canadian Wood Council
Conseil canadien du bois

WOODWORKS!
Program of the Canadian Wood Council

Cover Photo: Cindy Blazevic

Photo Above: Tom Arban

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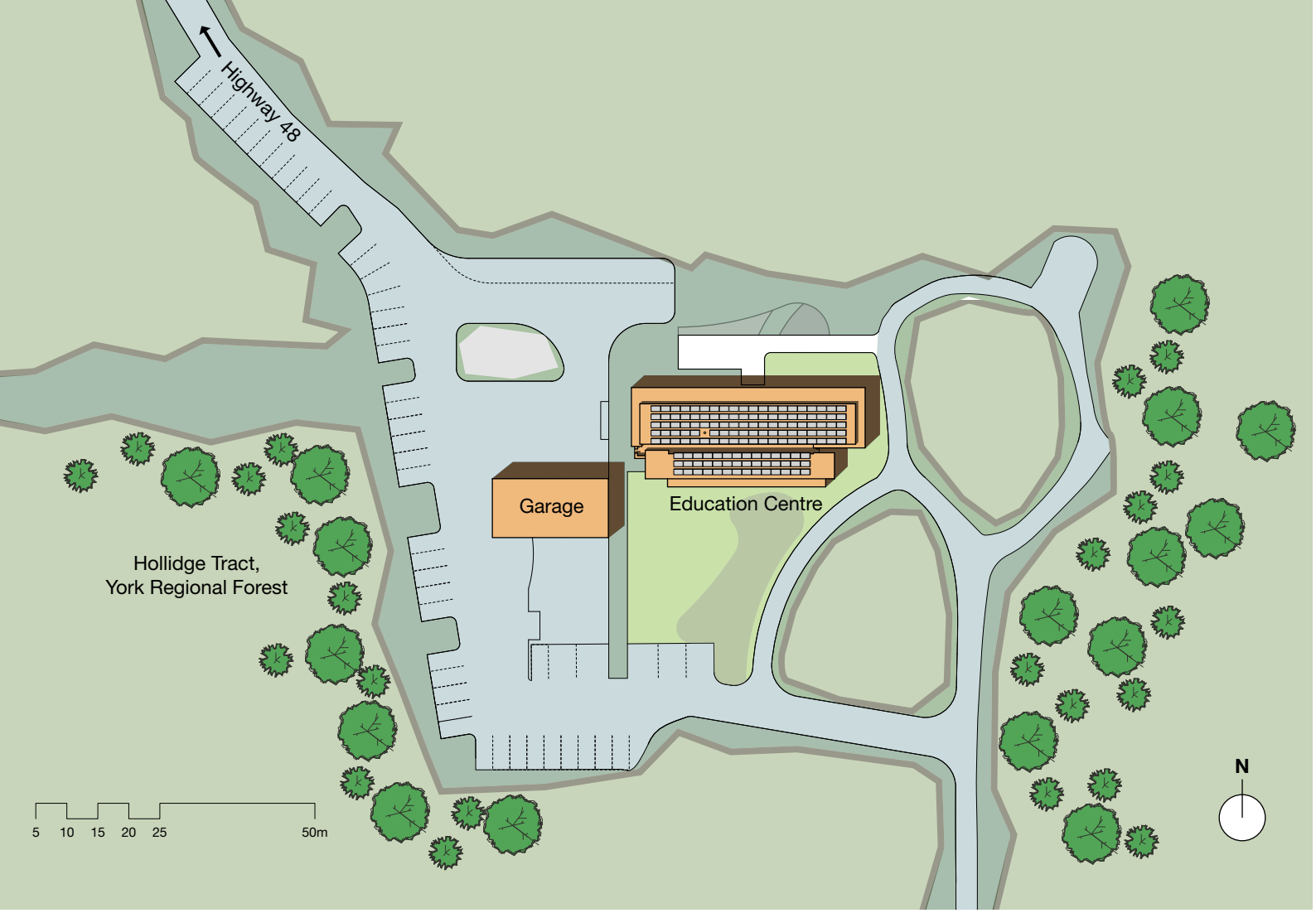


FIGURE 1 Site Plan

Introduction

The Bill Fisch Forest Stewardship and Education Centre (Education Centre) was planned and built to educate residents of the Regional Municipality of York about the importance of natural resources and forest ecosystems. The Regional Municipality of York, located on the Oak Ridges Moraine between Toronto and Lake Simcoe, includes the York Regional Forest, which is internationally recognized as a leader in site restoration and forest management, and is the first public forest in Canada to be certified by the Forest Stewardship Council (FSC).

