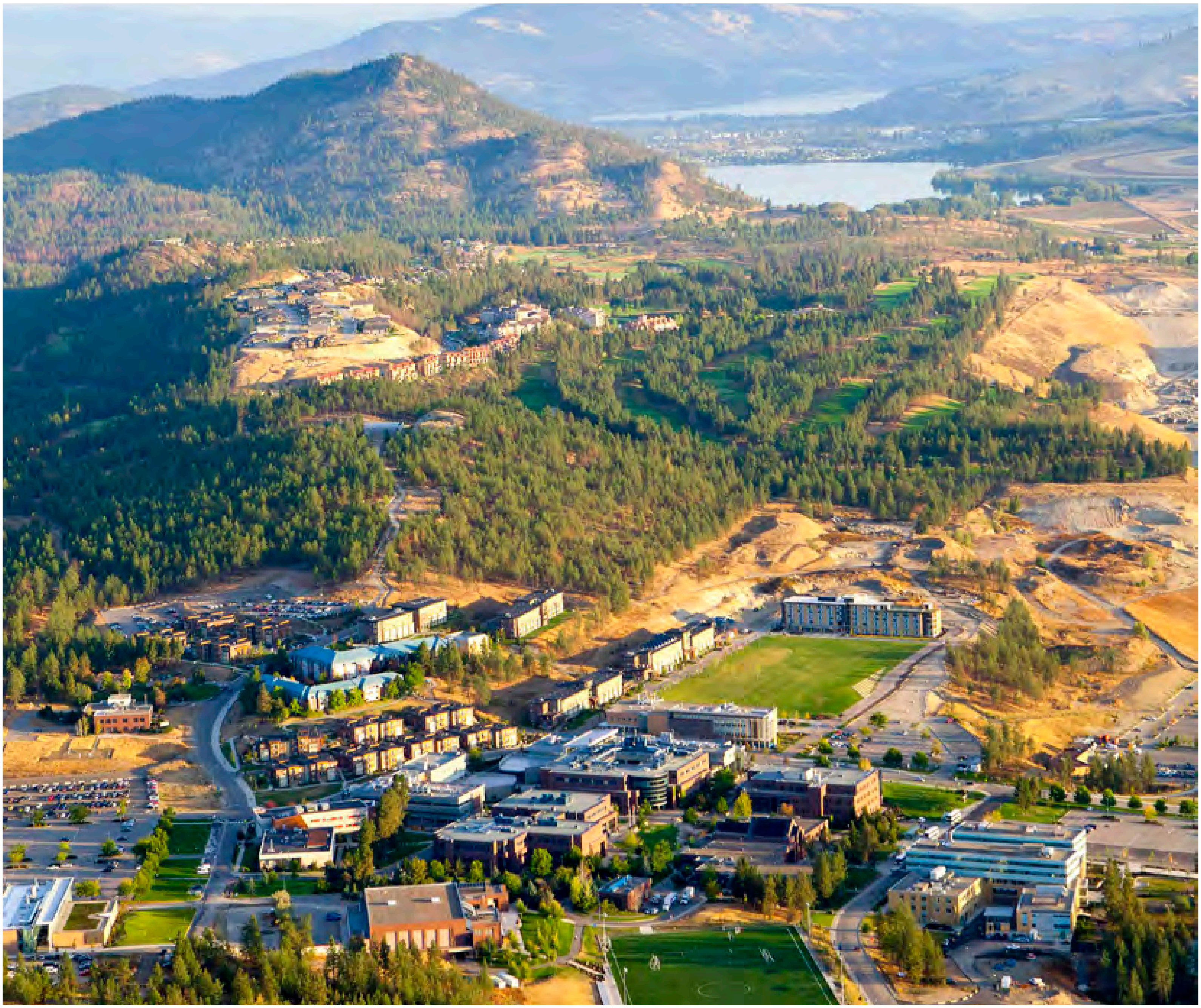
The University of British Columbia

Okanagan Campus Design Guidelines



THE UNIVERSITY OF BRITISH COLUMBIA

4 GREEN BUILDINGS

GREEN BUILDINGS GOALS

1. Achieve net positive performance
2. Support a low carbon future
3. Optimize water quality, supply and security
4. Enhance and/or restore ecology
5. Strive for full waste recovery
6. Divert 100% of rainwater from municipal systems
7. Support human health and wellbeing

Green buildings reduce energy use, reduce greenhouse gas emissions and improve occupant health and well being.

4.1
INTRODUCTION AND GOALS

The *Whole Systems Infrastructure Plan* (WSIP) defines and supports a long term vision for creating a sustainable campus using a whole systems approach that incorporates environmental, economic and social sustainability outcomes to achieve a net positive[1] impact on the wellbeing of the campus community and ecology. The WSIP provides an implementation framework for how this will be achieved, including recommendations for the Design Guidelines as well performance goals, both of which have been used in the development of guidance provided in this section.

