

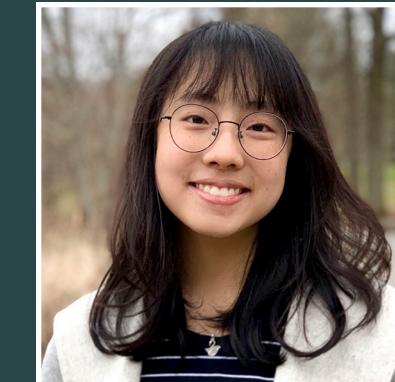
Cowichan Cultural Center

PROJECT RESEARCH BY STUDENTS AT CORNELL UNIVERSITY
UNDER THE DIRECTION OF PROF. JACK ELLIOTT IN THE COLLEGE OF HUMAN ECOLOGY, DESIGN + ENVIRONMENTAL ANALYSIS



Professor Jack Elliott

ASSOCIATE PROFESSOR
DESIGN + ENVIRONMENTAL ANALYSIS



Xin Wen

FOURTH YEAR UNDERGRADUATE STUDENT
DESIGN + ENVIRONMENTAL ANALYSIS



Krishna Parikh

GRADUATE STUDENT IN ARCHITECTURE
M.S. IN ADVANCED ARCHITECTURAL DESIGN (ECOLOGY)



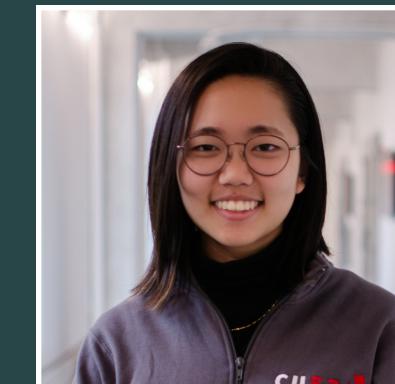
Erika Kane

FOURTH YEAR UNDERGRADUATE STUDENT
DESIGN + ENVIRONMENTAL ANALYSIS



Patricia Heye

GRADUATE STUDENT IN DESIGN + ENVIRONMENTAL ANALYSIS
M.A. IN DESIGN - SUSTAINABLE DESIGN STUDIES



Jennifer Lee

SECOND YEAR UNDERGRADUATE STUDENT
MECHANICAL ENGINEERING

The Team



Hawai'i Prep Academy Energy Lab¹

LOCATION: Kamuela, HI, USA

ARCHITECT: Flansburgh Architects

YEAR BUILT: 2010

KEY FEATURES

The Energy Lab integrates with the project site to take advantage of the southern sun exposure and abundant trade winds to generate sufficient energy to power the project through solar and wind power. Additionally the project uses radiant cooling which circulates water through roof panels to cool the water during lower evening temperatures and then stores it below-ground for use as chilled water. The project is also entirely naturally ventilated. Despite being located on an island, the project was able to use regional materials for concrete aggregate and a salvaged wood column.

RELEVANCE

Like the Energy Lab, our project is also located on an island, although it is less remote. The Energy Lab provides examples of successful methods for finding local materials despite the limitation. Additionally, The Energy Lab is excellent at integrating with its local site to maximize benefits from the sun and the wind while also creating a beautiful and protective building for its occupants. These are strategies we seek to emulate.



Te Kura Whare²

LOCATION: Tūhoe, Tāneatua, New Zealand

ARCHITECT: Jasmax

YEAR BUILT: 2014

KEY FEATURES

All of the project's water is collected and discharged on site. Much of it is stored in tanks, filtered & treated, and then used for the project's potable water. Additionally, black-water is naturally filtered through a botanical wastewater treatment system and discharged on site. Additionally, the project uses passive design techniques and solar panels to achieve a net zero design. Finally, to address materials, the project was constructed by the Te Kura Whare from local resources.



RELEVANCE

Like our project, Te Kura Whare is more than just a green building, it is a cultural symbol to the community. Furthermore, it represents a connection to the land that motivates the community's focus on environmental stewardship. "The sustainability values and practices connected with the Te Kura Whare will provide a platform for embedding into community aspirations and initiatives associated with cultural, social, health, and economic prosperity." Our project seeks the same ethos and could learn from this design. Additionally, this project is located in a similar climate to Vancouver Island, BC and has to deal with large quantities of annual rain and limited sun. Their water and solar strategies could apply well to our project.



Sustainable Buildings Research Centre ³

LOCATION: Wollongong, NSW, Australia

ARCHITECT: Cox Architecture

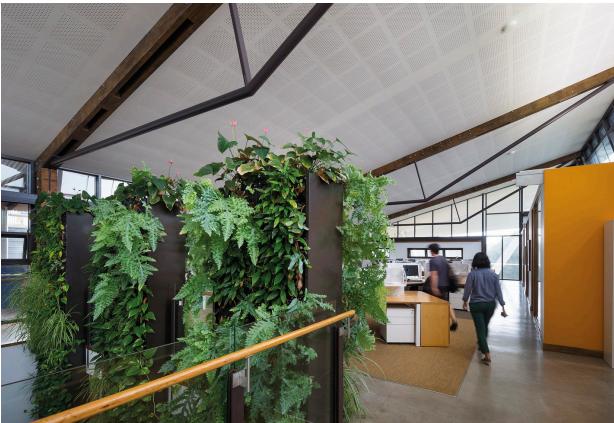
YEAR BUILT: 2013

KEY FEATURES

The campus and SBRC site is nestled between the Illawarra Escarpment and the Pacific Ocean and borders a local historic plant community in the adjacent reserve. While the site has been dormant with no vegetation for decades, the historic plant community that once thrived here remains at the adjacent nature reserve. It was decided that the landscape design for this site should restore the indigenous vegetation of the area, particularly those species used by the indigenous people for as food, fiber, tools or medicines.

RELEVANCE

This surrounding plant community is susceptible to clearing from continued coastal development. It was important to preserve and restore areas of this landscape character for its environmental benefit and the prominent cultural role it played in the lives of aboriginal people. Moreover, restoration of local ecological landscapes satisfies the Living Building Challenge (LBC). Being the first project to pursue LBC certification in Australia, the vision for the habitat exchange was to offset ecologically valuable site(s) within Australia.



Phipps Centre for Sustainable Landscapes ⁴

LOCATION: Pittsburgh, PA, USA

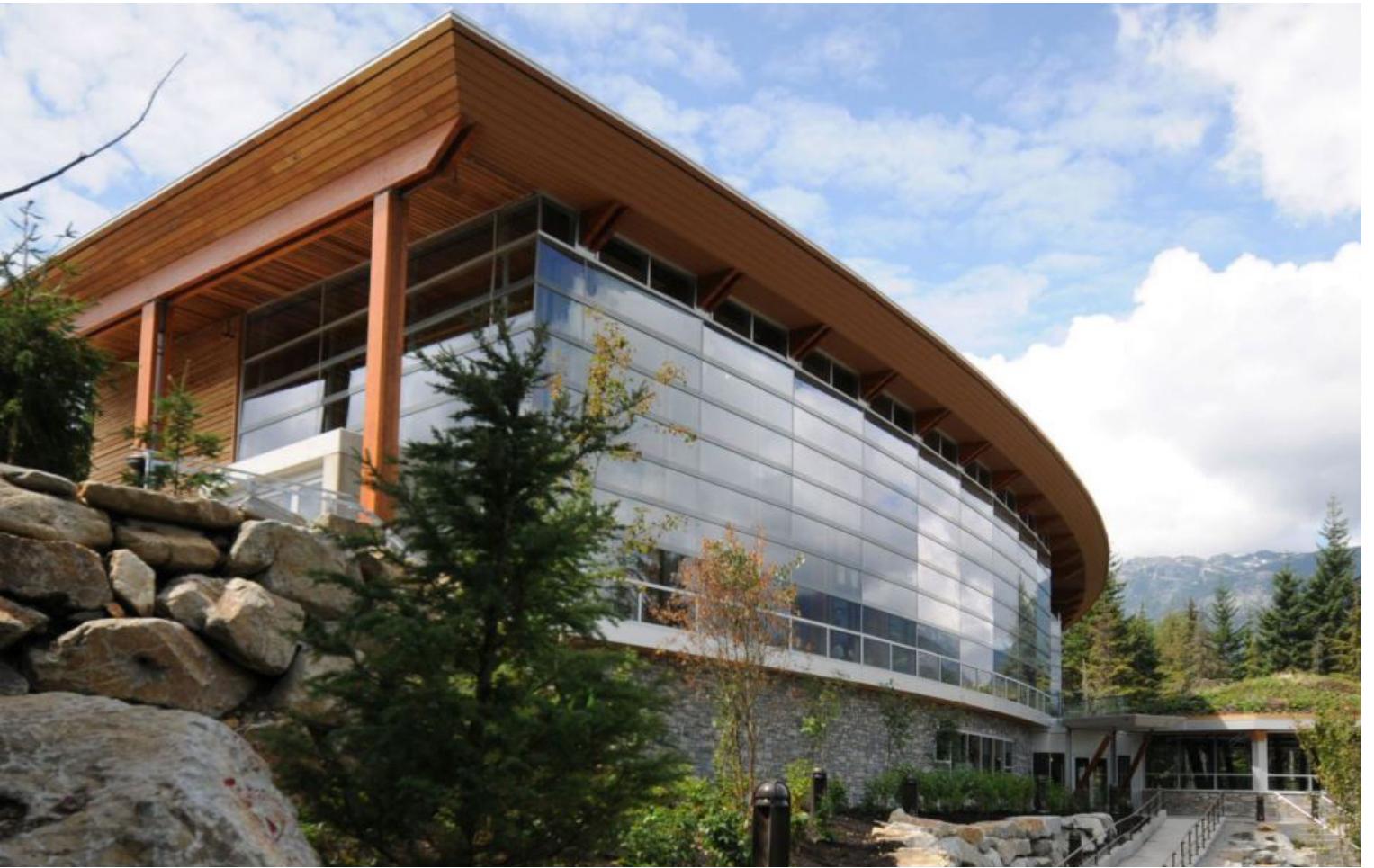
ARCHITECT: The Design Alliance Architects

YEAR BUILT: 2015



RELEVANCE

A restored brownfield is now a productive place that takes what it needs from what is available to it, and provides a healthy environment for life to thrive. The Center for Sustainable Landscapes project was built on brownfield site previously developed by the City of Pittsburgh's Department of Public Works.



Squamish Lil'wat Cultural Center⁵

LOCATION: Whistler, BC, Canada

ARCHITECT: Ratio & Alfred Waugh Architects

YEAR BUILT: 2008

KEY FEATURES

The design of this cultural center focused on environmental land stewardship as one of its primary goals. This reflects the values of the First Nation tribes who use this cultural center to preserve their culture. By evoking the tribe's heritage in the aesthetics of the design while using modern environmentally sustainable development techniques, the center provides the perfect environment for exhibits that teach visitors about the tribes' cultures. Programmatically, the center contains a great hall, indoor and outdoor exhibition spaces, and related support spaces.

RELEVANCE

The program of this facility is very similar to that desired by the Cowichan Tribe for their cultural center. Furthermore, this facility is of a similar size and complexity as what is sought by the Cowichan. With multiple structures on the same site, the building provides an example of a cultural center campus that functions well for its users. Finally, the focus on environmental stewardship in the project is similar to the focus desired by the Cowichan.



Aanischaaukamikw: The Cree Cultural Institute⁶

LOCATION: Oujé-Bougoumou, Quebec, Canada

ARCHITECT: Douglas Cardinal & Rubin Rotman Architects of Montreal

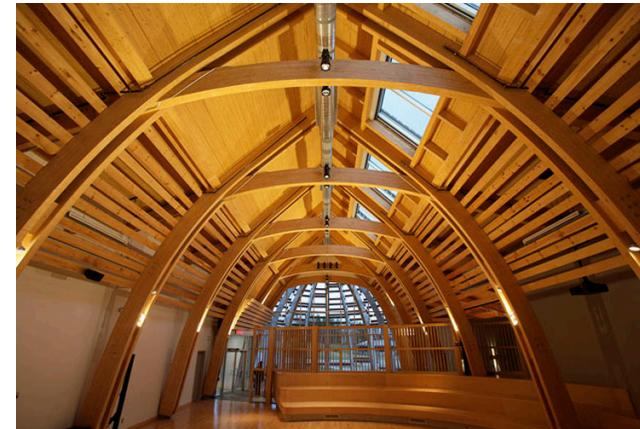
YEAR BUILT: 2011

KEY FEATURES

This cultural center contains spaces for exhibition, storage, labs, administration, and technical work. It was designed through a collaborative process between the Cree Nation's elders and local architects. Its design meets the international museum standards and provides the tribe with "first class storage, research labs, administration, and conservation spaces" to preserve the tribe's heritage.

RELEVANCE

The program of this facility is very similar to that desired by the Cowichan Tribe for their cultural center. Although the Cree Cultural Institute is likely smaller than what the Cowichan need, it still provides for many similar space types and does so to a high level of quality. The collaborative design process that accounted for the tribe's traditional building practices and cultural heritage is also worth referencing.





Harvard House Zero⁷

LOCATION: Cambridge, Massachusetts

ARCHITECT: Snohetta

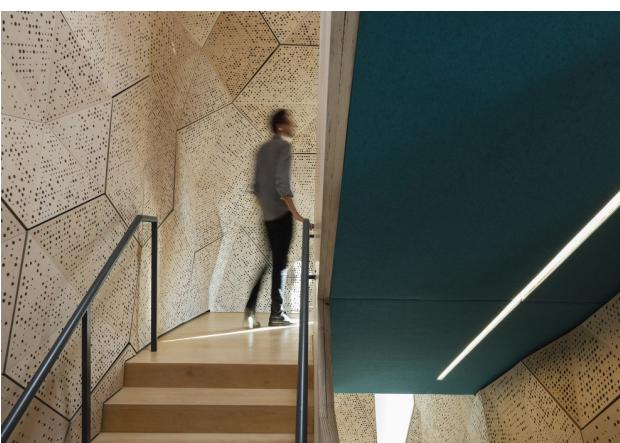
YEAR BUILT: 2018

KEY FEATURES

Harvard HouseZero, the Center for Green Buildings and Cities at Harvard's Graduate School of Design requires almost zero energy for heating and cooling. It uses passive design methods to allow for 100% natural ventilation, as well as 100% daylight autonomy, requiring no electric light use during the day. Finally, this Center has zero carbon emissions, which also includes the embodied energy in materials. A solar chimney, rain garden, green roof, improved envelope, photovoltaic roof, and thermal energy storage all contribute to the efficiency of this building.

RELEVANCE

Harvard House Zero is an example of sustainable renovation. This upgrade of an existing building is comparable to what we are trying to achieve in the design of the Cowichan cultural center- an increase in building efficiency that supports their program and is better for the land on which they occupy.



Indian Creek Nature Center⁸

LOCATION: Cedar Rapids, Iowa

ARCHITECT: Solum Lang Architects

YEAR BUILT: 2016

KEY FEATURES

This Nature Center is Petal Certified in the Living Building Challenge categories of Place, Water, Energy, Health + Happiness, Equity, and Beauty. It features geothermal heating and cooling, efficient, sub-metered energy and plumbing fixtures, and a photovoltaic roof, making this Center a net-positive energy building. Further, it used regionally-sourced or upcycled materials in its construction.



RELEVANCE

As a Nature Center, this project is a great role model for a building that is educational, expects visitors of all ages, and encourages a value-based connection to the land. As a Petal Certified building, the Indian Creek Nature Center is an exceptional example of the potential a building could have to be sustainable, beautiful, and impactful.



Tyson Living Learning Center⁹

LOCATION: Eureka, MO, USA

ARCHITECT: Hellmuth + Bicknese Architects

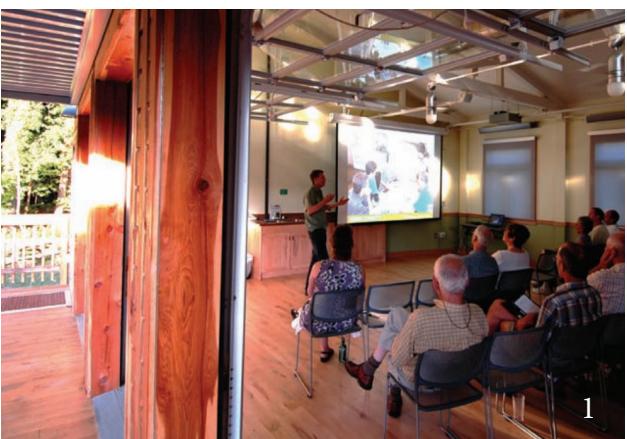
YEAR BUILT: 2009

KEY FEATURES

The Tyson Research Center is Washington University's satellite campus for environmental research and education, located in Eureka, MO and serves as both classroom facilities and an educational tool for students. It is also one of the world's first Living Buildings to be certified through the International Living Building Institute.

RELEVANCE

The Tyson LLC is a research center focusing on education for the community. There are operable windows and fans create cross ventilation which greatly reduces the energy load required by the HVAC system. This building also gathers rainwater and treating it non-chemically for potable water use as well as eliminating water use by introducing composting toilets. The material used was sustainably harvested. All of the framing lumber is FSC certified and all finish wood has been harvested from Tyson's site as part of a restoration plan or taken from trees that were fallen, dead, or dying.



Frick Environmental Center Building¹⁰

LOCATION: Pittsburgh, PA, USA

ARCHITECT: Bohlin Cywinski Jackson

YEAR BUILT: 2016

KEY FEATURES

The Frick Environmental Center is a Living Building dedicated to experiential environmental education. The new facility and its four-acre site act as a gateway to Pittsburgh's wooded park, and embody the neighborhood-to-nature ideal. The Center exemplifies equity, experiential learning, and public engagement. It also focuses a lot on conserving the site of the former nature center.

RELEVANCE

Pittsburgh Parks Conservancy is passionate about environmental education and this commitment manifests in all aspects of the Frick Environmental Center. It also uses the entire site as an educational opportunity. Situated in a verdant park, the site is alive with plants and animals, and provides abundant opportunities to visually engage with the park. The design team balanced life cycle assessment with programmatic requirements on the level of quality necessary.



Morris & Gwendolyn Cafritz Foundation Environmental Center¹¹

LOCATION: Accokeek, MD, USA

ARCHITECT: Re:Vision Architecture

YEAR BUILT: 2015

KEY FEATURES

The Cafritz Center is the 13th living building in the world. The building is net zero energy, net zero water, carbon neutral, and zero waste. It has minimal disturbance on the site. Notable strategies include solar panels, high performance building envelope, geothermal wells, natural daylighting, motion sensors for lighting, natural ventilation, storm water management, waterless composting toilets and urinals, food waste composting.

RELEVANCE

The building serves as an educational and events center for Alice Ferguson Foundation. It is designed to "encourage connections between people, the natural environment, farming and the cultural heritage of the Potomac River Watershed that lead to personal environmental responsibility". The building provides multiple ways for visitors to be sheltered while being outside, allowing outdoor education and enjoyment of nature.



Northern Arizona University Native American Cultural Center¹²

LOCATION: Phoenix, AZ, USA

ARCHITECT: Studio Ma

YEAR BUILT: 2011

KEY FEATURES

Located at the center of Northern Arizona University campus, the center serves as a "home away from home" for Native American students. The building achieved LEED Gold, through strategies such as exterior mounted blinds and interior shades to mitigate glare and summer heat gain; daylighting, high-efficiency light fixtures and occupancy-sensing technology to reduce energy; usage of native vegetation, low-flow fixtures, and storm water treatment to reduce water usage.

RELEVANCE

The LEED Gold certified building integrated Native American design and sustainability principles based on input from local Arizona Native American tribes throughout the design and construction phases of development (Indigenous Planning Process). It serves as a gathering space for Native American students to connect with their peers, cultures and traditions.

Humidity & Temperature¹

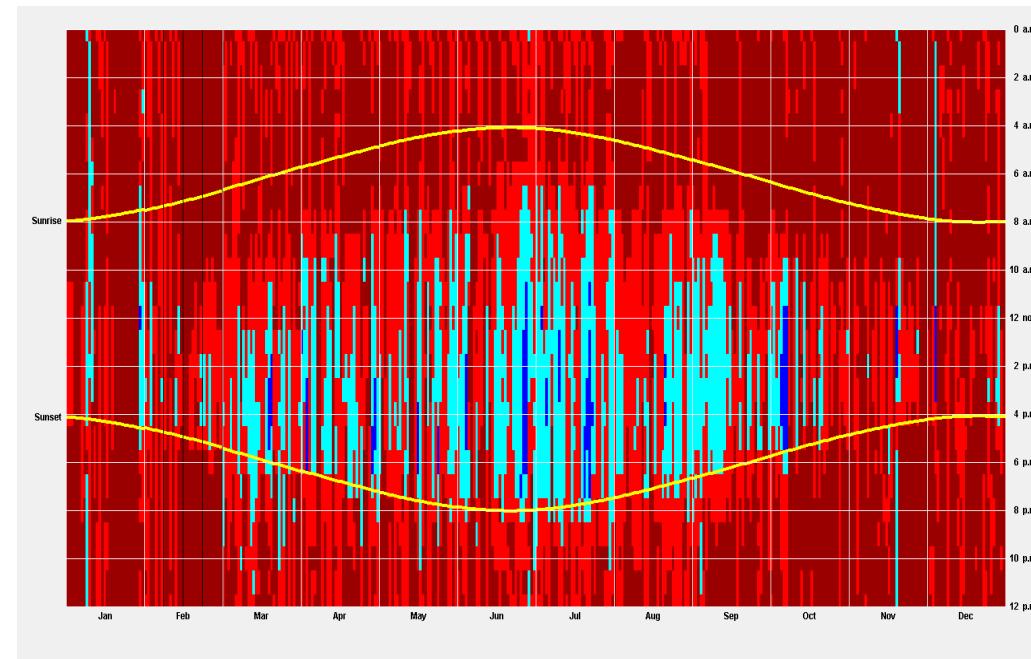
WHAT DO THESE CHARTS TELL US?

The temperature and humidity for the area around Duncan is fairly mild and easy to accommodate with passive design strategies. The temperatures in the summer in particular are extremely pleasant and it is unlikely the cultural center will need significant cooling as long as proper shading is provided. Heating will be necessary in the winter, but with good insulation it will be minimal. The climate is fairly humid but since it is associated with cooler temperatures, it will be easy to control. Since the center is a museum, significant humidity control will be needed inside the building.

TEMPERATURE RANGE



RELATIVE HUMIDITY

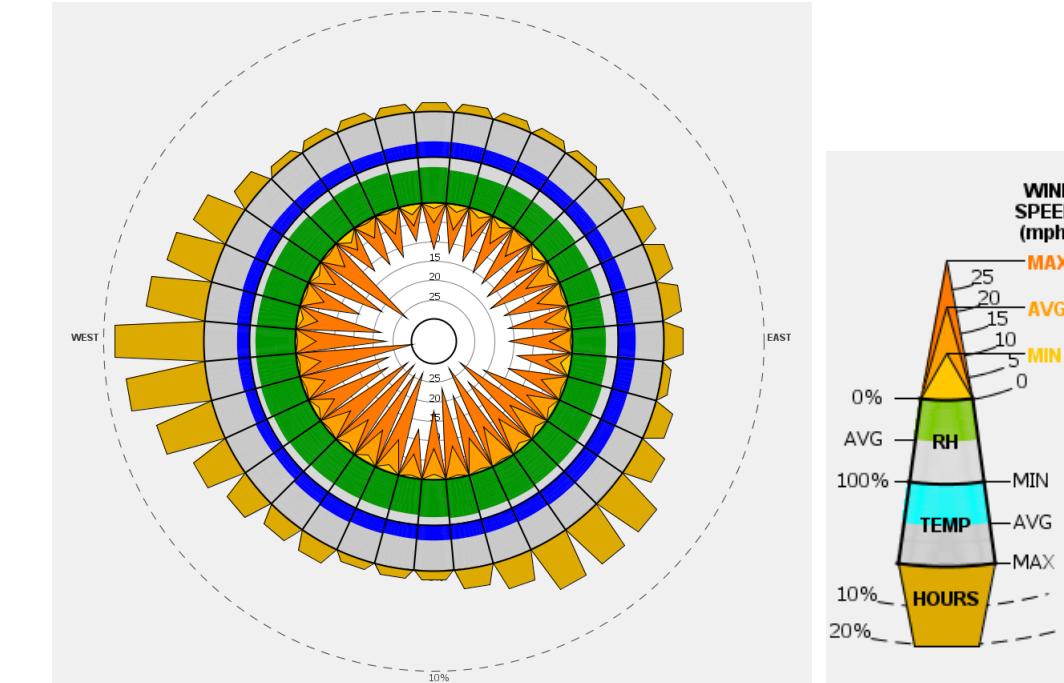


WHAT DO THESE CHARTS TELL US?

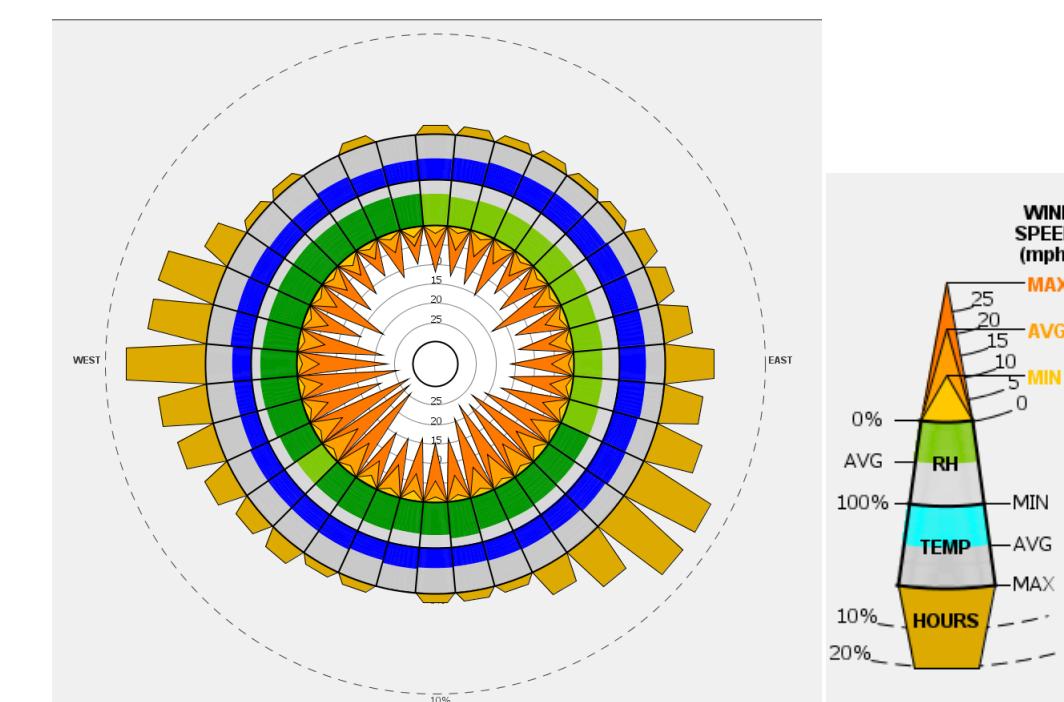
Please note: wind is often site-specific and this should be re-analyzed based on the characteristics of the individual site. However, for Vancouver Island as a whole, the winter wind comes predominantly from the west and south-east. Protection from this wind should be provided at the facility to extend use of outdoor spaces and protect the building from needing additional heating. The wind is somewhat more frequent in the summer time but comes from similar directions.

