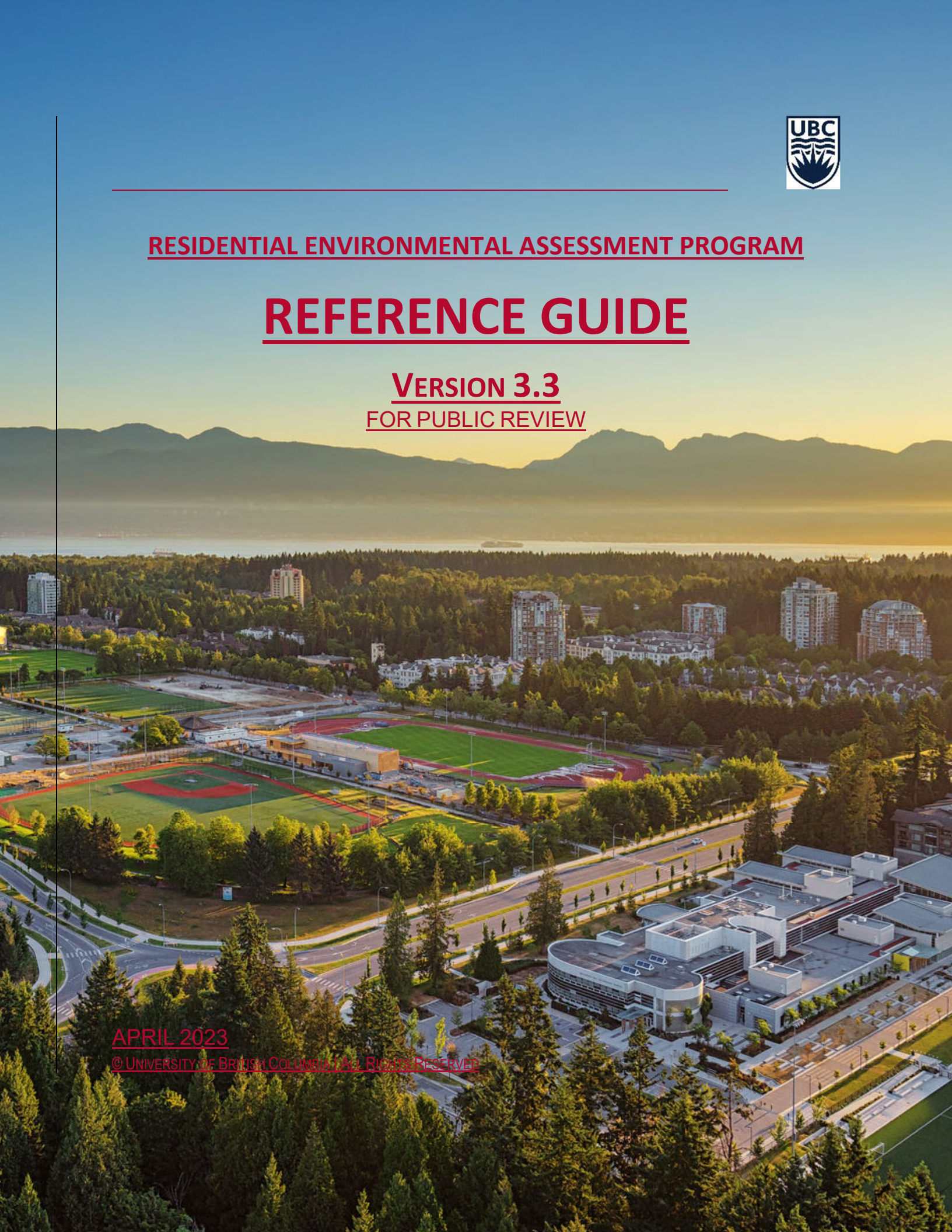


RESIDENTIAL ENVIRONMENTAL ASSESSMENT PROGRAM

REFERENCE GUIDE

VERSION 3.3

FOR PUBLIC REVIEW

APRIL 2023

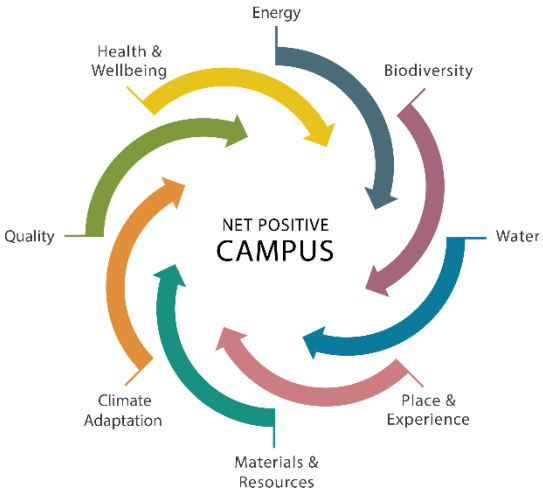
~~REAP REFERENCE GUIDE~~

~~VERSION 3.2~~

~~RESIDENTIAL ENVIRONMENTAL ASSESSMENT PROGRAM~~

Vision:

The Green Building Action Plan vision is for UBC's buildings to make net positive contributions to human and natural systems by 2035.



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PART 1: LAND USE RULES

1.0 Preamble

The UBC Residential Environmental Assessment Program (REAP) is a framework for mandating and measuring sustainable building practices for market-based and staff/faculty/student residential developments located in Neighbourhood Housing Areas at UBC's Vancouver campus. Developed by UBC, REAP is integrated into the community planning and development approval process, and plays a key role in the build out of UBC's Neighbourhood Housing Areas. REAP is similar in structure to other green building rating systems such as LEED®, but is uniquely designed for application to multi-family residential buildings built in UBC's Neighbourhood Housing Areas.

In addition to the general terms set out above, the objective for establishing REAP is to ensure that multi-family residential projects built in UBC's Neighbourhood Housing Areas are aligned with University's objectives for sustainable development and climate action. REAP projects achieve higher quality and have lower environmental impacts than standard construction in BC's Lower Mainland region, with the goal to benefit both individual consumers and the UBC community as a whole.

1.1 Definitions

In this Land Use Rule:

(a) "**Director of Planning**" means the person employed by Campus & Community Planning who is responsible for overall administration of the development and review process for development in UBC's Neighbourhood Development Lands (as at the adoption of this Land Use Rule, the Director of Planning and Development Services (Vancouver);

(b) "**Director of Sustainability**" means the person employed by Campus & Community Planning who is responsible for overseeing sustainability initiatives and engineering planning functions for developments in UBC's Neighbourhood Development Lands (as at the adoption of this Land Use Rule, the Director of Sustainability and Engineering);

(c) "**REAP Checklist**" means the checklist set out in Part 2 of this document;

(d) "**Reference Guide**" means the details of the credits available pursuant to REAP, as set out in Part 3 of this document;

(e) "**Campus & Community Planning**" means the department of UBC, as at the adoption of this Land Use Rule named Campus & Community Planning that is responsible for long-range planning, land use regulations, campus and landscape design, licensing and permits, and managing programs that cover sustainability initiatives to transportation and community-building activities; and

(f) "**Sustainability and Engineering, Campus & Community Planning**" is the unit within Campus & Community Planning that coordinates the University's operational sustainability initiatives.

1.2 Regulations

(a) The requirements set out herein are integrated with the permitting processes administered by Campus & Community Planning pursuant to the Development Handbook (which is another Land Use Rule). If there is a conflict between this Land Use Rule and the Development Handbook, the Development Handbook governs.

(b) All persons developing multi-family residential projects in any of UBC's Neighbourhood Housing Areas must:

(i) participate in REAP by submitting the statements and checklists and other information described in Section 1.3 (Procedures), at the times and in the matter described therein; and

(ii) achieve at least a **REAP Gold Certification**, which means achieving all of the preconditions and earning at least the number of points set out in Part 2 of this document, the REAP Performance Levels and Checklist, and obtaining certification of same by Sustainability and Engineering, Campus & Community Planning.

~~(ii)~~

~~(c)~~ The REAP Performance Levels and Checklist and the Reference Guide amendments shall follow the Land Use Policy (ubc.ca) process.
~~do not form a part of this Land Use Rule. The Vice-President External Relations may, in consultation with the Director of Planning, Director of Sustainability and UBC Properties Trust, amend (in whole or in part) the REAP Performance Levels and Checklist and the Reference Guide. Such amendments must be reported to the Land Use Committee at its next regular meeting.~~ If any portion of REAP is held to be either invalid by a court of competent jurisdiction or not in compliance with the laws of British Columbia and the laws of Canada applicable therein, then the invalid portion must be severed and the remainder of REAP is deemed a valid Land Use Rule

(c)

(d) Section 1.3 (Procedures) sets out the person or unit of the University to whom REAP submissions are to be made. That person or unit shall review each submission and may:

(i) seek additional information and clarifications from the project architect (or other responsible party); and

(ii) provide to the applicant interpretations of the requirements contained in any performance category.

(e) The Director of Planning (or their designate), may:

(i) grant a waiver or variance, or accept an equivalency; and

(ii) publish on the Campus & Community Planning website, standardized interpretations of the requirements contained in any performance category.

(f) The Director of Planning may permit a project to seek certification pursuant to an alternative green building rating system (e.g. LEED®), provided that:

(i) the Director of Planning must identify a minimum certification to be achieved by the project pursuant to that alternative rating system and once established, such minimum certification shall be binding upon the applicant; and

(ii) section 1.3 (Procedures) shall continue to apply, as adapted for the approved alternative rating system by the Director of Planning (or their~~his/her~~ designate).

(g) If this Land Use Rule, the REAP Performance Levels and Checklist, and/or the Reference Guide including any interpretations published pursuant to section 1.2(e)(ii)) are amended after an applicant has submitted a

development permit in accordance with the Development Handbook and this Land Use Rule, the amendments do not apply to the project unless the applicant agrees that the amendments do apply.

(h) If an applicant is not satisfied with a decision made pursuant to this Land Use Rule, the applicant may appeal the decision to the Associate Vice President, Campus & Community Planning, who will issue a final decision on the matter.

1.3 Procedures

As detailed below, during the course of project development, a series of project REAP submissions are required to be made to Campus & Community Planning. After review and approval of submissions at each stage detailed below, UBC will certify the REAP level attained. REAP documentation submission requirements are integrated into the permitting process administered by Campus & Community Planning pursuant to the Development Handbook.

REAP certification involves 5 stages:

1. **REAP submission with parcel tender documents** with a Sustainability Statement describing the development and a statement describing how REAP credits will be applied.
2. **REAP submission with Development Permit Application** identifying the REAP Checklist credits to be attempted and including payment of REAP application fee at the time when a Development Permit application is made to Campus & Community Planning.
3. **REAP submission with Building Permit Application** including an updated REAP Checklist of credits with all necessary documentation, and an updated Sustainability Statement.
4. **REAP submission with Occupancy Permit Application** including an updated REAP Checklist of credits with all necessary documentation, and an updated Sustainability Statement.
5. **Certification** will be issued when all requirements have been met, as detailed below.

(a) **REAP submission with parcel tender documents**: Developers are required to submit a "Sustainability Statement" with parcel tender documents that describes how their development will be designed to achieve high environmental standards and the ways in which they propose to apply REAP and earn credits in the eight component areas.

> **Submission:** Sustainability Statement
> **Format:** Electronic format
> **Submit to:** Campus & Community Planning

(b) **REAP Submission with Development Permit Application**: The architect (or other responsible party) is required to submit: a REAP Checklist verifying compliance with the REAP rating system and identifying the REAP credits they will attempt in their development. The REAP Checklist must identify that the development will target a minimum of REAP Gold.

> **Submission:** REAP Checklist
> **Format:** Electronic format (REAP Checklist-Excel spreadsheet)
> **Submit to:** Campus & Community Planning

(c) **REAP Submission with Building Permit Application:** The architect (or other responsible party) is required to submit an updated REAP Checklist and all the required Building Permit documentation including an updated Sustainability Statement at the time that a Building Permit application is made to Campus & Community Planning. These submissions will provide the documentation necessary for Sustainability and Engineering, Campus & Community Planning to verify compliance with the preconditions and optimization credits that have been incorporated into the project, and to verify that, at minimum, REAP Gold will be achieved. The REAP BP Checklist and documentation can be submitted a maximum of 3 times.

Submission: updated REAP Checklist, all documentation identified throughout this document as "Documentation: Submit at the Building Permit Phase", updated Sustainability Statement
Format: Electronic format (REAP Checklist-Excel spreadsheet; documentation with separate folders for each credit).
Submit to: Sustainability and Engineering, Campus & Community Planning ~~through the building permit portal~~.
Review Time: 15 business days after document completion check

(d) **REAP Submission with Occupancy Permit Application:** The architect (or other responsible party) is required to submit an updated REAP Checklist and all the required Occupancy Permit documentation as well as an updated Sustainability Statement at the time that Occupancy Permit applications are made to Campus & Community Planning. If an Occupational Permit application contains a substantive amount of information yet portions of the credit documentation are not available by the time of Occupancy Permit application, then a written statement must be submitted with such Occupational Permit application that identifies: (a) the missing documentation; (b) the reasons for the delay; and (c) the expected timeline for receipt and submission of such unavailable documentation. These submissions will provide the documentation necessary for Sustainability and Engineering, Campus & Community Planning to verify compliance with the mandatory and optional credits that have been incorporated into the project, and to verify that, at minimum, REAP Gold will be achieved. The REAP Occupancy Permit Checklist and documentation can be submitted a maximum of three times.

Submission: updated REAP Checklist, all documentation identified as "Documentation: Submit at the Occupancy Permit Phase", updated Sustainability Statement
Format: Electronic format (REAP Checklist-Excel spreadsheet; documentation with separate folders for each credit).
Submit to: Sustainability and Engineering, Campus & Community Planning
Review Time: 15 business days after document completion check

(e) **REAP Certification:** Documentation submissions will be reviewed and verified by Sustainability and Engineering, Campus & Community Planning. Final certification will be awarded when the project is complete, all documentation is complete, and occupancy is granted.

PART 2: PERFORMANCE LEVELS AND CHECKLIST

PERFORMANCE LEVELS

REAP administrators assess the performance of building projects based on the number of points that are earned by meeting the requirements of credits. Credits are distributed across eight component areas and an Innovation and Research category for exemplary or innovative design.
There are four levels of performance that can be achieved, and all building projects must achieve a minimum of REAP Gold certification~~1~~.
Building projects need to achieve ***all*** of the preconditions within each component area and earn at least 50 points from the optimization credits, in order to achieve a REAP Gold certification. In order to receive points for a credit, the stated requirements must be completed. A prorated number of points will not be awarded for partial credit compliance.

Developers have the discretion to choose which optional credits to incorporate into their designs. Higher REAP ratings may help developers to be more attractive to prospective buyers or renters by differentiating their product in the marketplace.