As part of the whole systems approach, individual campus buildings need to contribute to the overall ambitious vision of a net positive campus articulated in the WSIP. To achieve this, building designs need to meet incrementally improved performance goals on the building scale and consider of impacts beyond the site boundary that are beneficial for the entire campus. For example, individual buildings should connect to one of the District Energy Systems in order to reduce reliance on traditional heating and cooling systems and associated higher greenhouse gas emissions.

The following goals inform the application of the guidelines:[2]:

1. **Achieve a net positive performance in operational energy and carbon:** Buildings need to be designed to incrementally use less energy and emit less GHG's over time in order to reach a net positive goal for energy and carbon by 2050.
2. **Implement a framework that supports low embodied carbon in future development:** UBC seeks to promote building designs that minimize embodied carbon and other environmental and social impacts associated with the extraction, manufacturing, construction and operations.
3. **Optimize water quality, supply and security:** Given the Okanagan's arid drought prone climate together with population growth, water conservation is an important imperative in the design of new buildings and landscapes.
4. **Enhance and/or restore the ecology:** Including natural systems that can enhance habitat on campus as well as create a visual expression of biodiversity that can improve mental health, spark interest and provide educational experiences.
5. **100% diversion of rainwater from municipal systems:** Rainwater management is required at each development site to reduce the downstream impact and help achieve 100% diversion for the campus as a whole.

[1]Net positive: a mode of development that contributes to human and ecological systems more than it takes. This approach focuses on generating mutual benefits to humans and the environment as opposed to only attaining net zero or negative impacts.

[2]All goals are taken from WSIP except goal 6.

6. **Strive toward full waste recovery reuse:** UBC seeks to reduce consumer waste through management programs and waste from all demolition, construction and renovation projects by optimizing material use, reducing waste generated, and increasing waste diversion.

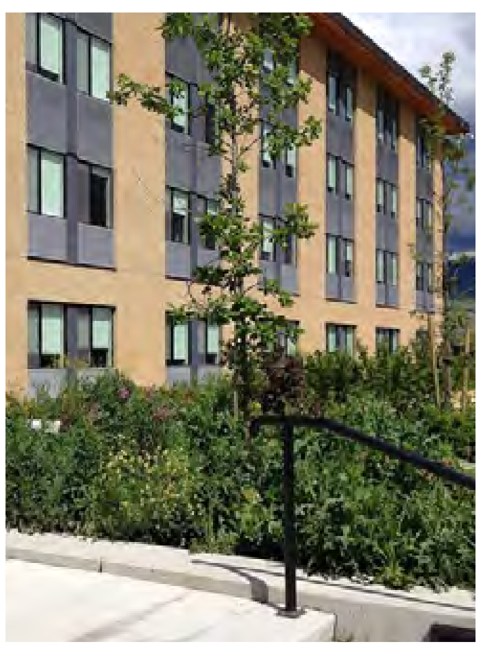
7. **Support human health and wellbeing in building design:** From design and construction, to inhabitation, to demolition - human health and wellbeing must be considered at all stages of a building's life-cycle.

4.2 GREEN BUILDING CERTIFICATION (LEED)

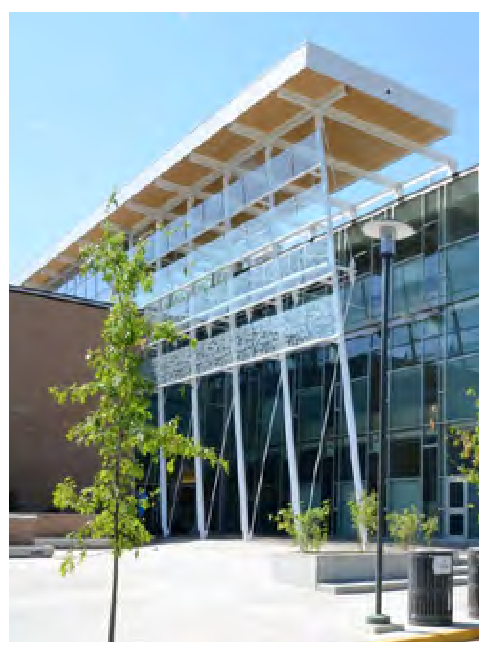
UBC's baseline policy is that all major institutional projects are to be LEED Gold certified, however other pre-approved certifications may be used (for example certification by: Living Building Challenge, Passive House or the WELL Building Standard). Note some certifications are focused on specific aspects of building design (e.g. Passive House focuses on Energy use) and projects will be subject to additional design requirements (e.g. water use reduction requirements)

New construction and major renovation projects targeting LEED certification should reference the UBC LEED Implementation Guide (version 4). This Guide was developed for the Vancouver campus and is intended to provide project teams with UBC specific guidance on LEED credits for the campus, as well as clearly identify credits that should be mandatory because they align with UBC policies. Specific parameters for UBC Okanagan projects will dictate individual approaches to LEED certification but the Guide will provide a useful starting point.

