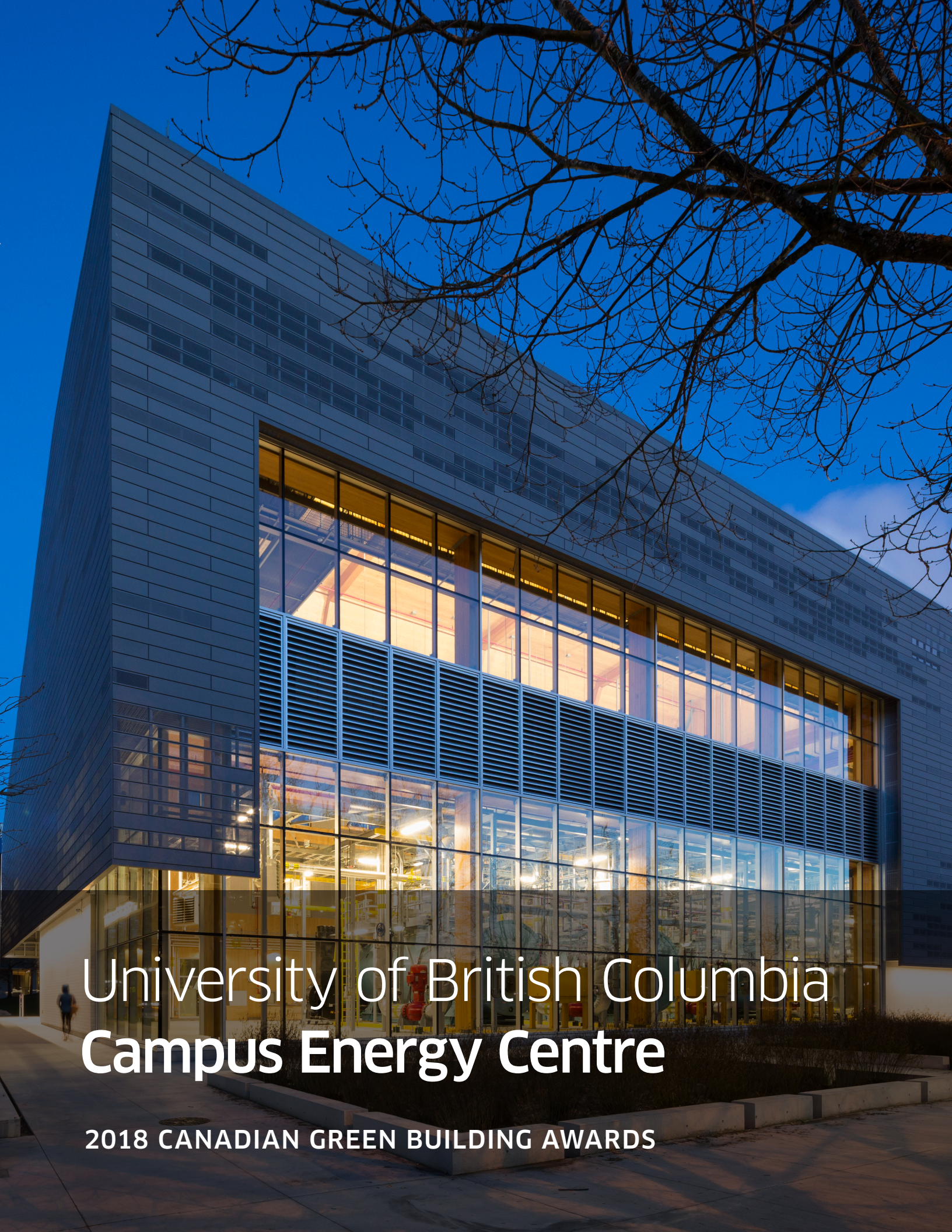


University of British Columbia
Campus Energy Centre

2018 CANADIAN GREEN BUILDING AWARDS

West Elevation

PROJECT SUMMARY

In 2007, The University of British Columbia (UBC) committed to reduce its greenhouse gas emissions by 33% from its baseline, by 2015.

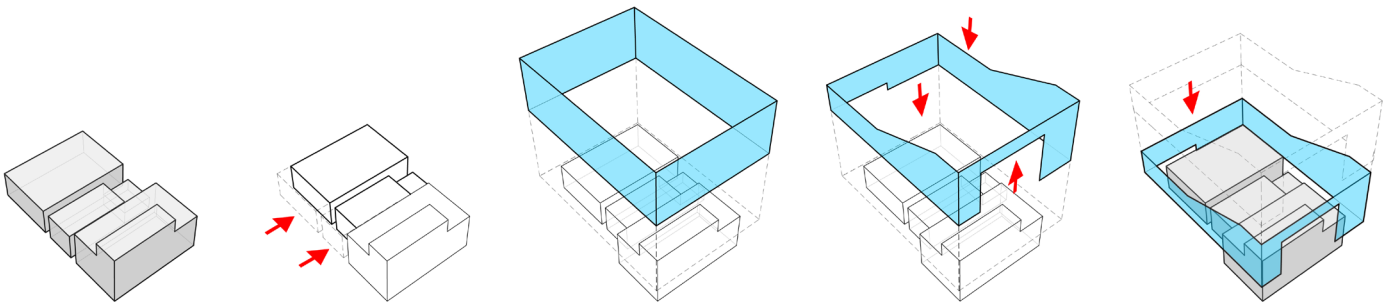
The LEED NC 2009 Gold Campus Energy Centre (CEC) is an integral part of this reduction strategy. The CEC, a new high efficiency hot water heating plant and district hot-water distribution loop, replaces UBC's pre-existing steam boiler plant constructed in 1925. The CEC is a major contributor to UBC achieving UBC's emission targets while simultaneously redefining public interaction with district energy infrastructure.