The REAP Performance Levels are:

Gold	50 points
Gold Plus	60 points
Platinum	70 points
Platinum Plus	80 points

UBC REAP 3.32 CHECKLIST

Y	?	N	Energy & Emissions (E&E)		/3135
precondition			P1	Energy Step Code Compliance (Step 32)	-
precondition			P2	Zero Carbon Step Code Compliance (EL-2)~~Overall R-Value~~	-
precondition			P3	Energy Star Appliances	-
precondition			P4	Programmable Thermostats	-
precondition			P5	Energy Modeling Workshop	-
precondition			P6	Energy Commissioning	-
precondition			P7	~~Building Level Energy Metering and Reporting~~Energy Systems Maintenance Contract	-
precondition			P8	Building Level Energy Metering and Reporting~~Domestic Hot Water Energy Use Sub-metering and Reporting~~	-
precondition			P9	Domestic Hot Water Energy Use Sub-metering and Reporting~~Greenhouse Gas Intensity Reporting~~	-
precondition			P10	Refrigerant Emission Reporting	-
precondition			P11	Electric Vehicle Charging Infrastructure	-
~~precondition~~			~~P12~~	~~Contribution to Low Carbon Transportation~~	~~-~~
0		16 ~~21~~	1.1	Optimized Energy Performance (Step ~~3~~/4/PH)	16~~21~~
0		6	2.1	Renewable Energy	6
0		5	3.1	Enhanced Energy Sub-metering and Reporting	5
0		~~3~~1	4.1	~~Electric Vehicle Charging Stations~~Smart Thermostat	~~3~~1
0		3	5.1	Electric Vehicle Charging Stations	3
Y	?	N	Water (W)		/15
precondition			P1	Low-Flow Plumbing Fixtures	-
precondition			P2	Outdoor Water Use Reduction	-
precondition			P3	Water Efficient Appliances	-
precondition			P4	Rainwater Management	-
0		7	1.1	Total Water Use Reduction	7
0		4	2.1	On-Site Rainwater Management	4
0		4	3.1	Domestic Hot Water Metering	4

Y	?	N	Biodiversity (B)		/8
precondition			P1	Ecological Planting	-
precondition			P2	Light Pollution Reduction	-
precondition			P3	Bird Friendly Design —– Basic	-
0		3	1.1	Planting for Biodiversity and Ecosystem Health	3
0		1	2.1	Site Green Space	1
0		3	3.1	Bird Friendly Design—– Enhanced	3
0		1	4.1	Food Growing Opportunity	1
			Materials & Resources (M&R)		/10~~8~~
precondition			P1	Zero Waste Ready	-
precondition			P2	Embodied Carbon Reporting	-
precondition			P3	Construction and Demolition Waste	-
0		2~~4~~	1.1	Responsibly Sourced ~~Environmentally Responsible~~ Materials	2~~4~~
0		5~~2~~	1.2	Embodied Carbon Target~~Local Materials~~	5~~2~~
0		2~~1~~	1.3	Mass Timber Superstructure	2~~1~~
0		1	1.4	Healthy Building Materials	1
Y	?	N	Climate Adaptation (CA)		/13
Precondition			P1	2050 Climate Ready Thermal Comfort Modelling and Design	-
0		7	1.1	2050 ~~Climate Ready~~ Energy Efficient Climate Ready Design	7
0		3	1.2	Enhanced Resiliency	3
0		3	1.3	On Site Backup Power	3
Y	?	N	Place & Experience (P&E)		/5
Precondition			P1	Project Community Amenity Spaces	-
0		5	1.1	Project Exemplary Community Amenity Spaces	5

Y	?	N	Health & Wellbeing (H&W)		/11~~8~~
precondition			**P1**	Bicycle Parking & Storage Room(s)	-
precondition			**P2**	Low-Emitting Products	-
precondition			**P3**	Construction Indoor Air Quality Management	-
precondition			**P4**	Air Filtration Requirement	-
0		1	**1.1**	IAQ Assessment	1
0		2	**2.1**	Additional Bicycle Facilities	2
0		2	**3.1**	Low-Emitting Products	2
0		2~~1~~	**4.1**	Connection to Nature	2~~1~~
0		2~~1~~	**5.1**	Daylight Access	2~~1~~
0		2~~1~~	**6.1**	Active Living	2~~1~~
Y	**?**	**N**	**Quality (Q)**		**/7~~8~~**
precondition			**P1**	Sustainability Commitment~~Statement~~	-
precondition			**P2**	Educate the Homeowner	-
precondition			**P3**	Educate the Sales & Leasing Staff	-
precondition			**P4**	Green Building Specialist	-
precondition			**P5**	Design for Security and Crime Prevention	-
precondition~~0~~ - 4			**P6~~1.1~~**	Integrated Design Workshop	-~~4~~
0		4~~2~~	**2.1**	Durable Building	4~~2~~
0		3~~2~~	**3.1**	Education and Awareness	3~~2~~
Y	**?**	**N**	**Innovation & Research (I&R)**		**/10**
precondition			**P1**	Contribution to Low Carbon Mobility and Research	-
0		2	**1.1**	Exemplary Performance	2
0		3	**1.2**	Innovation or Pilot	3
0		5	**2.1**	Research	5
Total					**/100+10**

Y	?	N		
0	**0**	**100**	Total Credits	100
0	**0**	**10**	Additional Innovation & Research Credits	10
Gold				50
Gold Plus				60
Platinum				70

Platinum Plus	80

PART 3: REFERENCE GUIDE

ENERGY & EMISSIONS

E&E P1: Energy Step Code Compliance (Step 3) ~~(Step 2)~~ **Precondition**

Requirement

Design and construct buildings to comply with Section 10.2 Energy Efficiency of the BC Building Code and conform to the following BC Energy Step Code energy performance requirements: ~~BC Energy Step Code~~ **Residential, Step ~~2~~3: ~~1320 kWh/m2-yr (TEUI) and 4530 kWh/ m2-yr (TEDI)~~** as specified by the BC Energy Step Code (Table 10.2.3.3.-H) **Offices and Other Businesses, Step 2** as specified by the BC Energy Step Code (Table 10.2.3.3.-I and Table 10.2.3.3.-J).

~~Complete an airtightness test meeting the ASTM E779 or USACE Version 3 standard as specified by the Energy Step Code Regulation.~~

Intent

To reduce building total energy usage and thermal demand by ensuring that the ~~designed~~ building energy performance meets a high standard and to allow flexibility for building design by specifying a performance target rather than prescriptive requirements.

Rationale

Construction at UBC aims for a high level of energy performance in order to fulfill the objectives of the UBC Community Energy & Emissions Plan. To improve building performance outcomes, ~~energy use intensity targets were introduced into REAP Version 3.0. In REAP Version 3.1, Energy Step Code Target credits were included to align with~~REAP references the province of BC's Energy Step Code energy use intensity targets.

Definitions

- *Total Energy Use Intensity (TEUI):* The modelled amount of total energy used by a building, per unit of area, per year, expressed in kWh/(m2·year). It is determined as defined by the BC Energy Step Code Regulation.
- *Thermal Energy Demand Intensity (TEDI):* The amount of annual heating energy needed to maintain a stable interior temperature, taking into account heat loss through the envelope and passive gains. It is calculated per unit of area of conditioned space per year, and expressed in kWh/(m^2·year). TEDI is determined as defined by the BC Energy Step Code Regulation.
- Energy Step Code Step 3 Targets for Residential Occupancies: 120 kWh/m2-yr (TEUI) and 30 kWh/ m2-yr (TEDI).
- *Airtightness Testing:* Airtightness testing uses fans to pressurize a building and quantify air leakage rates under controlled conditions. Testing must meet the requirements of the BC Energy Step Code.

Recommended Strategies

Many energy efficiency strategies can be employed in order to meet Energy ~~Step Code~~BC targets. Below are a few design approaches that may be considered during design and construction as cost-effective approaches to improve building energy performance.

- Improve airtightness.
- Install LED lighting and occupancy sensors throughout the building.
- Improve envelope performance.

- Utilize heat-recovery ventilation (HRV).

Resources

- The BC Energy Step Code ~~website has~~ resources for designers and builders.
- *BC Energy Step Code ~~Regulation~~ requirements*.
- The *Energy Step Code Energy Design Report* is the Energy ~~Step Code~~BC reporting template ~~for Energy Step Code.~~
- The *City of Vancouver Energy Modelling Guidelines* are required to determine compliance with BC Energy Step Code targets.
- The Architectural Institute of BC and Engineers and Geoscientists BC have developed *Professional Practice Guidelines for Whole Building Energy Modelling*
- BC Hydro produced a video of an airtightness test demonstration of a multi-unit residential building project at UBC.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- A p~~P~~reliminary ~~written~~energy modeling report with model parameters and inputs ~~and~~, energy and GHG emission reporting for energy end uses (including but not limited to space heating and cooling, domestic hot water, lighting, plug loads and fans and pumps) and a description of modelling software used.
- ~~P~~A preliminary Energy Step Code Part 3 Energy Design Report.
- A preliminary REAP Building Enclosure R-Value Calculator report.

Required Documentation: Submit at the *Occupancy Permit* phase

- A letter signed by the Architect declaring that the building design meets the requirements of the BC Energy Step Code regulation and that Energy Step Code targets have been met.
- An as-built ~~written~~ energy modeling report with model parameters and inputs and energy and GHG emission reporting for energy end uses (including but not limited to space heating and cooling, domestic hot water, lighting, plug loads and fans and pumps) and a description of modelling software use.
- An as-built Energy Step Code Part 3 Energy Design Report.
- Air tightness test results as specified by Section 10.2.3.5 of the BC Energy Step Code ~~Regulation~~.
- An as-built REAP Building Enclosure R-Value Calculator report.

ENERGY & EMISSIONS

E&E P2: Overall R-Value — Precondition

Requirement

Achieve an overall R-value target for each major building typology in a project (e.g., high rise, low rise or townhouse): 5.4 hr-ft2-f/BTU for high rise or 6.9 hr-ft2-f/BTU for low rise. This precondition credit is not required for projects that achieve the E&E 1.1: Optimized Energy Performance credit.

Intent

To control unwanted heat losses and gains by improving overall building envelope thermal performance.

Rationale

Improving building envelope thermal performance is a proven approach for reducing space heating and cooling energy consumption in buildings. Improved building envelope performance also has co-benefits for increasing occupant comfort by reducing drafts and reducing noise.

Definitions

- *R-value:* A measure of how well a material resists the passage of heat. The higher the R-value, the more effective the material is at keeping indoor environments warm in winter and cool in summer.

Recommended Strategies

Building envelope thermal performance can be improved through a number of strategies, including:

- Reduce thermal bridging.
- Reduce window to wall ratio.
- Improve thermal performance of wall and roof elements and windows.

Resources

- *BC Housing Energy Step Code Design Guide & Supplemental.*
- *BC Housing Energy Efficient Building Enclosures.*
- *BC Housing Building Envelope Thermal Bridging Guide.*
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Preliminary REAP Building Enclosure R-Value Calculator report.

Required Documentation: Submit at the *Occupancy Permit* phase

- As-built REAP Building Enclosure R-Value Calculator report.
- A letter signed by the Architect or Engineer declaring that the as-built REAP Building Enclosure R-Value Calculator report correctly represents the building design envelope thermal performance.

ENERGY & EMISSIONS

EE Credit P2: Zero Carbon Step Code Compliance (EL-2) **Precondition**

Requirement
Design and construct buildings to comply with Section 10.3 Greenhouse Gas (GHG) Emissions of the BC Building Code and conform to the GHG Emission Level (EL) target **EL-2** for **Residential, Business and Personal Services and Mercantile Major Occupancies** found in Table 10.3.1.3.

Intent

To reduce building greenhouse gas emissions by ensuring that the building emission performance meets a high performance standard and to allow flexibility for building design by specifying a performance target rather than prescriptive requirements.

Rationale

Tracking building GHG emissions is required for the UBC Community Energy and Emissions Plan emissions reporting.

Definitions

- *Greenhouse Gas Emission Level:* A measure of greenhouse gas emissions target expressed in tonnes of CO_2 equivalent per square meter on an annual basis.
- Zero Carbon Step Code Emission Level 2 target: 7 tonnes CO_2e/m^2-yr.

Recommended Strategies

- Obtain the low carbon emission factor for district energy from Campus and Community Planning to calculate the GHG Emission Level.
- For projects with site-generated renewable energy, use the method specified in Section 1.4 of the City of Vancouver Energy Modelling Guidelines to determine the emission factor for electricity.
- For grid electricity and natural gas, use emission factors specified in Section 10.3 of the BC Building Code.

Resources

- BC Zero Carbon Step Code requirements.
- The BC Energy Step Code resources for designers and builders.
- The *Energy Step Code Energy Design Report* is the BC Energy Step Code reporting template.
- The *City of Vancouver Energy Modelling Guidelines* are required to determine compliance with BC Energy Step Code targets.

Documentation: Submit at the *Building Permit* phase

- A preliminary Energy Step Code Part 3 Energy Design Report.

Documentation: Submit at the *Occupancy Permit* phase

- A letter signed by the Architect or Mechanical Engineer declaring that the building design meets the requirements of the BC Energy Step Code ~~regulation~~ and that BC Zero Carbon Step Code targets have been met.
- An as-built Energy Step Code Part 3 Energy Design Report.

E&E P3: Energy Star Appliances

Precondition

Requirement
Specify and install Energy Star-labelled, or equivalent performance, driers and refrigerators in each unit.

Intent

To reduce energy consumption associated with appliances.

Rationale

Appliance use represents one of the largest single end-uses in residential buildings. Energy Star qualified refrigerators reduce residential energy demand, operating costs, and environmental impacts.

Definitions

- *Energy Star*: The Energy Star program designates appliances that are among the most energy efficient in the marketplace. Requirements vary from one category to another, but typically an Energy Star model is 10% to 50% more efficient than a conventional model.

Resources

- *Energy Star for Products*: Natural Resources Canada and the Office of Energy Efficiency provide information on the Energy Star for Products program. The Energy Star appliance directory includes a comprehensive listing of the most energy efficient appliances in the market.
- *Energy Star Key Product Criteria:* Use Energy Star key product criteria to determine if a non-certified appliance meets Energy Star certification requirements. *Example for refrigerators and freezers*.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by the Architect or responsible party declaring that the requirements have been met.
- Cut sheet from the manufacturer of the Energy Star labelled or equivalent appliances that will be installed.
- Supporting documentation to prove that any non-Energy Star certified appliances installed meet the Energy Star key product criteria.

E&E P4: Programmable Thermostats

Precondition

Requirement
Specify and install programmable thermostats for at least the largest heating zone in each unit.

Intent

To reduce energy consumption associated with space heating.

Rationale

Programmable thermostats maintain a desired comfort level when a home is occupied, then enter an economizing mode at night and when the home is unoccupied. As peak heating or cooling only occurs when the home is occupied, programmable thermostats save energy and heating costs.

Definitions

- *Programmable thermostat:* A thermostat that senses room temperature and controls the HVAC system according to a pre-programmed schedule set by the homeowner. Some models are capable of accommodating different settings for every day of the week.

Recommended Strategies

- Programmable thermostats must have at least two different programming periods and at least four possible temperature settings to qualify.
- Consult with suppliers to identify models that are easy to use, and provide the homeowner with an operation manual.

Resources

- With its *Power Smart Residential* program, BC Hydro provides resources on a wide range of energy saving strategies, including installing programmable thermostats.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Electrical Engineer or responsible party declaring that the requirements will be met.
- Cut sheet from the manufacturer of the thermostat supplied and description of thermostat locations.

E&E P5: Energy Modeling Workshop

Precondition

Requirement

Model the energy performance of the building and hold a workshop with the design team, a representative from ~~UBC~~ Sustainability and Engineering, and contractor to evaluate the results and optimize the design of the building.

Intent

To reduce energy use associated with overall building operation and use.

Rationale

According to Natural Resources Canada, space conditioning and domestic hot water heating combined, account for approximately 78% of residential energy demand in BC. Designing buildings to optimize energy usage promotes conservation and reduces operating costs.

Recommended Strategies

- Use BC Energy Step Code compliant ~~commercial~~ building energy analysis software to model the building's design for code compliance ~~and EUI~~ for Step Code targets.
- Consider applying to BC Hydro Commercial New Construction for potential rebates associated with energy modeling.
- Use a building simulation that is able to measure the impact of various design scenarios on capital and operating costs to provide rapid feedback to the design team and workshop participants.
- Consider creating bundles that combine various energy performance options in order to identify and analyse the implication of various combinations for the final proposed design.

Resources

- *Energy Step Code Council (ESC) - Resources for Industry*: The ESC provides resources for builders, developers, architects, designers, and other industry practitioners.
- *Energy Step Code Council (ESC) - Compliance Tools for Part 3 Buildings*: The Part 3 Energy Design Report is a voluntary Excel-based tool that can be used by energy modellers and design professionals as a checklist and submitted to local government authorities to verify compliance with the BC Energy Step Code.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Minutes and results of the energy modeling workshop.