Purcell Residence is built to LEED Gold equivalent for student residences, and Reichwald Health Sciences Centre is LEED Gold Certified.



Purcell Residence



Reichwald Health Sciences Centre

4.3
INTEGRATIVE PROCESS

UBC supports an integrated design process for buildings and retrofits to ensure more consistent integration of sustainability measures and to ensure key design disciplines are brought together to achieve a high level of sustainability performance in a streamlined manner. Integrated design is critical for the success of a whole systems approach (recommended in the WSIP) for the campus and needs to start early in the design process.

The UBC Sustainability Process brings building stakeholders together right from the start of the design process to look for synergies between systems and components. The benefits of integrated design are many: achieving higher levels of building performance and occupant comfort, reduced environmental impacts and – with the input of the building operators and end users – improved building lifecycle management and user satisfaction.

UBC actively promotes processes that encourage integrated design. To this end, UBC requires that design teams follow the UBC Sustainability Process which provides guidance.

The first step in the UBC Sustainability Process is the development of a Project Design Brief. UBC stakeholder workshops are held to identify each project's social, economic and environmental sustainability goals prior to the engagement of the design team. The goals reflect UBC's WSIP implementation objectives and emerging priorities.

UBC has found that three workshops with the design team and university stakeholders are needed in order to fully explore and integrate the sustainability goals into the project design. The first workshop (3A) takes place during schematic design and provides early focus on building massing, orientation and sustainable energy and water systems. The second workshop (3B) investigates design strategy synergies that will meet the goals set out in the Design Brief. The final workshop (3C) takes place during design development and uses interactive energy modeling to evaluate the trade-offs between energy performance, lifecycle cost and system complexity.

The final step in the Process is to facilitate a feedback loop and officially report on the project's sustainability outcomes and performance to the UBC Board of Governors. This feedback step is crucial in transferring lessons learned from one project to the next.

4.3.1 Existing Buildings

In order to clearly identify policy and process requirements associated with new buildings, renovations, fit-outs and retrofits a classification system has been developed.

Existing buildings renovations and retrofits offer a significant impact in terms of achieving the campus sustainability goals because of the extent of the existing building stock. The tier system clarifies performance targets and expectations for the renovation and retrofits of existing buildings as well as new builds:

TABLE 01. TIER SYSTEM FOR INSTITUTIONAL BUILDING PROJECTS

TIER	DESCRIPTION	AREA/BUDGET	GREEN BUILDING REQTS.
TIER 1	New Buildings - Large	> 1000 m^2, > $5M	• Green building certification • Energy target* • UBC Technical Guidelines • Life cycle costing focus • Sustainability Process • Design Brief • Owner's Project Reqts. • DE Strategy*
TIER 2	New Buildings - Small	< 1000 m^2, > $5M	• Energy target • UBC Technical Guidelines • Life cycle costing focus • Sustainability Process • Design Brief • Owner's Project Reqts.
TIER 3	Major Project Renovations a. Renewal (includesenvelope and mechanical system upgrade)	> $5M	• Green building certification (consider) • Energy target* • UBC Technical Guidelines • Life cycle costing focus • Abbreviated Sustainability Process • Abbreviated Design Brief • Owner's Project Reqts.
	b. Other (extensive interior upgrades)		• UBC Technical Guidelines • Life cycle costing focus • Meeting with Project Services, Energy Team, Sustainability CP&D • Owner's Project Reqts.
TIER 4	Partial Fit-outs	$1M - $5M	• UBC Technical Guidelines • Life cycle costing focus • Meeting with Project Services, Energy Team, Sustainability CP&D • Owner's Project Reqts.
TIER 5	System Upgrades (e.g., chiller replacement, controls)	N/A	• UBC Technical Guidelines • Life cycle costing focus

in progress*

4.4

NET POSITIVE DESIGN

4.4.1 Passive Design

Passive design strategies developed early in the building design process, using modeling to understand the impacts of design decisions, have significant potential to reduce energy use, reduce greenhouse gas emissions and improve occupant comfort while allowing full compatibility with the campus district energy systems in a cost effective manner. The following passive design considerations are:

a. Design high performance envelopes that are air tight, minimize thermal bridging and provide a high level of thermal comfort for occupants.

b. Harness solar radiation and to take advantage of internal heat loads through well-insulated envelopes and orientation that maximizes solar gain in winter and minimizes solar gain in summer.

c. Prevent unwanted solar gain with shading, storing heat in thermal mass, and using outdoor cool air for passive ventilation.

d. Optimize daylight and views to the outdoors for occupants while controlling unwanted solar gain and glare and maximizing envelope performance.

e. Through orientation and massing, maximize the effectiveness of naturally occurring air flow patterns to facilitate passive ventilation and minimize the use of mechanical ventilation.