The Education Centre is located in the Hollidge Tract, just one of twenty-three tracts that make up the York Regional Forest (**Figure 1**).

Constructed of wood and accented with stone, the Education Centre reflects the materials of the surrounding forest. The use of wood in the design was integral to the building's performance and appropriate to its function as a forest education centre.

The **Living Building Challenge™** is the built environment's most rigorous performance standard. It calls for the creation of building projects at all scales that operate as cleanly, beautifully and efficiently as nature's architecture. To be certified under the Challenge, projects must meet a series of ambitious performance requirements over a minimum of 12 months of continuous occupancy. Net-zero energy certification is based on actual performance rather than modeled outcomes.

At the time of printing (Spring, 2016), only **21** projects have achieved certification through the Living Building Challenge, **five** of which have achieved full certification. (Several others have entered the twelve-month operational phase required prior to audit.)

www.living-future.org/lbc

Design

Workshops and design charrettes were conducted to identify project goals and targets. The design team included not only architects, engineers, and interior designers, but also forest education experts, arborists, and ecologists. The following targets were established to achieve high levels of sustainability within budget constraints:

- A high-performance building envelope to reduce heating and cooling loads, including highly insulated walls (R40) and roof (R60) combined with triple pane, argon-filled window glazing;
- Window-to-wall ratio limited to below 30% to minimize heat loss;
- Window positioning to maximize natural lighting;
- East-west orientation, south-facing glazing and large overhangs to maximize solar heat gain in winter and minimize it in summer;
- Energy reduction strategies such as continuous dimming of lighting systems in suitable areas, heat recovery ventilation, LED lighting, and low-energy-use electrical equipment;
- Net-zero water use based on captured rainwater to supply toilets and urinals and a biological filtration device to treat all wastewater on-site; and,
- Renewable energy provided by a roof-mounted solar panel array to generate 38 mWh of clean energy annually.

Environmental Certification

The Education Centre, is targeting LEED® Platinum certification. The building is also expected to be the first Living Building Challenge (LBC) project in Ontario, and one of only a few world-wide to achieve full certification (see textbox above).

Full seven-petal status under the Living Building Challenge (LBC) is considered the world's most demanding sustainability certification program. To achieve the LBC certification, buildings must meet specific requirements in the seven areas (petals): site, water, energy, health, materials, equity and beauty. Within these petals are 20 imperatives, prescriptive or performance-based goals that contribute to the overarching goals of sustainability and regeneration.

Full LBC certification is an ongoing process. The Bill Fisch Forest Stewardship and Education Centre will be required to be open for at least 12 months and pass through a rigorous auditing process before it receives its official LBC designation.

Materials were selected for: strength, durability, beauty, ability to reach the environmental targets identified by the client, and the LEED® and Living Building Challenge certification requirements. Wood was used extensively for both the structure and the interior and exterior finishes.

Building Description

The single-storey, 371 m^2 (4,000 ft.^{2}) building includes space for corporate meetings and community educational programs (**Figure 2**).

Cross-laminated timber (CLT) panels are the structural elements for the exterior walls (**Figure 3**) and are also their exposed interior finish. The insulation is located on the exterior of the CLT walls and the cladding is reclaimed Douglas fir.