Wind Rose¹

WINTER WIND



SUMMER WIND

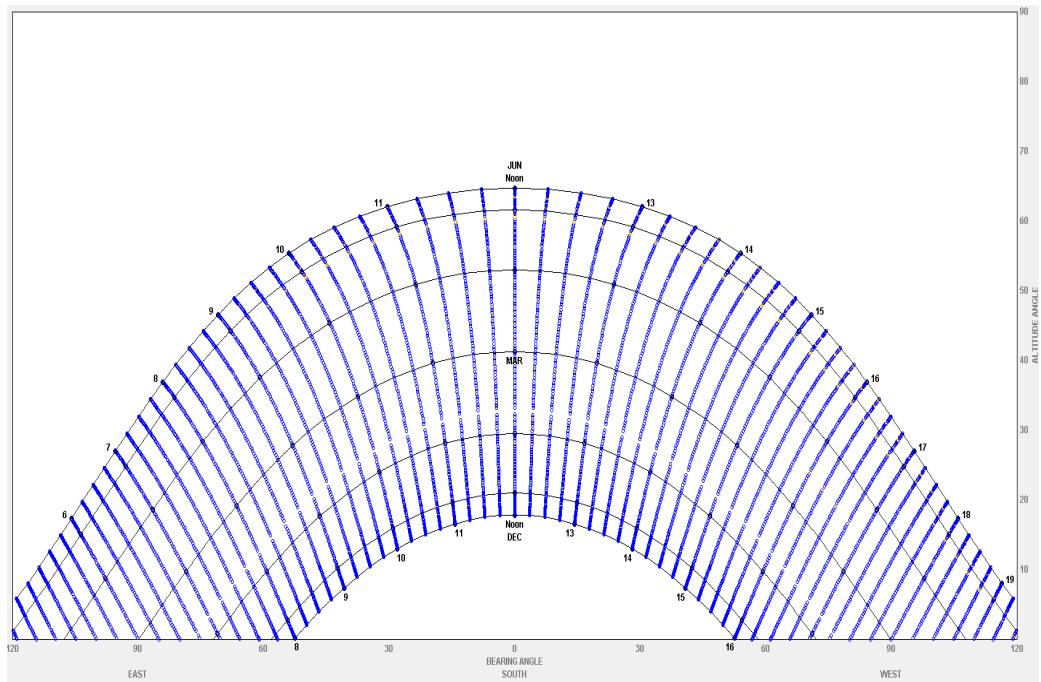
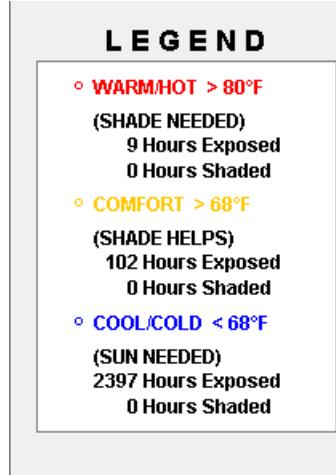


Sun Shading Charts¹

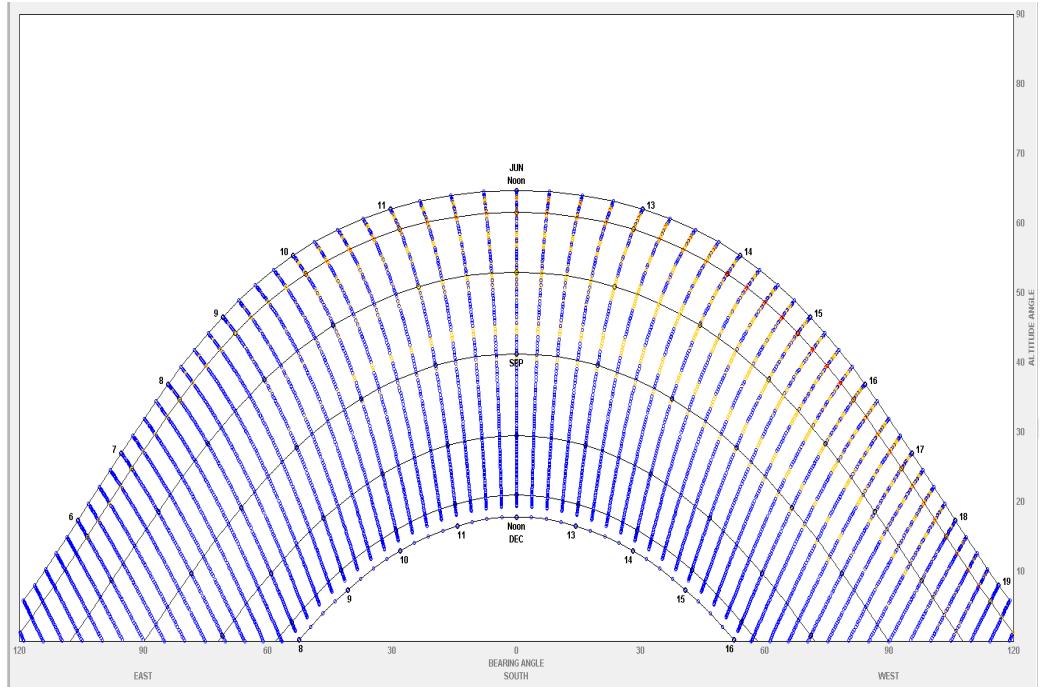
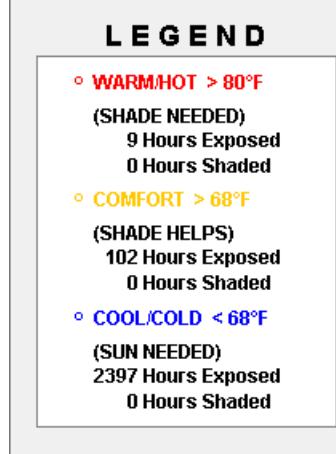
WHAT DO THESE CHARTS TELL US?

There are little to no concerns with excessive heat gain due to the sun on Vancouver Island. Some minimal shading may be needed on the southern and western sides of the building to prevent significant gain during afternoons in July and August. Otherwise, solar exposure should be maximized as much as possible in order to encourage what heat gain is possible to come into the building and reduce the heating load. South facing glass with shading overhangs designed appropriately for the latitude would work perfectly in this climate.

WINTER SUN SHADING



SUMMER SUN SHADING

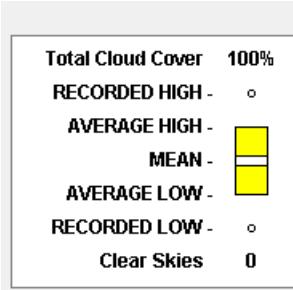
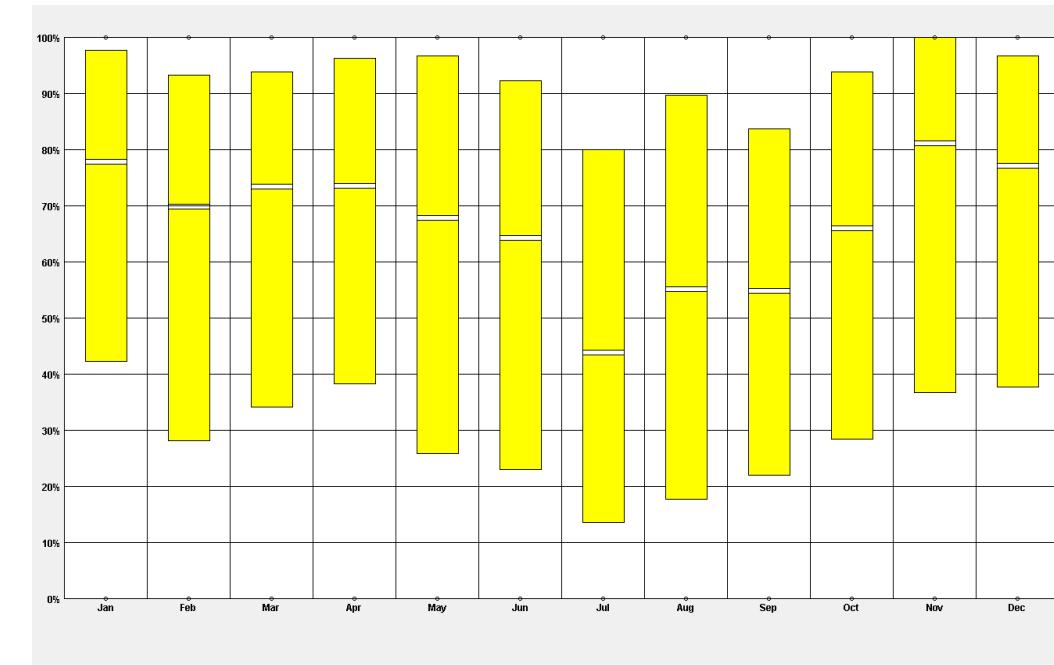


WHAT DO THESE CHARTS TELL US?

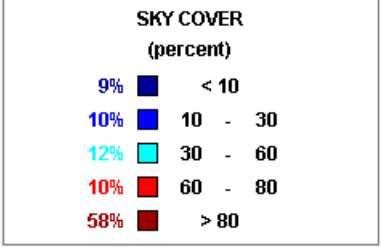
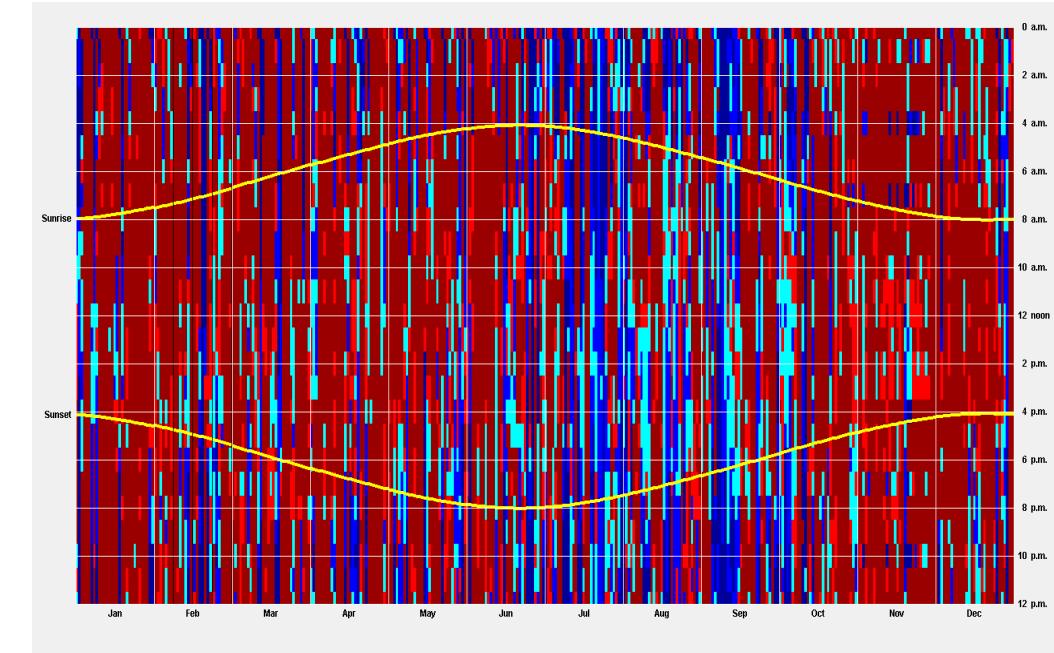
Unsurprisingly for the pacific northwest, the sky is cloudy on Vancouver Island for a significant portion of the year. In fact, there are very few days when there are no clouds. It will be important to consider this when providing windows for daylight. Additionally, this suggests that relying on solar heat gain for warmth in the shoulder months will likely be insufficient. Finally, it will be important to consider the sky cover when designing outdoor space. It is likely they will need to be covered to protect from precipitation in order to see frequent use.

Sky Cover¹

SKY COVER RANGE

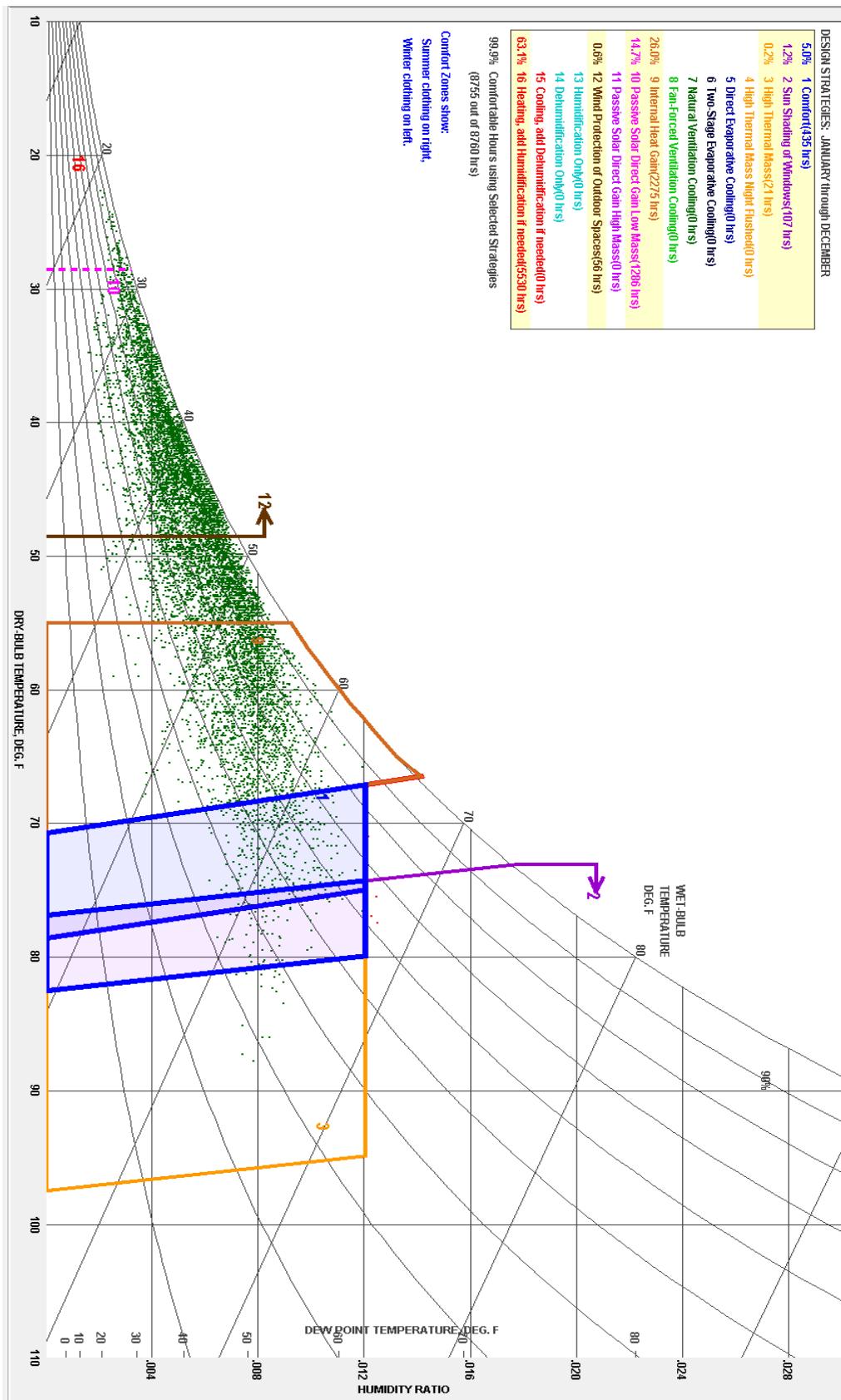


DAILY PERCENT SKY COVER



Psychrometric Chart¹

ANNUAL PSYCHROMETRIC CHART



WHAT DOES THIS CHART TELL US?

Each green dot represents an hour in the year and what the temperature and humidity levels are for that hour. Every dot that falls within the blue shaded region is in the comfort zone where no heating or cooling is needed. All of the dots outside of that range are uncomfortable points of time. Through the use of passive design strategies (like the ones listed on the following page), it is possible for the building to be comfortable for 47.7% of the year without any heating. For the rest of the year, active heating systems will be needed. Cooling will never be needed for human comfort.

BASED ON THE RESULTS FROM THE CLIMATE ANALYSIS, IT IS RECOMMENDED THAT THE FOLLOWING STRATEGIES ARE CONSIDERED IN DESIGN:

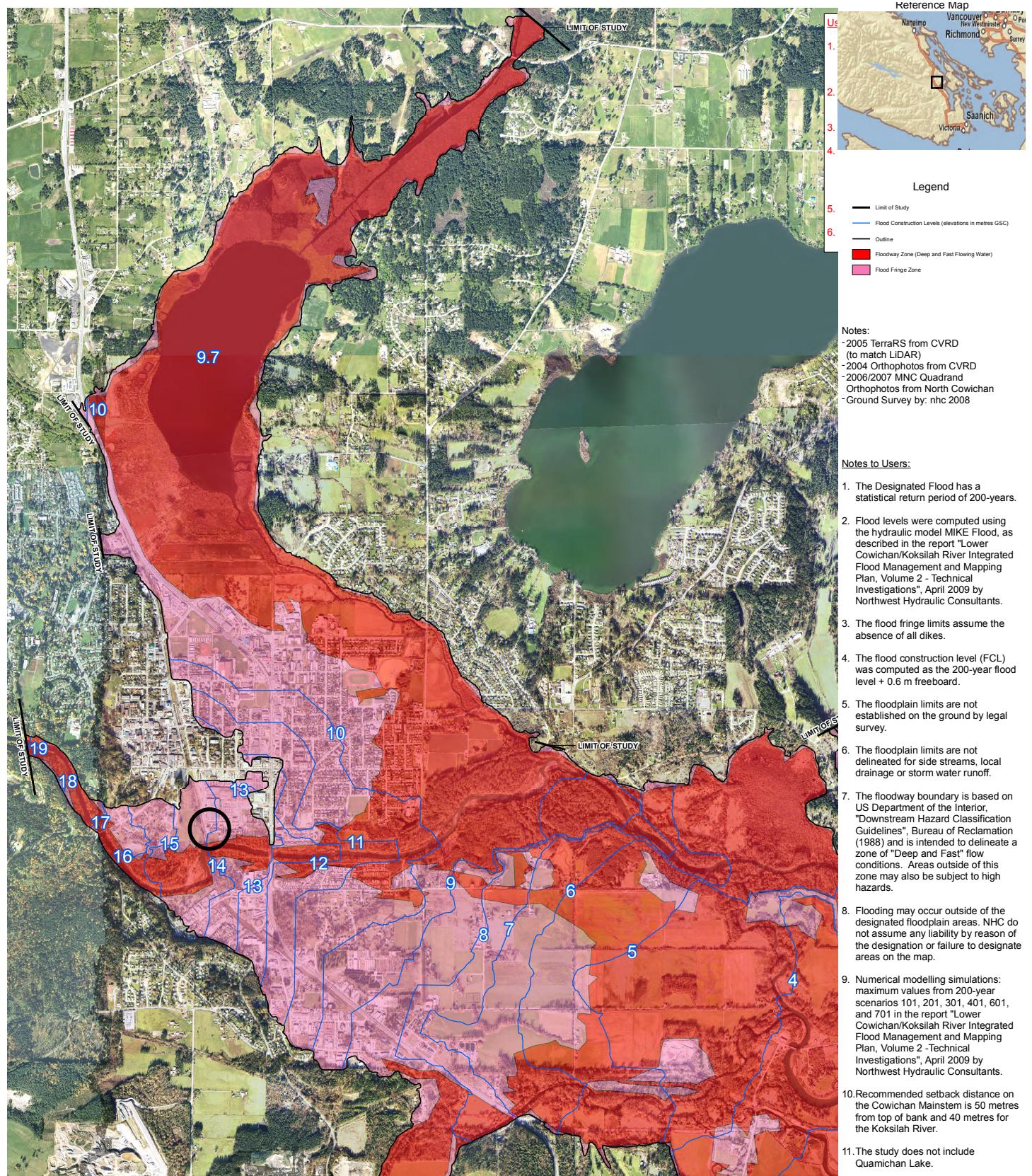
1. For passive solar heating, face most of the glass to the south to maximize winter sun exposure and design overhangs to shade in summer.
2. Provide double pane high performance glazing (Low-E) on west, north, and east, but clear on south for maximum passive solar gain.
3. Lower the indoor comfort temperature at night to reduce heating consumption.
4. Keep the building tight and well insulated to reduce heating needs by containing heat gain from lights, occupants, and equipment.
5. Tiles or slate (even on wood floors) will likely provide enough surface mass to store winter daytime solar gain and summer nighttime ‘coolt’
6. High efficiency heaters or boilers (at least Energy Star) should prove cost effective in this climate.
7. Sunny, wind-protected outdoor spaces are a good strategy in this climate to extend occupied areas in cool weather (enclosed patios, courtyards, etc.).
8. Small well-insulated skylights (less than 5% of roof area in overcast climates) are a good strategy to reduce daytime lighting energy loads.
9. Organize the floor plan so the winter sun penetrates into daytime use spaces.
10. Locate storage areas or garages on the side of the building facing the coldest wind to help insulate the more populated spaces.
11. Trees (neither conifer or deciduous) should not be planted in front of passive solar gain windows.
12. Insulating blinds, heavy draperies, or operable window shutters will help reduce winter night time heat losses if automatically controlled.

Site in Flood

Plain²

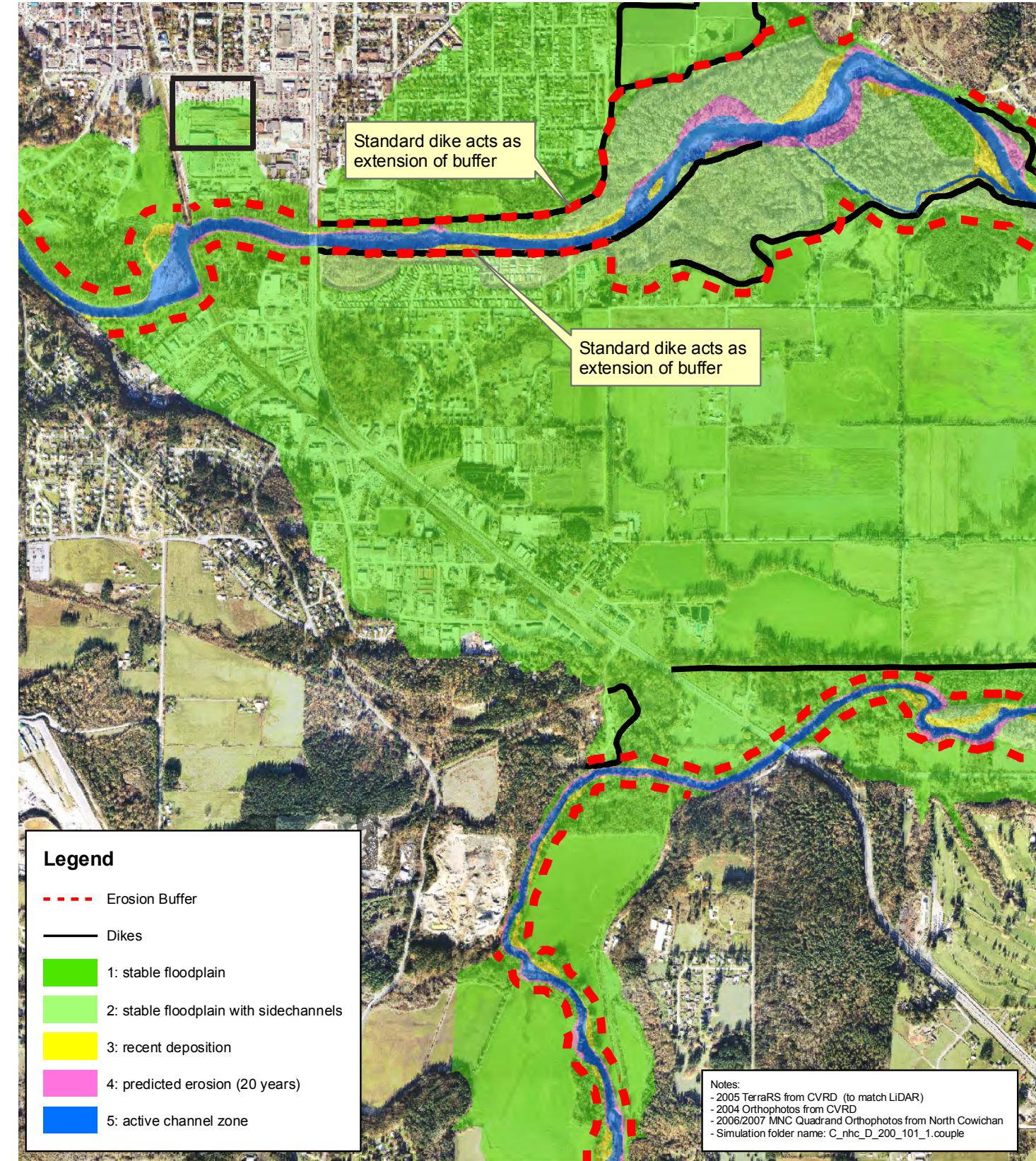
WHAT DOES THIS MAP TELL US?

The following map shows the site of Vancouver University building (marked in black) in the flood fringe zone (light red) of a 200 year flood plain in the Cowichan Valley. The flood fringe limits assume the absence of all dikes. The flood plain hazard map has been developed from data of river surveys in 2008. It shows minimum designated floodplain boundaries but flooding may occur outside these limits as well. Our site is located next to the Cowichan River creek which is a part of the floodway zone(dark red).



WHAT DOES THIS MAP TELL US?

The following map shows the existing flood control measures in form of two standard dikes :Duncan dike and North Cowichan South side dike(marked in black) around the site. The site is situated on a stable flood plain (green) with the dikes acting as an extension of the buffer. The two dikes upstream reduce flooding exposure of the buildings downstream. Water from these dikes are pumped out by Lakes Rd Flood Pump Station (North Cowichan), Beverly Street Flood Pump Station (North Cowichan) and Marchmont Flood Pump Station (City of Duncan).