4.4.2 Building Orientation and Massing

Optimizing building orientation is a fundamental and effective way to design comfortable buildings which use less energy. Building shape and massing can also significantly affect the energy performance of buildings.

a. Use the appropriate glazing response according to façade orientation and design specific solar shading appropriate to each façade orientation.

b. On south and west elevations, minimize unshaded windows, particularly the west elevation which contributes to significant undesirable afternoon and evening solar gain.

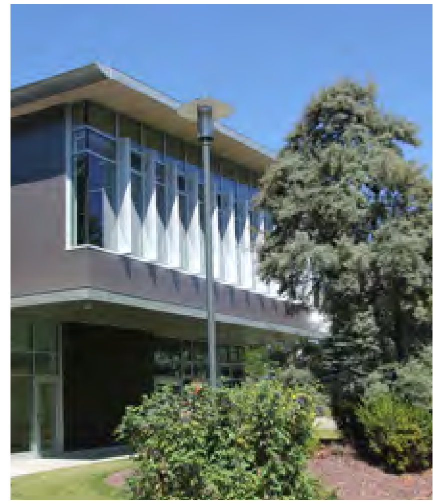
c. On existing buildings with extensive glazing on south, west or east elevations, consider strategies such as shading devices or buffer spaces to improve thermal comfort and to reduce energy use associated with glazing.

d. Design compact buildings to achieve a lower envelope to volume ratio. Where possible, include atriums to facilitate natural ventilation, day-lighting and passive cooling.

4.4.3 Space Planning

Matching program requirements with appropriate orientation, massing, and other passive design strategies can reduce energy use and play a role in occupant comfort.

THE HANGER FITNESS AND WELLNESS CENTRE



Cross laminated timber construction achieves a high performance building envelope and reduces embodied energy.

ARTS AND SCIENCES II

The building incorporates passive design strategies including natural/wind driven ventilation, high thermal mass and heat recovery.

a. Where possible locate spaces in the building so that particular thermal requirements can be met with minimal active building systems.

b. If possible, locate spaces with wider comfort ranges or that require heating in the more difficult orientations such as south and west. Program areas with large internal gains are ideally located on the north orientation to minimize cooling.

c. In challenging thermal comfort situations, projects can incorporate buffer spaces to act as a thermal buffer.

d. Consider zone control for heating and ventilation that can be used to capture energy costs savings. Zone design should incorporate current uses and future potential building use consolidation or change of use and layout.

e. Include vestibules at all major entranceways to reduce air infiltration by having only one set of doors open at any given time.

f. Building systems should be designed to be easily and efficiently reconfigurable.

4.4.4 Building Envelope

Buildings shall have institutional quality building envelopes that are well-insulated and airtight in order to reduce energy use, provide a comfortable environment for building occupants and protect the university's assets. Projects shall review the UBC Technical Guidelines early in the design process.

a. Insulation values shall be greater than the prescriptive code values. See the UBC Technical Guidelines (TG's) 07 21 00 Thermal Insulation.

b. Airtightness shall be tested according to ASTM E799 or USACE Version 3 standard, as required by the BC Energy Step Code.

c. Recommended cladding materials are: brick, stone, precast concrete, metal panels and cement composite panels. Wood (with coating) and architectural (poured in place) concrete are only permitted in protected locations under overhangs.

d. EIFS, stucco and exposed glulam elements are not permitted. See TG's Section 07 40 00 Cladding.

e. Subgrade waterproofing shall be provided for occupied spaces using a torch on membrane. See TG's section 07 10 00 Damp proofing and Waterproofing.

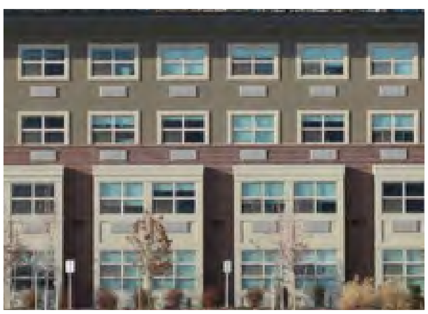
f. Roofing shall typically be two ply SBS at flat roof locations with a five year RCABC warranty. The level of leak detection and monitoring shall be determined according to risk. See TG's section 07 50 00 Membrane Roofing, 07 55 00 Vegetated Protected Membrane Roofing; 07 61 00 Sheet Metal Roofing and 07 62 00 Sheet Metal Flashing and Trim.

g. Exterior doors are to be protected by overhangs. See TG's section 08 00 10 Openings - General Requirements.