E&E P6: Energy Commissioning

Precondition

Requirement

Contract a third-party Commissioning Authority to develop and implement a commissioning plan for all major building energy systems, in accordance with CSA Z5000-18, and verify that they are installed, calibrated, and perform according to design intent.

Intent

To ensure that best practices in design of building energy systems are combined with best practices in construction.

Rationale

Energy system commissioning will help ensure that building energy systems operate according to design intent, and can significantly increase energy efficiency and reduce operating costs of the building. When a new building owner takes occupancy of a building, they want to ensure that the green building in which they have invested has energy systems that will operate as ~~designed~~ intended. The Commissioning Authority, hired as a third party directly by the developer, helps to offer an unbiased quality control step ~~in this development process~~during design and construction. ~~Additionally, energy system commissioning has been found to significantly increase energy efficiency of the building.~~

Definitions

- *Commissioning Authority:* Professional hired by the developer or building owner to report that ~~the construction and~~ construction decisions meet the intent of the original design.
- *Building Energy Systems:* Any building system, including mechanical, lighting, electrical and controls, which impact the energy consumption of the building.

Recommended Strategies

- Engage a Commissioning Authority early in the project to develop a Commissioning Plan and ensure the commissioning requirements are properly covered.
- Mechanical and/or electrical Commissioning Agents will oversee their respective work and schedule. The Commissioning Authority will oversee the Commissioning Agents.
- Have the Authority review design drawings at each milestone (e.g. 30%, 50%, issued for construction), prior to the developer's approval.
- Employ the Authority to do multiple site reviews to catch any potential errors or oversights early ~~before correcting the mistake is costly~~to avoid potentially costly changes after systems have been ~~.~~installed.
- Have the Authority produce a final commissioning report prior to occupancy confirming that the Building's Energy Systems are installed and operating according to design intent.

Resources

- *Canadian Standards Association (CSA)* CSA Standard Z5000 is a national standard for building commissioning for energy using systems for new construction of Part 3 Buildings as defined by the National Building Code of Canada.

- *Natural Resources Canada: Commissioning for New Buildings:* Information and resources for building commissioning, including energy system commissioning.
- *LEED v 4 Building Design + Construction: New Construction:* Information and resources for Fundamental Commissioning and Verification.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Commissioning Plan.

Required Documentation: Submit at the *Occupancy Permit* phase

- ~~Draft~~Final commissioning report, detailing ~~the final approvals and the project commissioning process.~~ the commissioning process and commissioning results at the time of building ~~A~~occupancy.
- A letter from the Developer stating that the final commissioning report, all operating and maintenance manuals and any required training for building managers ~~has been~~will be provided to the building owner and that a copy of the final commissioning report will be provided to Campus & Community ~~.~~Planning.

ENERGY & EMISSIONS

E&E P7: Energy System Maintenance Contract — Precondition

Requirement

For buildings with in-building heat pump based space heating systems, establish a comprehensive and preventative maintenance contract on behalf of the building owner, covering the heating and cooling system and all related building energy, HVAC and plumbing systems, established to cover a period of no less than 5 years after occupancy of the building. This precondition applies in cases where the building is not served by a utility-owned, professionally maintained and operated energy system (e.g. buildings not subject to a Community Energy Covenant as defined in the NDES Infrastructure Agreement between UBC and Corix).

Intent

An energy system maintenance contract will ensure that complex heating and cooling heat pump systems will be properly maintained.

Rationale

Heat pump systems that provide integrated space heating and cooling are complex and can fail to operated efficiently and be subject to system failure if not maintained properly.

Definitions

Heat pump heating system: An HVAC system that provides space heating via heat pumps. Typically, the system would also provide integrated cooling.

Recommended Strategies

- Engage a maintenance contractor with proven experience maintaining systems of the type included in the building design.

Resources

- A commercial HVAC maintenance checklist.

Required Documentation: Submit at the *Building Permit* phase

- A letter from the developer stating that a maintenance contract meeting the requirement will be in place by building occupancy.

Required Documentation: Submit at the *Occupancy Permit* phase

- A copy of the maintenance contract.

E&E ~~P7~~P8: Building Level Energy Metering and Reporting **Precondition**

Requirement

Support ~~UBC~~ Campus & Community Planning in establishing an ENERGY STAR Portfolio Manager (ESPM) account and reporting building utility consumption by:

- Providing completed auto upload permission forms where required; **or**
- Sharing ESPM account(s) with ~~UBC~~ Sustainability and Engineering that have been established by a qualified service provider. For mixed-use developments, establish utility metering for each major use class (e.g., residential, commercial or retail) and building typology (e.g., high rise or townhouse).

Intent

To enable building energy benchmarking which will allow building owners to better understand building energy use and manage building energy costs, and to provide Sustainability and Engineering with building performance information, supporting building policy refinement.

Rationale

In the absence of energy benchmarking, building owners have poor understanding of building energy consumption and performance, and policy makers have limited information about the effectiveness of building energy efficiency policies. This credit supports objectives of the UBC Community Energy and Emissions Plan.

Definitions

- *Energy Benchmarking:* A methodology for measuring and reporting a buildings energy performance.
- *ENERGY STAR Portfolio Manager (ESPM):* An online reporting tool for measuring and reporting building energy and water consumption created by the US Environmental Protection Agency, and established in Canada by Natural Resources Canada.
- *Qualified service provider*: A qualified service provider must be a member in good standing of the Association of Professional Engineers and Geoscientists of British Columbia or the Architectural Institute of BC, or otherwise holds a professional designation in building energy management, efficiency or sustainability (for example, a credential issued by a post-secondary institution or a third-party certification body such as ASHRAE or LEED).

Recommended Strategies

- Contact ~~UBC~~ Sustainability and Engineering for support in completing permission forms, providing utility invoices and building information; *or*
- Find a qualified service provider to prepare an ESPM account on behalf of the building owner and ensure that the account is shared with ~~UBC~~ Sustainability and Engineering.

Resources

- *ENERGY STAR Portfolio Manager*.
- *Natural Resources Canada ESPM*.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Indicate locations of utility meters on mechanical or electrical drawings and identify the major use classes and building typologies that they are associated with.

Required Documentation: Submit at the *Occupancy Permit* phase

- Confirmation that all required ESPM building information, utility permission forms and utility invoices have been provided *or* that an active ESPM account prepared by a qualified service provider has been shared with the ~~UBC~~ Sustainability and Engineering Community Energy Manager or other designated individual.
- Letter signed by Mechanical Engineer declaring that building information provided for ESPM are representative of the as-built building and that utility meters are associated with each building major use class and typology.

E&E ~~P8~~P9: Domestic Hot Water Energy Use Sub-metering and Reporting **Precondition**

Requirement

Install energy metering for domestic hot water energy use for each major use class (e.g., residential, commercial or retail) and building typology (e.g., high rise or townhouse) and report energy use to ~~UBC~~ Sustainability and Engineering.

Intent

To allow for determination of Thermal Energy Demand Intensity (TEDI), a performance metric required under REAP credit E&E P1: BC Energy Step Code Compliance and provide Sustainability and Engineering with energy performance information, supporting building policy refinement.

Rationale

Metering domestic hot water energy provides building owners with better information about hot water energy consumption and costs. Metering will allow ~~UBC~~ Sustainability and Engineering to determine whether buildings are achieving REAP energy performance targets and improve understanding of major energy end uses in buildings. This information will support building policy refinement and the objectives of the UBC Community Energy and Emissions Plan.

Definitions

- *Energy sub-metering:* Energy metering of energy end-uses or space uses that are a sub-component of energy metered by primary utility meters.

Recommended Strategies

- Retain a third party service provider to manage metering data.

Resources

- *NSTC (2018): Sub-metering of Building Energy and Water Usage*.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- A letter signed by the Mechanical Engineer declaring that the requirements for this credit will be met.

Required Documentation: Submit at the *Occupancy Permit* phase

- A description of the metering system and drawings showing locations of meters.
- A letter signed by the Developer declaring that a service provider has been retained to manage hot water energy sub-metering data and provide data to ~~UBC~~ Sustainability and Engineering upon request.

ENERGY & EMISSIONS

E&E P9: Greenhouse Gas Intensity Reporting **Precondition**

Requirement

Report building greenhouse gas intensity (GHGI) of emissions.

Intent

To support the tracking of UBC neighbourhood GHG emissions from buildings.

Rationale

Tracking building GHG emissions is required for the UBC Community Energy and Emissions Plan emissions reporting.

Definitions

- *GHGI (Greenhouse Gas Intensity)*: A measure of greenhouse gas emissions reported on a per square meter basis.

Recommended Strategies

Complete all applicable GHG sections of the Energy Step Code Energy Design Report. For district energy (DE) connected buildings, contact Campus & Community Planning to obtain up to date GHG emissions factors for DE energy supply.

Resources

- *BC Energy Step Code Energy Design Report*.
- *British Columbia Methodological Guidance for Quantifying Greenhouse Gas Emissions*[1].
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Preliminary Energy Step Code Part 3 Energy Design Report with GHG emissions reported in Section C and Section E of the design report.

Required Documentation: Submit at the *Occupancy Permit* phase

- A letter signed by the Architect or Engineer declaring that the building design meets the requirements of the Energy Step Code regulation and that Energy Step Code targets have been met.
- As-built Energy Step Code Part 3 Energy Design Report GHG emissions reported in Section C and Section E of the design report.

ENERGY & EMISSIONS

E&E P10: Refrigerant Emission Reporting **Precondition**

Requirement
Determine and report the life cycle equivalent annual carbon dioxide emissions of refrigerants in buildings in kgCO2.

Intent

To support minimizing direct contributions to climate change and reduction of ozone depletion.

Rationale

Refrigerants are known to have global warming potentials that can be thousands of times greater than that of carbon dioxide. Tracking life cycle emissions from buildings will help ensure that emissions from this potent greenhouse gas are kept to a minimum.

Definitions

- Global Warming Potential (GWP): The measure of how much energy the emissions of a gas will absorb over a given period of time, relative to emissions of an equivalent amount of carbon dioxide.

Recommended Strategies

- Use the refrigerant reporting methodology required by the City of Vancouver Green Buildings Policy for Rezoning.

Resources

- *City of Vancouver Green Buildings Policy for Rezoning – Process and Requirements*: Section 6 details calculation procedures for determining the life cycle equivalent annual carbon dioxide emissions of each building in kgCO2 from the emission of refrigerants.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Preliminary refrigerant emissions report, using calculation methodology from the City of Vancouver Green Buildings Policy for Rezoning requirements.

Required Documentation: Submit at the *Occupancy Permit* phase

- A letter signed by the Mechanical Engineer declaring that the refrigerant emissions report represents the as-build design of the building cooling system.
- As-built refrigerant emissions report, using calculation methodology from the City of Vancouver Green Buildings Policy for Rezoning requirements.

E&E P11: Electric Vehicle Charging Infrastructure

Precondition

Requirement

Provide a minimum of one energized level 2 outlet per residential unit ~~unit for non-rental developments or provide energized outlets for 50% of resident parking stalls for rental developments~~. Level 2 charging capacity that provides a minimum of 40A service and a minimum performance level of 12 kWh per stall, over an eight (8) hour period must be provided. Load sharing (up to four-way) and load management systems may be utilized. Exceptions may be granted in cases where utility mandated transformer upgrades are required.

Intent

To reduce the number of greenhouse gas emitting vehicles and encourage the use of ~~alternative fuel~~electric vehicles as well as provide charging access for residents for electric vehicles, which are becoming more widely available and gaining in popularity.

Rationale

Full battery electric ~~Alternative fuel~~ vehicles can reduce greenhouse gas emissions from vehicle operation by approximately 99~~28~~% in British ~~as~~Columbia compared to conventional petroleum-powered vehicles. Four-way load shared Level 2 charging with load management provides sufficient charging capacity for overnight charging of electric vehicles and is a cost-effective way to provide charging service while maintaining a reasonable building-level electricity demand.

Definitions

- *Electric v~~V~~ehicle(s):* V~~A v~~ehicle(s) that uses electrically charged batteries to provide all or partial energy to power an engine, while requiring connection to a power outlet for charging.
- *Level 2 c~~C~~harging:* A level 2 electric vehicle charging level as defined by SAE International's J1772 standard.
- *Load sharing:* Control of the current drawn by multiple electric vehicles on a single circuit, to ensure the capacity of the circuit is not exceeded, and that maximum charging is achieved at each EVSE based on the available capacity.
- *Load management*: Control of the current drawn by the electric vehicle charging system, at the main switchboard of the building.

Recommended Strategies

- Utilize load sharing and load management to provide cost-effective charging capacity and manage building-level electricity demand.
- Contact the ~~UBC~~ Sustainability and Engineering Green Building Manager for questions related to utility mandated transformer upgrades.

Resources

- *AES Engineering costing analysis prepared for the City of Richmond (2017).*
- *Canadian Electric Vehicle Infrastructure Deployment Guidelines (2014).*
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Electrical Engineer declaring that the requirements will be met.

Required Documentation: Submit at the *Occupancy Permit* phase

- Plans showing electrical service to stalls and documentation of load sharing and load management systems.

ENERGY & EMISSIONS

E&E P12: Contribution to Low Carbon Transportation — Precondition

Requirement

Contribute to the development of low-carbon transportation options or infrastructure by funding the equivalent of one community vehicle per 100 residential units.

Intent

To reduce the environmental impacts associated with private automobile use.

Rationale

Low-carbon transportation options such as car sharing networks, electric vehicles and more make public transportation a viable option by providing a cost-effective alternative for special trips.

Definitions

- *Community car-sharing network*: An organization that provides access to shared automobiles for its members as an alternative to private ownership.

Recommended Strategies

- Consult with UBC Properties Trust to make arrangements for the required contribution.
- Deploy hybrid or electric vehicles to reduce carbon emissions of neighbourhood fleet.
- Support deployment EV charging and bike share infrastructure.
- Provide information to homebuyers on the community car-sharing program

Resources

- The City of Vancouver provides resources on car-sharing, carpooling, and electric vehicles.
- *Victoria Transport Policy Institute (VTPI):* The VTPI is an excellent resource for information on a variety of sustainable mobility resources.
- Modo, the Car Co-op is a Vancouver-based not-for-profit co-operative venture incorporated to foster car sharing as an alternative to privately owned automobiles.
- The Metro Vancouver Car Share Study technical report and summary report provide excellent background information for car share programs in the region.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by Developer declaring that the requirements have been met.
- Documentation confirming the number of residential units and the amount contributed to the car-sharing network.

ENERGY & EMISSIONS

E&E Credit 1.1: Optimized Energy Performance (Step 4/PH) ~~(Step 3/4/PH)~~ **16~~21~~ points**

Requirement

Design and construct ~~the~~ buildings comply with Section 10.2 Energy Efficiency of the BC Building Code and to ~~meet~~conform to the following BC Energy Step Code ~~Regulation~~energy performance requirements:

~~**Step 3: 120 kWh/m2-yr (TEUI) and 30 kWh/ m2-yr (TEDI). – 8 points**~~

Residential, Step 4~~: 100 kWh/m2-yr (TEUI) and 15 kWh/ m2-yr (TEDI),~~ targets as specified by the BC Energy Step Code ~~Regulation~~ (Ttable 10.2.3.3.-H)~~.~~ **~~– 8 points~~**

Offices and Other Businesses, Step 3 as specified by the BC Energy Step Code ~~Regulation~~ (Table 10.2.3.3.-I and Table 10.2.3.3.-J) **– 10 points or**

Passive House Performance: Design and construct the building to conform to the Passive House Planning Package, version 9 or newer, meeting the requirements of Section 10.2.3.3 (3) of the BC Energy Step Code ~~Regulation~~. **– 16~~5~~ points**

Intent

To reduce building total energy usage and thermal demand by ensuring that the ~~designed~~ building energy performance meets a high standard and to allow flexibility for building design by specifying a performance target rather than prescriptive requirements.