Existing

flood control

measures²

Proposed flood control projects

3

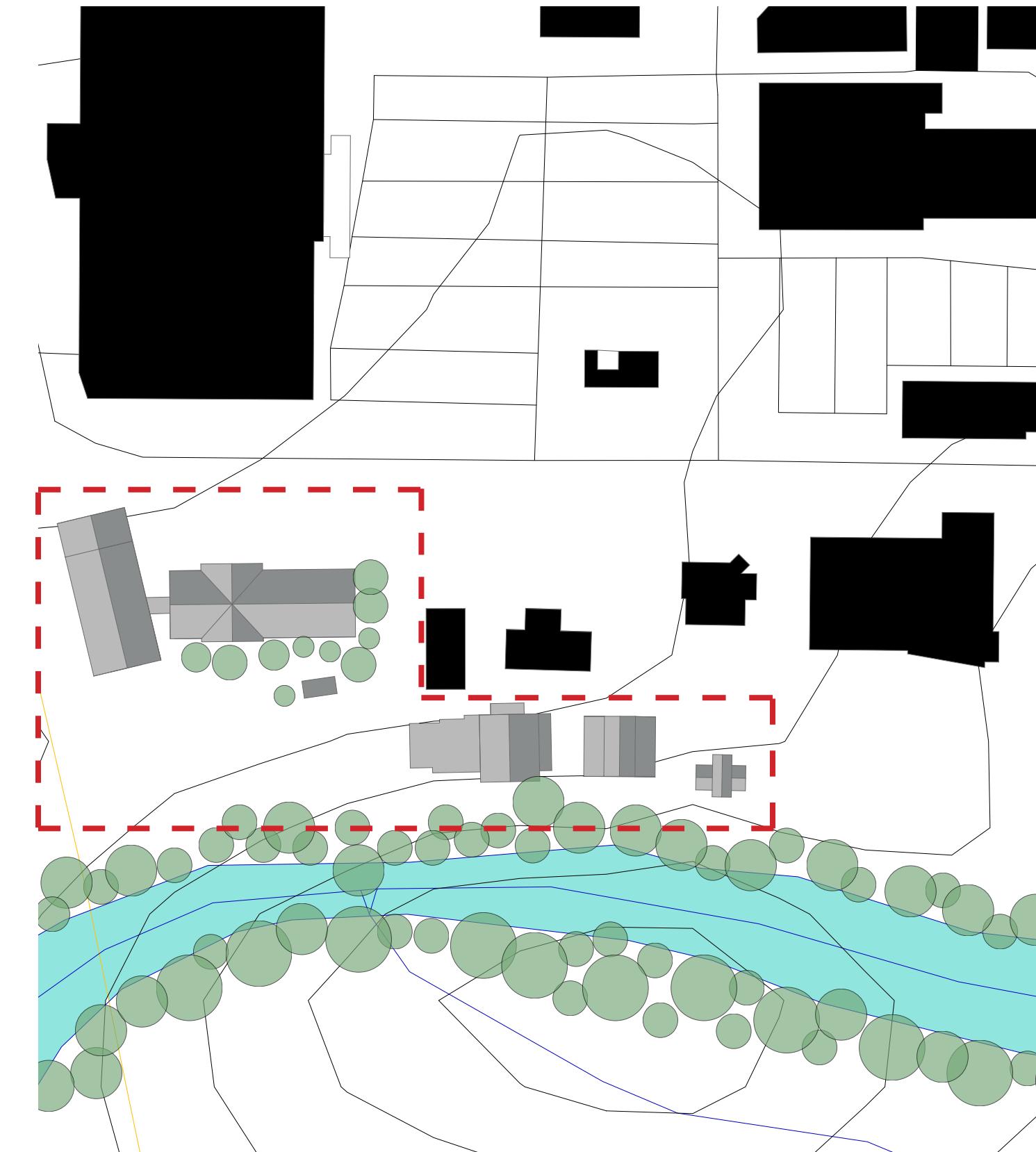
WHAT DOES THIS MAP TELL US?

This map shows new proposed infrastructure upgrades that will shift the floodplain levels away from the site. In mid 2009, the Integrated Flood Management Plan (IFMP) was completed. It predicted higher flood levels and outlined the actions needed to reduce the flood risk. The plan recommended the raising of existing dikes, construction of new dikes, and regular removal of gravel and log jams in the Cowichan River. The maps make it clear that flooding can be a potential disaster risk along with soil erosion and so the design has to account for that.



WHAT DOES THIS MAP TELL US?

The following site plan shows the location of The Vancouver University Building and the Comeakin house in context of Duncan. It marks the distance of the site from a riparian habitat (blue) and the nearest transportation infrastructure (yellow). It also shows that the site is on largely flat terrain with a slight slope towards the wetlands. One approach to the site is from the main road while the other approach is from a back road. Due to proximity with a flood risk zone, the design has to incorporate flood adaptation measures like dismantlable structures, raised platforms.



Existing site

Cultural Analysis



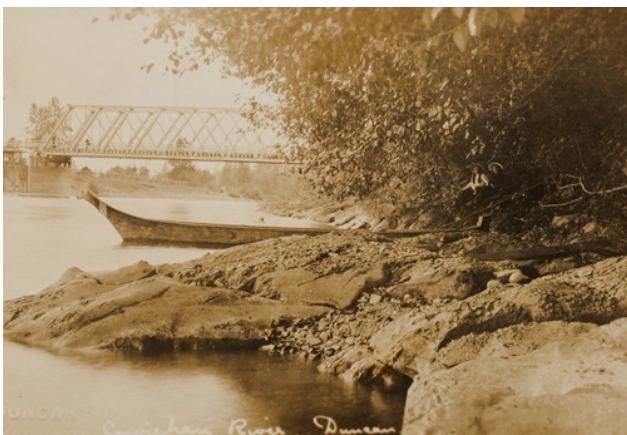
Overview of Cowichan Tribes¹

POPULATION: 5,000+ Members

LANGUAGE: Hul'qumi'num

RESERVE AREA: 24 square km

LOCATION: Cowichan Valley Region, Vancouver Island, BC, Canada



The Cowichan Tribes is the largest single First Nation Band in British Columbia. They are part of a larger first nations group referred to as the Coast Salish People. The Cowichan Tribes consists of seven traditional villages: Kw'amutsun, Qwum'yiqun', Hwulqwselu, S'amuna', L'uml'umuluts, Hinupsum, Tl'ulpalus. About 50% of the population lives on the reserve.

The Cowichan people are said to be “those who fell from the skies”, part of an ancestor myth that account for the origin of the race. Legends with magic, supernatural beings, and speaking animals play an important part in Native culture.

Located on the traditional lands of the Cowichan First Nation, the city of Duncan is Canada’s smallest city. Nowadays, it is known as the City of Totems serves as the urban center and the “heart of the Cowichan Valley.”



Cowichan Traditions ²

THE COWICHAN TRIBES HAVE MAINTAINED MANY TRADITIONS AND CEREMONIES THAT ARE STILL PRACTICED TO THIS DAY.

ORAL STORYTELLING

The Cowichan have a strong tradition of passing down knowledge and stories of the First Ancestors orally. This is often done by the Elders.

CEREMONIES

Elders Welcome: Special guests are blanketed and scarves are put around their heads, and led in by a procession of Elders, also wearing blankets and scarves, while singing and drumming in the traditional style.

Blanketing Ceremony: Performed to show respect for those who have made an important contribution to the Cowichan community. The respected guest is draped with special blankets in front of witnesses, and it is theirs to keep.

Witnessing: In the past, individuals of the audience were called to become witnesses during significant agreements due to oral nature of records. In modern days, agreements are no longer passed purely orally, but the tradition of calling upon witnesses to observe the proceedings is kept.



Cowichan Traditions ³

TRADITIONS SUCH AS KNITTING, CARVING, CANOE BUILDING, SINGING, AND DANCING HAS PERSISTED THROUGH TIME.

COWICHAN SWEATER

Originated in the late 19th century, the Cowichan sweaters and knitters are recognized by Canada as nationally and historically significant. They are made of bulky, unprocessed home-spun wool that is knit in one piece. Usually two or three natural wool colors are used to create both unique geometric and non-geometric patterns.

CARVING

Known as the Mother Tree by Indigenous, the Western Red Cedar tree is commonly used for carving totem poles and canoes. Totem poles were often created to create a permanent record of historical events. When a tree is chosen, there are ceremonies to celebrate the “rebirth of the tree” and the “spiritual connection between man and tree”.

CUISINE

The Cowichan Tribes still maintains the tradition of fishing by spear, on top of using more modern equipment. Traditional foods and plants are harvested for food and ceremonial purposes. Food, such as smoked salmon, are also prepared traditionally.



Self-Government ⁴

THROUGH SELF-GOVERNMENT AND AN EXPANSION OF THE LAND RESOURCE BASE, THE COWICHAN TRIBES ARE A SELF-SUSTAINING COMMUNITY-DRIVEN ORGANIZATION.

CHIEF AND COUNCIL

The Cowichan Tribes is governed by an elected Chief and 12 councilors with elections held every second December in odd years. This means every council and chief serves two years. They meet at least two times a month to employ the tribe's long-term objectives and mission statement.

SELF GOVERNMENT AND TREATY

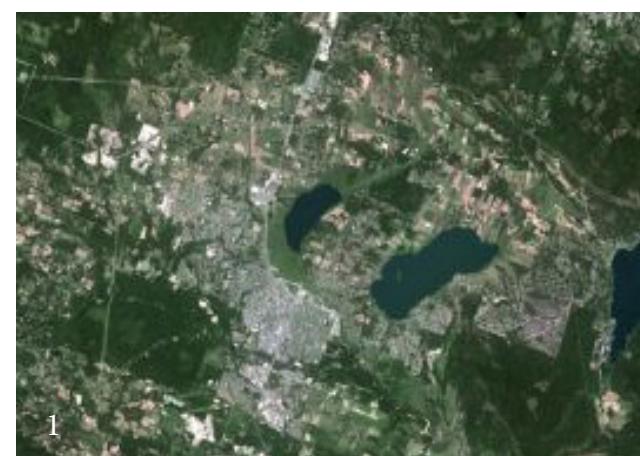
Historically, Canada and colonial governments have dismissed the tribes' governance structures. This has caused the Cowichan Tribes to assert their jurisdiction and responsibility for the governance and institution of their people. With their continued fight, their assertion has been supported by international agencies and courts. In 2014, Tsilhqot'in Nation's Aboriginal title case allowed Aboriginal title to lands outside of a reserve.

Although operating independently, for the purpose of treaty negotiations, Cowichan Tribes is part of the Hul'qumi'nom Treaty Group and are in Stage 4 of the Treaty Process.



Economy ⁵

COWICHAN TRIBES AND ITS SUBSIDIARY, KHOWUTZUN DEVELOPMENT CORPORATION, GENERATE REVENUE THROUGH TAXING, LICENSING AND ECONOMIC DEVELOPMENT.



EXPENDITURE

The Tribes focus on providing public works on Cowichan Reserves with a focus on eliminating health and safety hazards, preserving and protecting facility, and operating and maintaining recreation facilities. The Tribes are a significant economic contributor to the region, employing over 700 people in combined operations; making them one of the largest employers in the region.



Significance of Materials⁶

These direct quotes from the book “Those Who Fell From the Sky” by Daniel P. Marshall provide a look into which materials place a significant role in the culture of the Cowichan. These quotes are about Cowichan folklore and history.

QUOTES

Page 53: “Used as the fundamental building block in Northwest Coast communities for canoes, masks, clothing, and longhouses, the **cedar tree** also provided spiritual healing properties when the boughs were used to “brush off” emotional problems from people” (Marshall, 1999).

Page 74: “Some of the holy people were upset about that because **cedar** and **hemlock** are sacred and **arbutus** is blessed and **balsam** is holy, and destruction is a sin, but when people have smelled a lot of blood their brains go funny, and they lit the bush” (Marshall, 1999).

Page 53-54: “In recent local archaeological digs, a unique form of volcanic rock, known as **obsidian**, prized for its cutting properties, has been found in the shape of arrowheads” (Marshall, 1999).

Page 50: “While the transformer left stone monuments throughout the natural landscape, the Cowichan would now make their own marks too- indelible impressions upon the soft **sandstone** of the Gulf Islands and beyond” (Marshall, 1999).



Material Applications⁷

These materials can be considered for use in the construction, decoration, landscaping, or interior detailing of the cultural center to pay homage to materials that have played a role in the Cowichan culture for centuries.

CEDAR

A lightweight but durable, decay resistant soft wood that darkens with age. Great choice for decking, siding, roofing, and other outdoor applications.



HEMLOCK

A high strength, wear-resistant, soft wood that hardens with age. Used for windows, doors, moldings, and stairs.

ARBUTUS

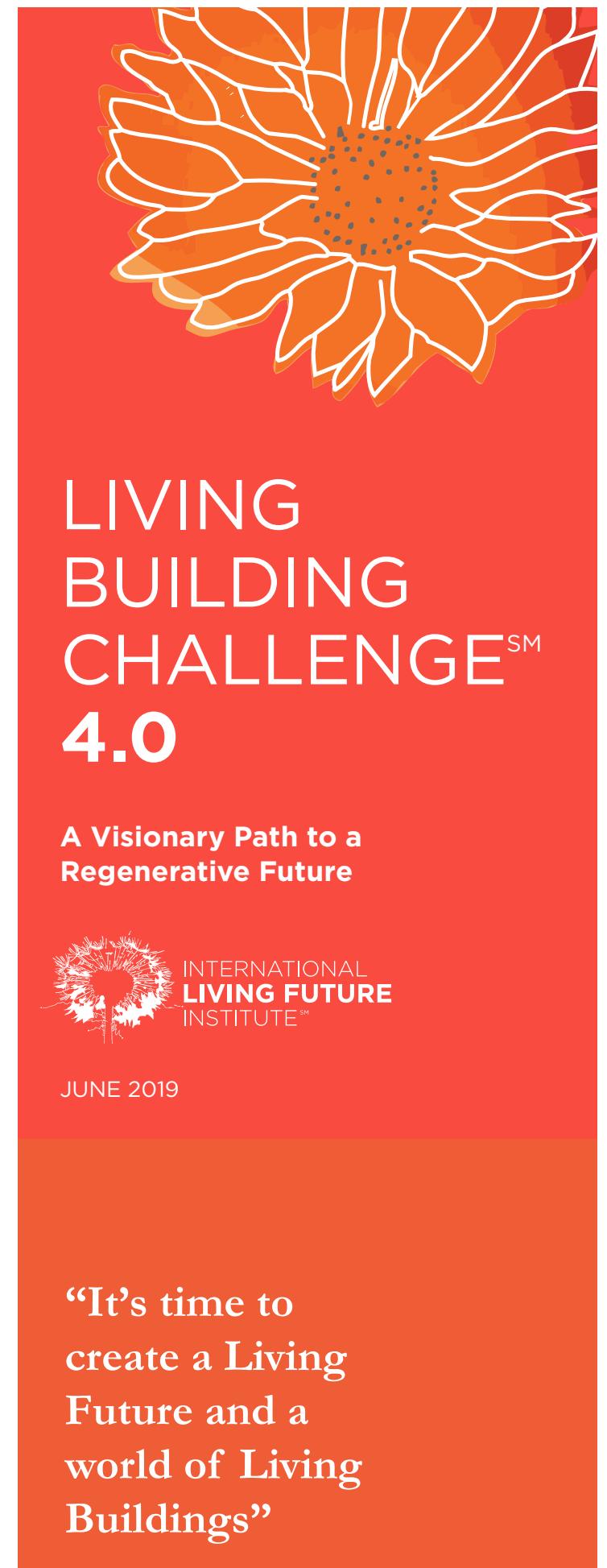
A fine textured, dense, heavy hard wood that is also known as Madrone. Used in decorative veneer applications or flooring.

SANDSTONE

A common sedimentary rock composed of mineral, rock, or other organic material. Used in both interior and exterior stone applications..

OBSIDIAN ROCK

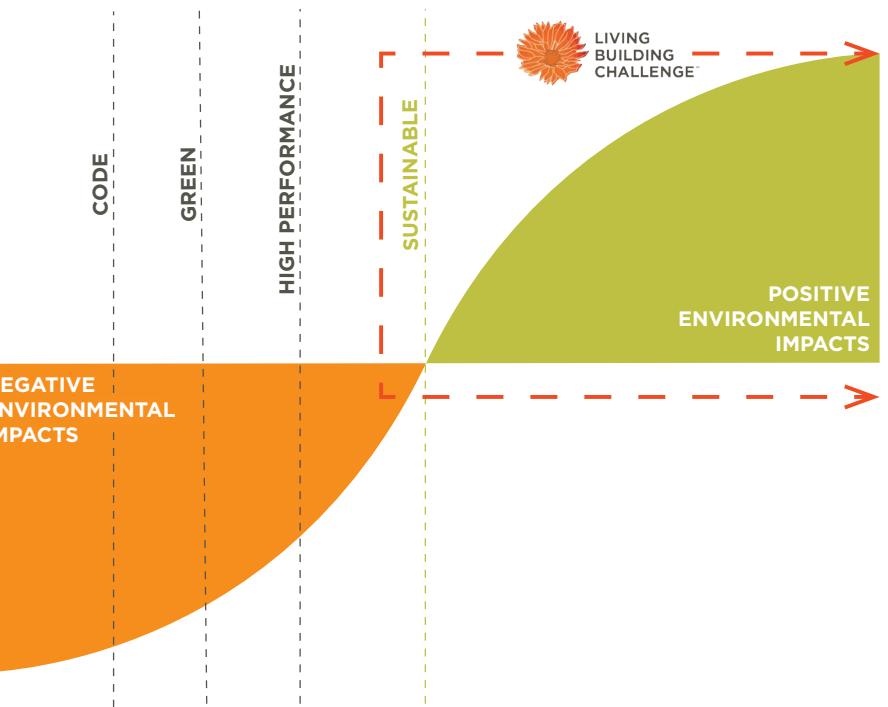
An igneous rock with a smooth, uniform texture. Used for decorative aggregates.



OVERVIEW OF THE LIVING BUILDING CHALLENGE

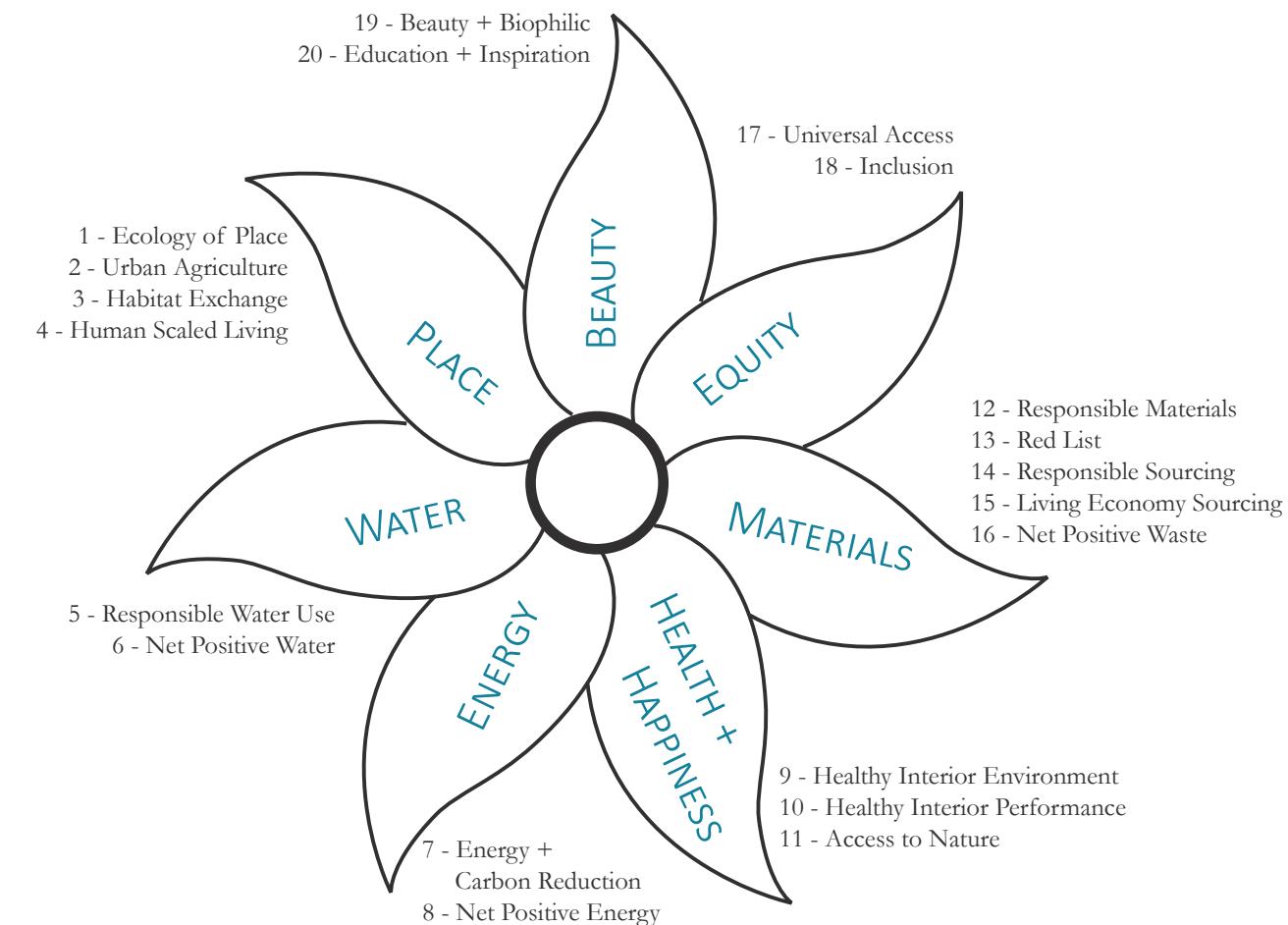
- The Living Building Challenge was born out of the idea that buildings should emulate the processes of nature. They should create all of their own energy, capture and treat all of their own water, leave behind no useless waste, and make the planet more beautiful and fair.
- The Living Building Challenge is operated and managed by the International Living Future Institute. They are responsible for awarding the certifications and for maintaining and updating the standard. You can find more information about them at this website: <https://living-future.org/>
- The LBC is holistic and addresses all aspects of the project from energy & water to aesthetics & equity.
- Projects that can claim Living Building Challenge Certification are considered to be the greenest buildings on the planet.
- Other building certification standards have resulted in High Performing Buildings that only lessen the negative impact of construction on the natural environment. The Living Building Challenge seeks to go beyond this and envisions buildings that are creating good for the world by having positive net environmental impacts
- Unlike other building certification standards, LBC Certification is based on actual performance. "Projects must be operational for at least twelve consecutive months prior to audit to verify Imperative compliance"
- To learn more about the Living Building Challenge, refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information or visit the website: <https://living-future.org/lbc/>

"The Living Building Challenge is a philosophy, certification, and advocacy tool for projects to move beyond merely being less bad and to become truly regenerative."



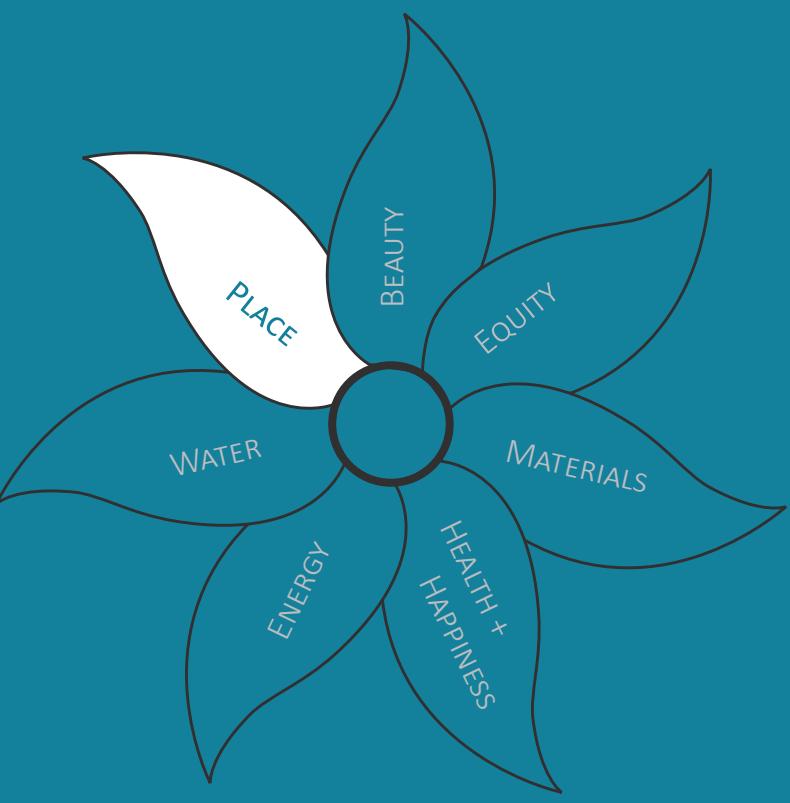
BREAKING DOWN THE CHALLENGE

"The Living Building Challenge consists of seven performance categories, or 'Petal': Place, Water, Energy, Health + Happiness, Materials, Equity, and Beauty." Each petal is further divided into Imperatives that can be applied to all building projects. Meeting these imperatives is critical to achieving certification for new building projects. For Interiors-only projects, only some of the imperatives must be addressed. The following pages dive into each imperative and illustrate how it might be possible to meet the requirements for the Cowichan Cultural Center. Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information. Also, refer to the appendix for specific examples of products and services related to each imperative



THE PLACE PETAL

“The intent of the Place Petal is to realign how people understand and relate to the natural environment that sustains us.” It seeks to establish guidelines by which people can create built interventions in the environment without doing harm to the land and its inhabitants. It also aims to support sustainable methods of travel, prevent sprawl, promote conservation, enhance ecosystems, and encourage consumption of local food. Please refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information about the Place Petal. Please also refer to the Appendix for additional resources regarding each imperative that might be useful to you in your pursuit of Living Building Certification.



Place

PLACE PETAL

CORE IMPERATIVE

01 Ecology of a Place

INTENT

To protect wild and ecologically significant places and encourage ecological regeneration and enhanced function of the communities and places where projects are built.

OVERVIEW OF REQUIREMENTS*

- Avoid building on pristine greenfield, wilderness, prime farmland or in a floodplain unless they meet an exception.
- Preserve thriving vibrant ecological environments and habitats.
- Document site and community conditions prior to the start of work.
- Demonstrate that they contribute positively to the ecology of their place and restore or enhance the ecological performance of the site towards a healthy ecological baseline.
- Assess cultural and social equity factors and needs in the community and consider those identified needs to inform design and process decisions.
- No petrochemical fertilizers or pesticides can be used for the operation and maintenance of the on-site landscape, including urban agriculture.



DESIGN STRATEGY: BROWNFIELD RESTORATION¹

Restore contaminated brownfield sites by removing asphalt and planting native landscapes.



DESIGN STRATEGY: INDIGENOUS ECOSYSTEMS AND GRAY WATER TREATMENT²

Use indigenous systems like constructed wetlands to provide on-site gray water treatment and also enhance biodiversity.



DESIGN STRATEGY: ON SITE LANDSCAPE³

Emulate the functionality of indigenous ecosystems with regard to density, biodiversity, plant succession, water use, and nutrient needs.

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.



Burdock



Comfrey



Devil's Club



Liquorice Fern



Plantain



Rosa Nutkana



Snowberry



Sword Fern



St. John's Fern



Yellow Dock



English Holly



English Ivy



Himalayan Blackberry



Periwinkle



Scotch Broom



Yellow Archangel



Yellow Iris

PLACE PETAL

IMPERATIVE 02

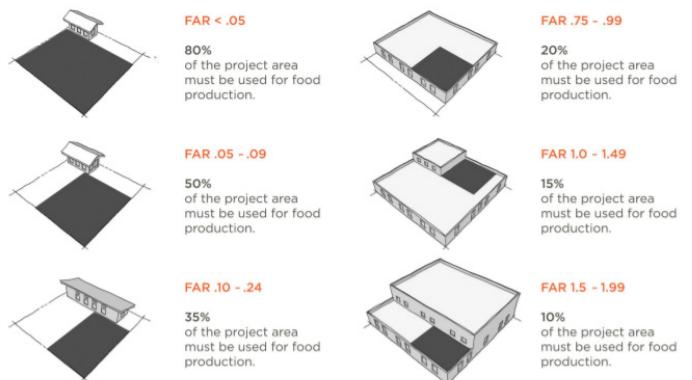
Urban Agriculture

INTENT

To integrate opportunities for connecting the community to locally grown fresh food where projects are built.

OVERVIEW OF REQUIREMENTS*

- Dedicate a portion of their total project area to growing food.
- Or dedicate a smaller portion of their total project area to growing food and must also directly provide weekly community access to healthy local food that address a community need, through farmers markets, CSA programs or other local food producers



*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.



DESIGN STRATEGY: GREEN INFRASTRUCTURE¹

Undulating green roofs with native flora invite local fauna and enhance biodiversity and complexity.



DESIGN STRATEGY: BOTANICAL GARDENS²

Botanical gardens with medicinal plants and herbs or fruit orchards provide opportunities for agroforestry.



DESIGN STRATEGY: INTERIOR LANDSCAPE³

Greenhouses, vertical gardens, hydroponics, aquaponics provide opportunities for interior productive landscaping.