The CEC serves over 130 buildings, or 12 million square feet of campus development delivered through 14 km of underground insulated pipe. The 20,000 sq ft building houses all process equipment including three 15 MW boilers with capacity for expansion to a total output of 80 MW.

The major sustainable design strategies were to locate the facility in a pre-existing parking lot; establish a comprehensive storm-water management plan that included previous paving, retention, detention equipment and rain gardens; harness the massing of the facility to drive natural ventilation; utilize as much structural engineered wood to offset embodied carbon; and to design the building as a "living lab" that showcases and communicates the building and district scale sustainability objectives.

East Elevation

North Elevation



1
PROGRAM ARRANGED
ESTABLISH FUNCTIONAL REQUIREMENTS OF ENERGY CENTRE

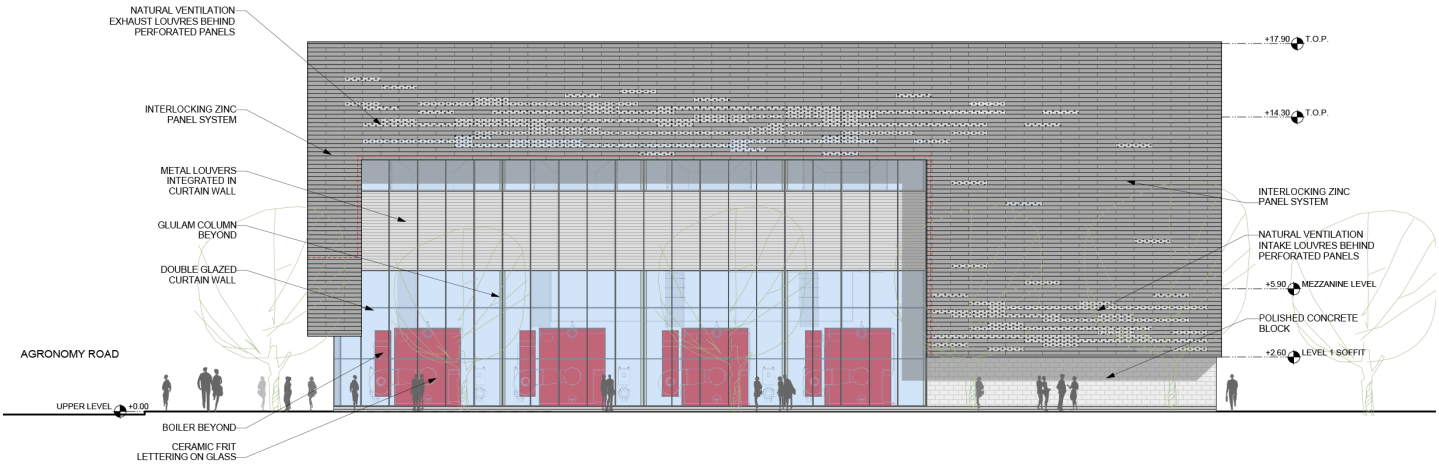
2
VOLUMES SHIFTED
ENHANCE PUBLIC SPACE AND SPATIAL HIERARCHY

3
SKIN APPLIED
MEDIATE THE MACHINE WITH THE CAMPUS CONTEXT

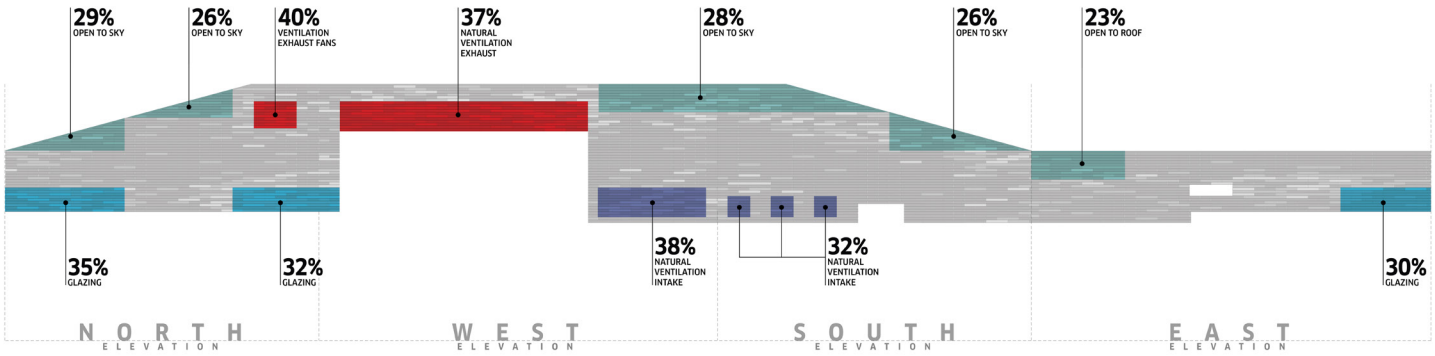
4
SKIN MODIFIED
SKIN RESPONDS TO INPUTS AND OUTPUTS

5
CAMPUS ENERGY CENTRE
