VanDusen Botanical Garden Visitor Centre

GROWING A GARDEN FOR THE 21ST CENTURY

Text by Ken Larsson and Cornelia Oberlander
Images as credited

1

PROJECT CREDITS

Location: 5251 Oak Street Vancouver BC **Completion Date:** September 2011 **Client/Owner:** Vancouver Board of Parks and Recreation, VanDusen Botanical Garden **Landscape Architects:** Sharp & Diamond Landscape Architecture Inc. in collaboration with Cornelia Hahn Oberlander **Architect:** Perkins + Will Canada, Inc. **Mechanical/Electrical Engineering:** Cobalt Engineering LLC **Structural Engineer:** Fast and Epp **Acoustics:** BKL Consultants Ltd. **Civil:** RJ Binnie & Associates **Ecology**: Raincoast Applied Ecology **Commissioning Agent:** KD Engineering **Cost Consultant:** BTY Group **Lighting Design:** Total Lighting Solutions Inc. **General and Construction Management:** Ledcor Construction **Roofing Contractor:** Metro Roofing **Area**: 202,343 m^2 (VanDusen Botanical Garden), 16,997 m^2 (Visitor Centre and Site Restoration) **Building Footprint:** 1,765 m^2 **Roof Area (Living Roof):** 1,486 m^2 **Roof Area (Blue Roof):** 371 m^2

Carefully planned to reflect the Pacific Northwest Coastal grassland community, the green roof includes over 20 species of plants, bulbs, and grasses.

"The Musqueam people like all Aboriginal people throughout the world lived in harmony with nature. We have respect for all life: we respect the plants that provide the medicines that heal our body; give our body nourishment through the foods that we eat; that clean the soil and water; and clean the air that we breathe."
—Jeri Sparrow, Musqueam Elder, Opening Prayer Speech (VanDusen Official Opening October 2011)

Traditionally, botanical gardens symbolised a human place in the natural world. Botanical gardens were typically organised into plant classifications based on research and education, medicinal and food plants of horticultural significance, as well as aesthetic beauty. Their principle role was to maintain and document collections of living plants for the purposes of scientific research, conservation, display, and education. Managed by the Vancouver Park Board, the 55-acre public VanDusen Botanical Garden has been popular among locals and tourists since its opening in 1975, with features including diverse plant collections, garden courses, and family and children adventures, among others.

Adding a new direction and value to the Gardens, a new state-of-the-art visitor centre was introduced in 2011, reconnecting people to the environmental issues of the twenty-first century, including water and energy conservation, recycling, the beauty of Canada's native plant ecology, and a healthier way of building and design. Forging a unique relationship between architecture, landscape, and ecology, the landmark facility has been inspired by the form of a native orchid leaf. The Centre further breaks ground with its innovations in sustainable design, integrated rainwater collection, and sensitive planting strategies.

Sustainability Challenge

The site, building, and roof were all designed to define the highest measure of sustainable design. Designed to exceed LEED Platinum standards, it is also registered for the Cascadia Green Building Council's Living Building Challenge—widely considered the world's most stringent criteria of sustainability in the built environment—and Canada's first Living Building.

Created in 2006, the Living Building Challenge was conceived by non-profit organisation International Living Future Institute as a philosophy, advocacy tool, and certification programme to promote the most advanced measurement of sustainability in the built environment, spanning new and renovated buildings to infrastructure, and landscapes to neighbourhoods. The Challenge is centred on projects' abilities to: incorporate regional design characteristics; generate their own energy needs; capture and treat all water; use resources efficiently; and maximise health and beauty. Projects must further be free of "Red List" chemicals, including chlorinated plastics, heavy metals, pesticides, halogenated flame-retardants, and petroleum-based products.

With the Visitor Centre, all construction details, materials, and specifications were carefully scrutinised and developed to reflect the criteria of the Living Building Challenge for a healthier way of building and design. On site, soils were tested, amended, and reused to provide growing mediums for garden native plantings. Plantings were chosen and sited to avoid use of irrigation. Existing site wood structures were disassembled, milled, and redesigned into site furnishings, bridges, and decking. Trees felled were milled and reused as children bench tables.