FARMING PATCH NEAR AMPHITHEATER⁴

Local nurseries supplied native berry bush varieties that were planted in courtyards and near the amphitheater steps so that they can be looked after by students.



HYDROPONICS⁵

For sites with limited outdoor area, hydroponics provides opportunities to meet LBC demand and grow plants indoors.



STUDENT/ RESIDENT RUN GARDENS⁷

The harvesting of on-site produce can be done largely by residents or users. The harvest can be used for widely-promoted campus events.

CLASS OF 1966 ENVIRONMENTAL CENTER AT WILLIAMS COLLEGE¹⁰

The LBC project is developed from an existing site. Previously lawned slopes are divided into three landscape areas. One part consists of farming beds near the entry, the courtyard and the amphitheater. Second part includes the Orchard, Berry Rows, Perennial Herbs & Vegetable Gardens and the Student Garden. The Regenerative Landscape includes the ponds and rain gardens, constructed wetland and meadow landscape. Each landscape type incorporates some level of agricultural practice, which is the main connective design element of the site. Over all the project has 35% urban agriculture initiatives. Due to shortage of large farm lands, these landscaped areas are divided into smaller patches, each with a different intention and function.



ROOF TOP FARMING⁶

Some part of the terrace can be used for growing vegetables and fruits in case of flat roof buildings.



POLLINATOR GARDENS⁸

The pollinator gardens can attract beneficial insects to the site. Seeds purchased from local nurseries help to insure that they are regionally climate and bio-system appropriate.

PLACE PETAL

IMPERATIVE

03

Habitat Exchange

INTENT

To protect land for other species as more and more land is taken for human use

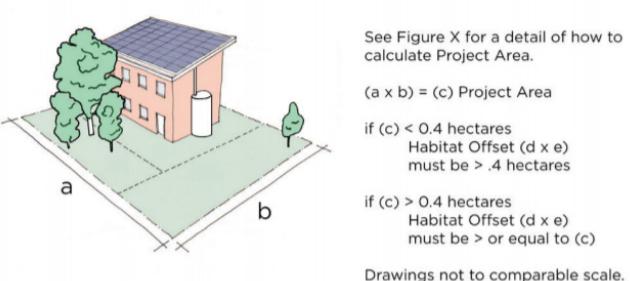
OVERVIEW OF REQUIREMENTS*

- Set aside land equal to the project area (or 0.4 hectares/1 acre, whichever is greater) 10 away from the project site, in perpetuity, through an approved Land Trust organization or the Institute's Living Future Habitat Exchange Program.
- For most projects, restoring or protecting a parcel of land on site, though commendable, does not comply with this Imperative



DESIGN STRATEGY: LIVING FUTURE HABITAT EXCHANGE PROGRAM²

ILFI aggregates funds from participating teams in order to make a more substantial annual purchase of high-value, intact ecosystem in partnership with the Wildlife Conservation Society.

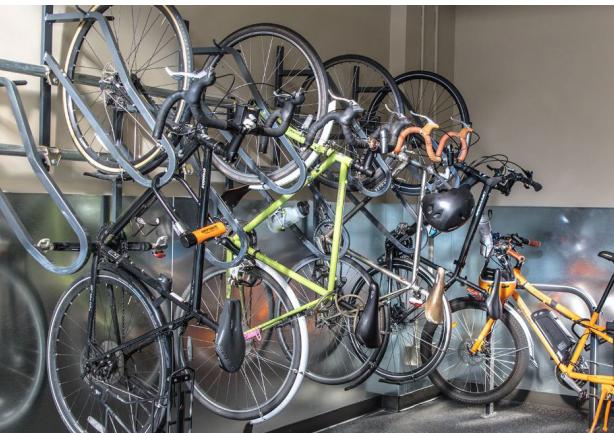


*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.



DESIGN STRATEGY: APPROVED LAND TRUSTS¹

Require that the land or easement be controlled by an accredited Land Trust (Canada Land Trust Alliance) to ensure that the area is protected and cared for in perpetuity.



DESIGN STRATEGY: ENCOURAGE BIKING¹

Provide secure bike storage and facilities such as showers and lockers to enable employees to easily commute to work via bicycle.



DESIGN STRATEGY: ENHANCE PEDESTRIAN ROUTES²

Provide enhancements to walking paths such as covers for protection from weather or plantings.



DESIGN STRATEGY: ACCESS TO EVs³

Provide access to shared electric vehicles on site that building occupants can borrow.

PLACE PETAL

CORE IMPERATIVE

04

Human Scaled Living

INTENT

To reduce the use of fossil fuel powered vehicles by encouraging the creation of walkable, pedestrian oriented communities through density of the site and supporting a human-powered lifestyle

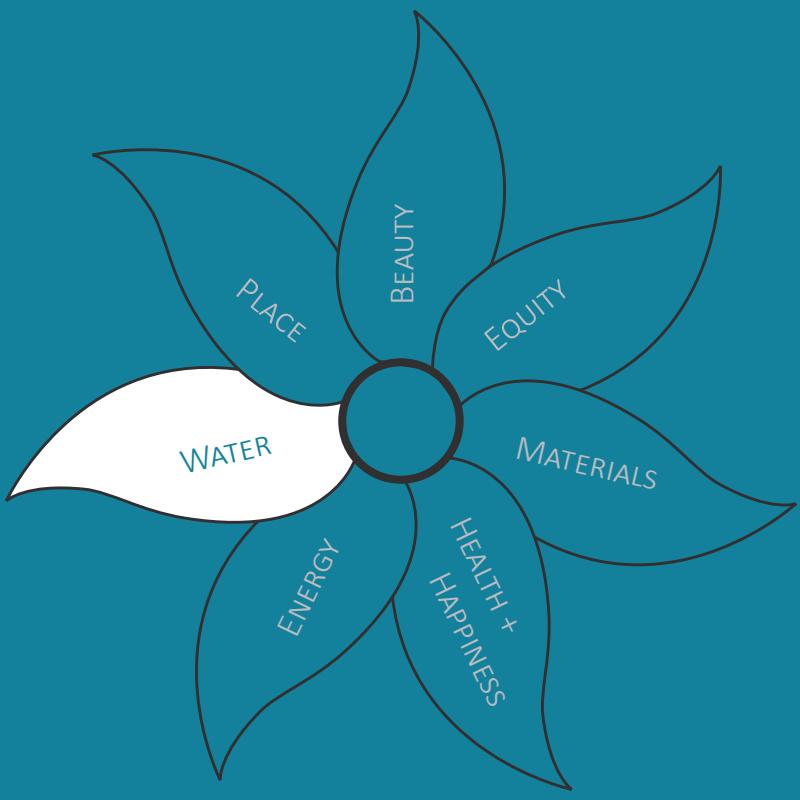
OVERVIEW OF REQUIREMENTS*

- Design to support neighborhood & community gathering
- Provide secure, weather protected bike storage and facilities such as showers and lockers to encourage biking.
- Provide at electric vehicle charging spaces (min 2).
- Minimize surface parking & divide parking up with planted areas.
- Reduce single-occupancy vehicle trips by 30%
- Implement four of the following best practices:
 - Enhance pedestrian routes
 - Advocate for human-powered and public transportation
 - Subsidize transit for building occupants
 - Support coordination for carpooling
 - Provide access to car sharing or electric vehicle
 - Regularly survey building occupant vehicle usage

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

THE WATER PETAL

“The intent of the Water Petal is to realign how people value water; to address the energy and chemicals involved in transporting, purifying and pumping water; and to redefine “wastewater” as a precious nutrient and resource.” It seeks to address the limited availability and energy intensity of potable water by encouraging closed loop systems that harvest and reuse water. In this way, buildings can reduce water consumption and energy usage. Please refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information about the Water Petal. Please also refer to the Appendix for additional resources regarding each imperative that might be useful to you in your pursuit of Living Building Certification.



Water

WATER PETAL

CORE IMPERATIVE 05 Responsible Water Use

INTENT

To encourage projects to treat water like a precious resource, minimizing waste and the use of potable water, while avoiding downstream impacts and pollution.

OVERVIEW OF REQUIREMENTS*

- Must not use potable water for irrigation
- Must use 30% less water (for existing building and interiors) for the project's other needs than a baseline regional building of the same type (50% less for new buildings).
- All projects must treat all storm water on site through natural or mechanical means (without chemicals).
- Manage all storm water based on both pre-development hydrology and current ecological conditions, as determined by a qualified professional.
- All projects on a Combined Sewer (CS) system, or in a floodplain must incorporate storm water detention and avoid sheet flow off the site.



DESIGN STRATEGY: RAIN-GARDENS²

Manage storm water by designing hardscape of permeable pavers and gravel, with rain-gardens and bioswales to treat and infiltrate runoff.



DESIGN STRATEGY: LOW-FLOW FIXTURES³

Reduce water demand by using low-flow fixtures such as toilets, urinals, shower heads, and faucets.



DESIGN STRATEGY: GRAYWATER REUSE¹

Use graywater (such as from sinks, showers, washing machine, etc.) for landscaping purposes or treated and disinfected for reuse.



NATIVE PLANT EXAMPLE: FLOWERING RED Currant⁴



ECOSENSE RESIDENCE IN VICTORIA⁵

IRRIGATION WATER REDUCTION

The city of Duncan experiences extreme seasonal variation in monthly rainfall, as it tends to have rainy winters and dryer summers.

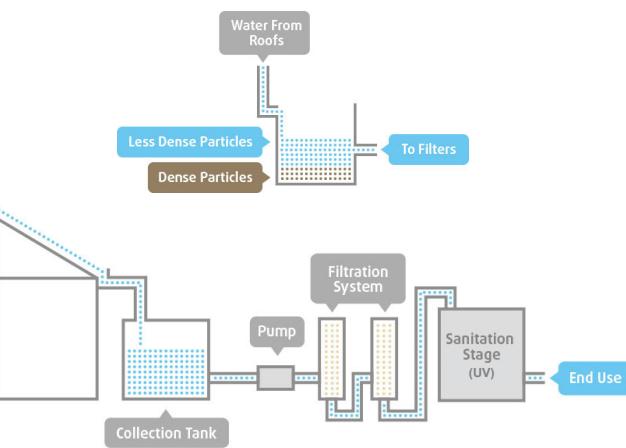
In order to achieve using no potable water for irrigation, xeriscaping strategies can be used. Native plant species such as the flowering red currant that are well adapted to the local climate would be ideal. Using nonpotable water, such as graywater for irrigation is also acceptable.

For this project, using native plants also helps to celebrate the Cowichan Tribes traditions and cultural. Native plants can be found at local nurseries (see appendix).

WATER USAGE BASELINE AND LOCAL REFERENCES

The LBC requires that the project must use a certain percentage less water compared to baseline regional building of the same type. Project teams can use the baseline data set provided by the Institute in the Water Petal Handbook (See Appendix for table) or one that they find more suitable for the region. Baselines may be calculated on a per square foot or per capita basis, but not a combination. Project teams are encouraged to use the gallons per capita per day as this typically is a more accurate measurement of water used.

Two projects in BC, Canada has successfully completed the water petal. One is the University Childcare Center located in Burnaby, BC. Another is Ecosense Residence located in Victoria, BC. These projects may serve as resource for references in the region.



STORM WATER FILTRATION PROCESS⁶

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

WATER PETAL

IMPERATIVE 06 Net Positive Water

INTENT

To ensure project water use and release to work in harmony with the natural water flows of the site and its surroundings.

OVERVIEW OF REQUIREMENTS*

- Supply one hundred percent of the project's water needs through captured precipitation or other natural closed-loop water systems, and/or through recycling used project water
- All water must be purified as needed without the use of chemicals.
- No potable water may be used for non-potable uses. If captured precipitation is not adequate to supply the needs of the project after all possible efficiency measures are applied, connection to the municipal water system is allowed.
- Address all gray and black water through on-site treatment and management through reuse, a closed-loop system, or infiltration. Projects that are not able to treat and manage on-site may use hand printing within the watershed.
- Must incorporate a resilience strategy to provide drinking water for at least a week for all regular building occupants through water storage on-site.

* Scale jumping strategies are allowed with some limitations

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.



DESIGN STRATEGY: RAINWATER HARVESTING ¹

Design the roof to capture rainwater in cisterns. Rainwater can be filtered and disinfected by ozone and UV to supply all water for the building.



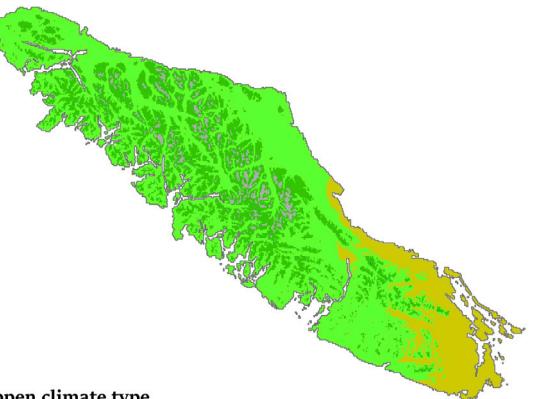
DESIGN STRATEGY: WATER STORAGE ²

Store water in correctly sized systems to ensure adequate supply throughout the precipitation seasons. Can also be part of the resilience strategy to provide drinking water.



DESIGN STRATEGY: COMPOSTING TOILETS ³

Use composting toilets treat waste on site to reducing water demand. Composted waste can be used as soil fertilizer.



Köppen climate type
■ ET (Tundra)
■ Dfc (Subarctic)
■ Cfc (Subpolar oceanic)
■ Cfb (Oceanic)
■ Csb (Warm-summer mediterranean)

DUNCAN CLIMATE: WARM-SUMMER MEDITERRANEAN ⁴



OMEGA CENTER: ECO MACHINE ⁵



COMPOSTING TOILET SYSTEM ⁶

PRECIPITATION IN DUNCAN

Rainwater can provide fairly clean and predictable source of water. It can be harvested from roofs or from any impermeable surface. Groundwater is also a common strategy, but the LBC requires that you must recharge the aquifer with an equal or greater amount of water as is withdrawn.

It is worthy to note that the other two buildings in BC that has received LBC certification both used rainwater harvesting to fulfill their water petal. Due to the precipitation rate and climate of the region, rainwater harvesting is the recommended method for providing water supply for this project. This can also be combined with the method of recycling used project water, which will be especially useful during months of the year with less precipitation.

GRAYWATER TREATMENT

Reusing graywater is a great way to conserve potable water. Graywater can be treated through filtration system and used for irrigation or toilet flushing. Non-chemical filtration systems can be biological or mechanical. Biological systems includes constructed wetlands or living walls. Mechanical systems includes sand filtration and UV radiation.

An example of an biological filtration system is the Eco Machine (Omega Center for Sustainable Living) that is meant to mimic processes of the natural world. The seven steps are, solid Settlement Tanks, Equalization Tanks, Anoxic Tanks, Constructed Wetlands, Aerated Lagoons, Recirculating Sand Filter, and Dispersal Fields. When the campus is open, the Eco Machine processes up to 52,000 gallons of water per day, running entirely on solar power.

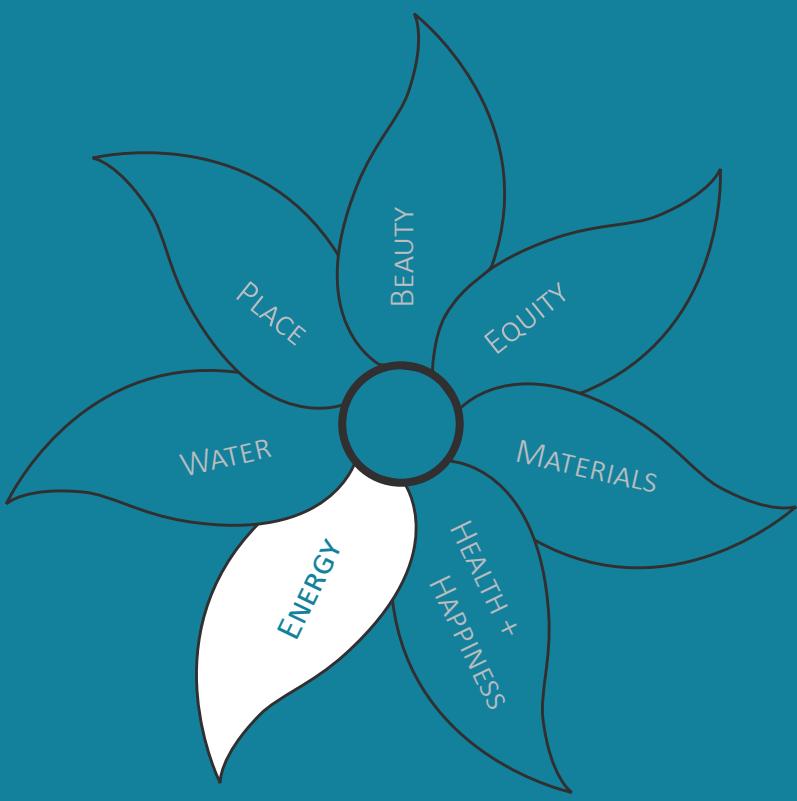
BLACK-WATER TREATMENT

Common black-water treatment includes septic tanks, and soil drain fields, and composting toilet systems. Most black-water treatment are essentially variations of the septic system approach. Although alternatives such as constructed wetlands can technically be a black-water treatment system, the permitting process may be more difficult. If such a system is desired, the project team may need to find appropriate city, county, or state department to discuss the system. Many LBC case studies listed in the Water Petal handbook uses the composting toilet strategy.

Generally, decentralized water system treatments varies widely. There is a fundamental trade off in the balance between system requirements for space and energy needed must be considered. Consult local water engineer for analyzing best solution for the site.

THE ENERGY PETAL

“The intent of the Energy Petal is to create new sources of renewable energy that allow projects to operate year-round in a resilient, pollution-free manner. In addition, the Energy Petal prioritizes energy efficiency as a means to reduce wasteful spending of energy, resources, and capital.” It seeks to encourage all buildings to become like plants in how they utilize only the energy they can harvest themselves. Please refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information about the Energy Petal. Please also refer to the Appendix for additional resources regarding each imperative that might be useful to you in your pursuit of Living Building Certification.



Energy

ENERGY PETAL

CORE IMPERATIVE

07

Energy + Carbon Reduction

INTENT

To treat energy as a precious resource and minimize energy-related carbon emissions that contribute to climate change.

OVERVIEW OF REQUIREMENTS*

- Limit net total annual energy consumption as compared to typical existing building with comparable climate, size, use and occupancy, and combustion must be limited as follows depending on state of building:
 - Establish baseline through tools such as Zero Tool, World Bank EDGE, or other approved tools.
 - See table 1 for specific statistics and requirements
- Meter energy used by project
- Reduce embodied carbon of primary materials compared to equivalent baseline by 20%** (New or Existing Building projects)
- Select interior material with lower than industry average carbon footprint for products with readily available embodied carbon data** (exception for Landscape + Infrastructure projects)
- Aim for decentralized energy infrastructure powered entirely by renewables.

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

**Refer to the v4.0 Energy Petal Handbook



DESIGN STRATEGY: SOLAR POWER ¹

Solar panels are a good and classic source of renewable energy. Some things to consider is the area available to install, angle of panels, orientation of panels, solar access, and efficiency.



DESIGN STRATEGY: WIND POWER ²

Wind power is another source of renewable energy with varying versions such as turbines ranging in size and output. This requires a consideration of average annual wind speed for the site, site size, aesthetics of wind turbines, and level of wind turbulence.

	New Building	Existing Building	Interior
Energy Reduction	70% reduction	50% reduction	35% reduction
Combustion	Not allowed (exception for imperative 08)	Allowed for HVAC systems that are not in the scope of the project. Phase out plan and advocacy are required.	
Renewables	Must be on-site to count towards the efficiencies above.		

TABLE 1:

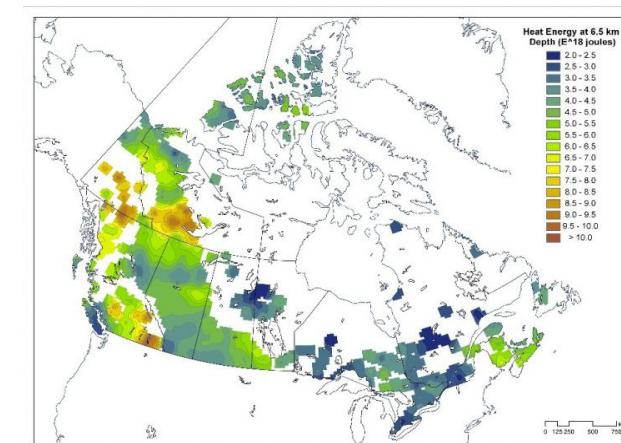
Figure shows the variable requirements for New, Existing, and Interior buildings. Specifically in regards to percentage of energy reduction, combustion limits, and renewable energy sourcing



DESIGN STRATEGY: MICRO-HYDRO TURBINES

Hydropower have been a reliable source of energy for centuries. Micro-hydro turbines produce up to 100kW and has a smaller required head distance (the measure of the vertical distance between the intake and turbine exhaust) of at least 3 feet. This is a good alternative to solar power if the location of site is does not get direct sunlight often. Micro-hydro turbines do not require a reservoir which is often an issue in regards to natural habitat. Micro-hydro turbines have little impact on surrounding ecology due to its use of water passing through the generator from the stream/river.

These turbines also require as little as two gallons per minute or a drop as low as two feet to generate electricity. Electricity can also be delivered a mile away to the location where it is being used. It also produces a continuous supply of electrical energy in comparison to smaller scale technologies. It can also be integrated with the local power grid so that power companies can buy back electricity overflow. Some drawbacks include distance from power source to building, stream size (flow rate, output, and drop), balance of system components such as inverter, battery, controller, transmission line, and pipelines. There will be low-power during the summer months due to less flow. An additional issue is the diversion of stream/river water from a portion of the stream. This needs to be in heavy consideration when planning this energy requirement.

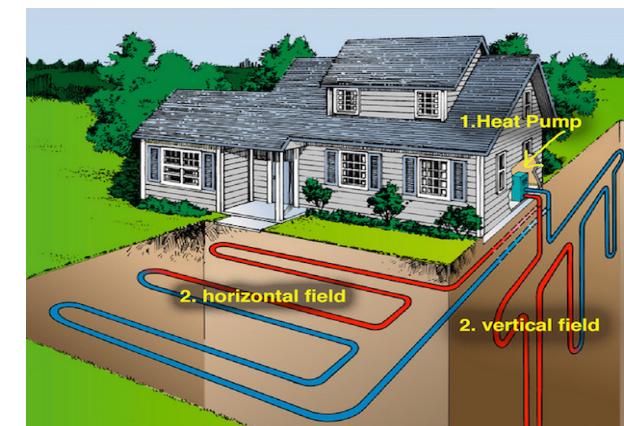


DESIGN STRATEGY: GEOTHERMAL DIRECT USE AND DISTRICT HEATING SYSTEM

Geothermal energy utilizes the earth's temperature, either near the surface in horizontal loops or deep into the earth with vertical bore holes. There are three types of geothermal systems: direct use and district heating systems, geothermal power plants, and geothermal heat pumps.

This is a good heating system to directly heat individual buildings or to heat multiple buildings with district heating systems. This process pipes warmed geothermal water to a heat pump which extracts the heat for space heating before it is circulated back into the coil and returned to the loops for reheating.

Some of the benefits of this system is that it is scalable. It is suitable for small houses or large commercial spaces. There is no cost fluctuation. This heat source is also not dependent upon weather or season.



Some drawbacks are the high upfront costs. This technology is also more suitable for new buildings due to large scale excavation. Electricity is also required to operate heat pumps. There are fewer installers than standard HVAC thus there is less competition in the market.

ENERGY PETAL

IMPERATIVE

08

Net Positive Carbon

INTENT

To foster the development and use of carbon-free renewable energy resources while avoiding the negative impacts of fossil fuel use, primarily the emissions that contribute to global climate change.

OVERVIEW OF REQUIREMENTS*

- Must supply 105% of project's energy needs through on-site renewable energy on net annual basis, without use of combustion.**
- Must sub-meter major energy uses.
- Must account for total embodied carbon emissions (tCO₂e) from construction (including energy used during construction) through utilization of carbon-sequestering materials and/or through a one-time carbon offset purchase through ILFI-approved carbon offset provider.**
- Must develop and incorporate a resilience strategy to allow building to be habitable for one week, or otherwise participate in support for local community in a disaster, through use of batteries, storage, etc.

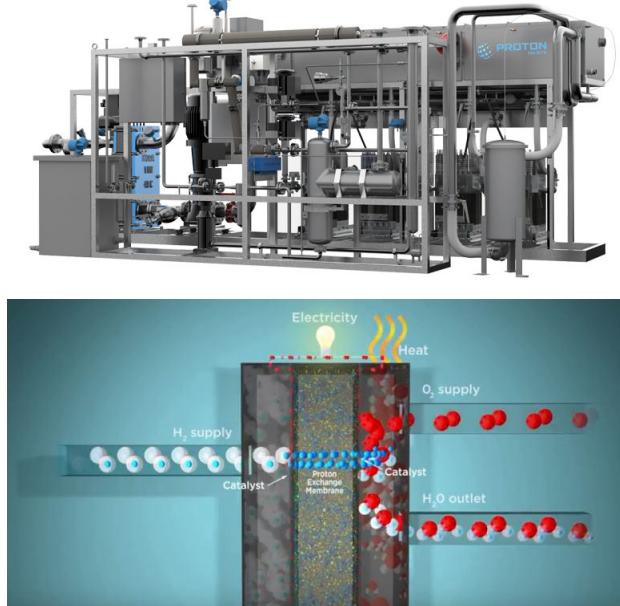


DESIGN STRATEGY: LOW CALCINED CLAY CONCRETE²

This alternative cement/concrete material allows a reduction of greenhouse gases in the material used for the building. Portland cement is an essential component of concrete, but is designated as a major greenhouse gas pollutant and generates 5% of human generated carbon dioxide. Changing this will allow for a lower tCO₂e of the project. Unlike fly-ash, clay-based concrete is recyclable and none of the production process requires coal combustion.