4.4.5 Windows and Glazing

Windows provide necessary views, daylight and ventilation, but are the weakest thermal elements in the building envelope. Careful consideration of the location,

NICOLA STUDENT RESIDENCES



The building uses of high efficiency wall and roof insulation and high efficiency windows.

Building orientation and strategic use of glazing and shading minimize solar gain and heat loss.

UNIVERSITY CENTRE

size and performance of windows can significantly improve thermal comfort and reduce energy use in buildings.

a. To conserve energy, windows and associated exterior solar shading are to allow beneficial solar gain in the winter and block it in the summer. Overall each project shall minimize the heat loss due to the poor thermal performance of windows. See TG's section 08 80 00 Glazing.

b. Projects are to have high performance windows: thermally broken, double or triple pane window assemblies designed for a cool climate. Glazing units are to incorporate low-e coatings and have low solar heat gain coefficient. See TG's section 08 00 10 Openings-General.

c. Fiberglass windows are encouraged in lieu of metal windows where code allows due to their superior performance. PVC windows will be permitted in non-academic, low rise buildings only. See TG's section 08 50 00 Windows.

d. Curtain wall is preferred, storefront is permitted in protected locations only. See TG's section 08 44 13 Glazed Aluminum Curtain Walls and 08 41 13 Aluminum-Framed Entrances & Storefronts.

e. Where operable windows are utilized, insect screens and HVAC interlocks must be provided unless otherwise approved. For areas without a defined single occupant, automated windows are preferred over manual.

4.4.6 Building Energy Efficiency

Incorporating energy efficiency in new buildings should conceptually first be tackled by reducing loads, then selecting efficient systems to meet the load and finally by looking at renewable electricity or carbon neutral district energy to meet the load.

Energy targets, including energy use intensity (EUI) targets and thermal energy demand intensity (TEDI), will be set by UBC for all new projects and major retrofits. Energy targets will be based on considerations in other policy documents including the WSIP, the District Energy Strategy, the Climate Action Plan and alignment with the evolving BC Step Code. Energy efficiency measures to achieve targets are to be selected for building designs based on cost efficiency over the lifecycle.

The targets, expressed in kWhr/m2/yr, will be identified during the Design Brief phase, based on the building use. The design team will be given an opportunity to review and discuss the targets and its implication for building design; after final agreement on the target the project shall be designed to meet the EUI. In addition to the EUI target, buildings may have a LEED EAc1 requirement and will need to achieve a minimum of 11 points for this credit, see the LEED Implementation Guide for details.

4.4.7 District Energy

All academic and residence buildings shall connect to the campus district energy systems for heating, cooling and domestic hot water wherever possible to prepare for a successful transition to a zero carbon campus. Buildings for

This facility uses low carbon energy supply to heat and cool campus buildings.

Geo-Exchange Facility

which connection to the low temperature district energy system is not practical (for example, due to high elevation) must apply for a variance, and instead must achieve GHG reductions through providing all space heating and domestic hot water from the efficient use of electricity.

4.4.8 Building Systems and Equipment

Building systems and equipment should be designed to be as simple as possible while meeting the functional requirements. Components, finishes, equipment and systems are to be selected that require minimal maintenance and exhibit a high level of maintainability and long-term reliability. Equipment shall be readily accessible for maintenance and replacement. Parts and service for all equipment should be readily available locally.

4.4.9 Metering and Controls

Understanding UBC's energy use helps to reduce campus energy and emissions. In order to measure energy use, all buildings are to have building meters for electricity, gas, water and district energy. Secondary side BMS meters are required in all buildings over 2,500m2 for the following uses: interior lighting , exterior lighting , space heating, space cooling, domestic hot water, fans and pups, receptacle loads and water for irrigation. The measurement devices shall have the capability to automatically communicate the energy consumption data to a data acquisition system.

Refer to UBC- OKanagan 01 92 00 Monitoring Based Commissioning TG for detailed requirements.

4.4.10 Heating, Ventilating and Air Conditioning

All systems should be compatible with UBC's ambient temperature DES system, without the need for packaged boilers for peak heating during winter. Mechanical cooling should be provided as required for thermal comfort, but should be optimized by the use of night setbacks, demand control ventilation and passive design strategies. Consideration should be given to future climate predictions see 4.7.10 Climate Adaptive Design. The following systems are recommended:

- 4 pipe heating/cooling system
- Ventilation heat recovery systems are generally required
- Displacement ventilation
- Dedicated outdoor air systems
- Natural ventilation(typically combination with mechanical ventilation)
- Sewage heat recovery (recommended in residences)

4.4.11 Lighting and Power

Building lighting shall incorporate efficient LED fixtures capable of dimming and lighting controls. Plug load controls in the form of occupancy sensor should be considered for office spaces and other locations where loads can be reduced without impacting research and other important functions. For the residences vacancy control sensors could be considered for the rooms. To reduce peak electrical loads from summer air conditioning and winter heating, major projects shall have a demand response plan that includes the capability to reduce a building's peak demand by 10% by automated or semi-automated means.