2

1. Fescue Meadow (Photo: Nic Lehoux).

2. Concept Plan (Image: Sharp & Diamond Landscape Architecture Inc.).

Design Objectives

The integrated and collaborative design followed four overarching objectives:

- Education: Communicate the importance of plant conservation and biodiversity
- Demonstration: Provide a living example of what it means to be a botanical garden in a modern society
- Performance: Foster a relationship between building and ecological systems
- Identity: Celebrate the concept of nature in the city

In fulfilling the above, the design process was highly collaborative between architects Busby Perkins + Will Architects, landscape architects Sharp & Diamond Landscape Architecture Inc. and Cornelia Hahn Oberlander, the clients City of Vancouver Parks Board and the Botanical Garden Steering Committee, and the rest of the multi-consultant design team.

Site

Within the gardens, the site of the new Visitor Centre was chosen to give a new "front door" to the gardens, increasing its public presence from Oak Street and thereby welcoming the public. The dramatic roofline of the building is a visual draw into the clearing and to the landmark Livingston Lake. The overall scope of the project is five acres, including a 20,000-squarefeet building.

The team was in unanimous agreement that building and site should appear seamless. The gently sloping terrain was carefully regraded to preserve 300 significant trees, many of them magnificent towering 100-foot Douglas Firs. Large chestnut and walnut trees were retained to create a shady wildlife corridor and habitat for butterflies, small animals, and birdlife. A distinctive and universally accessible arrival experience integrates a system of wetlands and rain gardens. The series of arrival plazas follow the natural terrain, gently leading people to the building, while framing views to the larger landscape and revealing views to a previously hidden stream and lake.

Orchid Petals as Living Roofs

The roof itself is shaped and divided like the orchid leaves. Carefully planned to reflect the Pacific Northwest Coastal grassland community, the green roof includes over 20 species of plants, bulbs, and grasses. The site and roof were entirely seeded with a blanket of native grasses featuring a mixture of fescues and perennial rye grasses grown from seed by Blue Stem Nursery. Sprinkled within the grassed meadows on the site and roof are varieties of native perennial bulbs (for example, Lilies, Camas, Onion, and Orchids), sedums in the thinner soil profiles, and Carex in the slightly deeper wetter valley areas. Adjacent large Firs, Cedars, Chestnut, and Walnut trees were retained to create shade and to enhance the "wildlife corridor" and habitat for butterflies, critters, and birdlife.

As a result of the unique undulating roof planes, the variety of solar orientation resulted creates multiple opportunities for grassland and bulb plant communities to thrive. Roof garden runoff is directed to the existing stream, enhanced infiltration beds, and wetlands, in addition to an underground cistern. Key sitelines were established from the main arrival bridge, upper terrace, restaurant, and street, as well as throughout the gardens, to reinforce the importance of the roof to the image of the project. The key roof design drivers are outlined below.

Weight

The roof is designed to support 45 pounds per square foot. A custom grid shell of sustainably harvested (FSC) Fir glulams, all uniquely shaped, was used to support the roof. The average lightweight growth medium depth was six inches. The lightweight grow medium specification was coordinated together with Zinco Canada and Landscape Architecture team. Growth media was supplied by Sumas, based out of British Columbia, and blown onto the roof.

Topography

The unique undulating roof planes simulate rolls and hummocks with gentle slopes of five-percent grades to near vertical, very steep 50-percent grades. The varying topography creates multiple low points and highpoints, with varying depths of growing mediums and solar orientations. This results in the creation of unique habitat design solutions: Carex in the deeper soil valleys and depressions; native fescue grasses at higher elevations; and sedums along the exposed edges and the thinner and dryer growing media profiles of the steeper 50-percent grade. Shear barriers were integrated within both the roof deck and membrane systems and required to prevent the green system from slipping off the roof.

Green roof and waterproofing system

For the landbridge area, the Zinco Floradrain FD 40 Semi Intensive system was used, consisting of a mechanical root barrier, a geotextile protection mat, a water-retaining drain board, a filter sheet, FLL-grade custom growth mediums, and seeded grasses and perennials. Within the petal areas, the Zinco Floraset FS 75 System was used, designed for modestly sloped roofs to retain growth media in place using engineered pockets for soil retention and anti-erosion control. Shear barriers were built into the structure and waterproofed to keep the system from slipping. In the oculus, the Zinco Georaster system employs interlocking modules that resemble a honeycomb design to hold grow media in place for steeper extreme sloped green roofs. Compared to the FD 40 system, the FS 75 and Georaster systems use an anti-shear geotextile protection mat and a larger soil and moisture retention board.