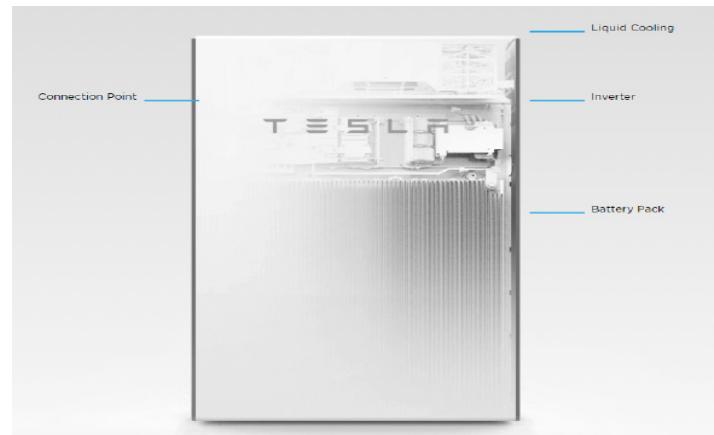
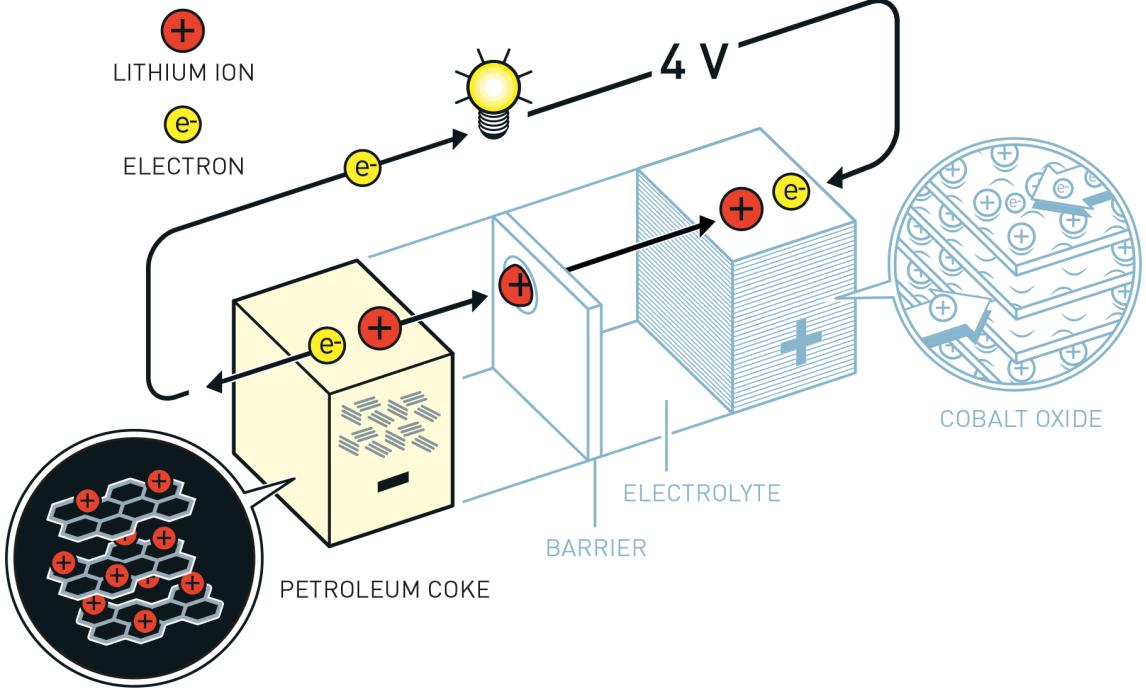
*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

**Refer to the v4.0 Energy Petal Handbook for specific information.



DESIGN STRATEGY: HYDROGEN POWER¹

A way to store energy is through a hydrogen electrolyzer and fuel cell stack. The electrolyzer is a device that uses electricity to break down water into hydrogen and oxygen. By breaking these down it allows for the fuel cell to take the hydrogen and oxygen supply and oxidize the hydrogen to create electricity and heat. The only waste product from this process is water which can be reused in this process. Hydrogen and oxygen can both be stored in fireproof containers before the fuel cells are used as a way to store power. Both electrolyzers and fuel cells can be found in many different sizes and different wattages for flexible applications.



DESIGN STRATEGY: BATTERIES³

The most common way to store energy in homes, especially homes that are off the grid, are batteries. Batteries come in many different specifications. The most common are lead acid batteries, lithium ion batteries, and saltwater batteries.

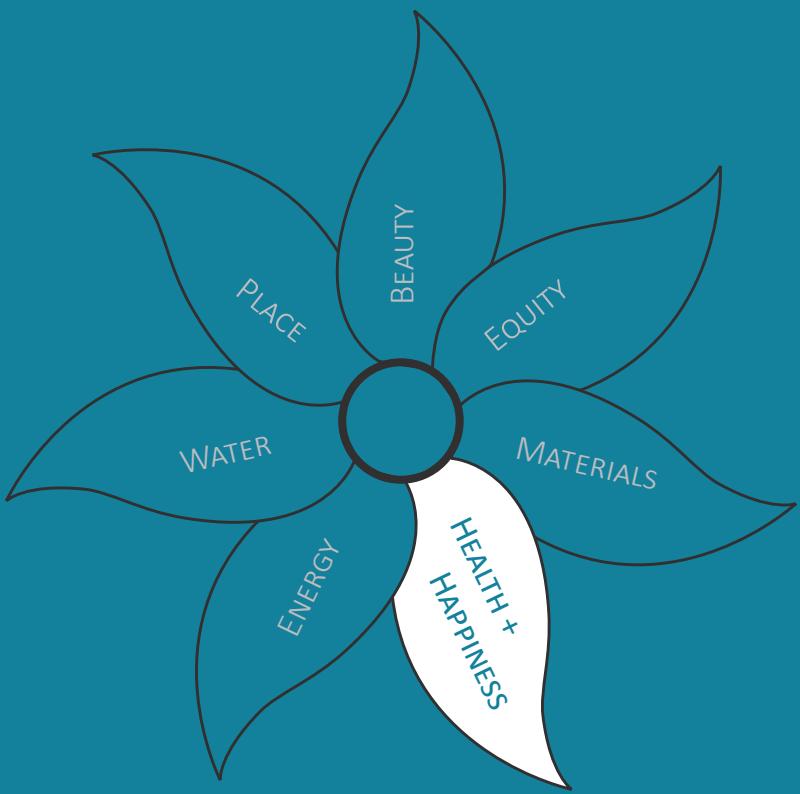
Lead acid batteries are the cheapest and most common batteries and have been used as an off-grid energy storage system for decades. In comparison to other battery types, they have a shorter lifespan and lower DoD, but they are one of the least expensive options on the market, especially in the home energy storage sector.

Lithium-ion batteries have a longer lifespan and higher DoD than Lead acid batteries, but they tend to be more expensive. It is important to note that they are recyclable and offer many environmental benefits when comparing them to the lead acid batteries. However, they are not perfectly environmentally friendly especially due to the mining and recycling processes.

Saltwater batteries are fairly new in the home energy storage industry. Because of the lack of reliance on heavy metals, these batteries can be easily recycled. This process utilizes saltwater electrolytes. Due to the newness of these batteries, these batteries are relatively untested.

THE HEALTH + HAPPINESS PETAL

“The intent of the Health + Happiness Petal is to create healthy spaces that allow all species to thrive by connecting people to nature and ensuring that our indoor spaces have healthy air and natural daylight.” It seeks to encourage designs which enhance occupants’ wellbeing and health to ensure beneficial human habitats are being created. Please refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information about the Health and Happiness Petal. Please also refer to the Appendix for additional resources regarding each imperative that might be useful to you in your pursuit of Living Building Certification.



Health + Happiness

HEALTH AND HAPPINESS PETAL

CORE IMPERATIVE

09

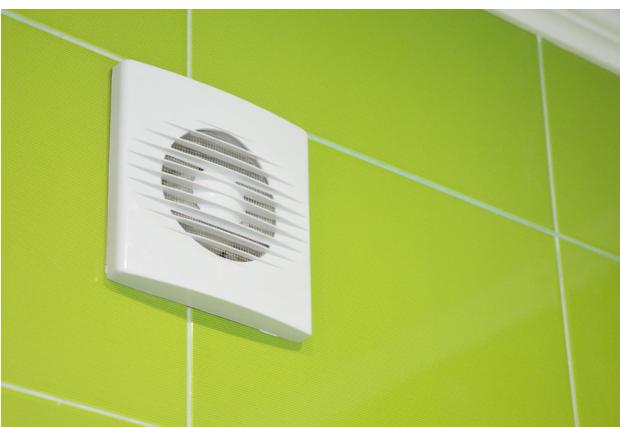
Healthy Interior Environment

INTENT

To promote good indoor air quality and a healthy interior environment for project occupants.

OVERVIEW OF REQUIREMENTS

- Comply with the current version of ASHRAE 62, or international equivalent.
- Prohibit smoking in enclosed spaces and within 25' of any building opening, including air supply vents.
- Develop a Healthy Indoor Environment Plan specific to the project's building type and location. The plan must address cleaning protocols, the prevention of particulates and toxins through an entry approach and implementation of at least one strategy to improve air quality.
- Provide views outside and daylight for 75% of regularly occupied spaces.
- Provide direct exhaust for kitchens, bathrooms, and janitorial areas.



DESIGN STRATEGY: DIRECT EXHAUST³

Provide direct exhaust for kitchens, bathrooms and janitorial areas to promote good indoor air quality.

DESIGN STRATEGY: ANTI-SMOKING SIGNS¹

Provide easily seen anti-smoking signs to notify occupants or visitors to smoke elsewhere.



DESIGN STRATEGY: VIEWS AND DAYLIGHT²

Provide access to views for occupants through strategic placement of windows.



BRINGING THE LIGHT IN⁴

The Tashjian Bee and Pollinator Discovery Center (MSR Design) uses skylighting and full ceiling height glass windows to maximize amount of natural light in the space.

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

HEALTH AND HAPPINESS PETAL

IMPERATIVE
10

Healthy Interior Performance

INTENT

To demonstrate ongoing high-quality indoor air and a healthy indoor environment.

OVERVIEW OF REQUIREMENTS*

- Provide the results from an Indoor Air Quality test one to six months after occupancy, or provide readings from an ILFI-approved continuously monitored indoor air quality system.
- Comply with the CDPH Standard Method v1.1-2010 (or international equivalent) for 90% of interior building products that have the potential to emit volatile organic compounds (VOCs).
- Implement a cleaning protocol that uses cleaning products that comply with the EPA Safer Choice label (or international equivalent, such as Globally Harmonized System [GHS]).
- Provide 95% of occupants access to views and daylight and opportunities for the remaining five percent of occupants to move to compliant spaces for a portion of their day
- Provide two of following:
 - Operable windows to provide natural ventilation for at least six months of the year.
 - Ability for the occupants to influence their local airflow and temperature through direct input or controls.
 - Flexible options for working and learning such as sit/stand options

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.



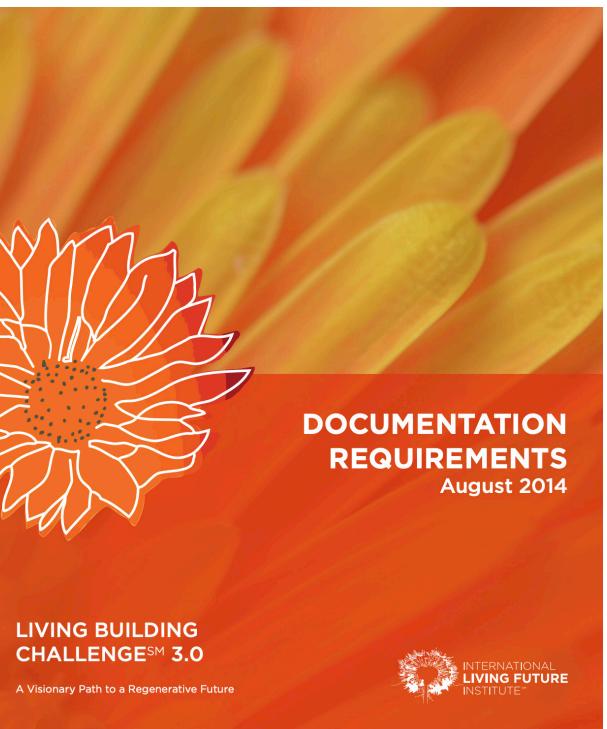
DESIGN STRATEGY: OPERABLE WINDOWS¹

Provide operable windows for natural ventilation. However, operable windows should not work against the heating system.



DESIGN STRATEGY: HEALTHY PRODUCTS²

Use products with the EPA Safer Choice label. All chemical ingredients of a cleaning product are reviewed by EPA before the product can carry the label.



RESOURCE: DOCUMENTATION REQUIREMENT

4

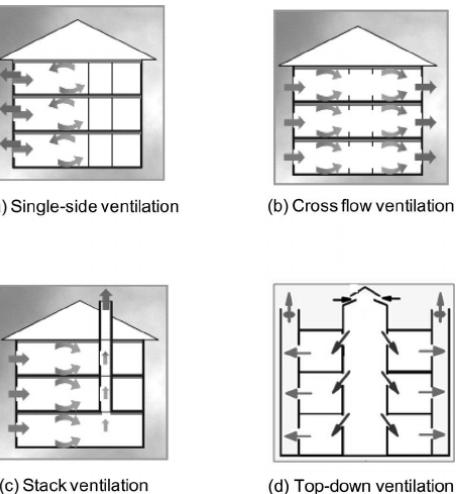


EPA SAFE CHOICE LABEL PRODUCT⁵



DESIGN STRATEGY: TEMPERATURE CONTROL³

Create better interior experience for users by implementing control system for occupants to change the local temperature and airflow within a room.



TYPES OF PASSIVE VENTILATION⁶

HEALTHY INDOOR ENVIRONMENT PLAN

The LBC requires the following documentation that outlines and demonstrates how all the imperative requirements have been met (LBC Documentation Requirement 3.0):

- Cleaning Product List: A list of the project's cleaning products that comply with the EPA Design for the Environment standard or international equivalent.
- HVAC Documentation: A statement confirming compliance with ASHRAE 62 or international equivalent and the dedicated exhaust systems requirement, as well as any copies of relevant HVAC Drawings.
- CDPH v1.1-2010 Documents: A list of all interior building products that have the potential to emit Volatile Organic Compounds (VOCs) and supporting documentation demonstrating each product's compliance with CDPH v1.1-2010 or equivalent standard.
- IAQ Testing Results: Results and any steps taken to remedy deficiencies identified by the testing authority.
- Systems Report: Verification of performance for permanently installed equipment used to monitor levels of carbon dioxide (CO₂), temperature and humidity, including photographs of any hidden systems.

CLEANING PROTOCOL

A list of products that has the EPA Safer Choice label can be found at epa.gov/saferchoice. All chemical ingredients of a cleaning product are reviewed by EPA before the product can carry the label. Example products include:

- Clorox Commercial Solutions Green Works 99% Naturally-Derived Glass Cleaner (Clorox Company)
- Clorox Compostable Cleaning Wipes (Clorox Company)
- Earth Force Ltd Kleenall (ABC Compounding Co., Inc.)
- Planet Green All Purpose Cleaner (Atco International Inc.)
- Cole Green Neutral Cleaner 407 (Cole Supply)

PASSIVE STRATEGIES AND CONSIDERATIONS

Passive strategies are great ways to improve the interior environment experience for occupants while saving energy.

Light can be reflected and directed deeper into room by using windows, skylights, clear doors, light tubes, mirrors, light shelves and other reflective surfaces (HMR Architects). It is important to consider the glass properties of the windows or skylights to maximize the beneficial effects of daylight.

Passive ventilation strategies can help to improve the indoor air quality in an energy efficient way. The micro-climate of Duncan should be carefully considered in the process of choosing the desired passive ventilation strategy.

HEALTH AND HAPPINESS PETAL

IMPERATIVE

11

Access to Nature

INTENT

To provide opportunities for project occupants to directly connect to nature, and to assess the success of the Health + Happiness Imperatives.

OVERVIEW OF REQUIREMENTS*

- Connect people and nature through the provision of human-nature interactions in both the interior and the exterior of the project.
- Occupants must complete a post- occupancy evaluation that addresses the health benefits of this project at least once within six to twelve months of occupancy.



DESIGN STRATEGY: INTEGRATE EXISTING LANDSCAPE¹

Reduce impact to surrounding natural landscapes and create access for people to walk into and interact with the existing natural areas.



DESIGN STRATEGY: CREATE AN OUTDOOR GARDEN²

Create outdoor gardens that are easily accessible from the building to provide opportunities for human-nature interactions. Gardens can potentially showcase culturally significant plants, such as an herb garden.



DESIGN STRATEGY: INDOOR PLANTS³

Plants may also be incorporated into an indoor environment in the form of arranged potted plants, hanging plants, plant walls, or small indoor gardens.

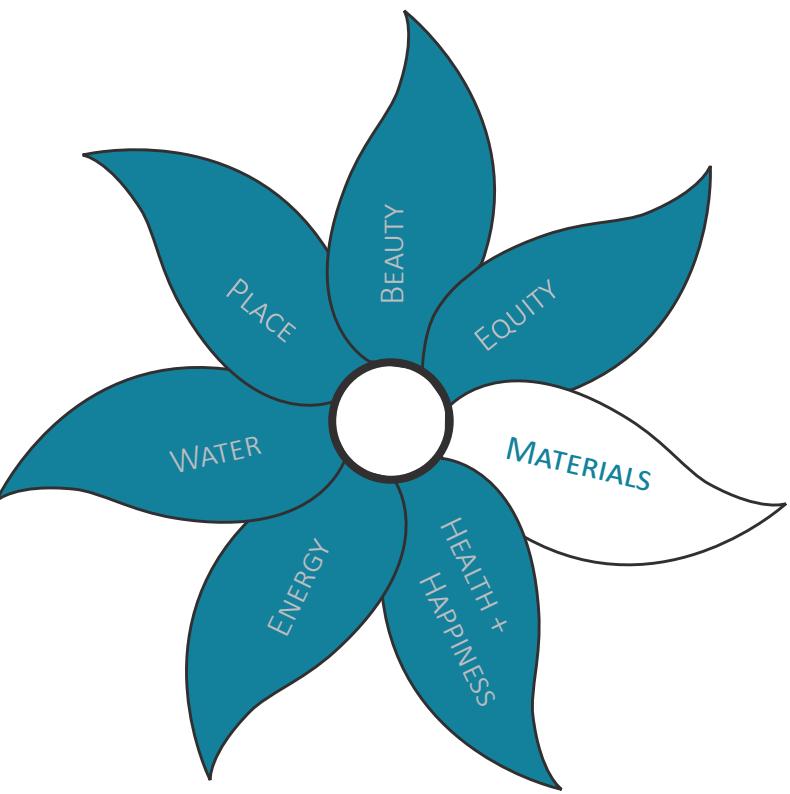


OUTDOOR-INDOOR RELATIONSHIP⁴

In this house designed by Yuko Nagayama & Associates, the tree remains outside, yet can be seen from all spaces in the interior.

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

“The intent of the Materials Petal is to help create a materials economy that is non-toxic, ecologically restorative, and transparent.” It seeks to prevent the usage of toxic, cancerous materials in the construction of all buildings in order to ensure the built environment is a healthy and safe place for people to inhabit. This also ensures the individuals creating building materials are protected from toxic side effects. Finally, it also aims to establish a circular economy for materials in order to prevent creation of pollution and waste. Please refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information about the Materials Petal. Please also refer to the Appendix for additional resources regarding each imperative that might be useful to you in your pursuit of Living Building Certification.



MATERIALS PETAL

CORE IMPERATIVE

12

Responsible Materials

INTENT

To set a baseline for transparency, sustainable extraction, support of local industry and waste diversion for all projects.

OVERVIEW OF REQUIREMENTS*

- The project must contain one Declare label product per 200 sq m of gross building or project area
- All projects (except residential) must incorporate one product certified under the Living Product Challenge.
- 50% of wood products must be FSC, salvaged, or harvested on site, remainder from low risk sources.
- 20% or more of the materials construction budget must come from within 500 kilometers of construction site.
- The project must divert 80% of the construction waste material from the landfill.



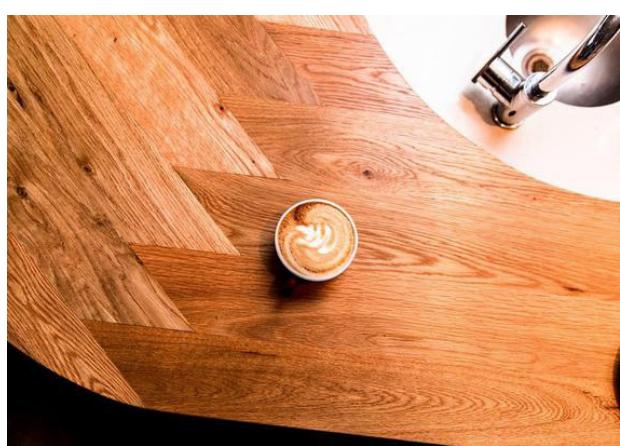
DESIGN STRATEGY: USE DECLARE CERTIFIED PRODUCTS¹

These three images are examples of products that are certified under Declare.



DESIGN STRATEGY: USE LIVING PRODUCT CHALLENGE CERTIFIED PRODUCTS²

These three images are examples of products that are Living Product Challenge certified.



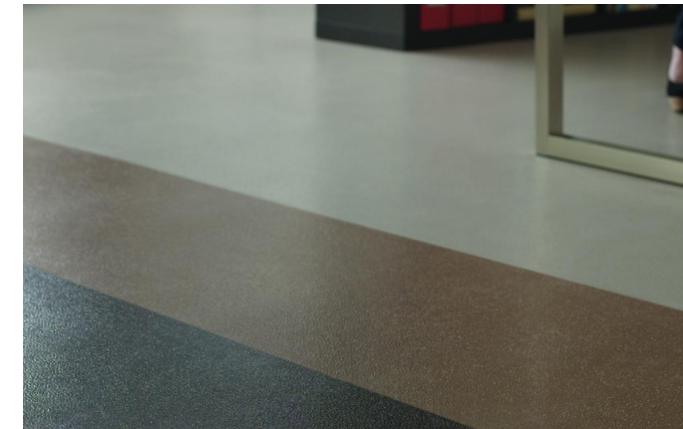
DESIGN STRATEGY: CHOOSE LOCAL³

These three images are examples of work done by Vancouver-based furniture manufacturer, Union Wood Company.



DECLARE. THE NUTRITION LABEL FOR PRODUCTS⁴

To meet the requirements for Responsible Materials, the cultural center should consider using Declare certified products. Declare certification ensures that a product is made of healthy materials. The International Living Future Institute established Declare in 2012 as a way to display healthy products in a radically transparent way. With the creation of an online database, designers can find answers and information about where products comes from, what it is made of, and where it will go at the end of its life.



LIVING PRODUCT CHALLENGE (LPC)⁵

To meet the requirements for Responsible Materials, the cultural center should consider using Living Product Challenge certified products. The Living Product Challenge is the highest standard of sustainable product certification. It goes beyond the material health of products, like Declare. It looks into multiple attributes that contribute to a net-positive life cycle.



CHOOSE LOCAL WHEN POSSIBLE⁶

Another aspect of meeting this imperative is to source from manufacturers that are regionally close and use sustainable sources of wood, such as FSC certified or reclaimed. A great example is Union Wood Company, who designs and creates high-quality handcrafted furniture from reclaimed wood that is sourced in Vancouver.



MATERIALS PETAL

IMPERATIVE

13

Red List

INTENT

To foster a transparent materials economy free of toxins.

OVERVIEW OF REQUIREMENTS*

- All projects must avoid the following Red List chemical classes in 90% of the project's new materials by cost.
- "In situ" materials do not need to be removed or vetted for Red List chemical classes.



DESIGN STRATEGY: USE RED LIST FREE MATERIALS¹

All of the following images are examples of products that are certified Red List free.

RED LISTED MATERIALS:

- Alkylphenols
- Asbestos
- Bisphenol A (BPA)
- Cadmium
- Chlorinated Polyethylene and Chlorosulfonated Polyethylene
- Chlorobenzenes
- Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs)
- Chloroprene (Neoprene)
- Chromium VI
- Chlorinated Polyvinyl Chloride (CPVC)
- Formaldehyde (added)
- Halogenated Flame Retardants (HFRs)
- Lead (added)
- Mercury
- Polychlorinated Biphenyls (PCBs)
- Perfluorinated Compounds (PFCs)
- Phthalates
- Polyvinyl Chloride (PVC)
- Polyvinylidene Chloride (PVDC)
- Short Chain Chlorinated Paraffins
- Wood treatments containing Creosote, Arsenic or Pentachlorophenol
- Volatile Organic Compounds (VOCs) in wet-applied products



WHAT IS THE RED LIST? ²

The building industry is notorious for using materials that are not good for human and planetary health. The Red List contain chemicals that pollute the environment, bio-accumulate up the food chain, reaching toxic concentrations, and that harm construction workers and the workers that make the materials.



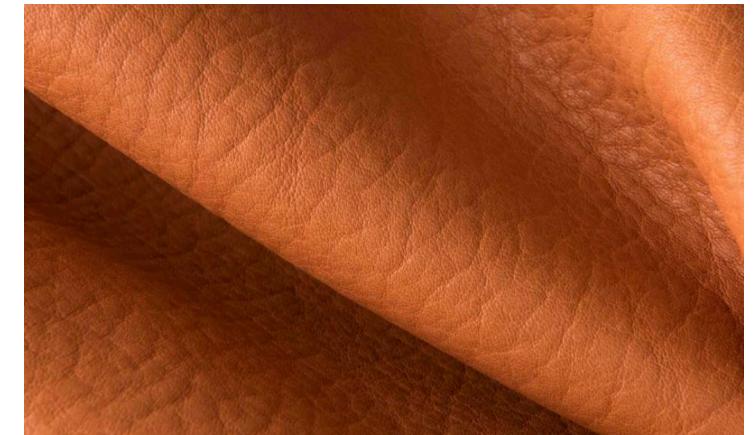
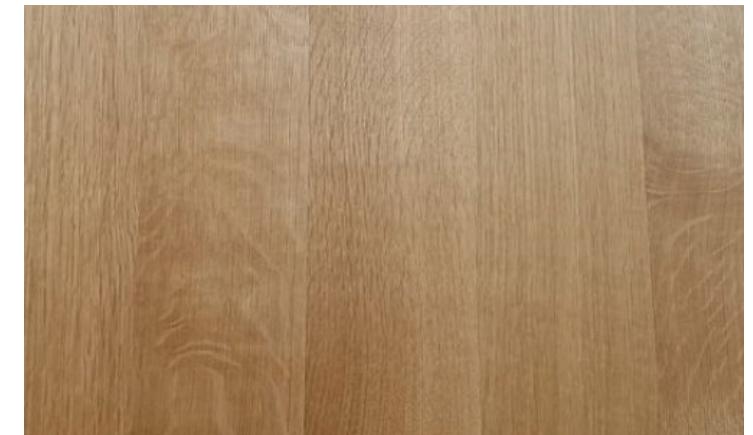
WHY IS IT IMPORTANT TO AVOID? ³

Materials have a lot of potential to decrease the indoor air quality of a building. Some short-term effects can include eyes, nose, and throat irritation, headaches, and dizziness. Long term exposure can lead to worse effects, such as respiratory disease, heart disease, and even cancer. Using materials that are red-list free will decrease these effects or eliminate them entirely.



WHERE CAN I FIND RED LIST FREE PRODUCTS? ⁴

To meet the requirements for this imperative, the cultural center should avoid the use of any red listed materials in all new materials. A full list of Red List free products are available on the Living Building Institutes's website. Product material information also may be available from the manufacturer directly.



*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.



NSC 373: SUSTAINABILITY ASSESSMENT FOR NATURAL DIMENSION STONE¹

Third party certification for sustainable production of stone.

MATERIALS PETAL

IMPERATIVE

14

Responsible Sourcing

INTENT

To support sustainable extraction of materials and transparent labeling of products.

OVERVIEW OF REQUIREMENTS*

- Must create or adopt third-party certified standards for sustainable resource extraction and fair labor practices
- Must have certification under the Natural Stone Council (NSC) 373 Standard by quarries and/or manufacturers of all dimension stone products used
- Refer to Imperative 12 for other requirements.



FSC US NATIONAL STANDARD (V1.0)²

FSC certification ensures that products come from responsibly managed forests that provide environmental, social and economic benefits.



JUST FOR FAIR LABOR PRACTICES³

JUST is not a certification program, it is a transparency platform for organizations to disclose their operations, including how they treat their employees and where they make financial and community investments.

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.



LOCAL WOOD PRODUCTS: BAHNMANN TIMBER¹

Bahnmann Timber is located on Vancouver Island and provides quality, sustainably-sourced wood and custom mill logs.



LOCAL SITE FURNITURE AND CUSTOM METAL PRODUCTS: WELLINGTON FOUNDRY²

Wellington Foundry is based on Vancouver Island and offers a wide range of site furnishings, iron work products and services.