Photo: Evan Dion

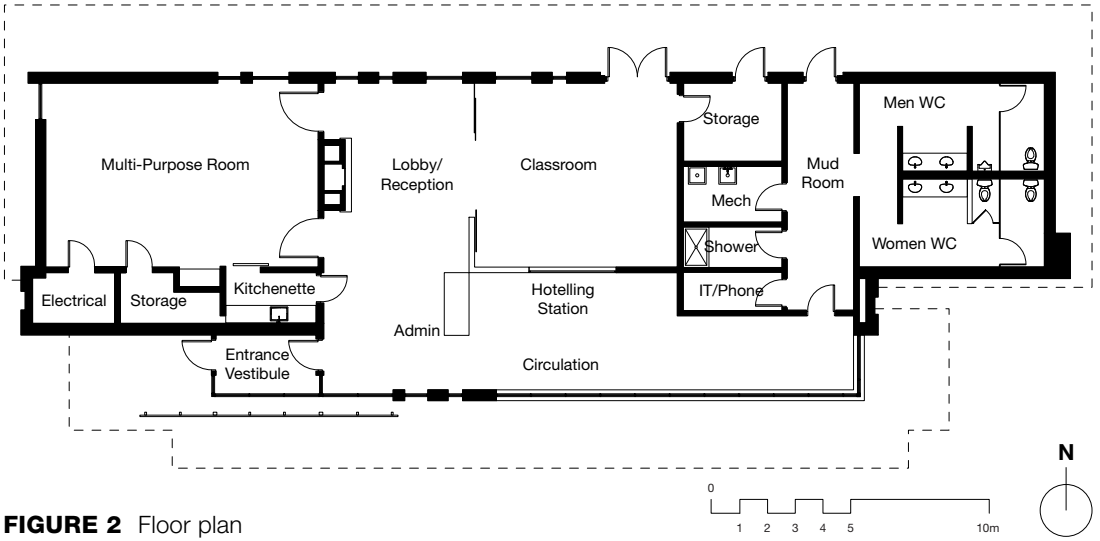


FIGURE 2 Floor plan

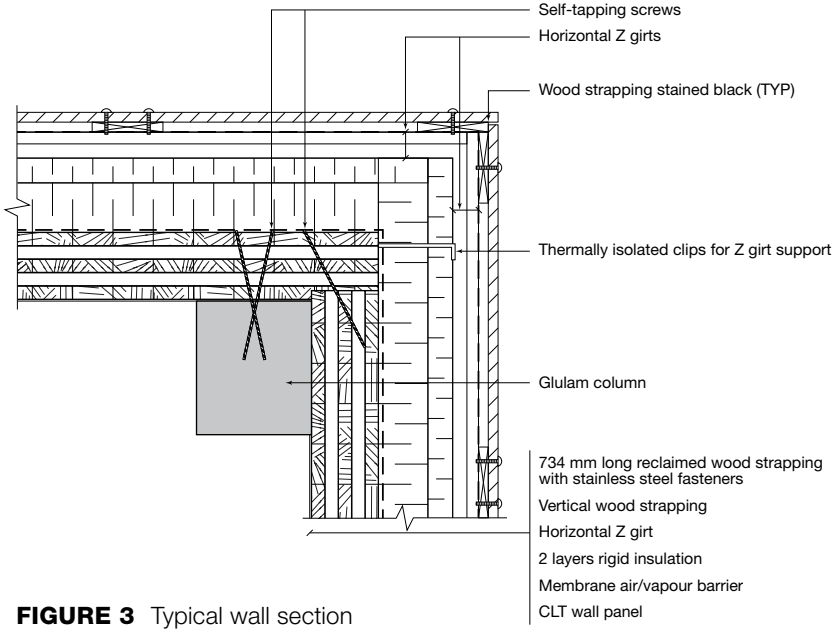


FIGURE 3 Typical wall section

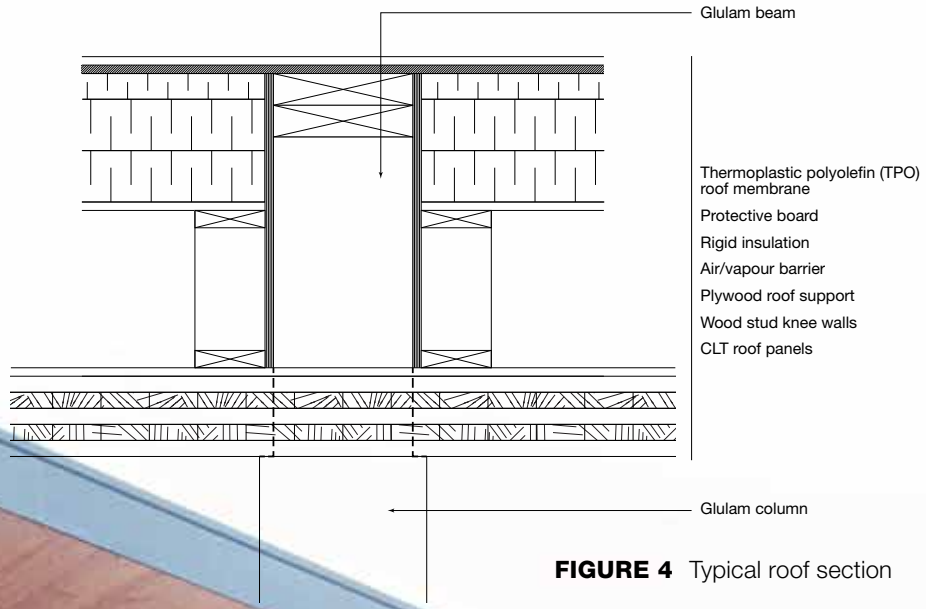


FIGURE 4 Typical roof section

Unlike most post-and-beam structures, the structural beams are located above the CLT roof (**Figure 4**) to provide interior clearance and a clean appearance for the ceiling. The glulam columns that support the beams have a shoulder at the top over which the CLT roof panels were placed. The shoulder does not provide structural support for the CLT panels; it provides a gap-free joint between the columns and the roof panels. The CLT roof panels and the entire structural load of the roof are suspended from the glulam beams by means of self-tapping, engineered screws and bolts.

The attachment system for the solar collector racks used concrete ballast for hold-down and therefore the roof membrane did not need to be penetrated by mechanical fasteners.

Photo: Cindy Blazevic

Net-positive Energy and Environmental Features