CENTRALIZED THERMAL ENERGY SOURCE IN THE HEART OF THE CAMPUS

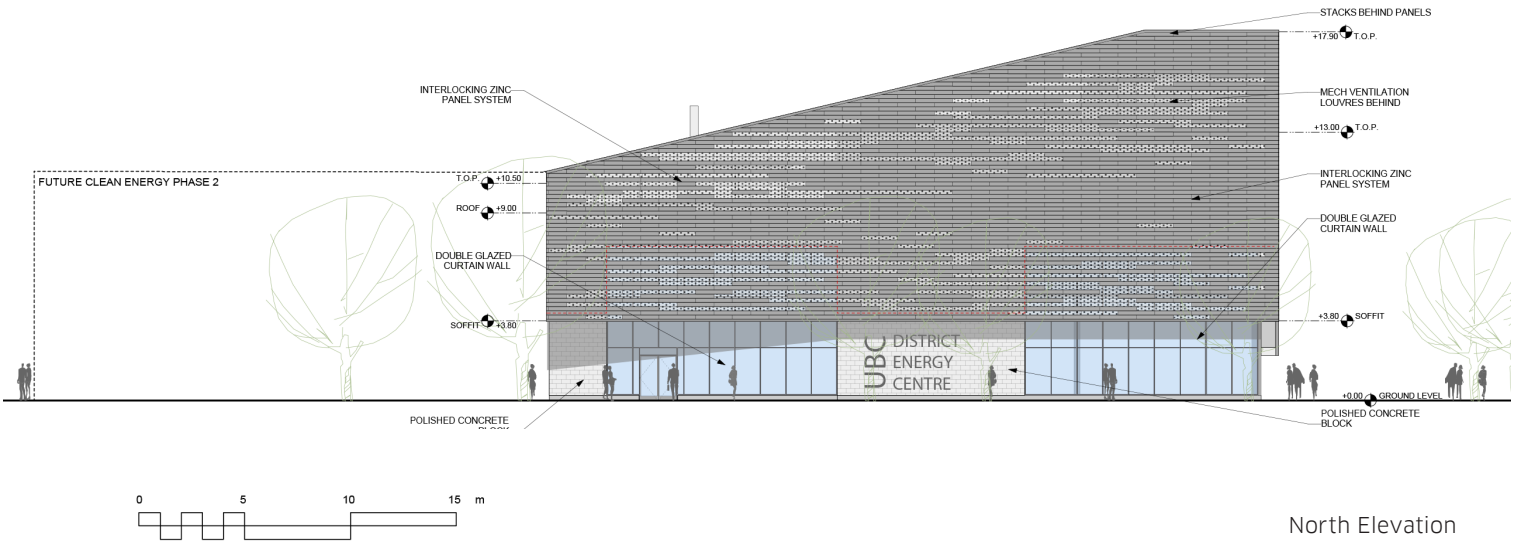
Design Concept



West Elevation



Skin Performance Parameters



North Elevation

MAIN PROJECT DESCRIPTION

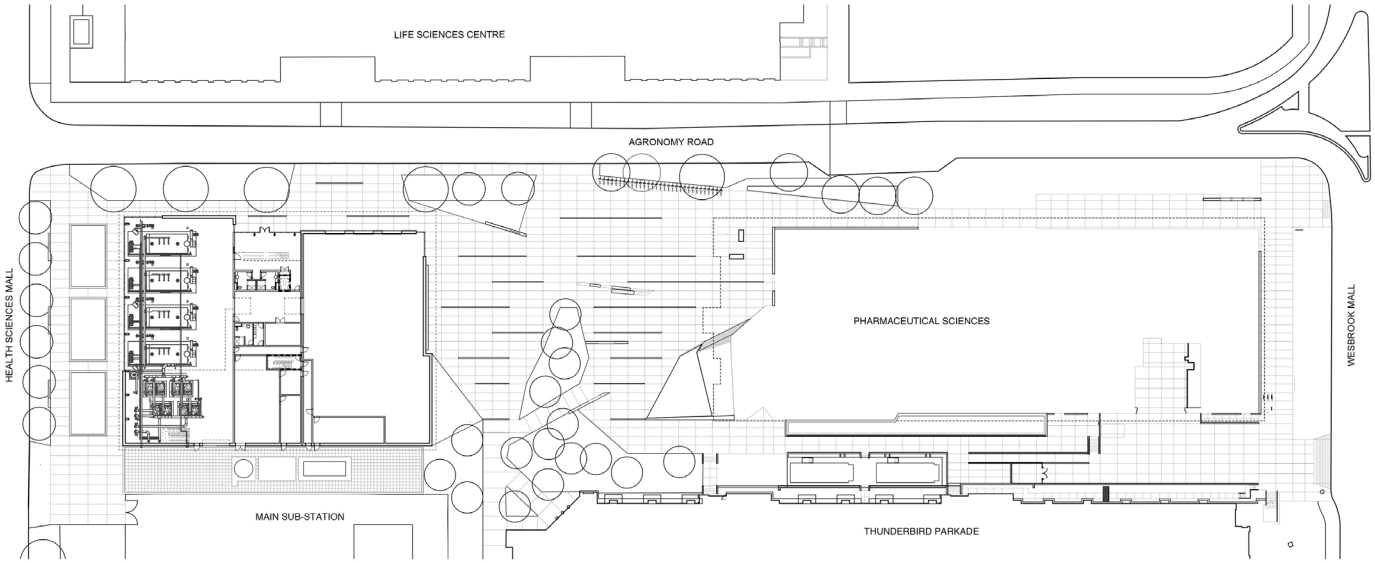
Strategic Decisions

Sited on a prominent corner of Health Sciences Mall and Agronomy Road, the CEC replaces an existing surface parking lot, adjacent to the Life Sciences Building to the north, the Pharmaceutical Sciences Building to the east and the campus electrical sub-station to the south. The east facade of the CEC frames a public plaza that acts as a connection point between the campus Health, Residential, and Sports precincts. Continuity of the campus fabric is reinforced by matching the street-wall setbacks and height datum established by adjacent buildings.

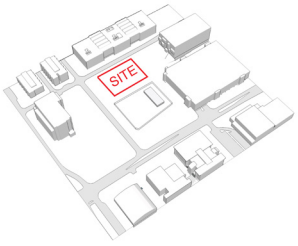
The design team helped select the site at a prominent intersection that showcases the infrastructure while also providing for the industrial requirements of the plant operation.