LOCAL LUMBER DISTRIBUTOR: WEST WIND HARDWOOD³

West Wind Hardwood is a custom, quality hardwood lumber distributor located on Vancouver Island. FSC- and SmartWood-certified.

MATERIALS PETAL

IMPERATIVE

15

Living Economy Sourcing

INTENT

To support local communities and businesses, while minimizing transportation impacts.

OVERVIEW OF REQUIREMENTS*

- The project must incorporate place-based solutions and contribute to the expansion of a regional economy rooted in sustainable practices, products, and services.
- 20% or more of the materials construction budget must come from within 500 kilometers of construction site.
- 30% must come from within 1000 kilometers.
- 25% must come from within 5000 kilometers.
- The remaining 25% may be sourced from any location.

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

MATERIALS PETAL

IMPERATIVE

16

Net Positive Waste

INTENT

To integrate waste reduction into all phases of projects and to encourage imaginative reuse of salvaged “waste” materials.

OVERVIEW OF REQUIREMENTS*

- All projects must feature at least one salvaged material per 500 square meters of gross building area or be an adaptive reuse of an existing structure.
- All projects must create a Materials Conservation Management Plan that explains how the project optimizes materials in the Design, Construction, Operation, and End of Life phases of the project.



DESIGN STRATEGY: RECLAIMED MATERIAL IN EXTERIORS²

The following images are examples of salvaged materials from deconstruction being adapted for use in outdoor applications, such as siding, landscaping, and paving.



DESIGN STRATEGY: MAKE A MATERIAL CONSERVATION MANAGEMENT PLAN³

A management plan ensures the full life cycle of a project is considered early in the design process, and that materials will be disposed or recycled responsibly.

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.



DESIGN STRATEGY: RECLAIMED MATERIAL IN INTERIORS¹

The following images are examples of reclaimed materials used in interior applications, such as walls, art pieces, and custom furniture.



REDUCE, REUSE, RECLAIM⁴

To meet the requirements for Net Positive waste, the cultural center should consider using reclaimed materials. “Reclaim” means to re-use materials that have been previously used in an existing building or project. The materials are not processed, but might be altered, re-sized, refined, or adapted to work for the new project.



RECLAIMED MATERIAL SOURCING⁵

It can be difficult to source salvaged materials, but one of the best ways to do so is by sourcing directly from a demolition or re-modeling project. Reclaimed materials can also be sourced from salvage centers or from companies that specialize in sourcing materials from deconstruction.

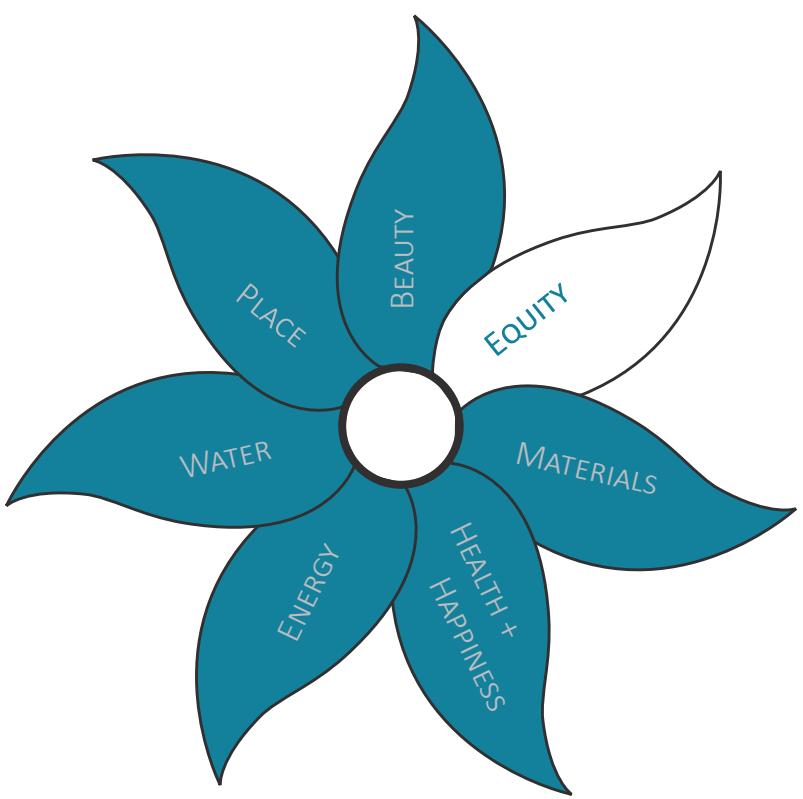


MATERIAL CONSERVATION MANAGEMENT PLAN⁶

Not only is the creation of a material conservation management plan required for sustainability purposes, such as reducing resource consumption, but it usually helps save on disposal and purchasing costs as well. A plan should show how protection of human health and the environment were considered, as well as how much material is being used and where.



“The intent of the Equity Petal is to elevate equity as a project goal, and to transform developments to foster a just and inclusive community that enables all people to participate, prosper, and reach their full potential. It is grounded in the belief that a society that embraces and engages all sectors of humanity and allows the dignity of equal access and fair treatment is a civilization in the best position to make decisions that protect and restore the natural environment that sustains all of us.” Please refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information about the Equity Petal. Please also refer to the Appendix for additional resources regarding each imperative that might be useful to you in your pursuit of Living Building Certification.



EQUITY PETAL

CORE IMPERATIVE

17

Universal Access

INTENT

To allow equitable access to, and protections from negative impacts resulting from the development of, Living Building projects.

OVERVIEW OF REQUIREMENTS*

- Provide for and enhance public realm through design measures such as street furniture, public art, gardens, and benches
- Safeguard access for those with physical disabilities through design and meet the international equivalent ***
- Appropriately address any noise audible to public.
- Project may not block access to nor diminish the quality of fresh air, sunlight, and natural waterways for any member of society or adjacent developments

PROJECT REQUIREMENT SPECIFICS*

- Fresh Air:
 - Protect adjacent property from any noxious emissions that would compromise ability to use natural ventilation
 - Operational emissions must be free of Red List items, persistent bioaccumulative toxicants, and known or suspect carcinogenic, mutagenic and reprotoxic chemicals
- Sunlight:
 - Not block sunlight to adjacent building facades and rooftops above a maximum height allotted for Transect**
 - Not shade the roof of adjacent building unless building was built to lesser density than acceptable for the Transect**
- Natural Waterways:
 - May not restrict access to edge of any natural waterway, except where access can be proven to be a hazard to public safety
 - Not assume ownership of water contained in body or compromise quality of water
 - Incorporate and maintain access path to waterway if project boundary is more than 60 meters parallel to edge of waterway.

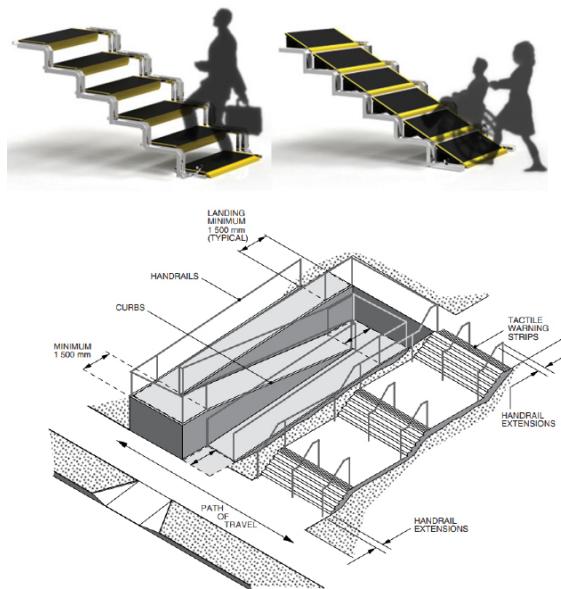
*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

**Refer to the v4.0 Equity Petal Handbook for specific information.

***Refer to British Columbia Building Access Requirements.



Convertible
Convert it your way
Convertible is a user-friendly dual function stairs which could transform into a ramp for the disabled and other users.
Convertible make use of simple mechanism and require minimal effort to operate so as to make it easy and efficient.



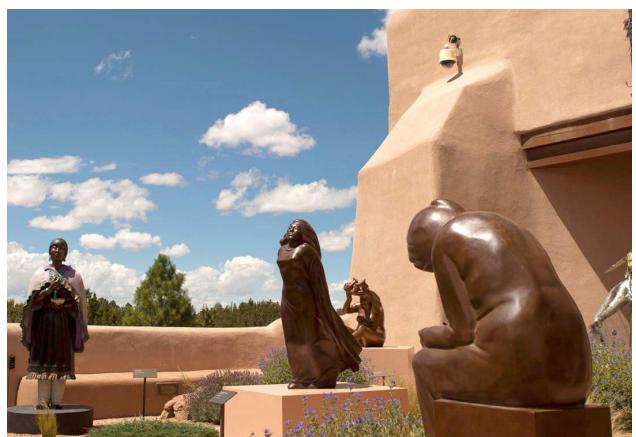
DESIGN STRATEGY: MINDFUL RAMPS³

Ramps are important to people in wheelchairs, but also benefits elderly and strollers. On the other hand, some may prefer stairs, thus there must be two alternatives for individuals.

There is an option to have both, but also an option to have convertible stairs. This conserves space and allows for voluntary choice.

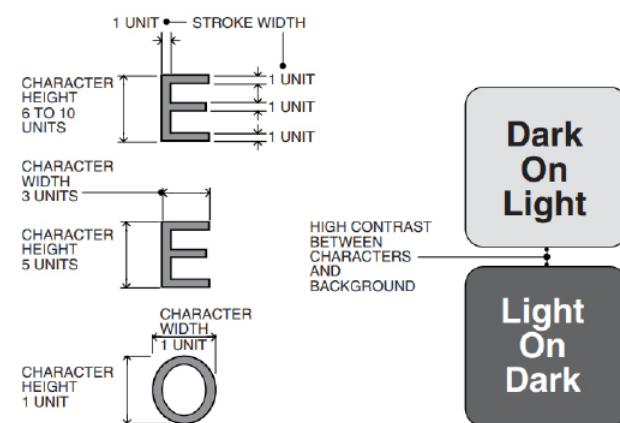
DESIGN STRATEGY: MINDFUL DOORS¹

To implement universal access, doors have specific guidelines it must follow. However to prevent any issues regarding which direction the door is swinging, a power-operated sliding door can be an option. Door knobs should not be used because it does not provide adequate grip.



DESIGN STRATEGY: SCULPTURE GARDEN²

In order to enhance the public realm and improve a sense of community, sculpture gardens are a great way to have the visitors interact with the project and further the mission statement such as education. It can also work in tangent with other imperatives.



DESIGN STRATEGY: EXHIBIT ACCESS⁴

For any building that is used for presenting information or exhibit anything, it is important for everyone to be able to access this. Any videos should have closed captioning. Signs should have light-on-dark visual contrast. Labels should be in large print and especially for a museum, it should allow visitors to choose to listen to or read descriptions. All auditory output should be redundant with visual display and vice versa. Volume control and speed control should also be available. Any auditory information should also be available in different languages.

EQUITY PETAL

CORE IMPERATIVE

18 Inclusion

INTENT

To help create stable, safe, and high-paying job opportunities for people in the local community, and support local diverse businesses through hiring, purchasing, and workforce development practices.

OVERVIEW OF REQUIREMENTS*

- Must have JUST label for at least two project team organizations with integral role in decisions.
 - Must have additional five organizations involved in the project must complete a self assessment**
1. Include diverse stakeholders from vulnerable or disadvantaged populations in the design, construction, and operations and maintenance phases:
 - 20% of design contract and/or construction contracts, and 10% of maintenance contracts must be with JUST organizations or are registered Minority, Woman, or Disadvantaged Business Enterprises (MWDBE) organizations***
 - Workforce development/training/community benefits agreements, registered apprentice programs, and similar programs are employed for 10% of the project maintenance contracts.
 2. Donate 0.1% of total project cost to a regional, community-based nonprofit organization focused on equity and inclusion.

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

** Refer to <https://living-future.org/just>; Just labeled “project team organizations” that are contracted to the owner can also count towards the 20% requirement below.

***Required levels for either the Gender or Ethnic Diversity Indicators: One in Just 1.0, two in Just 2.0



DESIGN STRATEGY: PWL PARTNERSHIP LANDSCAPE

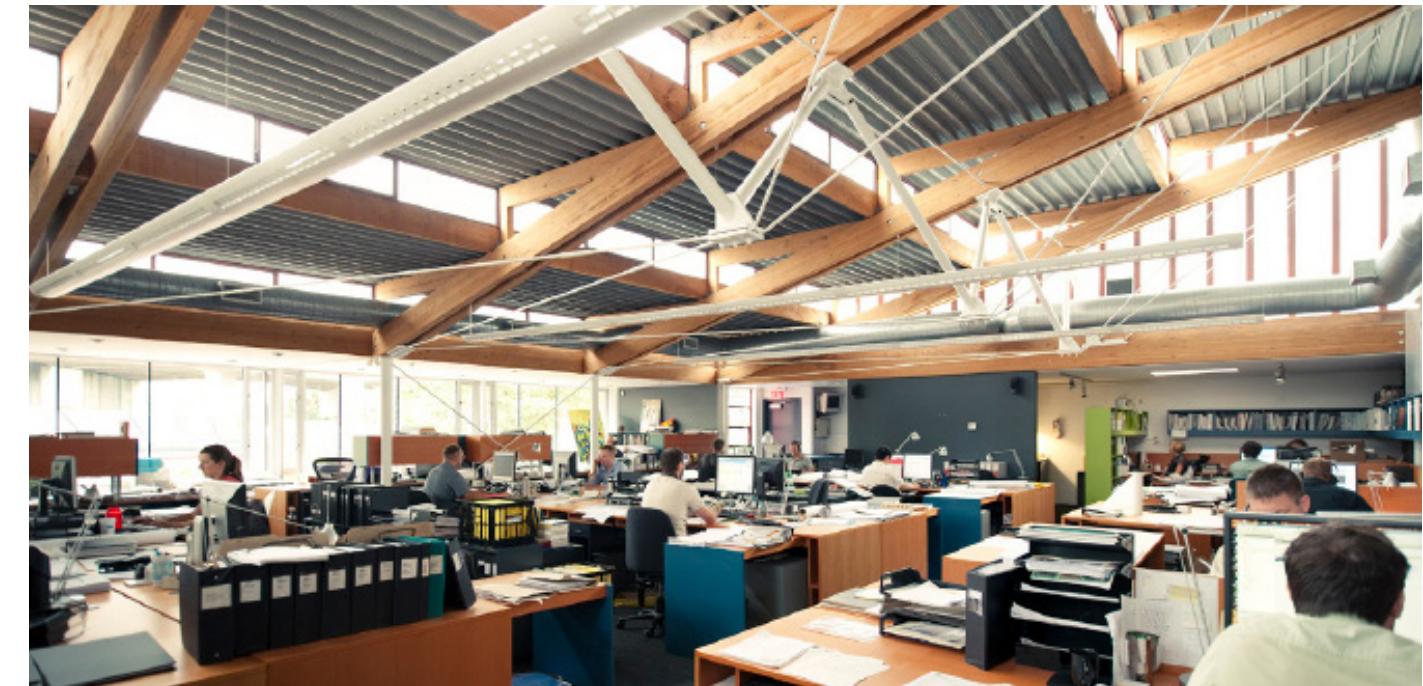
ARCHITECTS²

As landscape architects, urban designers, and site planners, PWL has built natural environments into ways that honor the cultural, historic, and environmental attributes of place. As a local company located in Vancouver, British Columbia, they contribute services from site planning to community engagement.



DESIGN STRATEGY: MISSION GREEN BUILDINGS (Now INTEGRAL GROUP)¹

A local JUST company is Mission Green Buildings (MGB) established in Calgary, AB. It recently merged with Integral Group, a international sustainable design consulting firm. MGB is a collaborative consultancy dedicated to sustainability in the environment. Their main areas of work include: sustainable policy development, sustainable design advice, greening existing facilities, commissioning, energy modeling and engineering, and; green certification for projects.



DESIGN STRATEGY: HCMA ARCHITECTURE DESIGN³

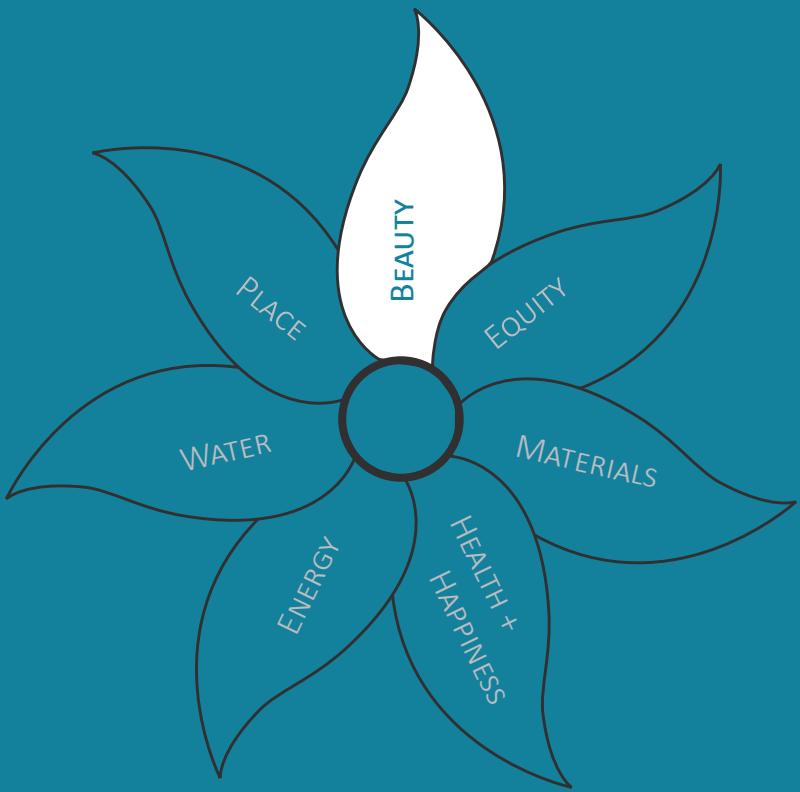
HCMA Architecture + Design is a firm located in Vancouver, BC. They develop architecture that integrated environmental, social, and economic considerations. Specialized in green building and LEED certification, this JUST approved organization has worked on buildings that focus on education, civic, cultural, recreation, and health care.



Architecture
+ Design

THE BEAUTY PETAL

“The intent of the Beauty Petal is to recognize the need for beauty and the connection to nature as a precursor to caring enough to preserve, conserve, and serve the greater good.” It seeks to encourage beautiful aesthetics that appeal to most people to be utilized in the design of a building in order to ensure people will care for the project for many years to come. It also aims to connect individuals with nature in order to inspire environmental stewardship. Please refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information about the Beauty Petal. Please also refer to the Appendix for additional resources regarding each imperative that might be useful to you in your pursuit of Living Building Certification.



Beauty

BEAUTY PETAL

CORE IMPERATIVE

19

Beauty + Biophilia

INTENT

To connect teams and occupants with the benefits of biophilia and incorporate meaningful biophilic design elements into the project.

OVERVIEW OF REQUIREMENTS*

- Projects must be designed to include elements that nurture the innate human/nature connection.
- Each project team must engage in a minimum of one all-day exploration of the biophilic design potential for the project. The exploration must result in a biophilic framework and plan for the project that outlines strategy and implementation ideas for the following:
 - How the project will be transformed by deliberately incorporating nature through Environmental Features, Light and Space, and Natural Shapes and Forms, Natural Patterns and Processes and Evolved Human-Nature Relationships.
 - How the project will be uniquely connected to the place, climate, and culture through Place-Based Relationships.
 - The project must meaningfully integrate public art and contain design features intended solely for human delight and the celebration of culture, spirit, and place appropriate to the project's function.
 - The framework should include a record of the exploration day and goals for the project, as well as historical, cultural, ecological, and climatic studies that thoroughly examine the site and context for the project. The plan must contain methods for tracking biophilia implementation at each design phase.

*Refer to Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life by Stephen R. Kellert, Judith H. Heerwagen, and Martin L. Mador for more information.

*More information can be found in Living Building Challenge Biophilic Design Guidebook.



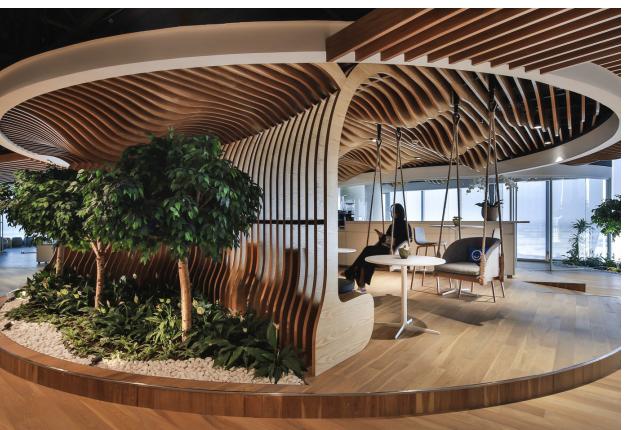
DESIGN STRATEGY: DAYLIGHTING ¹

Provide access to daylight through glass window, skylights, or atrium to increase exposure of occupants and visitors to natural lighting.



DESIGN STRATEGY: ACCESS TO NATURE ²

Provide access to nature, both physically and visually through easily accessible doors and placement of windows.



DESIGN STRATEGY: NATURE MATERIALS AND FORMS ³

Usage of natural materials and organic shapes in the interior space can also evoke the biophilia effect.

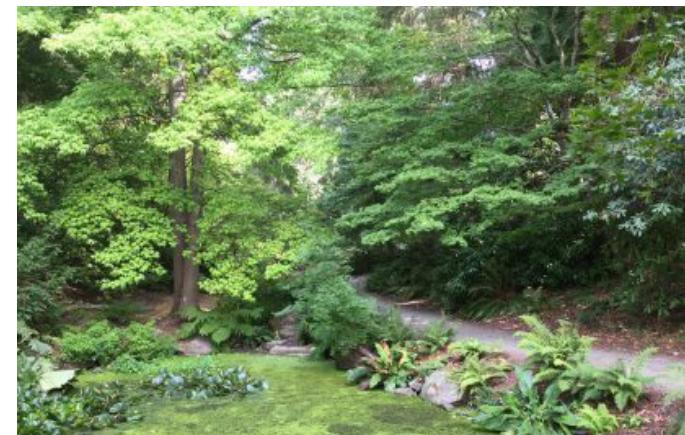
ENVIRONMENTAL FEATURES, LIGHT & SPACE, AND NATURAL SHAPES & FORMS ⁴

To meet the requirements for these features of biophilic design, the cultural center should consider taking advantage of the beautiful creek directly to the south of the site (see image below on the left). Large windows that highlight views to this creek would connect occupants with the ecosystem, provide views to the landscape, and allow warm southern light to spill in during the winter. The project should consider also using local wood for structural elements. This natural form would mimic local trees and the surrounding environment.



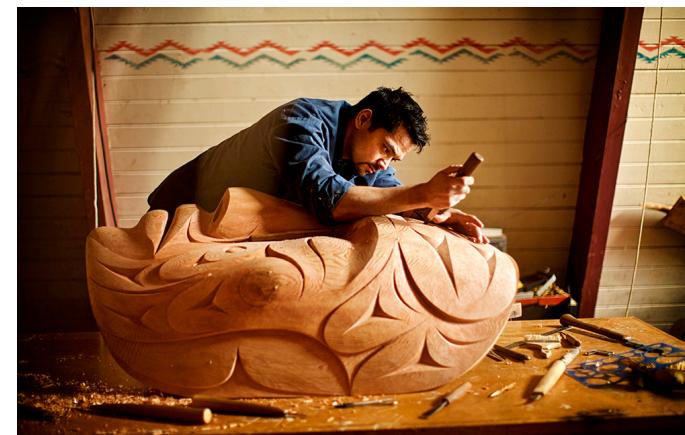
NATURAL PATTERNS & PROCESSES AND EVOLVED HUMAN-NATURE RELATIONSHIPS ⁵

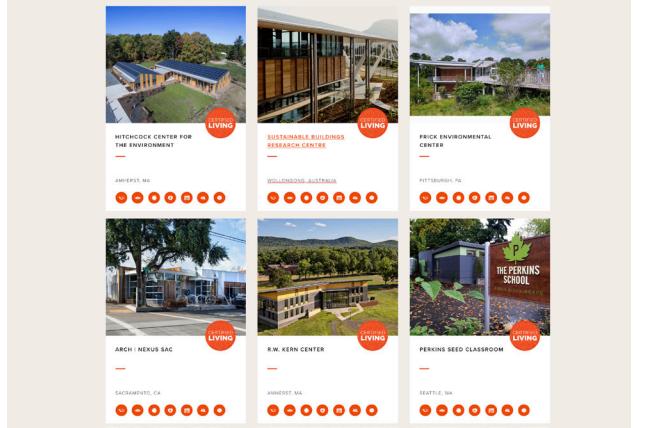
To meet the requirements for these features of biophilic design, the cultural center should consider exhibiting natural wood grain as a primary material and allowing it to naturally patina over time. Furthermore, the project should consider taking inspiration from historic Cowichan structures which used a structural system that created an organized complexity in their regularity and rhythm. Finally, providing winding paths and meditation gardens in the surrounding landscape would evoke feelings of reverence, spirituality, exploration, and awe.



PLACE-BASED RELATIONSHIPS, PUBLIC ART, & FEATURES FOR HUMAN DELIGHT ⁶

To meet the requirements for these features of biophilic design, the cultural center should consider exhibiting the Cowichan's own historical culture as a primary element in the design of the facility. By highlighting Cowichan building techniques, art, and value for nature, the cultural center will establish historical, ecological, and cultural connections to place that will develop into a spirit that gives the cultural center meaning. Additionally, the center should consider highlighting both modern and historical artists for inspiration and delight.





DESIGN STRATEGY: LBC CASE STUDY¹

Create a Living Building Challenge case study for the LBC website to serve as reference and inspiration for future projects.



DESIGN STRATEGY: ANNUAL OPEN DAY²

Host an annual open day event for the public to spread awareness and knowledge about the Living Building Challenge.

OVERVIEW OF REQUIREMENTS*

- Include one Living Future Accredited Professional on the project team.
- Provide the following
 - Living Building Challenge Case Study
 - Annual open day for the public
 - A copy of the Operations and Maintenance Manual
 - A brochure describing the design and environmental features of the project
 - Install interpretive signage that teach visitors and occupants about the project
 - Create an educational website about the project

*Refer to the Living Building Challenge Standard, Version 4.0 for additional & more specific information.