The Education Centre is designed to generate more energy than it uses and feeds excess renewable power back into the grid. This is made possible through the energy generation of roof-mounted photovoltaic panels, and energy conserving features such as a high-performance building envelope, heat recovery ventilators, and LED and natural lighting.

Figure 5 shows the energy exchange for the winter and summer periods. On an annual basis, the Education Centre is expected to have a net positive energy balance of 8 mWh. This predicted energy performance will be monitored in support of the Living Building Challenge application.

Heating energy is provided by a wood-burning masonry fire-place fueled by locally collected deadfall — but, in accordance with LBC requirements, the wood heating is not a significant contributor to the energy performance of the building.

FIGURE 5

Energy

Electrical system:

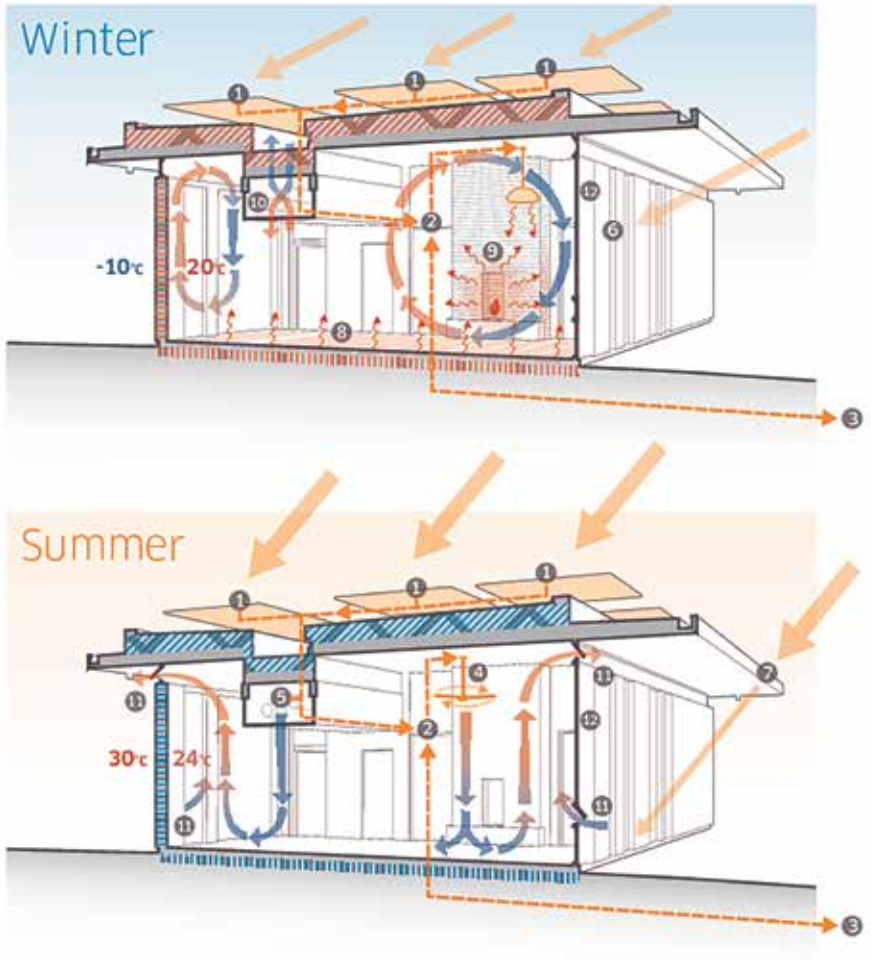
1. Photovoltaic solar panels w/ micro-inverters
2. Net meter
3. Grid connection
4. Displacement fan
5. Air conditioning