Rationale

Construction at UBC aims for a high energy performance in order to fulfill the objectives of the Community Energy & Emissions Plan. To improve building performance outcomes, ~~energy use intensity targets were introduced into REAP Version 3.0. In REAP Version 3.1, Energy Step Code Target credits were included to align with~~ REAP references the province of BC's Energy Step Code energy use intensity targets.

Definitions

- *Total Energy Use Intensity (TEUI):* The modelled amount of total energy used by a building, per unit of area, per year, expressed in kWh/(m2·year). It is determined as defined by the BC Energy Step Code Regulation
- *Thermal Energy Demand Intensity (TEDI):* The amount of annual heating energy needed to maintain a stable interior temperature, taking into account heat loss through the envelope and passive gains. TEDI is calculated per unit of area of conditioned space per year, and expressed in kWh/(m2·year). It is determined as defined by the BC Energy Step Code Regulation.
- Energy Step Code Step 4 Targets for Residential Occupancies: 100 kWh/m2-yr (TEUI) and 15 kWh/ m2-yr (TEDI).
- *Airtightness Testing:* Airtightness testing uses fans to pressurize a building and quantify air leakage rates under controlled conditions. Testing must meet the requirements of the BC Energy Step Code.
- *Passive House:* An internationally recognized building standard that is rigorous, voluntary, and energy-based. Passive House buildings consume up to 90% less heating and cooling energy compared to conventional buildings.
- ~~*Pro-rated EUI target for mixed use buildings (residential with commercial/retail):* To obtain a prorated target for your development, apply to the UBC Sustainability and Engineering Green Building Manager.~~

Strategies

Many energy efficiency strategies can be employed in order to meet BC Energy Step Code targets. Below are a few design approaches that may be considered during design and construction as cost effective approaches to improve building energy performance.

- Improve airtightness, consider achieving Passive House level of airtightness (0.173 l/s-m2).
- Install LED lighting and occupancy sensors throughout the building.
- Improve envelope performance, consider utilizing pre-manufactured panelized wall systems.
- Utilize high performance heat-recovery ventilation (HRV).

Resources

- The BC Energy Step Code ~~website has~~ resources for designers and builders.
- *BC Energy Step Code requirements~~Regulation~~*.
- The *Energy Step Code Energy Design Report* is the BC Energy Step Code reporting template ~~for Energy Step Code~~.
- The *City of Vancouver Energy Modelling Guidelines* are required to determine compliance with BC Energy Step Code targets.
- The Architectural Institute of BC and Engineers and Geoscientists BC have developed *Professional Practice Guidelines for Whole Building Energy Modelling*
- BC Hydro produced a video of an airtightness test demonstration of a multi-unit residential building project at UBC
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

- ~~*The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.~~

-

Required Documentation: Submit at the *Building Permit* phase

- A preliminary energy modeling report with model parameters and~~,~~ inputs~~, and~~ energy and GHG emission reporting for energy end uses (including but not limited to space heating and cooling, domestic hot water, lighting, plug loads and fans and pumps) and a description of modelling software used.
- A ~~P~~preliminary Energy Step Code Part 3 Energy Design Report.
- For the Passive House Energy Performance Credit, provide preliminary energy model documentation as required by Section 10.2.3.3 (3) of the BC Energy Step Code Regulation.

Required Documentation: Submit at the *Occupancy Permit* phase

- A letter signed by the Architect ~~or Engineer~~ declaring that the building design meets the requirements of the BC Energy Step Code regulation and that Energy Step Code targets have been met.
- An ~~A~~as-built ~~written~~ energy modeling report with model parameters and inputs and energy and GHG emission reporting for energy end uses (including but not limited to space heating and cooling, domestic hot water, lighting, plug loads and fans and pumps) and a description of modelling software used.
- As-built Energy Step Code Part 3 Energy Design Report.

- Air tightness test results as specified by Section 10.2.3.5 of the BC Energy Step Code ~~Regulation~~.
- For the Passive House Energy Performance Credit, provide energy model documentation as required by Section 10.2.3.3 (3) of the BC Energy Step Code ~~Regulation~~.

ENERGY & EMISSIONS

E&E Credit 2.1: Renewable Energy — 6 points

Requirement

Use on site renewable energy systems to offset all or a portion of the building's annual electricity consumption as follows:

- 4% **– 2 points**
- 8% **– 4 points**
- 12% **– 6 points**

Intent

To encourage and recognize increasing levels of self-supply with renewable technologies, to reduce environmental impacts associated with fossil fuel energy use.

Rationale

Renewable energy systems can help to transform buildings from energy consumers to energy producers.

Recommended Strategies

- Specify the use of PV-powered lighting where applicable such as exterior landscapes and pathway lighting.
- Consider solar access when designing roofs, walls, windows and external shading devices intended for solar collection. A system that is well integrated building design generally offers the best economics and aesthetics.

Resources

- *The Canadian Solar Industries Association's (CanSIA):* CanSIA's mission is to develop a strong, efficient, and professional Canadian solar industry, and offers current technical and product information.
- *Solar Energy Society of Canada, Inc. (SESCI):* SESCI is a volunteer based, non-profit solar organisation, and carries breaking Canadian solar news, workshops and conferences.
- *RETScreen:* The RETScreen International Clean Energy Decision Support Centre assists public and private decision to effectively analyze and implement renewable energy projects.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Electrical Engineer declaring that the requirements will be met.
- Specification sheet for technologies being installed including system capacity.
- Estimated annual electricity production and annual offset of total building electricity consumption.

E&E Credit 3.1: Enhanced Energy Sub-metering and Reporting — 5 points

Requirement

Install energy metering for the following: All major energy end uses (representing 10% or more of total energy consumption) for each major use class (e.g., residential, commercial or retail) and building typology (e.g., high rise or townhouse) and/or suite level thermal energy consumption. Report energy use to ~~UBC~~ Sustainability and Engineering.

- Major end and space use sub-metering. **– 2 Points**
- Suite level thermal energy sub-metering. **– 3 Points**

Intent

Enhanced energy sub-metering provides Sustainability and Engineering with performance data on major energy end uses, supporting building policy refinement. Suite level sub-metering allows residents to monitor energy use and costs, and allows building owners to allocate energy costs based on consumption.

Rationale

Sub-metering allows building owners to understand which energy sub-systems are operating sub-optimally and to allocate energy costs to tenants based on energy use so that residents only pay for energy they use (a strategy that has been demonstrated to reduce energy use). Sub-metering also enables ~~UBC~~ Sustainability and Engineering to gain knowledge on building energy system performance and refine building policy. This credit supports objectives of the UBC Community Energy and Emissions Plan (CEEP).

Definitions

- *Energy sub-metering:* Energy metering of energy end-uses or space uses that are a sub-component of energy metered by primary utility meters.

Recommended Strategies

- Retain a third party service provider to manage metering data and, for suite-level sub-metering, to allocate energy costs.

Resources

- *Research study:* Terés-Zubiaga, J. et al. (2018). Effects of individual metering and charging of heating and domestic hot water on energy consumption of buildings in temperate climates. Energy Conversion and Management, 171, 491-506. This study demonstrates the effects of individual metering and charging of heating and domestic hot water on energy consumption of buildings in temperate climates.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- A letter signed by Mechanical or Electrical consultant ~~Engineer~~ declaring that the requirements for this credit will be met.

Required Documentation: Submit at the *Occupancy Permit* phase

- A description of the metering system and drawings showing locations of the meters.
- A letter signed by the Developer declaring that a service provider has been retained to manage sub-metering data and provide data to ~~UBC~~ Sustainability and Engineering upon request. All suite-level data is to be anonymized.

ENERGY & EMISSIONS

E&E Credit 4.1: Smart Thermostat — 1 Point

Requirement

Install a smart thermostat to control heating and cooling that has wi-fi functionality, can detect absence through geofencing or occupancy sensors and allows users to track energy use.

Intent

To reduce energy consumption and energy costs and increase convenience and comfort for occupants.

Rationale

Smart thermostats allow occupants to more conveniently control energy use and track energy use through app-based tools and automated features than with a conventional thermostat.

Definitions

Smart thermostat: a Wi-Fi enabled device that automatically adjusts heating and cooling temperature settings in an oocupant's home for optimal performance.

Recommended Strategies

- Consult with suppliers to identify models that are appropriate for the energy system being controlled, and provide the homeowner with an operation manual.
- Use of set back temperatures during sleeping hours and absences.

Resources

Energy Star provides definitions and resources for smart thermostats.

Digital trends provides a blog that explains how smart thermostats work and save money.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Electrical Engineer or responsible party declaring that the requirements will be met.

Required Documentation: Submit at the *Occupancy Permit* phase

- Cut sheet from the manufacturer of the thermostat supplied and description of thermostat locations.

E&E Credit 45.1: Electric Vehicle Charging Stations — 3 points

Requirement

Install SAE J1772 compliant Level 2 charging stations that accommodate load-sharing ~~and provide~~and provide:

- One dedicated charging connector for visitor or shared use per 100 units. **– 1 point**
- A dedicated charging connector for 5% of residents' parking stalls. **– 1 point**
- A dedicated charging connector for 10% of residents' parking stalls. **– 1 point**

Intent

To reduce the number of greenhouse gas emitting vehicles and encourage the use of alternative fuel vehicles. Providing Level 2 charging stations will provide immediate opportunity for residents to access charging for electric vehicles.

Rationale

Full Battery ~~Alternative fuel vehicles~~electric vehicles can reduce greenhouse gas emissions from vehicle operation by more than ~~approximately~~ 9928% in British ~~as~~Columbia compared to conventional petroleum-powered vehicles. Level 2 charging stations will provide sufficient charging capacity for overnight charging of electric vehicles.

Definitions

- *Electric v~~V~~ehicle(s):* V~~A v~~ehicles that uses electrically charged batteries to provide all or partial energy to power an engine, while requiring connection to a power outlet for charging.
- *Level 2 c~~C~~harging c~~C~~onnector:* A level 2 electric vehicle charging connector that meets SAE International's J1772 standard.

Recommended Strategies

- Charging stations with advanced metering systems can facilitate tracking of energy use and management of energy use costs by building owners. A dedicated BC Hydro meter for the EV charging system will also allow building owners to track energy use and costs.
- In underground visitor parking, designate space(s) for electric vehicle charging.

Resources

- *Plug In BC:* Plug In BC have compiled resources for parties interested in installing electric vehicle charging stations in MURBS in BC.
- *Metro Vancouver EV Strata Condos:* Metro Vancouver has compiled resources for parties interested in installing electric vehicle charging stations in Strata-owned MURBS.
- BC Hydro provides rebates and other resources for installing EV charging stations in MURBs.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Electrical Engineer declaring that the requirements will be met.
- Plan showing location of parking spots equipped with charging stations for electric vehicles.
- Cut sheet from manufacturer of charging stations that will be installed.

WATER

W P1: Low-flow Plumbing Fixtures — Precondition

Requirement
Specify and install:
- Water-saving showerheads with a maximum flow rate of 5.7 L per minute in each shower.
- Low-flow faucets with aerators in all bathroom sinks with a maximum flow of 3.8 L per minute.
- Low-flow faucets with aerators in all kitchen sinks with a maximum flow of 6.8 L per minute.

Intent
To reduce potable water use associated with plumbing fixture use.

Rationale
According to the GVRD, approximately 19% of the water used in residential buildings is from bathroom and kitchen faucets and 20% is from showers. Water efficient fixtures reduce demand, which helps to reduce treatment costs and defer future costs of building additional infrastructure.

Definitions

- *Low-flow showerheads:* Low-flow showerheads use 6.8L of water or less per minute, approximately three quarters of the water of a traditional showerhead, while maintaining the same water pressure.
- *Low-flow faucet:* A faucet that is designed to use less water than conventional faucets.
- *Aerator:* Aerators restrict water flow at the outlet without reducing water pressure by mixing air into the water stream.
- *Potable water:* Water that meets drinking water quality standards and is approved for human consumption by the authority having jurisdiction.

Recommended Strategies
Consult with local suppliers to identify appropriate Low-flow faucets with the required performance ratings for all bathroom and kitchen sinks.

- Not all Low-flow showerheads perform equally well. Select manufacturers and models that have performed well in residential applications in the past.

Resources

- *Metro Vancouver* provides water saving tips for the residential sector.
- *BC Hydro*: Through the Power Smart at Home program, BC Hydro provides resources on a wide range of energy saving strategies, including installing low-flow showerheads and aerators.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Water component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Mechanical Engineer or responsible party declaring that the requirements will be met, including identification of specific fixtures used and flow rate.
- Cut sheet from the faucet manufacturer indicating flow rate.

WATER

W P2: Outdoor Water Use Reduction — Precondition

Requirement

Option 1:

- Design and install a water-efficient irrigation system that includes an automated controller, rain or soil sensors and pressure regulator; for non-grass areas, use a micro- or drip-feed irrigation.
- Reduce the project's landscape water use by at least 30% from the site's calculated baseline of the peak watering month through plant selection and irrigation efficiency.

Option 2:

- Install a temporary irrigation system.

Intent

To reduce potable water use associated with irrigation.

Rationale

While water seems plentiful in BC's Lower Mainland, the issues of supply and quality are becoming increasingly important and irrigation restrictions are in effect. Every summer, water use can increase by 50% when rainfall is at its lowest. In Metro Vancouver use as much as 1.5 billion litres on the hottest days (about 1 billion litres on a winter day) and much of water use comes from outdoor uses like lawn watering. Landscaping that uses water more efficiently helps reduce impacts on water infrastructure. Efficient irrigation systems can reduce water consumption by 50 to 70% in planted areas, and reduce overall per capita water consumption by 20-25%.

Definitions

- *Potable water:* Water that meets drinking water quality standards and is approved for human consumption by the authority having jurisdiction.

Recommended Strategies

- Use subsurface drip irrigation for trees to eliminate moisture losses due to evaporation.
- Specify a variety of drought tolerant plants in landscaping.
- Mulch planting beds to 50 mm depth to reduce loss of water by evaporation.
- Place plant communities with similar water regimes in common zones and match irrigation equipment and regimens with plant community requirements.

Resources

- *Waterbucket.ca* is the vehicle for communicating a water sustainability action plan for British Columbia, and includes a range of resources promoting water efficient planning and irrigation technologies.
- *The Irrigation Industry Association of British Columbia* fosters and promotes information exchange on a range of issues related to irrigation in BC.
- *Metro Vancouver* has outdoor water tips for residential uses.
- *LEED BD&C: New Construction v4* provides information and resources for water efficiency as part of the Outdoor Water Use Reduction credit.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Water component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Landscape Architect indicating the requirements will be met, including a description of the irrigation system.
- Calculation by the Landscape Architect showing how the 30% reduction will be achieved, if this option is chosen.
- Use WaterSense Budget Tool spreadsheet for required calculation.

WATER

W P3: Water Efficient Appliances **Precondition**

Requirement

Specify and install:

- Energy Star labelled, or equivalent performance, clothes washers; if washers are available only as an option, specify and offer only models complying to this standard.
- Energy Star labelled dishwashers, or equivalent performance; if dishwashers are available only as an option, specify and offer only models complying with this credit.

Intent

To reduce water and energy use associated with the use of clothes washers and dishwashers.

Rationale

Appliance use represents one of the largest single water end-uses in residential buildings. Energy Star qualified clothes washers and dishwashers reduce residential water and energy demand, operating costs, and environmental impacts.