BEAUTY PETAL

CORE IMPERATIVE

20

Education + Inspiration

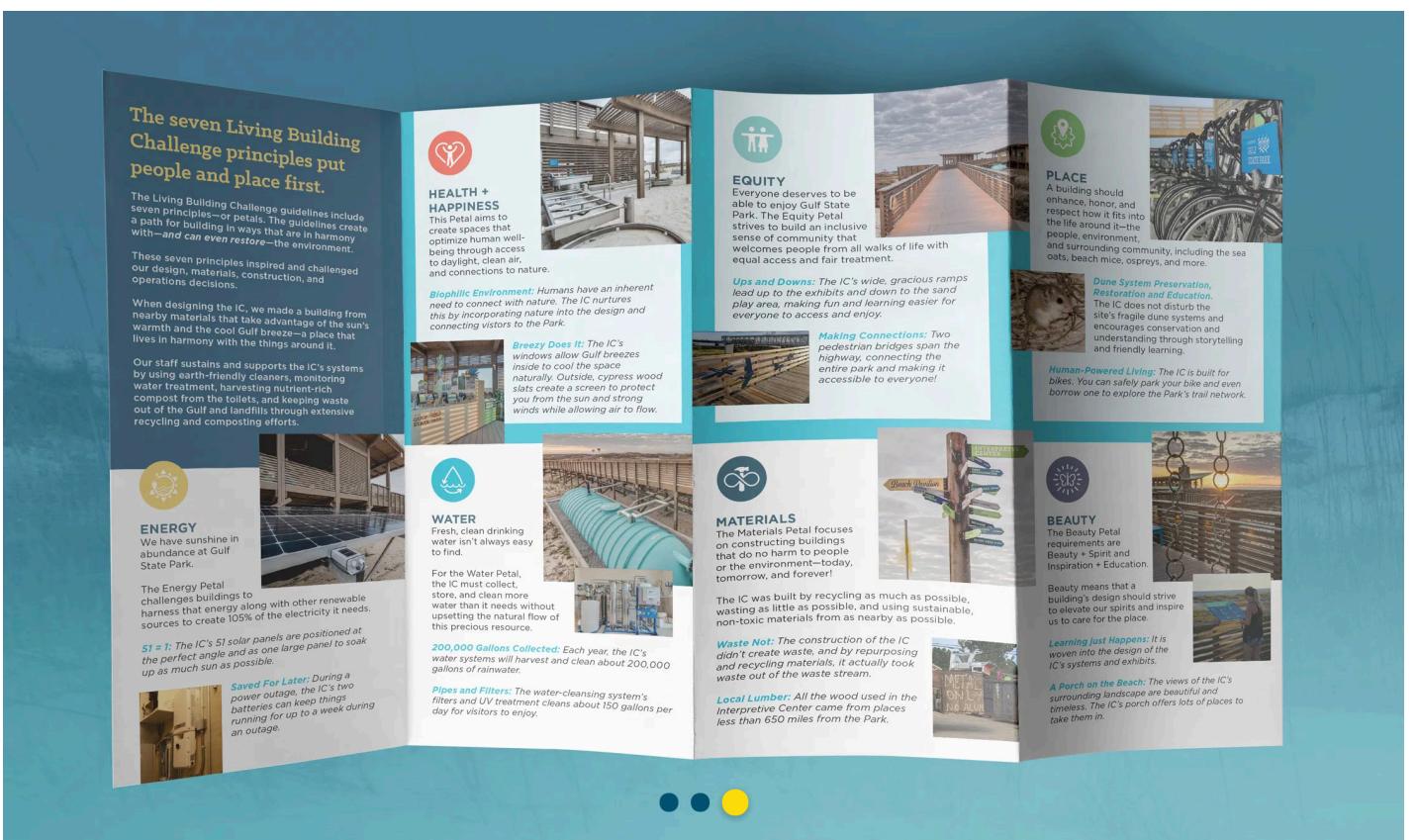
INTENT

To provide educational materials about the operation and performance of the project to the occupants and the public in order to share successful solutions and catalyze broader change.



DESIGN STRATEGY: INTERPRETIVE SIGNAGE³

Provide signage on site that educates visitors and occupants through highlighting the sustainable features of the project.



EDUCATIONAL BROCHURE⁴

An educational brochure designed by Hersick + Webster for the Gulf State Park Interpretive Center

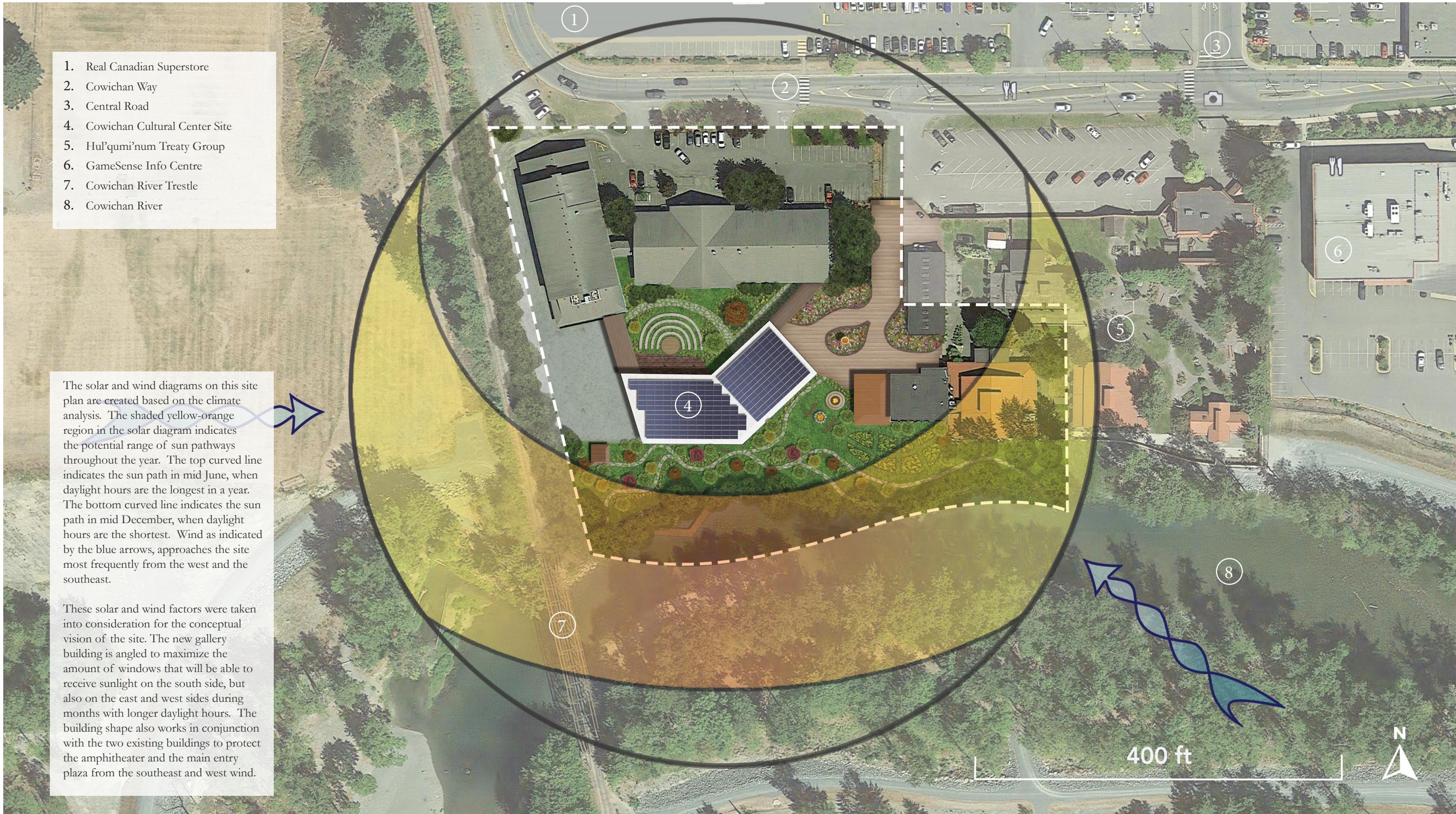
Preliminary Program

Preliminary Space Program

Space Type	Square Footage per Space	Number of Spaces	Total Square Footage	Notes
Outdoor Space				
Medicine Garden				
Resting Garden				
Walkways with Benches				
Hidden Spaces - for spiritual				
Circular Theater (possibly covered)			Space for 30-50 people	
Big House Structure			Traditional house planks - removable	
Salmon BBQ				
Fire pit (for telling stories around)				
Pit cooking				
Carving Shed (Outdoor, but covered)			Current one has walls but is NOT insulated, Lockable	
Grave House	120	1	120	Separate Out-Building , temporary storage, for keeping human remains safe and the living safe from the remains
Parking		TBD		Must be reduced per LBC Guidelines
Indoor Space				
General				
Entry Lobby	300	1	300	
Coat Check	100	1	100	
Gift Shop	400	1	400	
Locker Area (for school groups?)	200	1	200	
Exhibit Space				
Large Gallery	5000	1	5000	Canoes, Totem poles, platforms for potlach, fishing wier in River
Additional Galleries	1000	10	10000	Basketweaving & textiles, stone & tools, creation stories, modern achievements, etc; limited direct sunlight , some glass cases
Temporary Exhibit Gallery	3000	1	3000	
			0	
Storage Space				
Archival Area Reading Room / Library	400	1	400	Tables & Chairs, Reception Counter for archivist,
Archival Storage	2000	1	2000	
Exhibit Storage	4000	2	8000	Should be as close as possible to exhibit hall
Expansion exhibit storage	1500	2	3000	
Sacred Storage	1000	1	1000	
Temporary Exhibit Storage	2000	1	2000	
Meeting Space				
Community Meeting Space	5000	1	5000	Space for 200+ people! Stage, Projection & Sound equipment, Tables & Chairs, HIGHLY Flexible; Also dining? Adjacent to kitchen?
Large Conference & Classroom	600	2	1200	Space for 50 people
Medium Conference & Classrooms	300	2	600	Space for 20 people
Small Conference & Classrooms	150	2	300	Space for 10 people
Casual Meeting Space	200	1	200	Living Room Style Furnishings, Space for 1
Quiet Space	100	1	100	Living Room Style Furnishings, Space for up to 5

Space Type	Square Footage per Space	Number of Spaces	Total Square Footage	Notes
Office Space				
Director Office	100	1	100	All offices need room for storage, bookcases, pin up space, white boards, chairs for visitors
Curator Office	100	1	100	Adjacencies are TBD
Archivist Office	100	1	100	
Other Offices	100	9	900	
Staff Breakroom	300	1	300	Fridge, Microwave, Sink, Coffee Machine, Dishwasher!, Small seating area for 12, Cabinets
Workspace				
Workshop	2000	1	2000	Should be adjacent to conservation lab & storage (CCI Lab)
Large Freezer	100	1	100	Like a wood-working shop
Washrooms				
Public Women	300	2	600	
Public Men	300	2	600	
Public Neutral	70	4	280	
Staff	70	8	560	
Showers	70	2	140	
Staff Chaning Rooms & Lockers	200	2	400	
Kitchen & Food Prep				
Commercial Kitchen	600	1	600	Feed up to 200 people, room for range, oven, commercial fridge, commercial freezer, ocmmercial sink, etc.; Likely adjacent to community meeting space, Space for 10 staff
Kitchen Pantry	100	1	100	
Kitchen Equipment	100	1	100	
Coffee Shop / Cafe	200	1	200	Seating for restaurant space? Share kitchen area with commercial kitchen? Works for BOTH community space and daily restaurant-type/coffee shop space
CCI Laboratory				
Lab Space	400	1	400	Workspace for 3 people
Lab Workshop	300	1	300	Workspace for 2 people
Lab Storage	100	1	100	
Lab Freezer	70	1	70	
Office	100	4	400	Offices for 4 people
Unisex Restroom	70	2	140	
SQUARE FOOTAGE SUBTOTAL				
			51,390	
Circulation & Support Spaces Multiplier				
			1.5	
TOTAL INDOOR SF				
			77,085	

Design Vision



ANALYTICAL SITE PLAN

Based on the information generated in the climate analysis, this site plan shows a solar diagram and the wind direction. The solar diagram indicates the potential range of sun pathways throughout the year while the wind arrows illustrate that the wind approaches the site primarily from the west and the southeast.



It may be best to create a new building for the gallery, because it could be difficult to renovate the existing buildings into gallery spaces. The existing buildings can be used as offices, conference rooms, storage spaces, and classrooms. Based on estimation from the program, a new building of 30,000 square feet would be needed. The building on the site plan is around 20,000 square feet with an additional 10,000 square feet on the second floor. This ensures that the 30,000 square feet will be met while leaving sufficient area for natural green features of the site, which helps to address the garden area requirement of the living building challenge.

The pathway south of the entry arch (1) leads the visitor to the entry plaza (4) with multiple gardens. A totem pole in the center of the plaza serves as a symbol for the cultural center. The entry to the gallery building (9) is on its northeast face. Solar panels are located on the roof facing south and southeast in consideration of the Living Building Challenge. Slightly above the gallery is the central courtyard (6), which features a central walking path, trees and vegetation, as well as an amphitheater. Two covered walkways (5,7) provide access from one building to another while being sheltered from the weather. The west existing building (3) intended to be exhibition storage, and the west walkway (7) serves as a sheltered path for exhibit items as well. The other existing building (2) is intended to be offices, conference rooms, and classrooms.

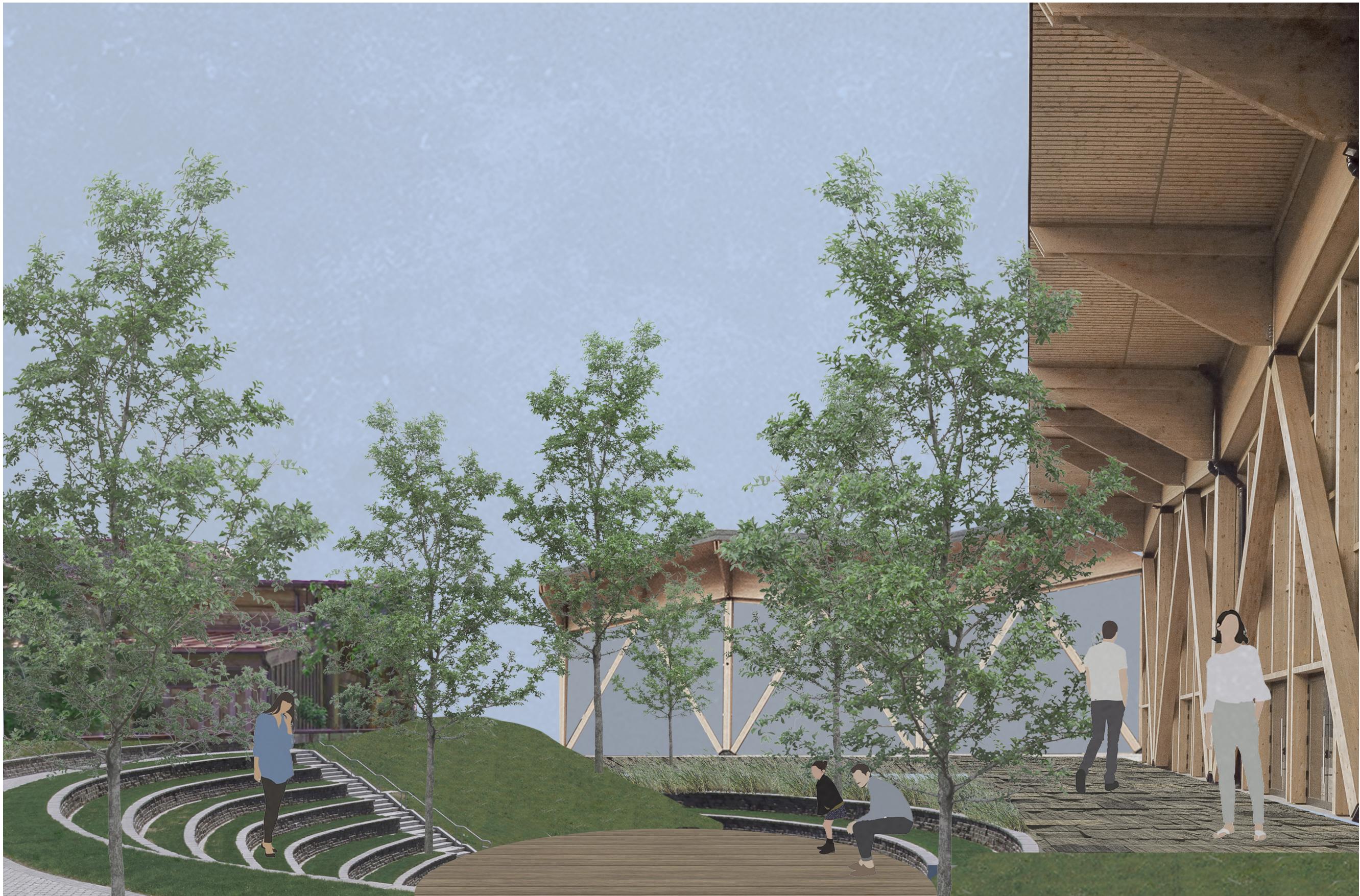
In consideration of the Living Building Challenge, no additional parking was added. The current existing parking is moved to the back of the gallery (8), providing an easier route to the gallery for necessary transportation. To the southeast of the plaza (4), the Big House (11), the BBQ pit, and the fire pit for storytelling (10) creates a central social zone. South of the gallery building consists of wandering walkways with small benches in various nooks. To the east side, there is a medicine garden (14). The water plank walkway (16) on the edge of Cowichan River provides a chance for people to get closer to the water and further connect to nature. The Grave House (17) is a separate entity away from most of the public. It is placed close to the gardens and nature, yet close to the back parking lot for any necessary transportation.



INSPIRATIONAL RENDERING - INTERIOR VIEW

A simple neutral interior space can be imagined with a large skylight and a green courtyard. Timber columns harvested sustainably support the double volume gallery space.

This collage envisions the gallery space. Nature is brought into the space through the implementation of timber columns and an indoor courtyard which can meet the requirements under the Beauty and Biophilia imperative. The timber should be sourced locally and be FSC certified to meet the requirements for the Responsible Material imperative. A large skylight could help maximize the amount of natural light coming to reduce the need for artificial lighting. Using natural daylighting in interior spaces is a passive design strategy that is great for energy conservation and contributes to the Energy and Carbon Reduction imperative. The neutral and simple design elements allow the visitor's attention to be drawn to the artifacts and items on display, and the large volume of space allows for diverse exhibits.



INSPIRATIONAL RENDERING - AMPHITHEATER VIEW

Stone steps carved into the ground face a wooden stage with the gallery space in the background. A central gathering space connects the entry, older renovated university building and the new volume.

This collage depicts the outdoor amphitheatre. Locally sourced stone steps carved directly into the landscape will integrate the amphitheatre into the courtyard itself. Responsible sourcing of stone can qualify for points under the Responsible Sourcing imperative. The amphitheatre is surrounded by the gallery space, as represented by the building on the right side of this collage. The shaded corridor outside the gallery space separates the auditorium and the exhibit. The amphitheatre is located in the central gathering space, which connects the entry, the older renovated university building, and the new volume. It is surrounded by pockets of produce growing gardens, which can qualify for points under the Urban Agriculture imperative. The amphitheatre doesn't have to be used exclusively for performances, but could be a great hub for outdoor meetings and gatherings. A grove of trees provide natural shaded spots for enjoying the outside space. Weather protection can be achieved by deployable rain shelter if needed.



INSPIRATIONAL RENDERING - CREEK VIEW

A wooden walkway takes you from the edge of the creek to the water. Benches for meditation surrounded by large shade giving trees offer peaceful vistas.

This collage depicts an outdoor view by the creek. A wooden walkway, made of recycled timber or FSC certified wood, gives visitors the ability to walk from the edge of the creek and along the water, emphasizing the relationship between water and the land. The addition of outdoor walkable paths would qualify for points under the Human-Scaled Living imperative. This wooden walkway can be designed so that it can be washed over during peak flooding season. It is also a new way to experience the constructed wetlands transitioning to natural wetlands. Custom woodwork benches should be placed by the river, creating peaceful corners that can become meditation alcoves. This would be a wonderful resting spot under the shade, surrounded by the large trees near the creek.

WALL SECTION:

INTRODUCTION

A wall section is a technical drawing that describes the construction inside of a wall. The typical wall sheet shows section cuts of the exterior walls from the roof down through the foundation. The sheet typically does not show every wall but serves as a guide for the builder and the county so they can see how the structure is designed. These wall sections specify the building's construction and materials.

R-VALUE

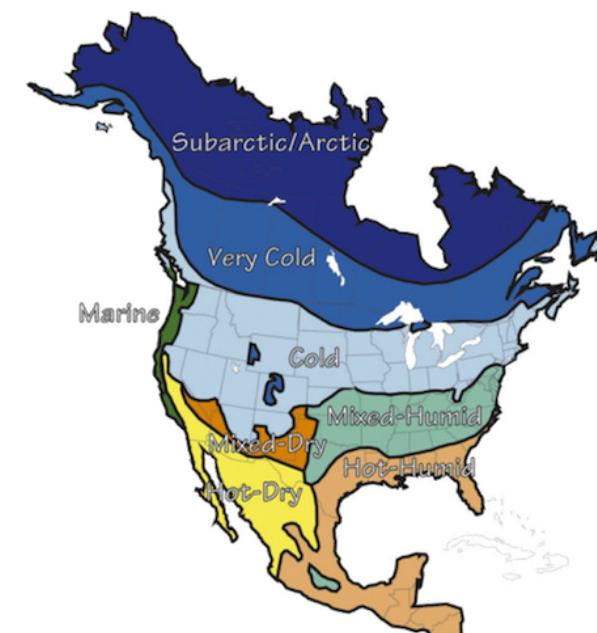
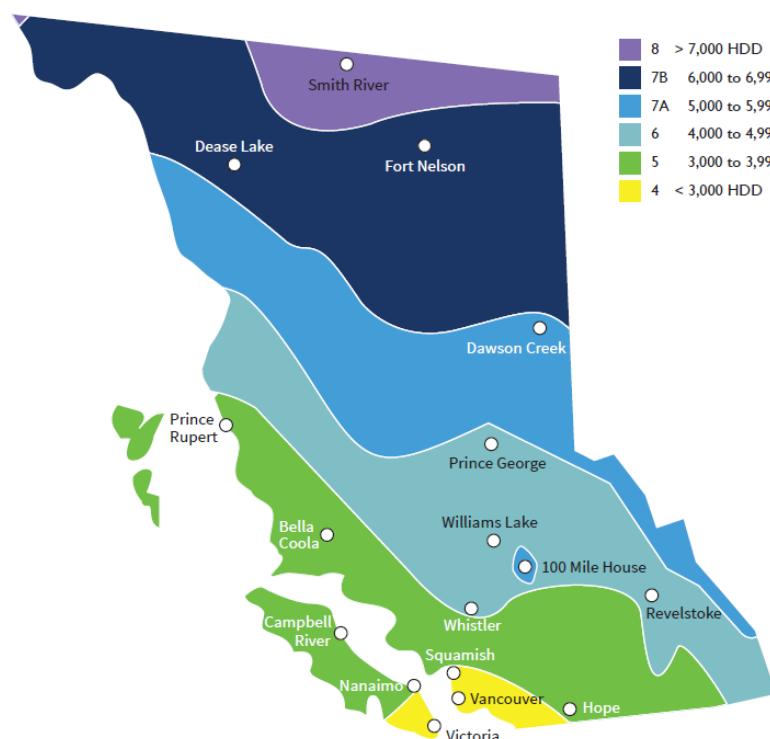
The R-value is the measure of heat resistance in a material or series of materials. It reveals the insulation capability of the wall section. If the material has a high value, then it is particularly good at not allowing heat to enter/escape. In general, thicker walls will have a higher combined R-value, but some are more efficient than others.

Some things that contribute to the R-value is the temperature, aging, moisture, thickness, density and type of insulation. These are somethings to keep in mind while constructing the wall section.

CLIMATE ZONE¹

Victoria is in climate zone 4-- Marine Oceanic. This climate is known to be not too hot in the summer (warmest month mean temperature below 22 °C (72 °F)), not too cold or too warm in winter (between 27 and 65° F), has at least four months with mean temperatures above 10°C (50 °F). It typically lacks a dry season, as precipitation is more evenly dispersed throughout the year. Some bigger cities that are in the same climate zone include Vancouver, Portland, and Seattle.

Zone	Attic	WALLS			
		2x4	2x6	Floors	Crawlspace
7	R49 to R60	R13 to R15	R19 to R21	R25 - R30	R25 to R30
6	R49 to R60	R13 to R15	R19 to R21	R25 - R30	R25 to R30
5	R38 to R60	R13 to R15	R19 to R21	R25 - R30	R25 to R30
4	R38 to R60	R13 to R15	R19 to R21	R25 - R30	R25 to R30
3	R30 to R60	R13 to R15	R19 to R21	R25	R19 to R25
2	R30 to R49	R13 to R15	R19 to R21	R13	R13 to R19
1	R30 to R49	R13 to R15	R19 to R21	R13	R13



CASE STUDIES

CASE STUDY CRITERIA

When looking for case studies as a reference for r-value, we selected buildings that were commercially designed, were Net Zero Energy, and were in climate zone 4C like Vancouver Island. These are important criteria that heavily effects the wall section construction.

LOPEZ COMMUNITY LAND TRUST²

- Location: Lopez Island, WA
- R-value: R-34 to R-42 (double required)
- South walls: R-21 2x6 stud construction, insulated with blown in cellulose
- Materials used: Earthen plasters + Straw bales for insulation
- Note: this case study did not satisfy the materials petal.

KING COUNTY PARKS NORTH UTILITY MAINTENANCE FACILITY³

- Location: Redmond, WA
- R-Value: R-18.5
- Walls:
 - Crew room: 2x6 wood framing, 24" o.c., 1 layer fiber-cement siding with building paper, 1/2" plywood sheathing, R-21 batt insulation, vapor barrier, and 5/8" wallboard
 - Shop area: 2x6 wood framing, 24" o.c., 1 layer fiber-cement siding with building paper, 1/2" plywood sheathing, R-21 batt insulation and 1/2" plywood
 - Parking building: 2x4 wood framing, 24" o.c., cement fiber batten, cement fiber siding, building paper, (2) layers type x 5/8" gypsum sheathing, (2) layers type x 5/8" gyp sheathing, 1 layer 1/2" plywood.
- Air sealing: Waterproof gypsum board was used at locations susceptible to moisture, and vapor retarder was installed on the warm side of insulation.
- Note: this case study did not have people regularly in their facilities

MAHLUM PORTLAND OFFICE⁴

- Location: Portland, OR
- Note: not energy certified, material petal certified
- Rockwool Cavity Rock Insulation, Thermafiber Mineral Wool Insulation FF – Unfaced
- USG Sheetrock EcoSmart drywall manufactured in Rainier, OR that is not only hyper local (manufactured < 70 km from the site), but also Declare Red List Free, and a lower CO2e product (25% reduction from average)

STUDY CONCLUSION⁵

Based on these case studies, we decided to create a theoretical wall section for the Cowichan Cultural Center with an average R-value around 30 and a wall thickness of 8 to 10 inches. The investigation of these case studies also led to local resources that inspired the design for the Cowichan Cultural Center's wall section.



THEORETICAL TYPICAL

WALL SECTION

To meet the energy performance requirements of the Living Building Challenge, the Cowichan Cultural Center will need a highly efficient wall section to prevent heat loss in the winter and heat gain in the summer. Based on other high performing projects in the area, the necessary R-value for the wall section is approximately 30. Above is one possible way of meeting that R-value with sustainable materials.



1 RECLAIMED WOOD

Thickness: > 0.5 in (1.27 cm)

R-value: 0.36

Source: Bahnmann Timber

Location: Cowichan Station, BC Canada

2 EXPANDED CORK + FURRING STRIPS

Thickness: 2 in (5.08 cm)

R-value: 7.2

Source: ThermaCork (smallplanetsupply)

Location: Vancouver, BC Canada

3 WATER BARRIER

Thickness: 0.02 in (0.58 mm)

R-value: 0

Source: Henry Blueskin® VP160

Location: El Segundo, California

4 PLYWOOD

Thickness: 0.5 in (1.27 cm)

R-value: 0.625

Source: Westwind Hardwood Inc.