Thermal system:

6. Solar heat gain
7. Deep overhang shading
8. Radiant floor
9. Wood burning hearth
10. Heat recovery ventilator
11. Natural ventilation
12. Triple-glazed window assembly

Insulation:

- R60 roof assembly
- R40 wall assembly
- R30 insulated slab



Electricity Generation/Use:

[Predicated]

[Annual]

+8Mwh/yr **Net Positive**

[October–May]

+12Mwh

-22Mwh

[April–September]

-10Mwh

+28Mwh

FIGURE 6

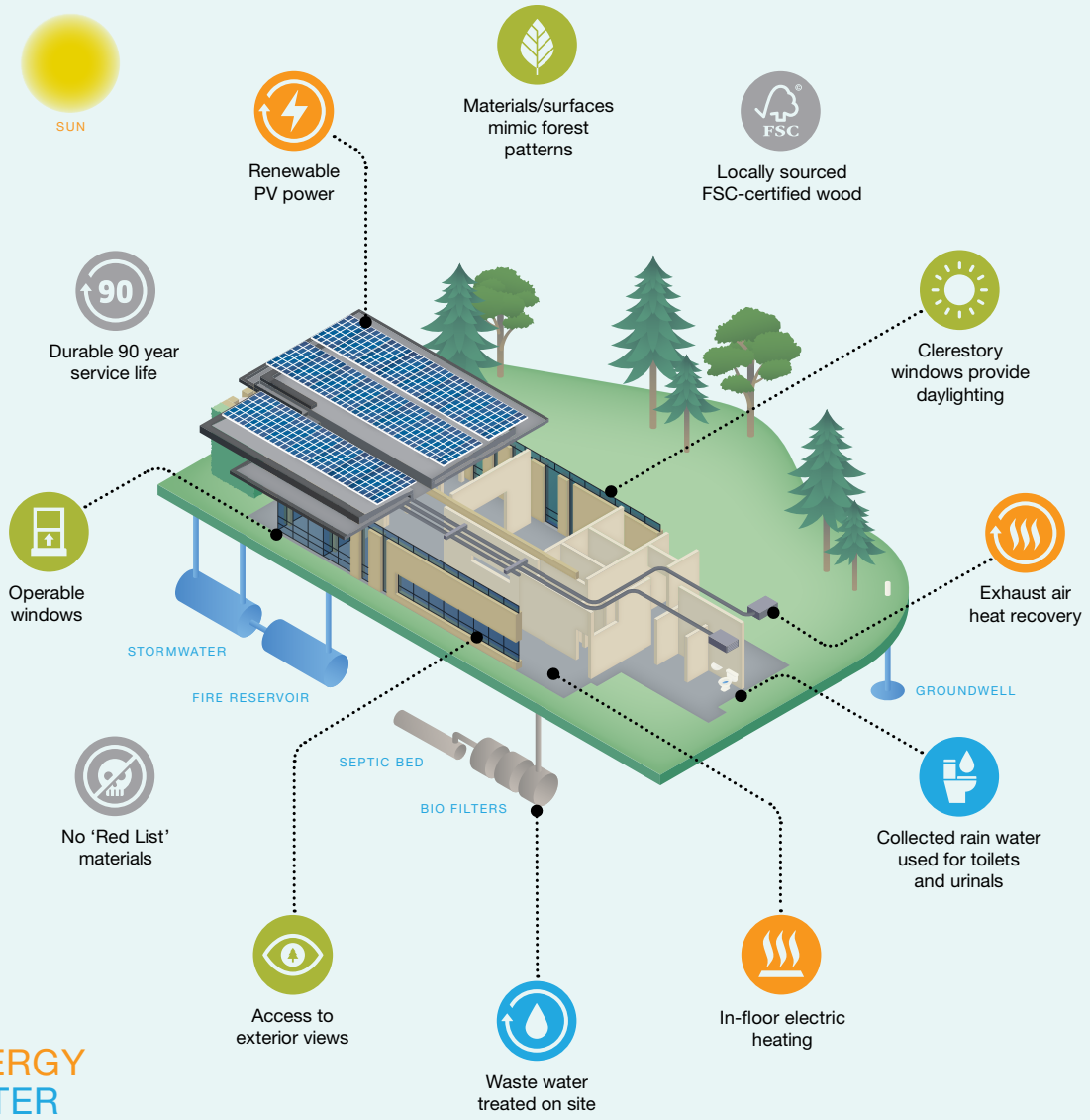


Figure 6 shows the environmental systems and features that support the Living Building Challenge application. In addition to net-positive energy balance, the building is expected to achieve 'net-zero' water performance.

The facility relies exclusively on water provided by nature. Roof-collected rain flows into a cistern that provides water for toilets and urinals. Groundwater wells supply water which undergoes UV filtration prior to its use in sinks and showers. Waste water passes through a treatment system which relies on aerobic and anaerobic bacteria and a biofilter to cleanse it of pollutants. The forested location of the building makes this process possible.

Structural Materials

The structure was built almost entirely of black spruce glulam and cross-laminated timber (CLT), all of which was FSC certified.

The CLT panels allowed the provision of significant roof cantilevers (over 2.8 meters in length) while maintaining a thin profile, and supporting the live and dead loads, such as PV solar panels and snow. Along the north elevation the supporting glulam structure was hidden (**see Figure 4**) by placing it above the CLT panels. To further enhance the natural beauty of the CLT, all connections are hidden, resulting in a monolithic interior appearance of the underside of the panel above.

Exterior Finishes