Definitions

- *Energy Star*: The Energy Star symbol designates appliances that are among the most efficient in the marketplace. Requirements vary from one category to another, but typically an Energy Star model must be at least 20% more efficient than a conventional model.

Recommended Strategies

- Refer to NRCan's Energy Star appliance directory to identify qualifying clothes washer and dishwasher makes and models; or
- Refer to NRCan's current Energy Star key product criteria to identify non-Energy Star-labelled clothes washer and dishwasher models of equivalent energy efficiency.

Resources

- *Energy Star:* Natural Resources Canada and the Office of Energy Efficiency provide information on the program. The Energy Star appliance directory includes a comprehensive listing of the most energy efficient appliances in the market. See links below to Energy Star qualified model lists for clothes washers and dishwashers.
- *EnerGuide:* Natural Resources Canada has developed the EnerGuide label for all major appliances to compare a model's energy consumption to similar models. This is particularly useful when looking at residential products that are not eligible for ENERGY STAR certification, such as ranges, ovens and wine chillers.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Water component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by the Architect or responsible party declaring that the requirements will be met.
- Cut sheet from the manufacturer of the Energy Star labelled or equivalent clothes washers and dishwashers that will be installed.
- Supporting documentation to prove that any non-Energy Star-labelled clothes washers and dishwashers installed meet the Energy Star key product criteria.

WATER

W P4: Rainwater Management — Precondition

Requirement
Detain the 10-year, 24-hour storm volume and discharge at the 2-year, 40-hour pre-development rate on site or at a designated central facility using low-impact development and green infrastructure as far as possible.

Intent
To provide safe conveyance of stormwater to protect people and property, minimize the need for stormwater infrastructure, and maintain the ecological integrity and health of landscapes and river systems.

Rationale
Development can significantly decrease the rate of natural water infiltration. Incorporating on-site stormwater management design features mitigates water flow into the storm sewer system, and promotes the health of nearby ecosystems and estuaries.

Definitions

- *Detention facility*: A storage facility that is normally dry but is designed to hold surface water temporarily after a runoff event slowing runoff e.g. natural swales, surface depressions, tanks, infiltration basins.
- *Retention facility:* A facility which collects stormwater and allows the water to soak into the soil. This infiltration process helps recharge groundwater.
- *Infiltration:* Water movement from land surfaces into the soil and water table.
- *Permeability:* Ability of a substance (i.e. soil) to transmit fluids through porous spaces.

Recommended Strategies

- Where available, hook into the neighbourhood system to achieve the requirements.
- Provide a subsurface infiltration trench below permeable paving to enhance water infiltration into soils.
- Optimize infiltration and plant health with a soil layer that is high in organic content.
- Consider installing green roofs, which both delay and reduce the runoff peak flows that occur with conventional roof systems.
- Design a stormwater detention system to handle storm events and reduce loading on storm sewers.

Resources

- *Stormwater management at UBC*.
- *UBC's Integrated Stormwater Management Plan*.
- *Government of British Columbia*: Local government Stormwater Infrastructure.
- *U.S. EPA Technical Guidance on Implementing the Rainwater Runoff Requirements for Federal Projects* under Section 438 of the Energy Independence and Security Act.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Water component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Civil Engineer or responsible party declaring requirements will be met.

- Copy of the Stormwater Management Plan.

WATER

W Credit 1.1: Total Water Use Reduction — 7 points

Requirement

Reduce the total indoor and outdoor potable water use from the calculated BC Plumbing Code baseline using efficient fixtures, efficient landscaping practices and/or alternative water sources.

- 35% reduction from baseline. **– 1 point**
- 40% reduction from baseline. **– 2 points**
- 45% reduction from baseline. **– 3 points**
- 50% reduction from baseline. **– 4 points**
- 55% reduction from baseline. **– 7 points**

Intent

To reduce total potable water use.

Rationale

The current average daily use of potable water in the Metro Vancouver area is 440 litres per capita. UBC aims to practise responsible water management and use at the building and site scale by advancing water conservation and efficiency, exploring alternative water supply and treatment solutions, and improving water supply resiliency.

Recommended Strategies

- Better landscaping can dramatically reduce and even eliminate the need for irrigation. Plant native and adapted species instead of turf grass (conventional monoculture lawns) to reduce maintenance, runoff, and fertilizer and pesticide applications.
- Faucets, showers, baths, and toilets typically account for two-thirds of a home's indoor water use; use the lowest flow fixtures where possible to ~~dramatically~~ reduce water use.
- Install water efficient appliances to reduce water use by approximately 10%.
- Install alternate water systems which use rainwater for toilet flushing or irrigation. These systems reduce water use, but are a less cost effective strategy.

Resources

- *Metro Vancouver* provides regional goals and data on regional water use.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Water component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Completed total water use reduction calculator.
- Letter signed by the mechanical engineer declaring that the requirement will be met.

WATER

W Credit 2.1: On-Site Rainwater Management — 4 points

Requirement
Part 1:
Provide permeable surfaces for low impact rainwater management for a percentage of areas of the site. The following surfaces are eligible: grass with 12" topsoil, planting areas with 24" topsoil, rain gardens, extensive vegetated roofs, swales, and pervious paving.

- Permeable surfaces on 30% of the site. **– 2~~1~~ point**
- Permeable surfaces on 50% of the site. **– 2~~1~~ point**

~~**Part 2:**~~
~~Detain the 10-year, 24-hour storm volume and discharge at the 1-year, 40-hour pre-development rate on site using low impact development techniques (scoring at least 1 point in part 1) and detention facility. **– 2 points**~~

Intent
To provide safe conveyance of stormwater to protect people and property, minimize the need for stormwater infrastructure, and maintain the ecological integrity and health of landscapes and river systems.

Rationale
Development can significantly decrease the rate of natural water infiltration. Incorporating on-site stormwater management design features mitigates water flow into the storm sewer system and promotes the health of nearby ecosystems and waterways.

Definitions

- ~~*Detention facility:* A storage facility that is normally dry but is designed to hold surface water temporarily after a runoff event slowing runoff e.g. natural swales, surface depressions, tanks, infiltration basins.~~
- ~~*Retention facility:* A facility which collects stormwater and allows the water to soak into the soil. This infiltration process helps recharge groundwater.~~
- *Infiltration:* Water movement from land surfaces into the soil and water table.
- *Permeability:* The ability of a substance (i.e. soil) to transmit fluids through porous spaces.

Recommended Strategies

- Provide a subsurface infiltration trench below permeable paving to enhance water infiltration into soils.
- Optimize infiltration and plant health with a soil layer that is high in organic content.
- Consider installing green roofs, which both delay and reduce the runoff peak flows that occur with conventional roof systems.
- ~~Design a stormwater detention system to handle storm events and reduce loading on storm sewers.~~

Resources

- *Stormwater management at UBC*.
- *UBC's Integrated Stormwater Management Plan*.
- *Government of British Columbia*: Local government Stormwater Infrastructure.
- *U.S. EPA*: Technical Guidance on Implementing the Rainwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Water component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Preliminary calculations by the Landscape Architect or Civil Engineer showing site requirements ~~and/or detention facility requirements~~ will be met.
- Copy of the Stormwater Management Plan.

Required Documentation: Submit at the *Occupancy Permit* phase

- Final calculations by the Landscape Architect or Civil Engineer showing site requirements ~~and/or detention facility requirements~~ will be met.
- Letter signed by the Civil Engineer or responsible party declaring requirements will be met.

WATER

W Credit 3.1: Domestic Hot Water Metering — 4 points

Requirement

In units with central domestic hot water consumption, provide building level and/or individual suite hot water sub-metering. Building level consumption should be metered for each major use class (e.g., residential, commercial or retail) and building typology (e.g., high rise or townhouse).

- Provide sub-metering of hot water consumption at the building level. **– 1 point**
- Provide sub-metering of hot water consumption at the suite level. **– 3 points**

Intent

To provide building owners with better information about hot water use and cost, and influence residents to reduce energy and water use in individual suites through hot water metering.

Rationale

Hot water consumption is a significant water and energy consumption source in buildings. If suites are not individually metered, homeowners will not have a clear idea of the amount of heated water they are using. Metering enables occupants to better understand their hot water usage patterns and to see the effectiveness of water saving strategies.

Recommended Strategies

- Consult with local suppliers to determine which types of water meters are commonly used in multi-unit residential applications.
- Consult with plumbing professionals for advice on locating the meters for easy access by meter readers or service personnel, which will depend on the type of meter that is selected.
- Consider installing meters with remote reading capability to reduce future operating costs, and facilitate the integration of future electronic billing systems.

Resources

- The US Environmental Protection Agency and others commissioned the *National Multifamily Sub-metering and Allocation Billing Program Study* which investigates the effectiveness of sub-metering water in multi-unit residential buildings ~~MURBS~~ in various U.S. cities, reporting 15% water savings in buildings with sub-metering.
- A UBC SEEDS study, *Effectiveness of multi-family hot and cold water sub-metering of buildings in UNA neighborhoods*, found that sub-metering provided water savings in UBC REAP buildings.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Water component area in residential buildings

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Mechanical Engineer declaring that requirements will be met.

Required Documentation: Submit at the *Occupancy Permit* phase

- A description of the metering system and drawings showing locations of the meters.
- A letter signed by the Developer declaring that a service provider has been retained to manage sub-metering data and provide data to ~~UBC~~ Sustainability and Engineering upon request. All suite-level data is to be anonymized.

BIODIVERSITY

BIO P1: Ecological Planting — Precondition

Requirement

Select native or adaptive plant species that are appropriate for the ecoregion, suitable for the site conditions and climate (including changing conditions); and fulfill the design intent. Mature plant height, spread, and form must be considered in plant selection as a means to reduce maintenance. Select plants that are suited to the sun and shade conditions of the site and are drought tolerant. Include plants that are pollinators and provide a food source for birds.

Intent

To promote low maintenance, resource-efficient landscapes that are climate adaptive, drought resistant, reduce pesticide use, and foster habitats for pollinators and birds.

Rationale

Landscaping can place considerable demands on water resources and require excessive levels of maintenance. Ecologically sound landscapes apply the principles of xeriscaping and integrated pest management to establish thriving habitats with multiple benefits for water savings, the elimination of harmful pesticides, and a holistic plan for future climate conditions.

Definitions

- Xeriscaping: Landscaping that conserves water and requires minimal maintenance by using a variety of indigenous and drought-tolerant plants
- Integrated Pest Management: A process of planning and managing ecosystems to prevent insects, plant diseases, and weeds from becoming pests. This approach only uses pesticide as a last resort.

Recommended Strategies

- Use native drought-tolerant species (such as *salal*) for groundcover and consider limiting non-drought-tolerant grasses to 50% of landscaped area to meet the Canadian Landscape Standard.
- Space shrubs appropriately to their mature size to reduce the frequency of maintenance and watering needed.
- In the case that pesticides are necessary, do not use neonicotinoid pesticides.
- Provide adequate volumes of high quality soil for all landscaped areas.
- Install efficient, low volume irrigation systems that deliver water directly to the root zone.
- Use 50 mm of mulching to reduce water lost to evaporation and runoff by 75-90% as compared to non ~~un~~mulched planting areas.
- If turf grass is selected, use regionally appropriate mixes that reduce post-establishment resource needs.
- Implement Integrated Pest Management strategies in order to reduce costs and liabilities associated with pesticide use.
- Consider access to sunlight/shade and over slab and off slab environments to create well adapted and aesthetically pleasing landscapes.

Resources

- *Integrated Pest Management, the Ministry of the Environment and Climate Strategy* provides information and support for Integrated Pest Management.
- *Canadian Landscape Standard (CLS) ($188 hardcopy):* The Canadian Landscape Standard is a detailed set of guidelines on landscape construction projects across Canada published by the Canadian Nursery Landscape Association and the Canadian Society of Landscape Architects.
- *The Metro Vancouver Grow Green Guide* provides recommendations for plant species and sustainable garden and lawn design. The guide is designed to fulfill water conservation, rainwater absorption, composting, control invasive species, and increase biodiversity
- *The Sustainable SITES Initiative*: SITES is a sustainable landscape rating system which provides promotes design to enhance ecosystem services
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Biodiversity component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by Landscape Architect declaring that the requirements will be met.
- A narrative of the principles applied to the landscape design for the requirements, appropriate to the planting conditions such as: on slab, off slab, over a parking garage structure, over a living roof, and other relevant conditions.

BIODIVERSITY

BIO P2: Light Pollution Reduction — Precondition

Requirement
Do not exceed the current Illuminating Engineering Society (IES) illuminance requirements as stated in Lighting for Exterior Environments.

Intent
To eliminate light trespass from the building site, improve night sky access, and reduce development impacts on nocturnal environments and wildlife.

Rationale
Light pollution and light trespass disrupt ecosystems, compromise astronomical research, cause adverse human health effects, and needlessly consume excess energy.

Definitions

- *Light Trespass:* Unwanted or nuisance light emanating from a neighbouring property.
- *Light Pollution:* Waste light from buildings sites that interferes with astronomical research, produces glare, and adversely affects the environment.
- *Illuminance:* Amount of light falling on a surface, measured in units of ~~footcandles~~foot-candles (fc) or lux (lx).

Recommended Strategies

- Use full cut-off luminaires to direct light downward where it is needed, e.g. on pedestrian pathways, sidewalks and landscaped areas. Do not provide additional illumination for roadways.
- Design for an illuminance uniformity ratio of 4:1 for pathway lighting.
- Minimize outdoor lighting levels (e.g. limit exterior lighting on decks, balconies). Carefully match outdoor lighting levels with the application and use no more than absolutely necessary.
- Use lighting that has a colour temperature of 3000 Kelvins maximum, for the health of humans and wildlife.
- Keep lighting poles low and closely spaced. For more uniform area lighting, such as parking lots, use a larger number of lower, pole-mounted luminaires instead of fewer, taller fixtures.
- Avoid reflective surfaces beneath down lit signs. Whenever possible, design the surfaces beneath down lit signs to be light absorptive rather than reflective.

Resources

- *Illuminating Engineering Society:* IES is the recognized technical authority on illumination. The society publishes a variety of technical documents on illumination, as well as other lighting-related publications that encourage good lighting design.
- *International Dark-Sky Association:* IDA provides extensive resources, guidelines and recommendations for minimizing light pollution.
- *LEED v4 for Building Design and Construction:* Information and resources for Sustainable Sites Credit, 'Light Pollution Reduction'.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by Electrical Engineer declaring that the requirements will be met
- A photometric light study of the lighting strategy employed to achieve the credit.
- Cut sheet from the lighting manufacturer indicating that the fixture's design and illuminance meet requirements.

BIODIVERSITY

BIO P3: Bird Friendly Design – Basic **Precondition**

Requirement

~~In compliance with the *UBC Bird Friendly Design Guidelines for Buildings* and *CSA A460:19 Bird-friendly Building Design Standards,*~~

Identify bird collision risks in building and landscape design; **and** a

~~A~~pply appropriate strategies to:

- ~~treat *or* avoid the construction of: glass corners without mullions, parallel glass (spaced 5m apart or less), transparent skywalks, glass guards or guardrails, and glass parapets.~~*eliminate flythrough conditions* in glazing up to height of 16m or 4 m above tallest vegetation; whichever is greater; include treatment of glass corners 5m in each direction
- *treat or cover by building integrated structure* glazing immediately adjacent to existing bird habitat (eg ravine, natural area) or known migratory paths

Intent

To reduce bird mortality and injury from in-flight collisions with transparent or reflective glass in the built environment.

Rationale

Each year, it is estimated that about 10,000 birds die due to collisions with buildings at UBC.~~[2]These collisions often occur when birds attempt to fly through transparent glass or towards reflections of vegetation and open sky. Incorporating bird friendly strategies to building and landscape design helps foster safer habitats for birds so that they can contribute to a biodiverse urban ecosystem.~~[3] Incorporating bird friendly strategies to building and landscape design helps foster safer habitats for birds so that they can contribute to a biodiverse urban ecosystem. Research also shows that neighbourhoods with more visible and audible birds help improve residents' mental health.[4]

Definitions

Fly through conditions: Conditions where birds have a sight to sky or vegetation on the other side, such as, transparent skywalks, transparent corners, parallel glass, and transparent glass guardrails.