4.4.12 Lab Ventilation Control

Laboratories must meet all ventilation requirements and guarantee safe operation while reducing air changes per hour (ACH) where possible to save energy. The baseline rate is 8 ACH with a night setback when unoccupied of 4 ACH. Fume hoods should be specified at the lower end of acceptable WorkSafeBC velocity range. See TG's section 23 05 00 HVAC – General Requirements and 23 38 16 Fume Hood Exhaust Systems.

4.4.13 Solar PV Readiness

New buildings must be ready to receive a future PV system on open roof areas. Building designs must indicate allocated space, capacity and pathways for infrastructure including rough-in and cable.

4.4.14 Commissioning

All major projects should be commissioned by a third party commissioning provider using monitoring based commissioning. The Owners Project Requirements are to be developed early in the design process in conjunction with UBC stakeholders. Facility operating staff shall be part of the commissioning team as well as transition team which will help UBC as buildings transition from the construction phase to the occupancy phase. Appropriate demonstration and training shall be provided to facilities as part of projects scopes.

See TG's section 01 91 00 Commissioning and 01 92 00 Monitoring Based Commissioning.

4.5
LOW EMBODIED CARBON FUTURE

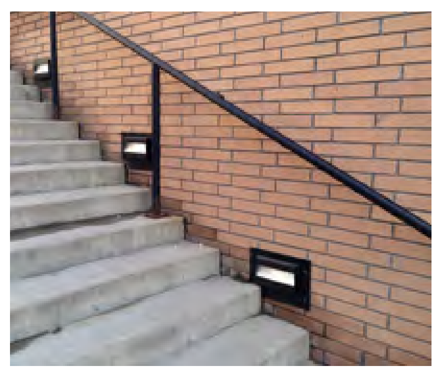
4.5.1 Materials Selection

Wood has the potential to be a low carbon, local building material which has been used in innovative ways successfully at UBC. The choice of a wood structural system is recommended to be used where there is a good fit with the use of the building (for example residences and some academic uses). Wood cladding as a secondary cladding material or as an interior finish materials is also encouraged.

The south atrium collects and heats air for heat recovery.

University Centre

Locally sourced, high-recycled content materials including low embodied energy high fly-ash concrete are used on the exterior.



University Centre Exterior

4.5.2 Durability

Buildings (tiers 1 to 5) and their systems are to be designed to optimize the university's total cost of ownership while meeting the functional requirements of building users. During design of major building systems or replacement of equipment, options should be compared that allow the university to choose the optimum total cost of ownership.

Durable materials should be selected that minimize the need for new resources and their operation and maintenance expenditures over the building's lifetime. Components, finishes, equipment and systems are to be selected that require minimal maintenance and exhibit a high level of maintainability and long-term reliability. Equipment shall be readily accessible for maintenance and replacement.

The target design service life for key building systems are to be as follows:

- 100 years for structure
- 100 years for the exterior envelope (based on a service life *Campus Plan* which may include *Campus Plan*ned replacements)
- 25 years for roof systems
- 30 years for mechanical and electrical systems
- 25 years for interior components and systems

4.6

WATER QUALITY, SUPPLY AND SECURITY

4.6.1 Water Conservation

UBC is currently undergoing a campus wide monitoring strategy and water metering program to establish a baseline for campus operations. All new buildings and renovations should work with building users early in the design process to reduce process water use and install water efficient plumbing fixtures. For reduction in exterior water use, drip irrigation is required where possible and native planting requirements will reduce watering requirements. A non-potable water system is being considered for the campus and buildings may be part of a pilot program for purple pipe plumbing system installation.

4.6.2 High Efficiency Plumbing Fixtures

New and existing buildings should install high efficiency plumbing fixtures as a water conservation measure.

- Fixture type Flush/Flow rate
- Toilets 4.8 LPF 1.26 GPF
- Urinals 1.9 LPF 0.5 GPF

- Lavatory faucets 1.9 LPM 0.5 GPM
- Kitchen faucets 5.7 LPM1.5 GPM
- Showers 5.7 LPM1.5 GPM

4.7
ECOLOGY

4.7.1 Biodiversity and Building Design

Naturalized systems should be integrated into new construction and landscape where possible. For buildings, green infrastructure such as living walls and green roofs should be considered where appropriate. Sustainable drainage should be considered in building design and tie into campus wide rainwater management goals and public realm design. Trees of an appropriate species should be planted wherever possible to contribute to increased biodiversity and provide shade for buildings.