The Education Centre features reclaimed wood as the principal exterior cladding material. The wood cladding was salvaged and re-purposed by a local company specializing in salvaging construction materials from decommissioned buildings in Ontario. The design team selected Douglas fir for its robust and stable properties. The finished boards have a rough-sawn finish, and will be left untreated, allowing them to weather naturally within their forest environment. The exterior also features interpretive and educational wood panels made from 12 York Regional Forest wood species.

Interior Finishes

The predominant interior finish is the exposed surfaces of the CLT wall and roof panels. The CLT and glulam columns are coated with a zero-VOC stain, which is used on all exposed surfaces. Several featured interior wall panels are clad in maple-veneered FSC plywood. These panels are located within the administrative areas of reception and open office workstations. Similarly, the open office areas are separated from the circulation corridor by a series of horizontal maple louvres which are supported on a metal frame.

Reclaimed ash salvaged from the area is used for the main entry reception desk as an educational feature. It retains the tracks of the emerald ash borer insects that have devastated ash forests in Ontario. The ash was treated to prevent further infestation.

In addition to enhancing both the exterior and interior structure and finishes of the Education Centre, specific wood products were selected for the environmental benefits they brought to the project.

“Almost every building harms our environment, whether it is through the use of toxic building materials, the use of energy and water to operate it, or the disposal of materials when it is torn down. We wanted to create a building that could function like a forest ecosystem, be an integral part of nature and enhance it.”