The RCABC warranty

Since the Roofing Contractors Association of British Columbia requires the complete scope of works for the green roof, roofing membrane, and roof installation to be captured by one complete tender, the design went through a prequalification process to select the roof installation team. Fall protection anchors were installed within each roof petal. Together with Zinco Canada, both Envelope Consultant and Structural Engineer extensively reviewed and approved the shear barrier design, locations, and installation.

3

4

5

Living Building Challenge 2.0

In accordance to the Living Building Challenge Red List, which specifies infrastructure requirements for cistern, rock ballast (blue roof), chambers and vaults for on-site bioreactors, vertical solar chimney, and hot water solar tubes, galvanised materials and PVC products were prohibited.

Planting

Capturing the over 20 species and approximately 14,000 in quantity of local in-situ plants and bulbs, together with custom fescue hydroseed grass mix, the fescue meadow was graded to bring the existing Botanical Garden onto the roof to reinforce the seamless relationship between the building and site and to create a wildlife corridor. The low-growing fescue requires minimal mowing, fertilisation, and will go dormant in the winter. A specialised maintenance programme has been developed with Botanical Garden Horticulture Maintenance for plant establishment and ongoing care.

Schedule

One of the project's tightest constraints, the project schedule directly affected the roof design process. The resolution of the complex shapes, forms, and materials of building roof and site were developed in only seven months, therefore multiple tenders and early works were underway during final roof installation.

A major objective achieved was to keep the unaffected Gardens, Restaurant, Administration, and parking areas operational and accessible during entire construction period. The original intent was to have a performance specification, sample planting mockups, and test alternatives, but plant sourcing, supply, and time of installation were adjusted and coordinated to meet the opening deadline.

Rainwater Collection

The landmark roof is the cornerstone of the building's water conservation strategy with six individual undulating roof petals, of which two are blue roofs for water collection and solar hot water tubes and four are planted living roofs. The rainwater collection cistern is a 35,500-US-gallon tank beneath the building, where the graywater is filtered and used in toilets and urinals. Excess water from the roof is collected and conveyed to adjacent streams and drywells.

The city of Vancouver requires both water and sewer systems to be connected to the city service. However, the VanDusen Botanical Garden Visitor Centre is notably the first building in Vancouver in more than 45 years to treat blackwater on site. In particular, the Centre uses a bioreactor wastewater system from Eco Fluid Systems. Blackwater from toilets and urinals is reclaimed and sent to the bioreactor for treatment, directed to a percolation field, and then returned to the surrounding garden wetlands—making the building truly net-zero when it comes to off-grid water system.

The Integrated Stormwater Management Plan has been developed to meet both the Living Building Challenge standards, which requires 100 percent of the site stormwater and building water discharge to be integrally managed on site, and LEED Platinum standards, where credits 6.1 and 6.2 in "Rate and Quantity" and "Treatment" respectively must be achieved.

The Integrated Stormwater Management Plan utilises the following strategies: a living roof for infiltration and increased evapotranspiration; absorbent landscapes to increase natural percolation and infiltration to groundwater through planted and granular surfaces; a roof rainwater cistern for reuse in building and to decrease runoff and a