The orientation and massing of the building worked with the rigid arrangement of the equipment layout and height requirements to enable natural ventilation and cooling of the facility. Locating the boiler bay near the intersection at the north west of the site also takes advantage of the required height clearances to provide natural daylight to the main plant space while dramatically displaying the three large, high-efficiency natural gas boilers.

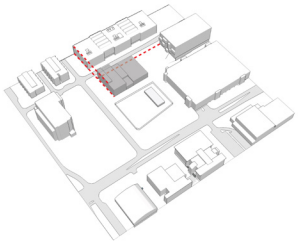
To reduce the embodied energy of the building itself, and further the greenhouse gas emissions reduction theme of the project, the team advocated for a primarily wood structure – both Glulams and cross-laminated timber (CLT) panels were used wherever possible – as a replacement to the standard concrete and steel for infrastructure buildings.



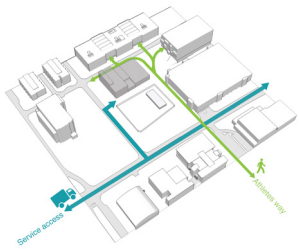
Site Plan



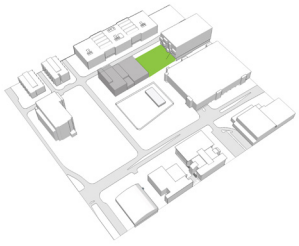
Site Location



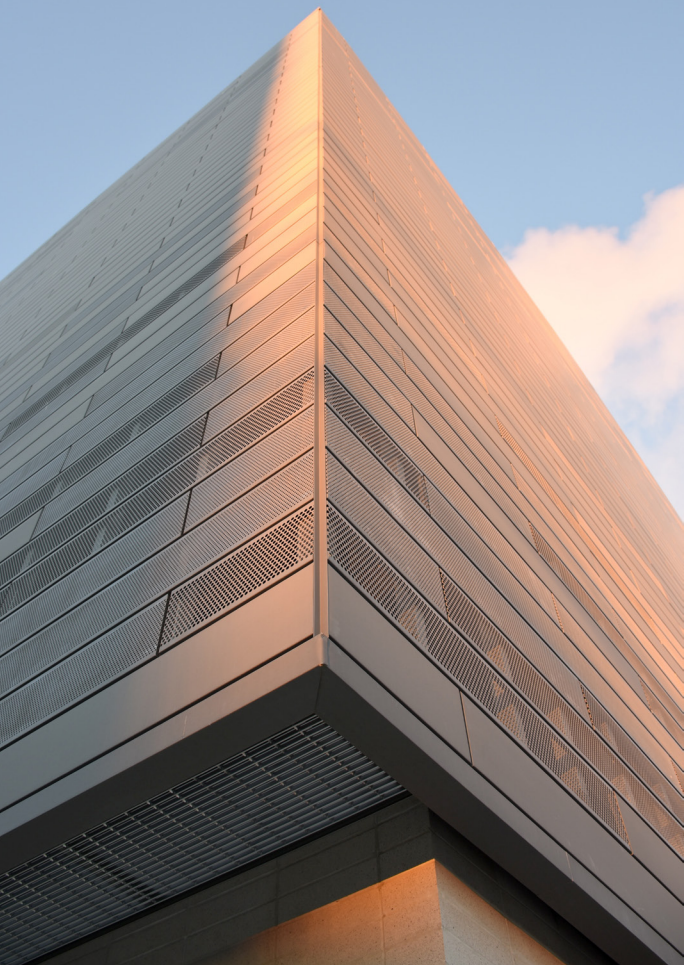
Setbacks and Height Limit



Vehicular and Pedestrian Circulation



Completing the Place



Southwest Corner

The building's simple volume is enlivened by the play of light across and through the shroud by the selective use of three different types of panels – an opaque, a 30% perforated, and a 50% perforated panel.