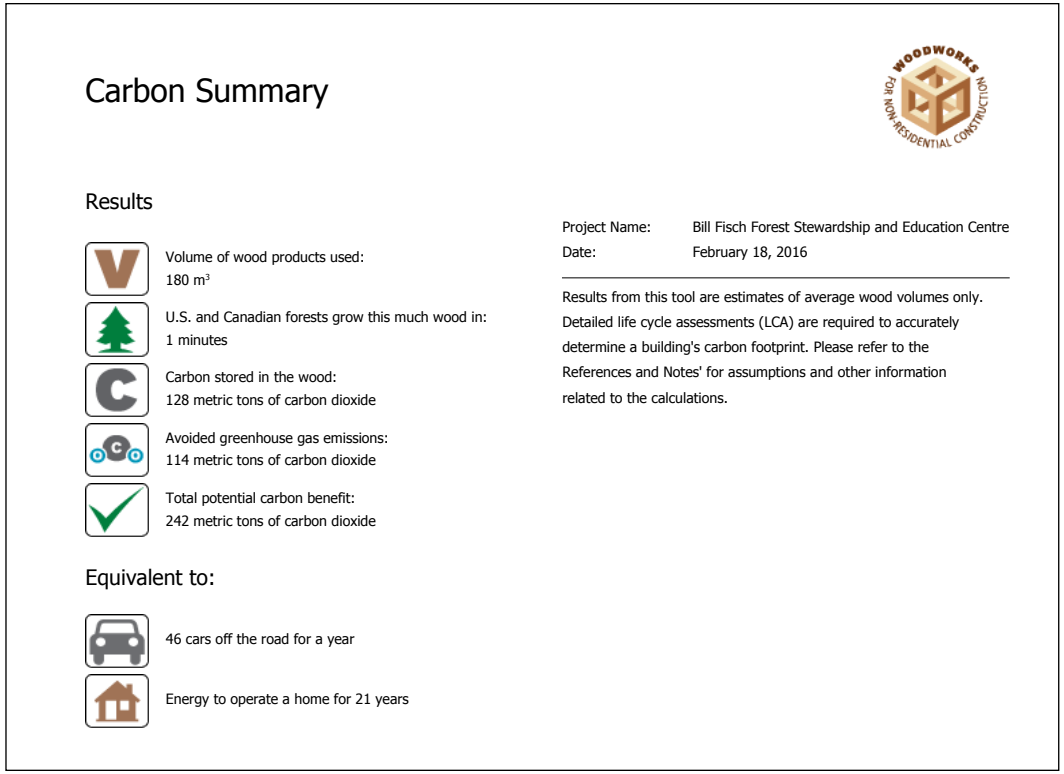
Craig Applegath, Principal, Architecture, DIALOG.

Meeting Building Code Requirements

The Education Centre is categorized as Group D, up to 2 stories. At one storey and an area less than 1,000 m^2, it is permitted to be of combustible construction and is not sprinklered.

The numerous floor-to-ceiling windows created a challenge for developing adequate shearwall strength. Strength was provided by using tie-down connections and vertical reinforcing plates for the portions of CLT walls between the windows.

Photo: Tom Arban



Carbon Summary

Results

Volume of wood products used:
180 m^3

U.S. and Canadian forests grow this much wood in:
1 minutes

Carbon stored in the wood:
128 metric tons of carbon dioxide

Avoided greenhouse gas emissions:
114 metric tons of carbon dioxide

Total potential carbon benefit:
242 metric tons of carbon dioxide

Equivalent to:

46 cars off the road for a year

Energy to operate a home for 21 years

Project Name: Bill Fisch Forest Stewardship and Education Centre
Date: February 18, 2016

Results from this tool are estimates of average wood volumes only. Detailed life cycle assessments (LCA) are required to accurately determine a building's carbon footprint. Please refer to the References and Notes' for assumptions and other information related to the calculations.

Advantages of Building with Wood

CLT and glulam are fully renewable, heavy-duty building materials. Their production creates only a fraction of the carbon emissions that are created by the production of other commonly used construction materials such as steel and concrete, and the wood fibre sequesters and stores significant amounts of carbon. Although they do contain somewhat more embodied energy than solid timber, the laminating process allows timber to be used for much longer spans and heavier loads, therefore reducing the amount of raw material required for a project.

Using sustainably harvested wood products that store carbon, instead of non-renewable, energy-intensive building materials that require large amounts of fossil fuels to manufacture, can help slow climate change. Trees provide the only major building material grown by energy from the sun.

The on-line Carbon Calculator tool (www.woodworks.org/design-and-tools/design-tools/online-calculators/) calculates the amount of carbon prevented from entering the environment when wood construction is used instead of other major building materials. The carbon calculation for the Bill Fisch Stewardship and Education Centre is shown on the left. The carbon benefit of the wood structure is equivalent to taking 46 cars off the road for one year or, expressed differently, the energy to operate a home for 21 years. And this does not include the carbon emissions avoided due to not using fossil fuels for heating and cooling over the service life of the building.

Conclusion

By targeting LEED® Platinum certification and full Living Building Challenge certification, the Bill Fisch Forest Stewardship and Education Centre is in rare company, especially for a non-residential building. The project advances the use of engineered wood products in small commercial buildings by using cross-laminated timber (CLT) for the walls and roof. By showcasing the interior surfaces of the CLTs and the generous use of maple veneer and other wood products, the interior provides a warm, natural ambiance well-suited for a forest education centre. On the exterior, the re-purposed exterior wood cladding provides a high level of visual interest that suits the forest setting.

Photo: Tom Arban

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Photo: Cindy Blazevic

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