Glass treatment: Any number of methods used to render glass visible to birds; acid etch, UV markers, fritted glass, film, non-film adhesive markers, closely spaced muntins; glass must have visual markers: 50mm x 50mm; 4 mm in diameter for individual elements or 2mm wide by 8mm long for linear elements, high contrast; on surface 1 (preferred) or surface 2. Emerging glazing technologies must be tested by independent third party.

~~[2] UBC Bird Friendly Building Design Guidelines. 2019. https://sustain.ubc.ca/sites/default/files/files/3276_UBC_BirdFriendlyDesignGuidelines.pdf~~

[3] UBC Bird Friendly Building Design Guidelines. (2019).

[4] Cox, D. T., Shanahan, D. F., Hudson, H. L., Plummer, K. E., Siriwardena, G. M., Fuller, R. A., Anderson, K., Hancock, S. & Gaston, K. J. (2017). Doses of neighborhood nature: the benefits for mental health of living with nature. *BioScience, 67*(2), 147-155.

Cover by building integrated structure: Building integrated structures that cover window glass, including sunshades, screens, grills, mesh and nets and shutters.
To qualify as bird friendly treatment:

- sunshades and louvers must be on the exterior of the building; should be parallel or angled to glass and at least 50 mm and less than 1m from the surface; made of opaque or non-reflective transparent material that has been perforated with holes no greater than 50mm and a solid-to-void ratio no less than 50%; Shutters: applied to the exterior of the building and with gaps 50 mm or less
- Insect screens, grills, mesh and nets must be installed in front of the glazing: void spacing should be a maximum of 19mm x 19mm

Recommended Strategies

- Review the UBC Bird Friendly Building Design Guidelines to identify bird collision risk elements in the site plan and project design early on.
-
- ~~Avoid the collision risk situations listed in the requirement where possible; if avoidance is not possible use the recommended strategies to mitigate the collision risk in each case.~~ Implement bird friendly strategies (such as glass treatment or installation of building integrated structure) to meet the requirements

Resources

- ~~The *UBC Bird Friendly Building Design Guidelines*~~ The UBC Bird Friendly Building Design Guidelines (2019) provides a comprehensive list of cost-efficient, co-beneficial bird friendly building design ~~strategies.~~
- strategies. *Potential Mitigation strategies for UBC*
- The *CSA A460:19 Bird-Friendly Building Design Standard* provides design requirements for glazing, building-integrated structures, and overall site design.
- *FLAP Canada* is a leading authority on bird-building collisions. They provide resources to assess building bird collision risk and methods to reduce bird collisions. ~~*Site:*~~ https://flap.org/~~.~~
- *LEED Canada Reference Guide for Building Design and Construction*: Information and resources available under the Sustainable Sites Pilot Credit, 'Bird collision deterrence'.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the biodiversity component area in residential buildings.
- *Products & Solutions to Stop Birds Flying Into Windows | ABC (abcbirds.org)* provides a list of international bird-strike mitigation strategies and products.
- *Pacific Coastal Campus.pdf* provides an example of a collision monitoring study conducted on UBC campus from 2015-2017.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Architect declaring that the requirements will be met, including a description of the strategies used to achieve the credit.

- Building elevations and/or landscape drawings showing the design strategies and materials chosen to meet the credit requirements.
- Manufacturer cut-sheet of the bird-friendly materials used.

BIODIVERSITY

BIO Credit 1.1: Planting for Biodiversity and Ecosystem Health — 3 points

Requirement

Enhance biodiversity and ecosystem health by achieving the following:

1. **Develop a Landscape Maintenance Plan — 1 point**
   Develop a landscape maintenance plan that instructs maintenance contractors on the sustainable care of plants over the lifetime of the building and landscape.
2. **Maximize Native Planting — 1 point**
   Provide a plant list that demonstrates that 70% of the plantings (by number of plants) are native.
3. **Pollinator Gardens — 1 point**
   Provide a plant list that demonstrates that 20% of planting choices (by number of plants) and landscape design support pollinators such as hummingbirds, native bees, butterflies, moths, and bats.

1. Develop a Landscape Maintenance Plan — 1 point

Intent

To reduce the need for unnecessary, costly maintenance and harmful pesticides.

Rationale

Proper maintenance of landscapes can improve plant health, increase water efficiency, and reduce pesticide use, resulting in more resource-efficient and cost-effective landscapes. Establishing a clear landscape maintenance plan to the maintenance contractors ensures that there is a long term path to establishing ecologically sound landscapes.

Recommended Strategies

- Devise a clear landscape maintenance plan to pass on to maintenance contractors. Address at a minimum: irrigation allotment and schedule; soil management process; use of fertilizers (only if needed); alleviating soil erosion or compaction; plant health care; plant materials management; diseased and invasive plant disposal; pest management; equipment maintenance; snow and ice management.
- Refer to the BC Ministry of Environment & Climate Strategy for guidance on pesticides, pest management and the reduced use of nitrogen based fertilizers.
- Tree, shrub, vine, and groundcover pruning instructions should enhance natural growth
- Plant understorey or ground cover to use spaces between shrubs.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Developer declaring that the requirements will be met.
  ~~Copy of the Landscape Maintenance Plan specifying instructions for the sustainable care of plants as directed to the landscape maintenance contractor/strata.~~

Required Documentation: Submit at the *Occupancy Permit* phase

- Copy of the Landscape Maintenance Plan specifying instructions for the sustainable care of the landscape and as directed to the landscape maintenance contractor/strata.

2. Maximize Native Planting — 1 point

Intent
To establish low maintenance, water efficient landscapes and promote the conservation of native plants

Rationale
Native planting is essential to a healthy ecosystem. They require less irrigation, help store carbon, and provide shelter and food for wildlife.

Recommended Strategies

- Choose the right plants for the site conditions

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Landscape Architect declaring that the requirements will be met.
- Plant list highlighting native plants.

3. Pollinator Gardens — 1 point

Intent

To promote the natural pollination of plants and provide food and habitats for native pollinators.

Rationale

Pollinator populations are rapidly declining due to loss of habitat and pesticide use on non-native species. Pollinator gardens help ensure that native bee species and other pollinators have food and habitats for their survival and can contribute to aesthetically pleasing landscapes.

Recommended Strategies

- Choose flowers and plants with a diversity of colours, shapes, heights, and sizes to attract different pollinators.
- Use a variety of plants that bloom at different months throughout the year.
- Avoid planting large areas of turf grass as they provide little food or shelter for pollinators.
- Prioritize the use of native and heirloom plant species.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Landscape Architect declaring that the requirements will be met.
- Plant list highlighting plants and pollinators that will be attracted to them.

Resources

- *The Ministry of the Environment and Climate Strategy* provides guidance on pesticides and pest management.
- *Canadian Landscape Standard (CLS) ($188 hardcopy):* The Canadian Landscape Standard is a detailed set of guidelines on landscape construction projects across

Canada published by the Canadian Nursery Landscape Association and the Canadian Society of Landscape Architects.

- *The Metro Vancouver Grow Green Guide* provides recommendations for plant species and sustainable garden and lawn design. The guide is designed to fulfill water conservation, rainwater absorption, composting, control invasive species, and increase biodiversity
- *The Sustainable SITES Initiative*: SITES is a sustainable landscape rating system which provides promotes design to enhance ecosystem services
- *The City of Seattle Public Utilities* department provides examples for sustainable landscape maintenance specifications and guidelines for the use of contracting landscape maintenance services
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Biodiversity component area in residential buildings.

BIODIVERSITY

BIO Credit 2.1: Site Green Space — 12 points

Requirement
Dedicate 30% of the total site area (including the building footprint) to green space. Eligible green spaces include grass lawns, areas with plants, vegetated roofs, living walls, balcony greenery, areas dedicated to food production (excluding paving).

Intent
To foster landscapes which support biodiversity, natural ecosystem processes, reduction of the urban heat island effect, social interaction, and mental wellbeing.

Rationale
Green spaces provide vital ecosystem services at the building scale by aiding local climate regulation, water supply retention, and providing habitats for pollinators and wildlife. Quality greenery can also benefit the wellbeing of residents by facilitating physical activity and community connections.

Definitions
Green spaces include:

- Areas in accordance with the mandatory BIO P1 Ecologically Sound Planting credit.
- Garden spaces dedicated to food production.
- Extensive or intensive vegetated roofs.
- Living walls.
- Private balcony greenery (if pre-installed or infrastructure for gardening is installed).

Recommended Strategies

- Plan to allocate the appropriate percentage of outdoor space early on in the project.
- Use a mix of native groundcover, shrubs, trees, and vines which support water conservation and provide habitats for pollinators and animals.
- Maximize opportunities for green spaces to be ~~publically~~publicly accessible amenity spaces for recreation and socialization.

Resources

- *The Metro Vancouver Grow Green Guide* provides recommendations for plant species and sustainable garden and lawn design. The guide is designed to fulfill water conservation, rainwater absorption, composting, control invasive species, and increase biodiversity.
- *The Sustainable Sites Initiative* is a rating system administered by the Green Business Certification Inc. which provides performance-based measures for sustainable and resilient landscape design.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Biodiversity component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Landscape Architect declaring that the requirements will be met, including a description of the landscape and open space strategy employed to achieve the credit.
- Landscape plan with calculation of the planned green space percentage for the project.

BIODIVERSITY

BIO Credit 3.1: Bird Friendly Design – Enhanced — 3 points

Requirement

~~In compliance with the *UBC Bird Friendly Design Guidelines for Buildings* and *CSA A460:19 Bird-friendly Building Design Standards,* identify bird collision risks in building and landscape design and apply appropriate strategies to create bird friendly environments.~~

Part 1 – **2 points**

~~*Apply strategies from the UBC Bird Friendly Design Guidelines for Buildings to T*~~*treat* or *cover by building integrated structure* a minimum of **55%** of all glazed surfaces ~~and surrounding glass structures~~ (e.g., window glass, glass guardrails and windbreaks) of the building and surrounding glass structures up to a height of 16m ~~the 4th floor~~ or the tallest adjacent vegetation at maturity ~~mature tree height~~, whichever is taller. ~~.~~ **and**

treat or cover all glazing adjacent to large areas of vegetation (over 100m2) and/ or water features (such as hard surface water features, pond, stream, rain garden)

~~Surfaces posing the highest risk, including courtyards, glass guardrails, windbreaks, glass adjacent to water features or vegetation, should be prioritized .~~ **or**

Part 2 – **3 points**

Treat or cover *by building integrated structure* a minimum of ~~**In accordance with CSA A460:19, apply strategies from the *UBC Bird Friendly Design Guidelines for Buildings* to treat 85**~~**90%** of all glazed surfaces ~~and surrounding glass structures~~ (e.g., window glass, glass guardrails and windbreaks) of the building and surrounding glass structures up to a height of 16m ~~the 4th floor~~ or the tallest adjacent vegetation at maturity~~mature tree height~~, whichever is taller **and**

treat or cover all glazing adjacent to large areas of vegetation (over 100m2) and/ or water features (such as hard surface water features, pond, stream, rain garden)~~r. Surfaces posing the highest risk, including courtyards, glass guardrails, windbreaks, glass adjacent to water features or vegetation, should be prioritized.~~

Intent

To reduce bird mortality and injury from in-flight collisions with transparent or reflective glass in the built environment.

Rationale

Each year, it is estimated that about 10,000 birds die due to collisions with buildings on the~~at~~ UBC campus.[5] Incorporating bird friendly strategies to building and landscape design helps foster safer habitats for birds so that they can contribute to a biodiverse urban ecosystem. Research also shows that neighbourhoods with more visible and audible birds help improve residents' mental health.[6]

Definitions

[5] UBC Bird Friendly Building Design Guidelines. (2019). https://sustain.ubc.ca/sites/default/files/files/3276_UBC_BirdFriendlyDesignGuidelines.pdf

[6] Cox, D. T., Shanahan, D. F., Hudson, H. L., Plummer, K. E., Siriwardena, G. M., Fuller, R. A., Anderson, K., Hancock, S. & Gaston, K. J. (2017). Doses of neighborhood nature: the benefits for mental health of living with nature. *BioScience, 67*(2), 147-155.

Fly through conditions: Conditions where birds have a sight to sky or vegetation on the other side such as, transparent skywalks, transparent corners, parallel glass, and transparent glass guardrails.

Glass treatment: Any number of methods used to render glass visible to birds; acid etch, UV markers, fritted glass, film, non-film adhesive markers, closely spaced muntins; glass must have visual markers: 50mm x 50mm; 4 mm in diameter for individual elements or 2mm wide by 8mm long for linear elements, high contrast; on surface 1 (preferred) or surface 2. Emerging glazing technologies must be tested by independent third party.

Cover by building integrated structure: Building integrated structures that cover window glass, including sunshades, screens, grills, mesh and nets and shutters.
To qualify as bird friendly treatment:

- sunshades and louvers must be on the exterior of the building; should be parallel or angled to glass and at least 50 mm and less than 1m from the surface; made of opaque or non-reflective transparent material that has been perforated with holes no greater than 50mm and a solid-to-void ratio no less than 50%; Shutters: applied to the exterior of the building and with gaps 50 mm or less
- Insect screens, grills, mesh and nets must be installed in front of the glazing: void spacing should be a maximum of 19mm x 19mm

Recommended Strategies

- Use the UBC Bird Friendly Building Design Guidelines to identify bird collision risk elements in the site plan and project design early on.
- Implement bird friendly strategies (such as glass treatment or installation of building integrated structure) to meet the requirements
  ~~Apply bird friendly strategies strategically within the collision risk zone, up to the 4th floor of a building façade or mature tree height, whichever is taller. For green roofs, apply strategies up to 3.6m above the roof.~~

Resources

- ~~The *UBC Bird Friendly Building Design Guidelines*~~The UBC Bird Friendly Building Design Guidelines (2019) provides a comprehensive list of cost-efficient, co-beneficial bird friendly building design strategies.
- *Potential Mitigation strategies for UBC*

- The *CSA A460:19 Bird-Friendly Building Design Standard*: provides design requirements for glazing, building-integrated structures, and the overall site design.
- *FLAP Canada* is a leading authority on bird-building collisions. They provide resources to assess building bird collision risk and methods to reduce bird collisions.
- *LEED Canada Reference Guide for Building Design and Construction*: Information and resources available under the Sustainable Sites Pilot Credit, 'Bird collision deterrence'.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Biodiversity component area in residential buildings.
- *Products & Solutions to Stop Birds Flying Into Windows | ABC (abcbirds.org)* provides a list of international bird-strike mitigation strategies and products.
- *Pacific Coastal Campus.pdf* provides an example of a collision monitoring study conducted on UBC campus from 2015-2017

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Architect declaring that the requirements will be met, including a description of the strategies used to achieve the credit.
- Completed Bird Friendly Building Calculator template.
- Building elevations and/or landscape drawings showing design strategies and materials chosen to meet the credit requirements.
- Manufacturer cut-sheet of the bird-friendly materials used.

BIODIVERSITY

BIO Credit 4.1: Food Growing Opportunity — 1 point

Requirement

Provide food gardening spaces of at least 2.4 m^2 for 30% of residential units which do not have access to a private outdoor space of more than 9.3 m^2. Food gardens can be provided in raised common area garden plots on grade and/or on rooftops in planters or communal gardens.

Intent

To connect people to local, healthy, accessible food, and build food resilience at the community level.