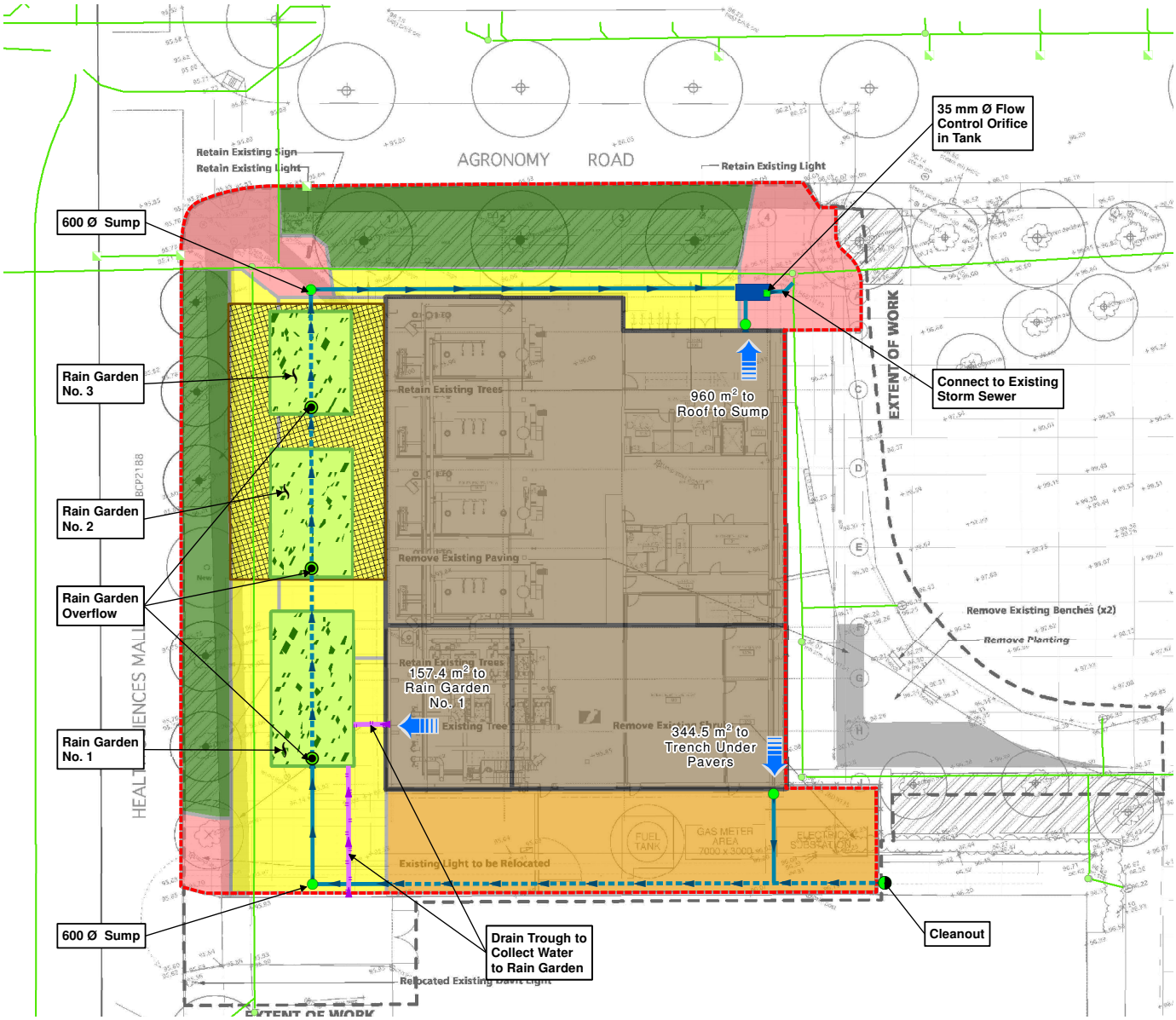
Entry at Northeast Corner

West Elevation with raingardens in foreground

Community

The CEC and its internal and external design considerations greatly enhance the experience of the public realm. The experience along Health Sciences Mall is now framed between a generous sidewalk with planted rain gardens that treat the project's storm water runoff, and the striking views through the glazing of the 17-meter-tall exposed CLT boiler bays.

The CEC is encompassed by a zinc shroud which acts as a mediator between the educational occupancies surrounding it and the large, functional infrastructure that is housed within. Along Agronomy Road, the shroud descends to 3.7 meters above the sidewalk, becomes transparent and creates an overhang - providing a human-scaled canopy that invites visitors to the facility's entrance. Towards the east, the landscape completes the plaza and park.