4.7.2 Green Infrastructure

Green infrastructure such as living walls or green roofs may be considered in some locations, despite their cost premium, as they offer many social and environmental benefits that tie into WSIP goals.

Living walls can provide shade for buildings and offer psychological benefit to building occupants by creating a closeness to nature. Living wall design should allow for ease of maintenance and irrigation and should be planted either in the ground or in horizontal containers.

Plant selection should be suitable to the climate, drying out in the summer drought and re-growing with the rain in the fall and spring. Native or adaptive plants should be selected where possible to enhance habitat for pollinators, butterflies and some birds.

4.7.3 Bird-Friendly Building Design Strategies

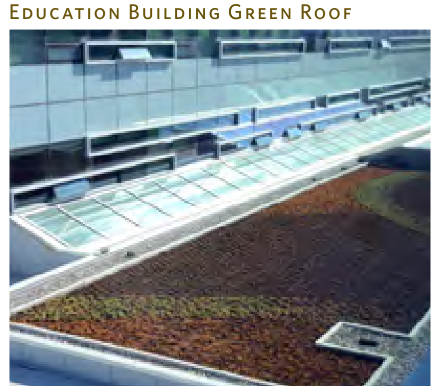
Birds are important for biodiversity because they provide essential ecosystem services in the form of pest control, pollination, and seed dispersal. In addition to this, the high visibility and audibility of birds creates a valuable experiential link between people and local wildlife in urban settings.

Glass is currently one of the largest sources of anthropogenic bird mortality in North America. Birds are unable to perceive glass as a solid object and building collisions occur when they try to fly into the sky or vegetation they see through or reflected by glass. If glass is sensitively incorporated into the built environment, these pitfalls can be avoided and we can continue to enjoy the benefits this material offers. For further information, see *UBC's Bird Friendly Design Guidelines.*

Engineering Management and Education Landscape

The naturalized landscape adjacent to storm water retention pond supports campus ecology and biodiversity.

Engineering Management and Education Building Green Roof



The use of native and adaptive plants for the green roof captures rainwater for irrigation.

4.8

RAINWATER

4.8.1 Rainwater Management

[3]Retention is as: complete containment on-site for disposal through infiltration or evaporation. (Detention is defined as temporarily holding and releasing of water (e.g., using a tank or orifice, but the volume still runs off) and does not meet the IRMP requirements.)

[4]Submittals: design, calculated added volume rates for the 100 year storm event and description of how overland water will be directed off the site.

All rainwater will be managed on campus in compliance with the Integrated Rainwater Management Plan, 2017 (IRMP). Individual projects must achieve minimum on-site retention[3] storage requirements which accommodate volume changes from the predevelopment state in order to reduce downstream effects on infrastructure. Site control can be achieved through Low Impact Development (LID) techniques such as rain gardens and lineal vegetated swales, designed to slow down, infiltrate, evaporate and treat submittals[4] to support the minimum retention requirements. In addition to meeting the IRMP's requirements, all LEED Certified projects are required to manage the 95th percentile of regional or local rainfall events.

4.9

WASTE RECOVERY AND REUSE

4.9.1 Construction and Demolition Waste

UBC seeks to reduce waste from all demolition, construction and renovation projects by optimizing material use, reducing waste generated, and increasing waste diversion.

A minimum waste diversion requirement for all projects (including renovation projects and minor projects) is to divert at least 75% of construction and demolition waste from disposal. This is easily achievable in most projects and can often have economic benefits. LEED projects should follow the additional requirements as described in the LEED Implementation Guide.

All projects need to track the amount of waste and diversion achieved via project submittals. See TG's Construction and Demolition Waste for templates and more information.

4.9.2 Waste Separation Guidelines

To allow conformance with UBC's waste management programs and regional waste disposal bylaws, UBC buildings must make provisions for indoor recycling stations, rather than stand-alone garbage receptacles, in addition to providing the necessary facilities for storage and loading of waste and recycling. Refer to TG's 10 20 00 Interior Specialties (section 5.0 Recycling and Water Management) and 11 82 00 Waste Handling Equipment.

Recycling stations are configured to collect waste in the following streams:

- Blue Bins – Recyclable Items

- Green Bins – Refundable Items
- Grey Bins – Waste
- Yellow Bins – Organic Materials (only located in lobbies of academic and administrative buildings as well as in lunchrooms across campus)

On average, each recycling station can service about 1,000m2 of gross building floor space. The number of stations may need to be adjusted up or down depending on the number of users and the size of the stations. High traffic areas should use full sized stations and low traffic areas will more easily accommodate small stations). Stations should be located such that the front of the station, and therefore signage, is facing the majority of users. Typical placement is against a wall. (See the *Recycling Infrastructure Guidelines* for more details).