Rationale

In the current global food production system, consumers are disconnected from where their food comes from and the ways their food is grown and made. Increasing access to local food provides nutritious fruits and vegetables to residents, and helps build a more food resilient community where people are equipped with gardening skills and a knowledge of how their food is grown. Urban food gardens also contribute to vital ecosystem services and support a diversity of plant varieties, pollinators, insects, and birds.

Recommended Strategies

- Raised garden plots on grade should be a maximum of 1.2m wide. Plots accessible from only one side should be a maximum of 0.9m wide. Length should be a minimum of 1.2m. Provide good quality soil at least 45cm deep. Ensure good drainage.
- Planters for food growing on rooftops should be a maximum of 1.2m wide. Planters accessible from only one side should be a maximum of .9m wide. Length should be a minimum of 1.2m. Provide good quality soil at least 60cm deep. Ensure good drainage.
- Provide durable, high quality infrastructure and soil for the garden space to reduce the frequency of replacement.
- Food gardens must receive at least 6 hours of direct sun exposure per day during the growing season (spring to fall equinox approximately).
- Co-locate the food gardens with other amenities to encourage social interaction
- Consider the accessibility (height, location, space between) of garden spaces to accommodate wheelchairs, strollers, and senior gardeners with mobility restrictions.
- Provide support facilities including a hose bib, storage room for tools, and composting facility.
- Consider management strategies for the organization, registration, and maintenance of garden plots between the strata and property manager. For example, designate a garden manager or set up a recruitment process for a volunteer garden committee.

Resources

- *The City of Vancouver Urban Agriculture Guidelines* provides direction for medium to high density residential developments on the siting, design and support facilities of food gardens.
- ~~*The University Neighbourhoods Association* page on Community Gardens includes Guidelines for Gardeners and Terms and Conditions.~~
- Gočová, Anežka. 2015. Urban Agriculture Green Guide: Manual for Starting and Designing Urban Agriculture Projects. Greenest City Scholar.
- McConnel, Kristy. 2017. Making Space for Urban Agriculture in Multi-unit Residential Buildings: Guidelines for Developers and Recommendations for Policy. UBC SEEDS.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Biodiversity component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Landscape Architect declaring that the requirements will be met, including a description of the food garden strategy and possible management strategies.
- Landscape plan and design details as required, showing the food garden with calculations indicating that requirements have been met.
- Shadow plan indicating that all food gardens receive a minimum of 6 hours of sun during the growing season (spring to fall equinox approximately).

MATERIALS AND RESOURCES

M&R P1: Zero Waste Ready **Precondition**

Requirement

1. Design buildings to be zero waste ready by providing dedicated ~~areas~~*resident recycling areas* for the collection and storage of recyclable materials and organics as follows: ~~from the entire building. Areas must be accessible to waste haulers and conveniently located for building occupants .~~
    - Design the areas in accordance with ~~Recycling storage space shall be designed to promote recycling in accordance with the current version of~~ the Metro Vancouver Technical Specifications ~~-~~ (see link in Resources section) ~~of Recycling and Garbage Amenities in Multi-family and Commercial Developments~~.
    - Design and locate areas to be convenient, accessible and pleasant for all residents including those with restricted mobility, identifying specific strategies to minimize barriers and increase convenience, this may include dedicated in-unit storage and/or multiple collection points within the building.
    - Minimize the total one-way horizontal distance residents need to travel, limiting it to 50 m or less.
    - Centralized areas should be located at grade, or if not feasible no more than one level down from grade.
    - Co-locate organics, recycling and garbage at recycling areas ~~collection points~~ to provide equal convenience for each waste material.
    - Provide clear visual cues and signage to support residents in correct sorting of waste materials. ~~for recycling and organics.~~

2. ~~Provide convenient and accessible recycling and organics collection locations to residents: where appropriate, this may include dedicated in-unit storage and/or multiple collection points within the building.~~ Waste collection areas must be provided that are accessible to waste haulers. These may be the same or separate from the resident recycling areas; in the latter case, provision must be made to ensure transfer of waste from resident recycling areas to collection areas.

~~2.~~3. Provide a recycling and organics collection guide in the homeowners guide and in the resident recycling ~~storage~~ areas.

AND

~~3.~~4. Provide for the adequate collection of the following materials by contracting with a ~~waste management~~waste management services provider, ensuring adequate servicing frequency to prevent bin overflows, and maintain cleanliness of recycling areas: ~~company for the service:~~
    - Mixed paper, cardboard, mixed containers and glass.
    - Food scraps and accepted organic materials.
    - Optional collection: soft plastics, styrofoam and other specialty items.

Intent

To facilitate recycling, reduce the amount of waste sent to landfill, and support the development of the circular economy.

Rationale

Recycling diverts valuable materials from the waste stream and allows them to be reclaimed for use as feedstock, for new products, or to be reused as reconditioned or remanufactured

products. ~~Recyclable materials should include, at minimum, containers made from glass, metal or plastics labeled 1, 2, 4 or 5, as well as recyclable papers and cardboard.~~

Composting organic waste reduces the volume of materials sent to municipal ~~landfills,~~ landfills, reducing landfill greenhouse gas emissions and providing organic material to enrich soils.~~which helps to reduce demand for landfill infrastructure and to reclaim organic material for use as mulch and fertilizer.~~

Decisions to relegate many materials to the waste stream occur at the household level. By making it easier to recycle or compost materials ~~than to throw them away~~, thoughtful design can help to make waste diversion a standard household practice. In-suite containers provide a visual reminder to residents to participate in waste diversion, and facilitate the transporting of materials to the main collection area.

UBC research studies have shown that high rates of resident recycling and composting are most strongly influenced by convenience. In multi-unit residential buildings, convenience is typically impeded by inconvenient infrastructure, relative to single family housing. A typical status quo setup for a MURB entails a number of barriers, including longer distances, elevators, multiple doors, walking through less secure or desirable paths such as parking areas or basement corridors, and/or exposure to weather. Providing a more convenient and pleasant experience decreases barriers and improves recycling rates significantly.

Definitions

Resident recycling areas: dedicated areas in the building for the collection and storage of recyclable materials and organics

Recommended Strategies

- Contact waste and recycling providers for the building location for more ~~UBC Waste management for community information on recycling and organics.~~
- ~~Consult with recycling contractors about~~ information on the available services and the number, type, and size of recycling bins that will be needed. This should be done
- ~~Contact the recycling contractor~~ early on to aid in coordinating in-suite collection systems with the collection system for the whole building.
- To streamline waste management, consider contracting with haulers that will handle and remove compost and recycling in addition to regular garbage pickup.
- Consider complete built-in, under-counter compost/recycling bins. Review examples of in-suite separation systems. Select a location in the suite that is accessible and easy to keep clean. Provide container labels that list compostable and recyclable items. Coordinate labelling of in-suite separation containers with containers in the main collection area to simplify transfer.
- To achieve convenience for residents, multiple resident recycling areas may be necessary or advantageous. The gold standard for convenience is to provide a recycling area on every residential level. This solution requires additional custodial servicing to transfer materials to central collection areas. Minimize horizontal travel distance for residents by locating recycling areas close to elevators.

Resources

- *Metro Vancouver:* Metro Vancouver's *Technical Specifications for Recycling Amenities* offers space specifications for recycling storage in new developments.
- ~~*UBC Waste Management, Building Operations orchestrates campus recycling and composting activities and provides education and information on waste reduction to the campus community.*~~ *https://www.myuna.ca/sustainability/* Includes info on the UNA green depot

- The *Recycling Council of British Columbia* provides information on waste reduction, recycling, disposal and pollution prevention throughout the province.
- The *Composting Council of Canada* is a national non-profit which serves as the central resource and network for the composting industry in Canada.
- The *City of Vancouver* maintains a source list of commercial organic waste haulers.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Materials and Resources component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Location and size of ~~recycling and organics storage~~resident recycling ~~-~~areas in the building.
- ~~Letter signed by the Architect declaring that the~~ resident recycling ~~in-suite recycling and compost requirements~~area requirements will be met including a ~~.~~
- narrative describing how the requirements will be met ~~Description of the in-suite recycling and compost system implemented~~.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by the Developer or Building Owner declaring that the requirements have been met, including a description of the waste management contract in place.

M&R P2: Embodied Carbon Reporting

Precondition

Requirement

Perform a ~~LCA (~~Whole Building L~~l~~ife C~~c~~ycle A~~a~~ssessment (WBLCA) of the project's ~~foundation,~~ structure and enclosure~~ and report the embodied carbon~~ following the UBC Whole Building Life Cycle Assessment Guidelines v1.0. ~~Use Athena Impact Estimator or an approved LCA software and include all envelope and structural elements including the parking structure~~Report the embodied carbon emission reduction of the proposed building compared to the equivalent baseline ~~-~~building along with other required environmental categories. Assume a 60-year life, covering~~time for the building and include~~ cradle-to-grave impacts, excluding operational energy and water use and addressing optional 'beyond system boundary' impacts separately.~~using a bill of materials methodology and building permit or issued for construction drawings. Operational impacts should not be included.~~

Intent

To encourage life cycle thinking and assessment in designing multi-unit residential buildings, reduce the potential environmental impacts from cradle to grave stages ~~introduce a whole building approach to assessing building materials' environmental performance and contribute~~ and to the support establishment of~~ment of~~ a benchmark for embodied carbon emissions~~s .from building materials choices in multi-unit residential buildings.~~

Rationale

WB~~Life cycle assessment (~~LCA~~)~~ ~~is a tool that~~ can help project ~~-~~teams make design decisions to reduce embodied carbon emissions and other environmental impacts from the building project and support policy-makers in ~~develop~~the development of performance targets for ~~-~~more climate-resilient~~sustainable~~ buildings. By standardizing and collecting ~~LCAs~~submissions, UBC intends to build ~~is building~~ a database of projects that will ~~be used to~~ inform future environmental performance benchmarks and targets.

Definitions

- *Whole Building Life-Cycle Assessment (WBLCA):* A technique to assess environmental impacts associated with ~~all~~ the stages of a product's life. A ~~from~~ cradle-to-grave WBLCA assesses the following stages: ~~(i.e., from~~ raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling).
- *Environmental c~~C~~ategories:* Global warming potential (kg CO_2-eq), depletion of stratospheric ozone (kg CFC-11-eq), acidification of land and water sources in (kg SO_2-eq), eutrophication (kg PO_4^{3-}-eq), formation of tropospheric ozone in (kg ethene-~~eq) and~~eq) and depletion on non-renewable energy resources (MJ).

Recommended Strategies

- ~~Consult with local LCA firms who can provide the most up-to-date tools and resources on LCA integration into a project.~~
- Consult with experienced WBLCA practitioners with expertise in conducting WBLCA studies to guide projects in reducing embodied emissions from conceptual design to occupancy.

- ~~Include LCA in the project's major consulting contracts. As the LCA inputs are based on the materials, some price economy may be gained by using the consultant's in-house expertise.~~
- ~~Incorporate LCA into the contract with the Green Building Specialist. Many green building specialists also have expertise in LCA.~~
- ~~Train staff on the use of LCA software, such as Athena's Impact Estimator.~~
- ~~Look for academic links with LCA.~~
- Ensure optimization of building life cycle impacts for at least 60 years and design for adaptability and disassembly to adapt to change over the years.
- Explore lighter structural options like wood structures and choose low-carbon products with improved environmental performance.
- Ensure structural material strengths are not generalized but optimized for different uses.
- Incorporate compact and simple shape massing with thinner floor slabs to lower the embodied carbon of a building.
- Do not build separate parking structures or have parking in the basement to reduce substantial materials in walls around the parking spaces.
- Avoid using finish materials like flooring, ceiling or facades only for aesthetic function as it provides better maintenance access to installations and cabling.
- Invest in durable and suitable windows and roofing materials.
- Reduce waste through careful specification and buying with takeback agreements.

Resources

- *UBC Sustainability* provides information about UBC's LCA studies.
- *P+W Architects* provides a primer on embodied carbon in buildings.
- *Athena Sustainable Materials Institute* provides case studies using Impact Estimator.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Materials and Resources component area in residential buildings.
- *Life Cycle Assessment Practice to Estimate Embodied Carbon in Buildings* by ZEBx provides whole-building life cycle assessment information.
- UBC Whole Building Life Cycle Assessment Guidelines v1.0 provides guidelines for conducting whole building life-cycle analysis for proposed and baseline design.

Required Documentation: Submit at the *Occupancy Permit* phase

- WBLCA ~~Life-cycle assessment~~ report and the submittals listed in the UBC Whole Building Life Cycle Assessment Guidelines v1.0~~t, the materials input list and output data for the model assessment and the building's bill of materials (where available).~~
- A letter signed by the developer declaring credit requirements have been met.

MATERIALS AND RESOURCES

M&R P3: Construction and Demolition Waste **Precondition**

Requirement
Prepare and implement a Waste Management Plan that diverts 85% (by weight) of construction and demolition waste from landfill.

Intent

To divert construction and demolition from landfill disposal, to redirect recyclable material back to the manufacturing process, and to reclaim reusable construction materials for future use.

Rationale

Although actual waste reduction quantities and techniques will vary by site (based on materials used, local recycling markets and other conditions), builders can manage waste safely and effectively while diverting the maximum possible amount of construction waste from disposal.

Definitions

- *Waste Management Plan*: A document prepared in advance of construction that details how construction waste will be managed throughout the project. Plans include specific instructions to crews and subcontractors on material separation and handling procedures.

Recommended Strategies

- Consider on-site separation and recycling of cardboard, metals, brick, concrete, plastic, clean wood, glass, gypsum wallboard, carpet, and insulation.
- Designate a specific area on the construction site for recycling, and track recycling efforts throughout the construction process.
- Identify construction haulers and recyclers to handle the designated material.

Resources

- *Metro Vancouver* has local construction and demolition waste resources.
- UBC has a tool for simple steps for demolition and construction waste diversion.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Materials and Resources component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by Contractor declaring that the requirements have been met.
- Copy of construction Waste Management Plan and hauling summary demonstrating 85% diversion.

MATERIALS AND RESOURCES

M&R Credit 1.1: Responsibly Sourced ~~Environmentally Responsible~~ Materials **2~~4~~ points**

Requirement

Specify and use ~~environmentally responsible~~responsibly sourced materials for at least 90% of a building component*, by weight or volume. Materials must meet one of the following requirements:

- Contain at least 25% reclaimed material
- Contain at least 25% post-consumer or 50% pre-consumer recycled content
- Wood products that are certified Forest Stewardship Council, (FSC) or CSA Z809
- Bio-based material (other than wood)
- ~~Concrete mixes optimized to an average of 20% reduction in embodied carbon~~
- Sustainable concrete certified by the Concrete Sustainability Council's Responsible Sourcing Certification Manufacturer participates in an extended producer responsibility program
- No finish material used (e.g. concrete floor)

***Building components for 1 point:** Floor covering, insulation, sheathing, framing, drywall (interior), concrete, roofing, siding.
Building components for 0.5 point: Pedestrian doors, cabinets, counters, interior trim, deck material, windows.

Intent

To support marketplace transformation and promote products and building components that minimize material consumption, life-cycle impacts, and harm to ecological health.

Rationale

Using materials with recycled content reduces the environmental impacts associated with extracting raw materials for the manufacture of new building materials. By shifting material choices based on ecological and health impacts, UBC buildings can support the development of the circular economy and help move the marketplace towards a more sustainable direction.

Definitions

- Pre-consumer recycled content: Includes manufacturer waste or scrap materials that are diverted from landfills and repurposed into new products.
- Post-consumer recycled content: Includes consumer products which are diverted from landfills and repurposed into new products.
- Bio-based material: Includes materials that are derived from living matter and occurs naturally or is chemically processed.

Recommended Strategies

- Consider incorporating recycled content materials into the project in the early stages of design.
- Identify local sources for materials with recycled content and support regionally produced recycled content products to reduce the costs and energy consumption associated with transportation.
- Evaluate recycled content materials for durability and performance in order to ensure that recycled content materials perform well in terms of strength, maintenance, and lifetime.