Stormwater Management Plan

Legend

- Existing Storm Main
- Proposed Perforated Pipe
- Proposed Solid Pipe
- Proposed Drain Trough
- 320 m² x 300 mm Deep Rock Pit for Rain Gardens No. 2 and No. 3
- LEED Boundary
- Paved Areas to be Directed to Rain Gardens
- Roof - Runoff Directed as Shown
- Pervious Pavers - Runoff to be Infiltrated in 300 mm Deep Rock Trench. Overflow to Rain Garden Perforated Pipe
- Vegetated Areas with Retained Trees
- Impervious Areas that Flow Directly Off-site to Storm System.
- 4.5 m² x 1.1 m Deep Detention Tank with a 35 mm Ø Orifice
- Rain Gardens - All rain gardens to be 0.3 m deep with vertical sides and 300 mm of amended soil. Rain gardens No. 2 and No.3 have a rock trench underneath, rain garden No. 1 has no rock trench

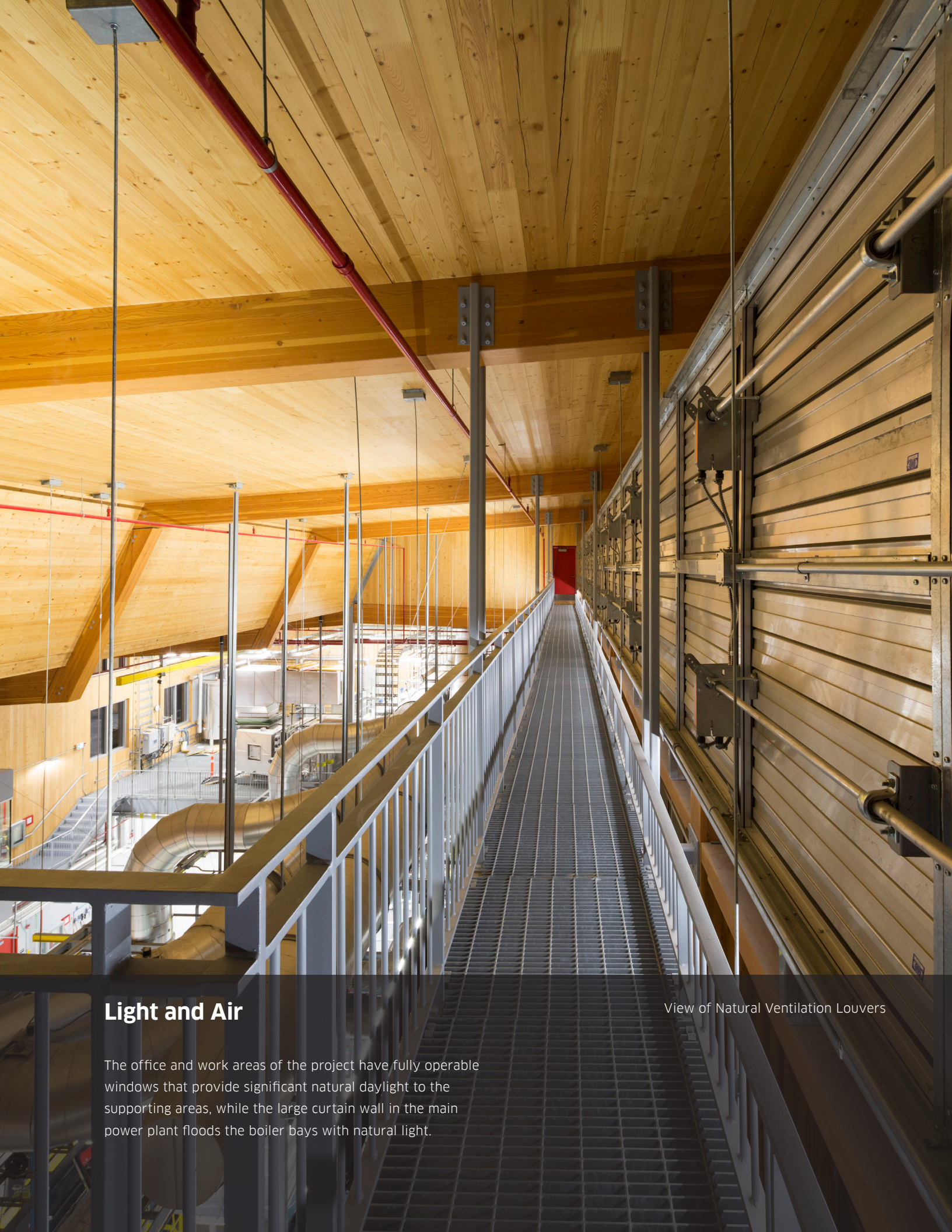
Site Ecology

The overall stormwater strategy for the site reduces the rate and volume of storm-water runoff from pre-development and treats 90% of the average annual runoff using infiltration, detention, filtration, and settling. The site was enhanced from 75% to 54% impervious area, by including 385 m^2 of previous pavement over a rock retention trench, pavement draining to raingardens with absorbent topsoil and a detention facility.

The runoff is redirected, retained and allowed to infiltrate back to the ground through raingardens located all along the west of the site instead of directly discharging to the stormwater piping.

The raingardens infiltrate runoff from the roof as well as impervious areas around the site and an underdrain beneath the topsoil prevents the site from becoming flooded, while excess flows are conveyed to a 4.95 m^3 detention facility.