In lobbies, recycling stations should be situated such that most building visitors will be able to see at least one full-size station when entering or leaving the building through the main entrances.

Recycling stations should be located with 5m of the door to large classrooms or lecture halls and 10m of the door to smaller classrooms. Stations are typically located in hallways and not inside classrooms.

In lunch rooms and kitchenettes, recycling stations should be located in the same room or within 3m of the food preparation area and must include an organic materials stream. Constrained spaces may use a 3-bin station with the paper bin omitted provided there is a paper recycling bin/station nearby.

Individual offices should have desk-side recycling units, which consist of a blue recycling bin and black garbage bin attachment, typically emptied by occupants. Recycling stations should be within 25m of all offices and on the same level. Organic materials and recyclable/refundable items may be omitted from an office station provided these streams are provided at another station within 25 m (e.g., at a lunch room).

4.10
HUMAN HEALTH AND WELLBEING

4.10.1 Healthy Materials

To promote optimal material selection, UBC is committed to working towards content transparency for all products used on campus. Project teams should choose building materials that have demonstrated content when possible, for example materials for which the manufacturer has developed Environmental Product Declarations and Health Product Declarations. Building materials choices should be optimized to minimize impacts on human health over their life cycle.

4.10.2 Environmental Quality

Projects are to consider the impacts of their design on the health and well-being of the cmpus community. Specifically, projects are to consider how air quality, lighting levels, noise levels, thermal comfort, and design for a healthy lifestyle can benefit students, staff, faculty, and visitors.

4.10.3 Air Quality

Projects are to ensure a healthy, steady and adequate flow of fresh air in order to enhance the users' sense of comfort and well-being. Refer to TG's UBC Okanagan Section 23 05 00 HVAC - General Requirements. Buildings should also have provisions to mitigate the impact of poor outdoor air quality by filtering outside air. Natural ventilation, displacement ventilation and dedicated outdoor air systems are all encouraged. Interior building products should be chosen to optimize air quality and particularly minimize the emission of VOC's. Building entrance systems should be installed at each major entrance to reduce the tracking of harmful contaminants indoors.

4.10.4 Lighting Levels

Good lighting design is required to achieve the lighting level and quality required for the functional requirements of each space. Natural lighting is a priority as it promotes circadian health and minimizes electricity use. All lighting is to be LED and occupancy and daylight sensors are required in appropriate locations. See TG's section 26 51 00 Interior Building Lighting.

4.10.5 Acoustics

Built environments can harbour sounds that are distracting and disruptive. To promote a good environment for learning, social interaction, satisfaction and productivity, thoughtful acoustic design is essential for UBC buildings. An acoustic consultant is required for projects with extensive or large learning spaces. Design strategies which often accompany green building design (such as increased airflow between spaces and a reduction in interior finish materials) are particular sound control challenges that need to be mitigated.

For acoustical requirements of classrooms see TG's 10 00 10 Special Room Requirements.

For acoustic requirements of finishes see TG's Division 9.

4.10.6 Thermal Comfort

Thermal comfort design plays a role in the way users experience places where they live and work. Contributing factors are: air speed, temperature, radiant temperature and humidity. Spaces should be designed to have thermal conditions acceptable to a majority of occupants. Extensive glazing should be avoided to avoid impact on thermal comfort of occupants. Radiant systems, displacement ventilation and dedicated outdoor air systems are recommended as they are more energy efficient and increase thermal comfort.

For Thermal Comfort Requirements see TG's 20 00 30 Indoor Thermal Environment.

4.10.7 Climate Adaptive Design

The impacts associated with climate change are becoming more pressing with long term warming, more extreme weather events and changing precipitation patterns. Climate adaptive design is now recognized as an important direction for green buildings at UBC. Building modeling should include climate projections for temperatures and rainfall in 2030 and 2050, using current and developing best practices, to understand and plan for adaptation over the building's service life.

4.10.8 Healthy Lifestyle Design

One key design consideration is to locate stairs close to the building entrances so that they provide a convenient way to incorporate short periods of physical activity for building users. Such stairs can additionally include elements of aesthetic appeal and/or daylighting.

See the *Active Design Guidelines* for strategies for creating healthier buildings and urban spaces base on the latest research and best practices.

4.10.9 Celebrating Whole Systems

The celebration of the university's whole systems based approach to development is encouraged. Visual expression and educational elements can contribute to raising awareness regarding natural cycles and the science of sustainability. Some designs may appropriately include interactive elements and artistic expression. Celebrating rainwater management, sustainable drainage, enhanced ecology, district energy, building energy efficiency measures and waste recovery can contribute to expressing UBC's whole systems goals to the campus community and the outside world.