Location: Vancouver Island, BC Canada

5 WOOL BLOW-IN +2X6 STUDS

Thickness: 5.5 in (13.97 cm)

R-value: 23.65

Source: Havelock Wool

Location: Victoria, BC Canada

6 VAPOR BARRIER

Thickness: 0.02 in (0.4 mm)

R-value: 0

Source: Henry Blueskin® SA

Location: El Segundo, California

7 DRYWALL

Thickness: 0.625 in (1.59 cm)

R-value: 0.45

Source: CertainTeed Type X Drywall

Location: Chemainus, BC Canada

8 PAINT

Thickness: 0.04 in (1 mm)

R-value: 0

Source: ECOS Paints

Location: Vancouver Island, BC Canada

Appendix

Appendix

RESOURCES AND ADDITIONAL INFO REGARDING EACH LIVING BUILDING CHALLENGE IMPERATIVE

01 - ECOLOGY OF PLACE

Landscape Architects in Cowichan Valley

- Outside Design- <https://outsidedesign.ca/>
- A cut above landscaping- <http://www.acutabovelandscaping.ca/>
- Ceres Edible landscaping- <https://cowichangreencommunity.org/hire-us/ceres/>

02 - URBAN AGRICULTURE

Hydroponics Suppliers

- Duncan Plants and Ponics Limited- <http://duncanplantsandponics.ca/>
- Cowichan Hydroponics- <https://cowichanhydroponics.wordpress.com/>
- Native Plant Nursery (NALT)- http://nalt.bc.ca/1_10_native-plant-nursery.html

Local Nurseries & Gardners

- Aerial Tree Service- <http://www.aeraltreeserviceltd.ca/>
- West coast Evergreen Gardening- <http://westcoastevergreengardening.com/>

03 - HABITAT EXCHANGE

Local Land Trusts

The Land Trust Alliance is the voice of the land trust community. As the national leader in policy, standards, education and training, we work passionately to support land trusts so they can save and secure more lands now and for future generations.

<https://www.landtrustalliance.org/tags/canada>

The Cowichan Land trust is dedicated to the conservation and protection of natural areas in the Cowichan Valley

#6-55 Station Street, Duncan BC

V9L 1M2

(250) 746-0227

04 - HUMAN SCALED LIVING

Bicycle Storage Racks:

- Swagman - <https://www.swagman.net/>
- Sportworks - <https://www.sportworks.com/products/bike-parking>
- Urban Racks - <https://urbanracks.com/>
- Cora Bike Racks - <http://www.coracanada.ca/>
- Dobra Design - <http://dobradesign.com/>

Pedestrian Oriented Public Spaces:

- False Creek Neighborhood, Vancouver, BC - <https://vancouver.ca/parks-recreation-culture/false-creek-olympic-village.aspx>
- Robson Square, Vancouver, BC - <https://tclf.org/robson-square>
- McGilbra Place Park, Seattle, WA - <https://living-future.org/lbc/case-studies/mcgilvra-place-park/>
- Bell Street Park Shared Street, Seattle, WA - <https://nacto.org/case-study/bell-street-park-seattle/>

EV Charging Stations:

- EVgo - <https://www.evgo.com/>
- ChargePoint - <https://www.chargepoint.com/>
- Le Circuit électrique - <https://lecircuitelectrique.com/>
- SemaConnect - <https://semaconnect.com/>

05 - RESPONSIBLE WATER USE

Local On-site Water Treatment

- OSI On-site Systems Inc. is a Canadian-based company located on Vancouver Island specializing in innovative on-site wastewater system design for both commercial and residential applications. <http://www.osieagle.ca/>
- Wcowma On-site Wastewater Management Association Of BC. <https://www.wcowma-bc.com/>

Low Flow Fixtures

- WaterSense Low-flow fixtures - <https://www.epa.gov/watersense/watersense-products>

Local Native Plant Nurseries on Southern Vancouver Island

Dinter Nursery
2205 Phipps Road
Duncan, BC V9L 6L2
250 748-2023
info@dinternursery.ca

Woodgate Native Plant Nursery
Box 508
Duncan, BC V9L 3X8
250 748-2558
rwoodgate@shaw.ca

Ts'uts'siimt Restoration Nursery
Cowichan Tribes
5760 Allenby Road
Duncan, BC V9L 5J1
250 746-5741

Mayo Creek Gardens
Box 3510
6596 MacLean Road
Lake Cowichan, BC V0R 2G0
250 749-6291

Charter Creek Nursery
6879 Old Lake Cowichan Road
Box 1125
Lake Cowichan, BC
V0R 2G0
250-749-3232

Fraser's Thimble Farms
175 Arbutus Rd
Saltspring Island, BC V8K 1A3
250 537-5788
Richard Fraser
thimble@saltspring.com
www.thimblefarms.com

The Water Baseline

OCCUPANCY TYPE	GALLONS PER DAY (MINUS IRRIGATION)	PER UNIT	LITERS PER DAY (MINUS IRRIGATION)	PER UNIT
Education	8.50	student	32.16	student
Entertainment/Public Assembly	1.84	seat	6.97	seat
Food Sales + Service	0.35	square foot	14.26	square meter
Healthcare	154.38	bed	584.33	bed
Hotel	33.18	guest	125.59	guest
Warehouse/Manufacturing/Industrial*	10.27	employee	38.87	employee
Office	10.61	employee	40.15	employee
Parking	0.001	square foot	0.04	square meter
Retail/Public Service/Religious	0.03	square foot	1.20	square meter
Single-family/Multi-family	52.56	person	198.94	person

*Warehouse/Manufacturing/Industrial data does not include process water. These projects must separately meter their process water and submit a narrative detailing measures put in place to reduce the potable water required by these uses.

06 - NET POSITIVE WATER

Water Harvest/Treatment Related Service on Vancouver Island

Raindrop Harvesting
<https://www.raindropharvesting.ca/>

Rainwater Harvesting Systems for Vancouver Island
 Jamie Wallace - Owner/Certified CANARM Professional
 250-933-6335

Van Isle Water
<https://www.vanislewater.com/>
 461 Dupplin Rd, Victoria, BC V8Z 1B8, Canada
 250-383-7145

RainTek Drainage & Waterproofing
<http://www.raintek.ca/>
 2250 Marlene Dr, Victoria, BC V9B 2E1, Canada
 250-896-3478

Holman's Pump & Water Systems
<http://www.holmanplumbing.ca/>
 1715 Shawnigan Lake-Mill Bay Rd, Shawnigan Lake, BC V0R 2W2, Canada
 250-701-1272

07 - ENERGY AND CARBON REDUCTION

- BC Hydro (selling clean energy and connecting to renewable grid) (net metering services) - https://www.bchydro.com/work-with-us/selling-clean-energy/net-metering.html?WT.mc_id=rd_netsupply
- Chart of Independent Power Producers: - <https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/independent-power-producers-calls-for-power/independent-power-producers/independent-power-producers-currently-supplying-power-to-bc-hydro.pdf>

Solar Power Resources

Informational Resources:

- Clean Energy BC, Solar Power - <https://www.cleanenergybc.org/about/clean-energy-sectors/solar>
- Solar Map of British Columbia - <https://ecosmartsun.com/wp-content/uploads/2014/11/Solar-Map-BritishColumbia-Full-Contour-e78e.png>

Terratek:

<http://terratek.ca/>
 Victoria Island, BC Canada
 250.914.5654
 info@terratekenergy.com

HESPV, Canada based solar equipment manufacturers:
<https://hespv.ca/commercial>
 320 Mary St, Victoria, BC V9A 3V9, Canada
 +1 250-483-0871

Victoria Solar Power Services (includes quotes, installation, repair, replacement, etc.):
<https://www.victoriasolarpower.com/>
 +1 250-800-2721

Energy Alternatives LTD.

<http://www.energyalternatives.ca/>
 Smithers, British Columbia Canada V0J 2X2
 (250) 846-9888

UBSCO, Off-Grid

<https://ubsc.ca/>
 Unit 2-19585 96th Ave., (Located in the Fountain Tire building) Surrey (Port Kells), BC, V4N 4C5
 604-276-9494, 1-888-477-2700
 sales@swisco.ca

Wind Power Resources

Informational resources:

- Clean Energy BC, Wind Power - <https://www.cleanenergybc.org/about/clean-energy-sectors/wind>
- Canadian Wind Energy, Wind Energy in British Columbia - <https://canwea.ca/wind-energy/british-columbia/>
- Small Wind Energy Systems - <https://www.energy.gov/energysaver/save-electricity-and-fuel/buying-and-making-electricity/small-wind-electric-systems/ms>

Cape Scott Wind Farm:

<https://www.power-technology.com/projects/cape-scott-wind-farm-vancouver-island-british-columbia/>

Northeast coast of Vancouver Island, BC

Owners:

GDF Suez Canada (Parent company: Engie Energy International): <https://www.engage.com/>
 Mitsui: <https://www.mitsui.com/jp/en/index.html>

Fiera Axium Infrastructure Inc: <https://www.axiuminfra.com/?lang=en>

Engineer, Procurement and Construction contract:

AMEC Black & McDonald: <https://www.blackandmcdonald.com/>

Amix Heavy Lifts: <https://amixgroup.ca/tag/amix-heavy-lift/>

Energy Alternatives LTD.
<http://www.energyalternatives.ca/>
Smithers, British Columbia Canada V0J 2X2
(250) 846-9888

Quantum Windpower Manufacturing Corp:
Kelowna Design & Engineering Lab
Vancouver Corporate Office, West Kelowna, BC CA
Number: 1.888.700.1251
General Inquiries: info@quantumwind.com
Factory Pre-Order Program: sales@quantumwind.com
Engineering / Technical: designlab@quantumwind.com
Investment Inquiries: investment@quantumwind.com

Micro-Hydro Turbines

Informational Resources:

- Microhydropower system: <https://www.energy.gov/energysaver/planning-microhydropower-system>
- Run-of-River Power, BC: <http://energybc.ca/runofriver.html>
- Clean Energy BC: <https://www.cleanenergybc.org/about/clean-energy-sectors/run-of-river>

Energy Alternatives LTD.
<http://www.energyalternatives.ca/>
Smithers, British Columbia Canada V0J 2X2
(250) 846-9888

Idenergie, Canada based water turbine installation - <http://idenergie.ca/en/>
Idénergie Inc.
8340 rue Labarre,
Montréal (Québec)
H4P 2E7

Dependable Turbines LTD.
<http://www.dtlhydro.com/>
17930 Roan Place Surrey, B. C. Canada V3S 5K1
Phone (604) 576-3175
Email: sales@dtlhydro.com

Geothermal Heating System

General Information:

- Canadian National Geothermal Database, BC: <https://www.cangea.ca/britishcolumbiageothermal.html>
- Clean Energy BC, Geothermal: <https://www.cleanenergybc.org/about/clean-energy-sectors/geothermal>

West Coast Geothermal:
<https://www.westcoastgeothermal.com/>
24303 McClure Dr
Maple Ridge, BC V2W 2E6
604-463-1723
service@WestCoastGeothermal.com

Okanagan Geothermal:
<https://www.cleanenergybc.org/about/clean-energy-sectors/geothermal>
195 Brickyard Road Enderby BC V0E-1V2
+1 250-838-0809
info@okanagangeoenergy.net

08 - NET POSITIVE CARBON

Hydrogen Power

General information:

- University of British Columbia, Clean Energy Research Center: <http://cerc.ubc.ca/research/hydrogen/>
- British Columbia Hydrogen Study - https://www2.gov.bc.ca/assets/gov/government/ministries-organizations/ministries/zen-bcbn-hydrogen-study-final-v5_noappendices.pdf

Renewable Hydrogen Canada Corporation:
<http://www.renewableh2canada.ca/>
100-9800 Sidney, BC
Canada
V8L 5W5
(+1) 250-655-0330

Hydrogen Technology and Energy Corporation:
<https://www.htec.ca/>
344 Harbour Avenue North Vancouver, BC V7J 2E9 Canada
604-904-0412
info@htec.ca

Low tCO₂e Concrete

CORE(environmentally aware driveway, parking installation paving):
<https://www.coregravel.ca/contact/>
2750 Cumberland Road, Courtenay, BC V9N 9P1.
250.871.6840
info@coregravel.ca

ConcreteBC (sustainable, LEED certified projects):
<https://www.concretebc.ca/>
26162-30A Avenue, Langley, BC V4W 2W5
604-626-4141
concrete@concretebc.ca

Cabicrete (sustainable, LEED certified) (cement free carbon-negative concrete)
<http://carbicrete.com/>
4927-B Sherbrooke Street West
Westmount (QC) H3Z 1H2
514-210-5078
info@carbicrete.com

Batteries

Energy Alternatives LTD.
<http://www.energyalternatives.ca/>
Smithers, British Columbia Canada V0J 2X2
(250) 846-9888

Terratek:
<http://terrakek.ca/>
Victoria Island, BC Canada
250.914.5654
info@terrakekenergy.com

09 - HEALTHY INTERIOR ENVIRONMENT

Local Air Related Services

Island EHS
<https://www.islandehs.ca/>
255 Ingram St #217, Duncan, BC V9L 1P3, Canada
250-619-0995

Essential Air Ltd
<http://essentialair.ca/>
1983 Millstream Rd, Victoria, BC V9B 6E2, Canada
250-727-1831

Hazpro Environmental Ltd
<https://hazpro.org/>
944 N Park St, Victoria, BC V8T 1C6, Canada
250-891-4977

Pacific Ridge Landscapes Ltd.

2C - 9851 Seaport Pl Suite 2C, Sidney, BC V8L 4X3, Canada
778.351.4120

Urban Habitats Landscape Studio
4193 Quadra St, Victoria, BC V8X 1L3, Canada
250 858-2384

Larix Landscape
21 Obed Ave, Victoria, BC V9A 1H8, Canada
778-401-0806

LADR Landscape Architects Inc.
3-864 Queens avenue, Victoria, BC V8T 1M5, Canada
250.598.0105

Acacia Landscape Inc
1625 Fort St, Victoria, BC V8R 6N4, Canada
250.595.0527

10 - HEALTHY INTERIOR PERFORMANCE

Safe Cleaning Products
EPA Safer Choice Products - <https://www.epa.gov/saferchoice>

Local Heating and Cooling Services

Exchangenergy Inc.
<https://www.exchangenergy.ca/>
2865 Roberts Rd c, Duncan, BC V9L 6W3, Canada
250-746-9850

Sub Zero Heating & Cooling Ltd
<https://subzeroheat.ca/>
636 Charlotte St, Duncan, BC V9L 2V6, Canada
250-597-8097

Westisle Heating & Cooling Ltd.
<https://www.westisle.ca/>
2939 Boys Rd, Duncan, BC V9L 6W4, Canada
250-746-9600

360 Comfort Systems
<https://360comfortsystems.com/>
1059 Canada Ave, Duncan, BC V9L 1V2, Canada
250-597-2653

11 - ACCESS TO NATURE

Local Landscaping Services

A Cut Above Landscaping
1572 Nimpkish place, Duncan, BC V9L 0A6, Canada
250.746.9744

12 - RESPONSIBLE MATERIALS

Declare Information
Declare Product Database - <https://declare.living-future.org/>

Local Furniture Manufacturer
Union Wood Company
1340 East Pender Street
Vancouver BC V5L 1V8
Phone: 604.675.9033
Email: sales@unionwoodco.com
Website: <https://unionwoodco.com/>

Commercial Manufacturer's Green Initiatives

- Humanscale: "Green Design" - <https://www.humanscale.com/resources/designer-toolkit/green-design.cfm>
- Mohawk Group: "Living Product Challenge" - <https://www.mohawkgroup.com/sustainability/living-product-challenge>
- Bernhardt: "Ethical Sourcing" - <https://bernhardt.com/the-company/social-responsibility>
- Corian: "Building Green with Corian" - <https://www.corian.com/-building-green-with-corian-r>
- Tarkett: "Living Product Challenge" - https://commercial.tarkett.com/en_US/node/living-product-challenge-3811
- Carnegie: "Xorel is Sustainable" - <https://carnegiefabrics.com/xorel/sustainability/>

13 - RED LIST

Declare Information
Declare Red List - <https://living-future.org/declare/declare-about/red-list/>

Commercial Manufacturer's Green Initiatives

- Armstrong: "Greenprint" - <https://www.armstrongworldindustries.com/en-us/responsibility/sustainability.html>
- Acoufelt: "Environmental Practices" - <https://acoufelt.com/us/wp-content/uploads/2020/01/acoufelt-environment-practices-2019.pdf>
- Allegheny Mountain Hardwood Flooring: "Forest Stewardship" - <https://alleghenymountainhardwoodflooring.com/forest-stewardship/>
- Kohler: "Waste Lab" - <https://wastelab.kohler.com/>
- Moore and Giles: "Sustainability Statement" - <https://www.mooreandgiles.com/about/>
- bioMASON: "Revolutionary Cement" - <https://www.biomason.com/>

14 - RESPONSIBLE SOURCING

Sustainable Sourcing

- Natural Stone Council - <https://naturalstonecouncil.org/>
- Forest Stewardship Council - <https://us.fsc.org/en-us>

Transparent Employee Policy

Just. Program - <https://living-future.org/just/>

15 - LIVING ECONOMY SOURCING

Sustainably Sourced Wood

Bahnmann Timber
2265 Koksilah Rd
Cowichan Station, BC
V9L 6M2, Canada
Phone: 250.748.7124
Email: irvin@bahnmanntimber.ca
Website: <http://bahnmanntimber.ca/>

West Wind Hardwood Inc.
#5-10189 McDonald Park Rd.
Sidney, Vancouver Island
British Columbia, Canada
V8L 5X5
Phone: 250.656.0848
Email: info@westwindhardwood.com
Website: <https://www.westwindhardwood.com/>

Custom Metal Products & Site Furniture

Wellington Foundry
1084 Herring Gull Way,
Parksville, BC, Canada
V9P 1R2
Phone: 250.248.0225
Website: <http://www.wellingtonfoundry.com/>

Sustainable Engineered Wood

WholeTrees
4616 25th Ave. NE #752
Seattle, WA 98105
Phone: 206.384.2702
Email: info@wholetrees.com
Website: <https://wholetrees.com/>

16 - NET POSITIVE WASTE

Using Reclaimed Materials

- Salvaged Building Material Savings - <https://www.houselogic.com/save-money-add-value/money-saving-diy/saving-money-salvaged-building-materials/>
- Top Recycled Building Materials That Are Changing the World - <https://buildgreenhh.com/recycled-building-materials/>
- Top 9 Methods of Finding Reclaimed Building Materials - <http://purelivingforlife.com/finding-reclaimed-building-materials/>

Material Conservation Management Plan Information

- Conservation Management Plans - A Guide - http://ip51.icomos.org/~fleblanc/documents/management/doc_ConservationManagementPlans-Guide.pdf

17 - UNIVERSAL ACCESS

General information

- Canadian Equity, Diversity, and Inclusion Guidelines: <https://www.chairs-chaires.gc.ca/program-programme/equity-equite/index-eng.aspx>
- British Columbia Building Access Handbook - https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/construction-industry/building-codes-and-standards/guides/2014_building_access_handbook.pdf
- New 2018 Requirements - <https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/the-codes/2018-bc-codes-33901> ; <https://www.bchousing.org/publications/Builder-Insight-17-BC-Building-Code-Changes-2018.pdf>
- Building Housing Designing Guidelines - <https://www.bchousing.org/publications/BCH-Design-Guidelines-Construction-Standards.pdf>

Sculpture Garden

General information:

- Role of Sculpture in Shaping The Style of Garden Objects: <http://www.ejournals.eu/pliki/art/8402/>
- Guide to Sculpture Parks and Gardens: <https://archive.org/details/guidetosculpture00mcca/page/1>

Vancouver Island Sculptors Guild (lists around 50 sculptors on the island):

<https://www.sculpt.ca/members-directory>
kumo@shaw.ca

Mindful Doors

General Information:

- ADA Compliant Doors: <https://www.ada-compliance.com/ada-compliance/ada-doors.html>

NorthShore Door:

<https://www.northshoredoor.ca/doors/custom-doors/>
2433 Dollarton Hwy, North Vancouver, BC V7H 0A1
604.980.3667

Wescon Doors:

<http://www.wescondoors.com/custom/>
5120 Polkey Road Duncan, BC, Canada V9L 6W3
(250) 748-5595
info@wescondoors.com.

Mindful Ramps

General Information:

- Staircase code of BC: <https://www.prestprop.com/wp-content/uploads/2016/08/STAIRCASE-CODE-BC.pdf>
- Handrail and Guards BC Building Code - http://www.rdosmaps.bc.ca/min_bylaws/building_inspect/forms/Guard_excerpt.pdf
- Wheelchair Ramp Information: <https://mobilitybasics.ca/wheelchair-ramps/>

Island Mediquip (ramps, folding ramps, etc):

<https://www.islandmediquip.com/>

1063 Canada Avenue Duncan, BC V9L 1V2 Canada

250-597-0151

Macdonald's Home Health Care:

<https://macdonaldshhc.com/category/products/ramps/>

148 West 6th Ave Vancouver BC, V5Y 1K6 Canada

info@macdonaldshhc.com

604-872-5496

Project and Environmental Review

<https://iaac-acic.gc.ca/050/evaluations/proj/80509>

100 The Pointe, 999 Canada Place Vancouver, BC, V6C 3T4

per@portvancouver.com

Exhibit Access

General Information:

- Smithsonian Accessible Exhibition Design Guideline - https://www.sifacilities.si.edu/ae_center/pdf/Accessible-Exhibition-Design.pdf
- BC Accessible Graphics Guidelines - <https://www2.gov.bc.ca/gov/content/governments/services-for-government/policies-procedures/web-content-development-guides/writing-for-the-web/visual-design-guide/accessible-graphics>
- Braille Literacy Canada, Accessible Signage Guideline - http://www.brailleliteracycanada.ca/CMFiles/Accessible_Signage_Guidelines_BLC-PrintFormatted.pdf

Accessible Website design:

- Trace Research and Development Center: <https://trace.wisc.edu/>
- CPB/WGBH National Center for Accessible Media: <https://www.wgbg.org/ncam/>
- Center for Applied Special Technology (CAST): <https://www.cast.org/bobby/>

Accessible Sign:

FastSigns:

<https://www.fastsigns.com>

470 Bay St. Victoria, BC V8T 5H2

(250) 995-2221

652@fastsigns.com

Graphic FX Signworks:

<http://www.gfxsigns.com/>

375 Hillside Avenue Victoria, BC Canada V8T 1Y4

info@gfxsigns.com

250.382.7446

Douglas Signs LTD.

<http://www.signsvictoria.ca/#!/home>

852 Devonshire Rd, Victoria, BC V9A 4T4

250 382 7614

info@signsvictoria.ca

18 - INCLUSION

General Information:

- Living future about Just: <https://living-future.org/just>
- JUST organization Manual: http://justorganizations.com/sites/all/themes/pixture_reloaded/files/15-0515%20Just%20Manual_Updated.pdf
- Living Future Just Manual 2.0: https://living-future.org/wp-content/uploads/2019/03/Just_2_0_Manual_FINAL.pdf
- MWDBE Organization: <https://www.mwbe-enterprises.com/>

Mission Green Buildings:

<http://missiongreenbuildings.com/>

Suite 101 – 1019 Wharf St Victoria, BC Canada V8W 2Y9 1.250.418.1288

info@integralgroup.com

PWL Partnership Landscape Architects:

<http://www.pwlpartnership.com/>

1201 West Pender Street Vancouver, BC V6E 2V2

(604) 688-6111

info@pwlpartnership.com

HCMA Architecture + Design:

<https://hcma.ca/>

205–26 Bastion Square Victoria, BC V8W 1H9 Canada

250.382.6650

victoria@hcma.ca

19 - BEAUTY & BIOPHILIA

Buildings featuring Wood Materials

- Brock Commons Tallwood House, Vancouver, BC - <https://vancouver.housing.ubc.ca/residences/brock-commons/>

Gardens with Winding Paths

- The Butchart Gardens, Victoria, BC - <https://www.butchartgardens.com/>
- University of Washington Botanic Gardens, Seattle, WA - <https://botanicgardens.uw.edu/>
- VanDusen Botanical Garden, Vancouver, BC - <https://vandusengarden.org/>

Local Cowichan Artists

All artists listed below are found here: <https://www.cowichantribes.com/presence-valley/cowichan-entrepreneurs/arts-and-crafts>

- Alicia Boone - Cowichan knit apparel
- Dora Wilson, Elder - Cowichan Knitter & Traditional Blanket Weaver
- Joe Wilson - Paintings
- Herb Rice - Cowichan / Cnuneymuxw Tribes Carver
- Joe Jack - Traditional Salish Artist
- Virginia Jack - Basket Weaver
- Edward Joe - Paintings; Gold & Silver Jewelry
- Brant Johnny - Cowichan Tribes Carver
- Stella (Tina) Johnny - Clothier / Weaver
- Evelyn Louie, Elder - Cowichan Knitter
- Maureen Tommy - Traditional Blanket Weaver & Cowichan Knitter
- Maritna Wilson - Cowichan Knitter & Spinner

20 - EDUCATION + INSPIRATION

Living Building Challenge Certified Case Studies

https://living-future.org/lbc-3_1/case-studies/

Sustainability Educational Signage and Brochure Examples

- Tufts University Collaborative Learning and Innovation Complex - <https://www.behance.net/gallery/38006449/LEED-Educational-Signage>
- Portland State University - <https://www.flickr.com/photos/jakejake/8117690143>
- Portland State University - <https://www.flickr.com/photos/jakejake/8117690469>
- Purdue University France A. Córdova Recreation Center - <https://campusrecmag.com/leed-ing-green-initiatives/>
- Gulf State Park Interpretive Center - <https://watershed.pro/portfolio/gulf-state-park-interpretive-center/>
- Gulf State Park Interpretive Center - <https://www.hersickwebster.com/project/gulf-state-park-interpretive-center-brochure/>

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Middle Image: Sustainable Buildings Research Centre the First Building in Australia to Achieve International Living Building Challenge Compliance. (n.d.). Retrieved from <https://www.coxarchitecture.com.au/latest/sustainable-buildings-research-centre-the-first-building-in-australia-to-achieve-international-living-building-challenge-compliance/>
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- 5 Squamish Lil'wat Cultural Centre: Architectural & Interior Design Project. (n.d.). Retrieved from <https://thinkratio.com/project/squamish-lilwat-cultural-centre>
- 6 Douglas Cardinal Architect. (n.d.). AANISCHAAUKAMIKQ CULTURAL INSTITUTE. Retrieved from <http://www.djarchitect.com/work/#/new-gallery-5/>
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- 7 Grimm, M. (n.d.). Harvard Center for Green Buildings and Cities. Retrieved from <https://www.snohetta.com/projects/413-harvard-housezero#>
- 8 Indian Creek Nature Center. (n.d.). Retrieved from <https://clubrunner.blob.core.windows.net/00000002884/Images/Indian-Creek-Nature-Center.jpg>
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Bottom Image: Tyson Living Learning Center. (2017, January 12). Retrieved from <https://living-future.org/lbc/case-studies/tyson-living-learning-center/>
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Top Image: The Morris & Gwendolyn Cafritz Foundation Environmental Center. (n.d.). Retrieved from <https://www.aia.org/showcases/92581-the-morris--gwendolyn-cafritz-foundation-env>
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- 3 Our Flood Protection System. (n.d.). Retrieved from <https://www.northcowichan.ca/EN/main/departments/engineering/Flood-Protection/our-flood-protection-system.html>

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 Middle Image(R): Jackson, J. (2011). Arbutus menziesii in Seward Park October 2011. photograph. Retrieved from <http://metropolitangardens.blogspot.com/2011/11/madrone-in-seward-park.html>
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CHAPTER 6 - THE LIVING BUILDING CHALLENGE OVERVIEW

All information & images in this chapter come from the LBC Handbook.

All information & images on Pages 41, 49, 55, 61, 69, 79, 85 (Petal Introductions) come from the LBC Handbook.

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Core Imperative 1

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Imperative 2

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