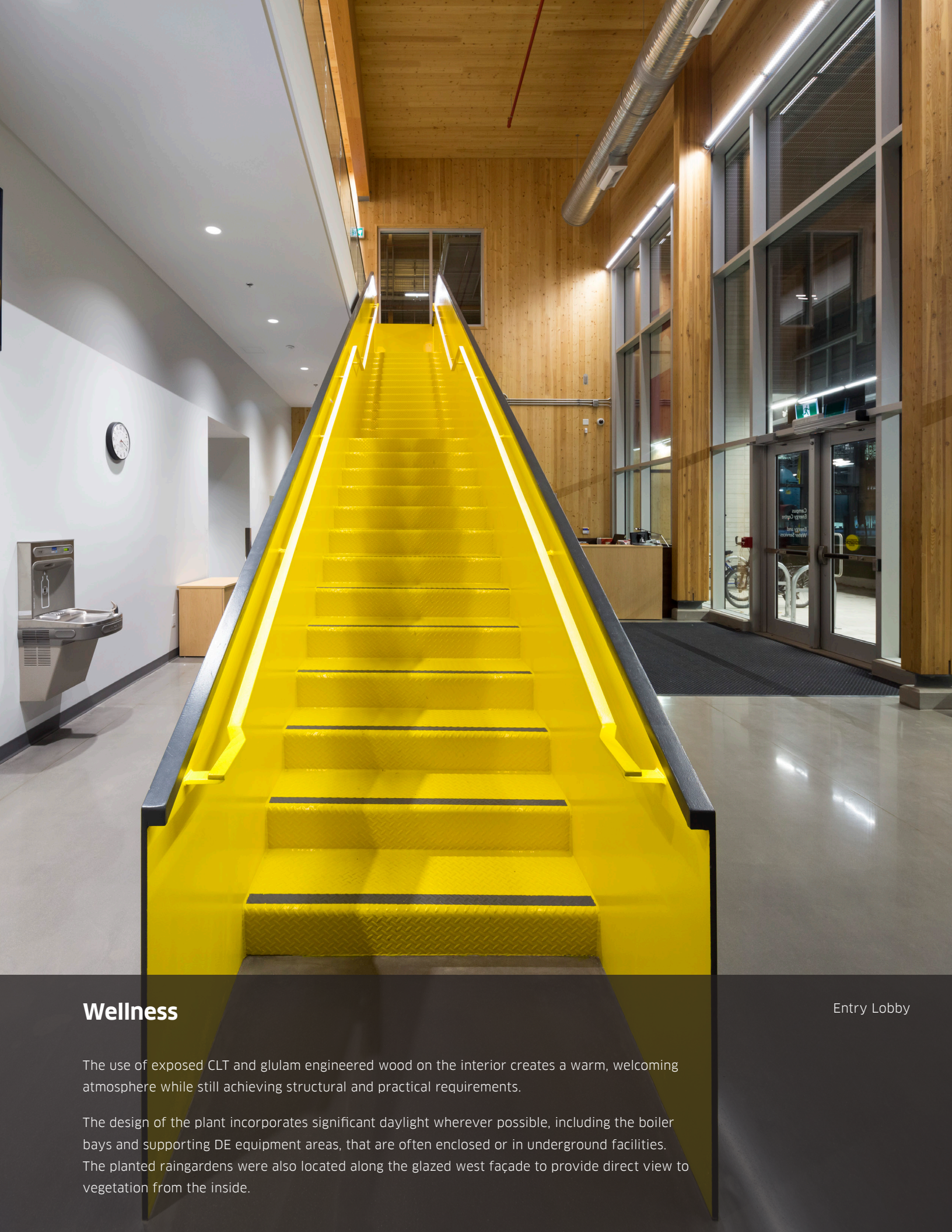
As part of the efforts to improve the ecology of the site, a nutrient management plan provides nutrient control procedures for monitoring structural measures, exterior cleaning products and landscape fertilizers. These measures help reduce and treat nutrients as they are transferred through storm water to surrounding natural water bodies, avoiding algal blooms, oxygen depletion, biodiversity reduction, and the proliferation of invasive species.



Light and Air

View of Natural Ventilation Louvers

The office and work areas of the project have fully operable windows that provide significant natural daylight to the supporting areas, while the large curtain wall in the main power plant floods the boiler bays with natural light.