6

7

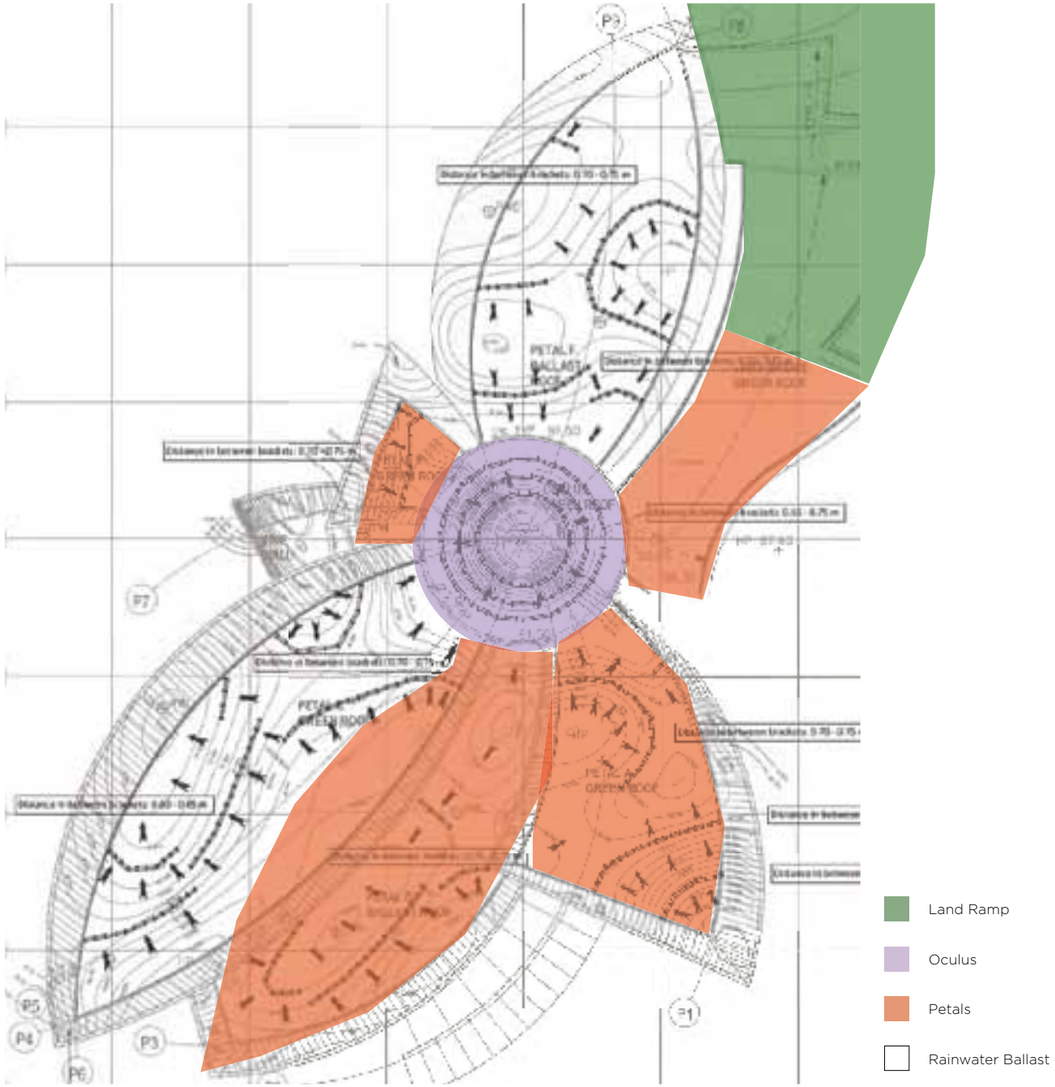
3. Arrival and drop-off, Arbutus, Fescue (Photo: Nic Lehoux).