Wellness

Entry Lobby

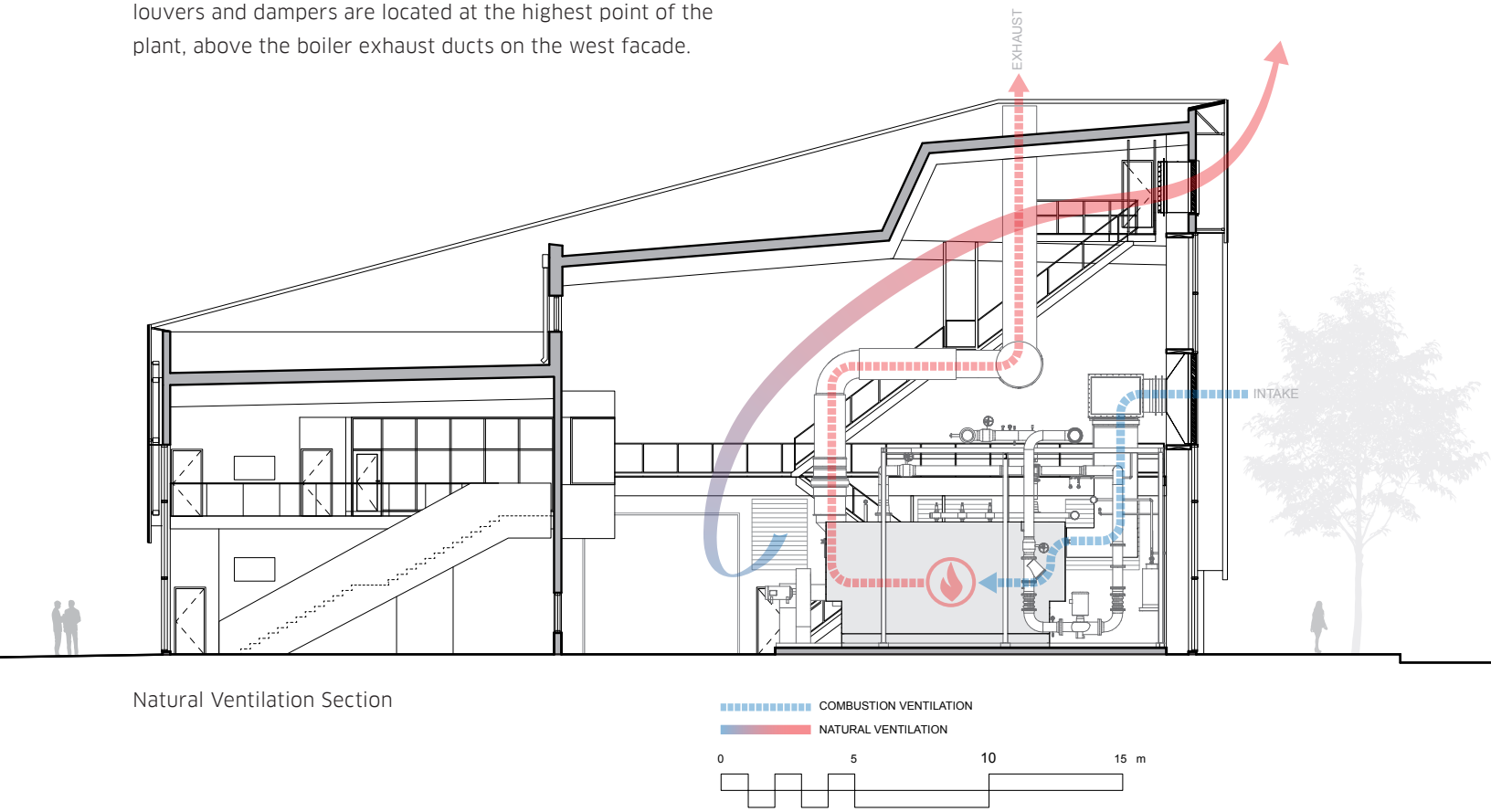
The use of exposed CLT and glulam engineered wood on the interior creates a warm, welcoming atmosphere while still achieving structural and practical requirements.

The design of the plant incorporates significant daylight wherever possible, including the boiler bays and supporting DE equipment areas, that are often enclosed or in underground facilities. The planted raingardens were also located along the glazed west façade to provide direct view to vegetation from the inside.

View of Rooftop Exhaust Stacks Screened by Facade Extension

Energy Present and Future

As a large thermal energy generation plant, the equipment housed by the CEC emits significant amounts of residual heat into the interior space. Mechanically cooling this would have required large amounts of energy. The design team saw this as an opportunity for significant energy reduction by using the large volume of the main plant space to drive natural ventilation via stack effect. The ventilation intake is supplied through louvers and automatic dampers at ground level in the southeast elevation. The ventilation exhaust louvers and dampers are located at the highest point of the plant, above the boiler exhaust ducts on the west facade.



Natural Ventilation Section

View of Boiler Bays Looking West

Building Life Cycle Considerations

The primary structure is constructed of renewable, locally sourced CLT panels supported by glulam columns and 20m clear span beams. A Life Cycle Analysis (LCA) was carried out to compare between a steel and concrete reference building and the proposed glulam and CLT building. The LCA indicated an 18% global warming potential reduction by using engineered wood.

West Elevation Detail

Education and Information Sharing

The CEC showcases and informs the crucial role this facility plays as the main source of thermal energy for the growing UBC Campus. The zinc cladding is a key aspect of this strategy, both as a means of integrating the facility within its campus setting but more importantly, as a 'diagram' of the internal process requirements. This 'shroud' responds to various conditions: it allows openings for combustion intake, ventilation intake and exhaust, lets daylight into glazed areas, becomes transparent in front of open spaces, rises to reveal equipment and lowers to provide a human scale and create weather protection at the entrance.

On the west facade, the shroud has been peeled back to reveal the glazed skin of the 17m-high boiler house providing pedestrians with views into the vaulted space of the process area and celebrating the building's operation and process equipment through interpretative signage. Tours of the space are given to students and visitors.

The CEC highlights the innovative campus-wide thermal energy production on the UBC Campus, and is recognized as a leading example of utilizing design to showcase sustainable infrastructure.