4. Arrival—Recycled Wood Bridge (Photo: Nic Lehoux).

5. Oculus (Photo: Nic Lehoux).

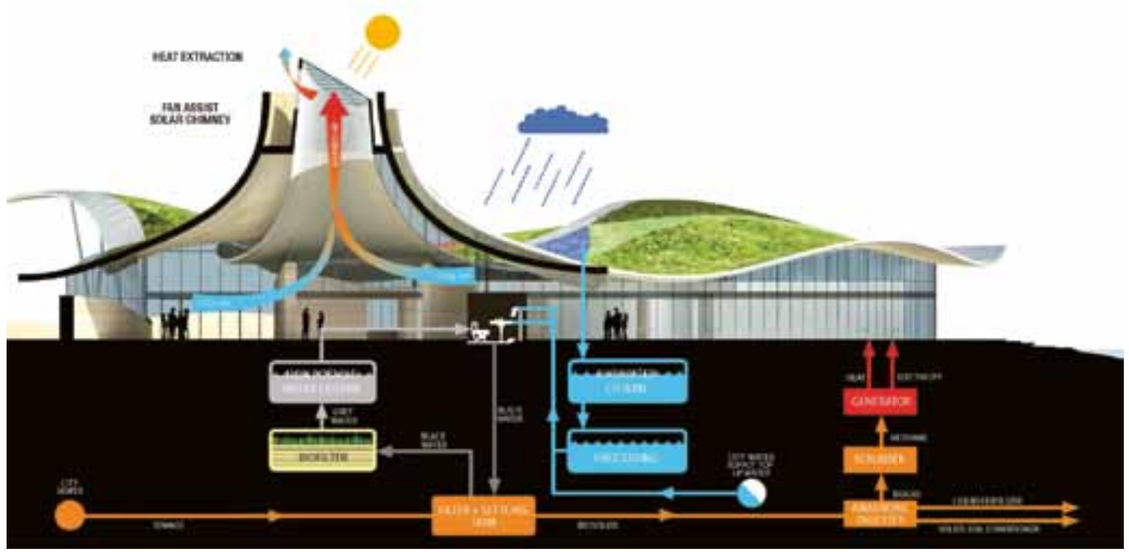
6. Landramp (Photo: Nic Lehoux).

7. Green Roof Construction (Photo: Bryce Gauthier).



8

Illustration of Roof Types (Image: Ken Larsson and Sharp & Diamond Landscape Architecture Inc.)



9

Building and Site Systems Performance Scheme
(Image: Perkins + Will Canada, Inc. and Sharp & Diamond Landscape Architecture Inc.)

drywell for overflow; and constructed naturally planted raingardens, swales, stream restoration, and wetland to retain runoff temporarily and allow infiltration into the ground. They reduce peak runoff flows while also filtering contaminants like oil and hydrocarbons.

Planting Strategy

Inspired by the historical journals of botanist Archibald Menzies and Captain George Vancouver during a journey along the Pacific West Coast in 1792, the transformative planting strategy for the garden, roof, and site was built on their vision. The planting approach designated five regionally significant planting palettes, with special references to the Cascadia region that includes the ecology of British Columbia, Washington, and Oregon. They are:

- Cascadia Pacific Northwest and a Garry Oak Meadow: Inspired by Menzies, the palette comprised native trees, shrubs and groundcovers, cedar, vine maple, gaultheria, mahonia, ferns, garry oak, arbutus, douglas fir, kinnikinnick, and salal.
- 16,000 square feet of Green Roof: Doubling as a wildlife corridor, coastal grasslands (of native fescues with native perennial bulbs) were grown from seed by BlueStem Nursery. Enviro-turf uses fescue grasses that do not grow higher than about six inches so as to reduce demand for irrigation, fertilisation, and most importantly mowing.
- Wetlands: Functioning stormwater infiltration gardens (of Carex, iris, juncus, and Equisetum) were utilised for public demonstration and incorporated into the site's stormwater management plan.
- Ethno-Botanical Garden: Plant species significant in the lifestyle of First Nations were highlighted here, such as huckleberry, currant, and salmonberry.
- Demonstration Food Gardens: Adjacent to the cafeteria, the gardens highlight plants and herbs used for cooking, scent, and beauty, including Rosemary, Lavender, Sage, and Basil.

To reinforce the Centre's commitment to the Living Building Challenge requirements and address the sustainable choice for long-term management and maintenance, the site and roof plantings were designed to be adaptable to Vancouver's wet winters and dry summers. July 2010 in Vancouver received only 0.6 millimetres of recorded rainfall and was described as the warmest July on record. As a result, the landscape designers made the choice to use irrigation for establishment only. A maintenance programme was coordinated between the Contractor and Garden Horticulture crews to give the plant material the greatest chance of survival.

Summary

Created as a harmonious balance between architecture and landscape, VanDusen Botanical Garden Visitor Centre was designed in the spirit of collaboration and to address concerns of the twenty-first century. It was a true design process, with all disciplines, contractors, and suppliers working together to solve problems of a technical nature in a very tight time frame. Visitors will be connected to a healthier way of building and design, one that seamlessly blends architecture, landscape, and ecology. CG