- Consider concrete mixes that have reduced embodied carbon such as using Portland-limestone cement and alternate SCM's.

Resources

- *BuildingGreen* supports building professionals to make their projects greener and healthier.
- The *Forest Stewardship Council (FSC)* provides certification for wood products that have been harvested from forests that are deemed to be sustainably managed.
- *CSA Sustainable Forest Management Standards:* The CSA SFM Z809 standards require forest companies to set in place a comprehensive management system.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Materials and Resources component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by Architect declaring that the requirements have been met.
- Completed Environmentally Responsible Materials Template
- Manufacturer's cut sheet for each material selected, indicating how the material meets the credit requirements.

MATERIALS AND RESOURCES

M&R Credit 1.2: Local Materials — 2 points

Requirement

Specify and use products that were extracted, processed, and manufactured locally within 200km from project site for the following building components:

- Minimum 50% of aggregate for concrete by value. **— 1 point**
- Minimum 50% of drywall or interior sheathing by value. **— 1 point**

Intent

To foster sustainable regional economic development by increasing demand for building materials that are manufactured locally, and to reduce the environmental impacts associated with transporting materials over long distances.

Rationale

In 2018, transportation was the second largest source of greenhouse gas emissions in Canada, accounting for 25% of national emissions.[7] By using materials that are extracted and processed locally, buildings can reduce their transportation embodied carbon footprint and support the local economy.

Recommended Strategies

- Establish a project goal for locally sourced materials and identify materials and material suppliers that can achieve this goal.
- During construction, ensure that the specified local materials are installed and quantify the total percentage of local materials installed.
- Set up a reporting and documentation system with sub-contractors and materials suppliers to collect and track required information.

Resources

- *BuildingGreen* supports building professionals to make their projects greener and healthier.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Materials and Resources component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by Architect declaring that the requirements have been met.
- Total value of framing, aggregate and/ or drywall and total value of those materials that are also regionally extracted, processed, and manufactured.

[7] Environment and Climate Change Canada. (2020). Canadian Environmental Sustainability Indicators: Greenhouse gas emissions. Consulted on July 16, 2020. Available at: www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gasemissions.html.

MATERIALS AND RESOURCES

M&R 1.2: Embodied Carbon Reduction — 54 points

Requirement

Follow the requirements of M&R P2 Embodied Carbon Reporting and achieve the following:

- Minimum 10% reduction for embodied carbon of the project's structure and enclosure in the proposed building compared to equivalent baseline building - 2 points **OR**
- Minimum 20% reduction for embodied carbon of the project's structure and enclosure in the proposed building compared to equivalent baseline building - 5 points

Intent

To encourage life cycle thinking and assessment in designing multi-unit residential buildings, reduce the potential environmental impacts from cradle to grave stages and to the support establishment of a benchmark for embodied carbon emissions.

Rationale

WBLCA can help project teams make design decisions to reduce embodied carbon emissions and other environmental impacts from the building project and support policy-makers in the development of performance targets for more climate-resilient buildings. By standardizing and collecting submissions, UBC intends to build a database of projects that will inform future environmental performance benchmarks and targets.

Definitions

- *Whole Building Life-Cycle Assessment (WBLCA):* A technique to assess environmental impacts associated with the stages of a product's life. A cradle-to-grave WBLCA assesses the following stages: raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling).
- *Environmental Categories:* Global warming potential (kg CO_2-eq), depletion of stratospheric ozone (kg CFC-11-eq), acidification of land and water sources in (kg SO_2-eq), eutrophication (kg PO_4^{3-}-eq), formation of tropospheric ozone in (kg ethene-eq) and depletion on non-renewable energy resources (MJ).

Recommended Strategies

- Consult with experienced whole-building LCA practitioners with expertise in conducting whole-building LCA studies to guide projects in reducing embodied emissions from conceptual design to occupancy.
- Ensure optimization of building life cycle impacts for at least 60 years and design for adaptability and disassembly to adapt to change over the years.
- Explore lighter structural options like wood structures and choose low-carbon products with improved environmental performance.
- Ensure structural material strengths are not generalized but optimized for different uses.
- Incorporate compact and simple shape massing with thinner floor slabs to lower the embodied carbon of a building.
- Do not build separate parking structures or have parking in the basement to reduce substantial materials in walls around the parking spaces.
- Avoid using finish materials like flooring, ceiling or facades only for aesthetic function as it provides better maintenance access to installations and cabling.
- Invest in durable and suitable windows and roofing materials.
- Reduce waste through careful specification and buying with takeback agreements.

Resources

- *UBC Sustainability* provides information about UBC's LCA studies.
- *P+W Architects* provides a primer on embodied carbon in buildings.
- *Athena Sustainable Materials Institute* provides case studies using Impact Estimator.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Materials and Resources component area in residential buildings.
- *Life Cycle Assessment Practice to Estimate Embodied Carbon in Buildings* by ZEBx provides whole-building life cycle assessment information.
- UBC Whole Building Life Cycle Assessment Guidelines v1.0 provides guidelines for conducting whole building life-cycle analysis for proposed and baseline design.
-

Required Documentation: Submit at the *Building Permit* phase

- WBLCA report and the submittals listed in the UBC Whole Building Life Cycle Assessment Guidelines v1.0
- A letter signed by the developer declaring compliance with embodied carbon reduction target.

MATERIALS AND RESOURCES

MR Credit 1.3: Mass Timber Superstructure — 2~~1~~ points

Requirement
Specify and install a building superstructure consisting of at least 50% mass timber manufactured in BC (by value of the total superstructure). **— 2~~1~~ points**

Intent

To encourage the use of mass timber construction and benefit from reduced embodied emissions, carbon sequestration, improved thermal performance, enhancement of occupant well-being (biophilic benefits) and increased prefabrication opportunities.

Rationale

The use of mass timber as a building material offers economic and environmental benefits. By using mass timber construction that is extracted and processed locally, buildings can reduce their embodied carbon footprint due to transportation.

Recommended Strategies

- Establish a project goal for mass timber construction early in the process and identify materials and material suppliers that can achieve this goal.
- During construction, ensure that the specified mass timber materials are installed and quantify the total percentage of the value of mass timber materials installed in superstructure.
- Set up a reporting and documentation system with sub-contractors and materials suppliers to collect and track required information.

Resources

- *UBC* describes details of the design and construction of an ~~18-storey~~18-storey mass timber building, Brock Commons Tallwood House located on the UBC campus.
- *WoodWorks* displays benefits of using mass timber products for non-residential and multi-family construction.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Materials and Resources component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by Architect declaring that the requirements have been met.
- Total value of the superstructure and the BC manufactured mass timber construction materials.

MATERIALS AND RESOURCES

M&R Credit 1.4: Healthy Building Materials — 1 point

Requirement

Install ten different building products from at least three different manufacturers which meet the ingredient transparency criteria of a program specified below. The chemical inventory of the products must be disclosed to an accuracy of 0.1% (1000 ppm).

- Declare Label (International Living Future Institute): Red List Free, Declared; or LBC Compliant if at least 99.9% of the ingredients are disclosed; **or**
- Health Product Declaration (HPD); **or**
- Manufacturers Inventory of all ingredients by Chemical Abstract Service Registry Number (CASRN).

Intent

To support marketplace transformation by encouraging building material transparency and the transition towards building products that contain less potentially harmful chemicals.

Rationale

Many building products contain ingredients that are detrimental to human health; some are regulated, but many are not. By committing to the transparency of product ingredients, manufacturers are encouraged to optimize their products for human health and avoid the use and generation of hazardous chemicals.

Definitions

- *Declare Label*: A product ingredient disclosure program developed by the International Living Future Institute which lists manufacturing details, ingredients, and harmful chemicals used in the product. Products are rated as Declared, LBC Red List, or LBC Red List Free.
- *Health Product Declaration (HPD)*: A building product "nutrition label" which reports health-related information. HPDs can be developed using an open standard which is available to manufacturers for disclosure of product contents, emissions and health information.
- *Chemical Abstract Service (CAS) Registry:* A database which discloses information about chemical substances. All chemicals are identifiable by a unique CAS Registry Number.

Recommended Strategies

- Contact manufacturers as early as possible to ask for documentation.

Resources

- *Declare 2.0, Living Building Challenge* provides information about the Declare Label levels, how to read the label, and a searchable database of products.
- *Health Product Declaration (HPD) Open Standard* provides a searchable database of HPD specified products, disclosing their ingredients and health impacts.
- *The Pharos Project* provides a building product library with in-depth information about product ingredients.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Materials and Resources component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by Architect declaring that the requirements have been met.
- Completed Healthy Building Materials Template listing the chosen products and how they meet the requirements.
- Documentation for each product which demonstrates how it meets the healthy building material program criteria.

CLIMATE ADAPTATION

CA P1: 2050 Climate ~~Ready~~ Thermal Comfort Modelling and Design **Precondition**

Requirement

The building design must meet thermal comfort requirements for 2050s. Buildings with mechanical cooling systems must follow requirements specified in Article 2.4 of the UBC Indoor Thermal Environment Technical Guidelines (Vancouver). Passively cooled buildings must meet City of Vancouver Energy Modelling Guideline requirements for passively cooled buildings using 2050's weather files and not exceed temperature acceptability limits by more than 20 hours. Perform thermal comfort modelling for buildings using ~~PCIC~~ future climate weather files for the ~~2020's and~~ 2050's (RCP 8.5 scenario) ~~with attention to the warmest spaces in the building for the months of May to September inclusive~~. ~~The building design must should meet thermal comfort requirements for 20520s and have a design strategy to meet 2050 requirements. Buildings with mechanical cooling systems must follow requirements specified in Section 2.4 of the UBC Indoor Thermal Environment Technical Guidelines (Vancouver). Passively cooled buildings must meet City of Vancouver Energy Modelling Guideline requirements for passively cooled buildings using 20520's weather files and not exceed temperature acceptability limits by more than 20 hours. and have design strategies for meeting these requirements using 2050 weather files.~~

Intent

To meet ~~warm season~~summertime thermal comfort requirements for future climate conditions and avoid experiencing significant overheating over the building lifetime.

Rationale

The Canadian Weather Year for Energy Calculation (CWEC) weather files typically used for energy modelling are based on past weather averages, and thus do not account for climate warming trends and underestimate future building cooling needs ~~for the present and future~~. Weather files available from the Pacific Climate Impacts Consortium (PCIC) provide the opportunity to undertake future climate thermal comfort modelling, allowing for design strategies that ensure thermal comfort is maintained under future climate conditions.

Definitions

- *Canadian Weather Year for Energy Calculation (CWEC):* Weather datasets used for energy modelling created by joining "typical meteorological months" representing average weather conditions for a location.

Recommended Strategies

Use future climate weather files available from PCIC for energy modelling to support building design strategies to maintain warm season thermal comfort under future climate conditions.

Resources

- UBC Indoor Thermal Environment Technical Guidelines (Vancouver)
- *PCIC Future Weather Files:* PCIC provides future shifted CWEC files for all locations in British Columbia that a CWEC file is available for.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Climate Adaptation component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- A p~~P~~reliminary BC Energy Step Code Part 3 Energy Design ~~r~~Report ~~showing results of future climate modeling and proposed design strategies~~using 2050s weather files.

Required Documentation: Submit at the *Occupancy Permit* phase

- A letter signed by the Architect or Engineer declaring that the building design meets ~~2020~~ summertime thermal comfort requirements for 2052~~0~~0's ~~and has a design strategy to meet thermal comfort requirements for 2050s.~~
- ~~~~
- ~~~~An as-built Energy ~~Step Code~~BC Energy Step Code Part 3 Design Report using 2050s weather files.~~showing results of future climate modeling and describing design strategies used in the as-built building design.~~
-

CLIMATE ADAPTATION

CA Credit 1.1: 2050 Climate Ready Energy Efficient Design — 7 points

Requirement

Meet a Cooling Energy Demand Intensity (CEDI) target ~~U~~using 2050 ~~RCP 8.5~~ future climate weather files (RCP 8.5)~~, achieve a reduction in Cooling Energy Demand Intensity (CEDIover a base case 2050 ready design that meets REAP E&E and CA preconditions, with passive design measures (e.g., fixed or operable shading, reduced SHGC windows or reduced window to wall ratio)~~and following BC Energy Step Code energy modelling requirements as follows: ~~Passive measures must be established at building occupancy.~~

- ~~5% reduction.~~25 kWh/m2-yr **– ~~3~~2 points**
- 20 kWh/m2-yr – **4 points**
- ~~10% reduction.~~15 kWh/m2-yr – ~~5~~**7 points**
- ~~15% reduction. – 7 points~~

Intent

To use passive measures in order to reduce future energy consumption for mechanical cooling and provide more resilient designs by reducing dependency on mechanical systems for thermal comfort.

Rationale

Future climate conditions are expected to result in significant increases in energy demand for cooling, and buildings without passive design measures in place are expected to experience higher risks of overheating.

Definitions

- *Cooling Energy Demand Intensity (CEDI)*: The annual cooling energy demand for space conditioning and conditioning of ventilation air per unit area. Note that CEDI does not account for system efficiency.

Recommended Strategies

Reduction in glazing, reduced solar heat gain glass and fixed or operable exterior shading on exposed orientations are design strategies that have been demonstrated to improve cooling energy demand. See *UBC Designing Climate Resilient Multifamily Buildings* report in "Resources", below for more information.

Resources

- *PCIC Future Weather Files:* PCIC provides future shifted CWEC files for all locations in British Columbia that have a CWEC file.
- *UBC Designing Climate Resilient Multifamily Buildings:* PCIC provides future shifted CWEC files for all locations in British Columbia that have a CWEC file.
- *BC Housing Energy Step Code Design Guide Design Guide Supplement on Overheating and Air Quality.*
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Climate Adaptation component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Preliminary report showing results of future climate modeling and proposed design strategies.

Required Documentation: Submit at the *Occupancy Permit* phase

- Report showing results of future climate modeling and design strategies used for the as-built building design.
- A letter signed by the Architect or Engineer declaring that the building design strategies were included in the as-built design.

CLIMATE ADAPTATION

CA Credit 1.2: Enhanced Resiliency — 3 points

Requirement

Achieve appropriate design strategies from the Mobilizing Building Adaptation and Resilience (MBAR) discussion papers on "Air Quality", "Fire", "Heat waves" and "Power outages and emergencies".

- 10 different design strategies with at least 1 from each paper. **— 1 point**
- 15 different design strategies with at least 1 from each paper. **— 2 points**
- 20 different design strategies with at least 2 from each paper. **— 3 points**

Intent

To protect building infrastructure and adapt to anticipated climate change stresses (i.e. higher precipitation, warmer summers, and fire-related air pollution) and climate change shocks (i.e. severe flooding, fire, windstorms).

Rationale

At the present time, there are uncertainties regarding what combination of resilience strategies will provide the best cost effective project outcomes. This credit presents a prescriptive approach which initiates the discussion and testing of an array of resiliency strategies as policy continues to develop in this area.

Recommended Strategies

Early in the design process, during schematic design: Facilitate a discussion with the project team to review the best, appropriate design strategies for the project to offer protection of the building infrastructure and occupants. The objective of the MBAR Design Discussion Primers is to stimulate discussion through the presentation of a variety of resiliency strategies — a facilitated process is essential to ensure that context-specific and effective strategies for each development are chosen.

Resources

- The *Mobilizing Building Adaptation and Resilience (MBAR)* discussion papers developed by BC Housing show an array of design strategies a project might adopt to boost resilience and on which this credit is based.
- *The RELi™ 2.0 Rating System (RELi 2.0)* is a holistic, resilience-based rating system that combines innovative design criteria with the latest in integrative design processes for next-generation neighborhoods, buildings, homes and infrastructure.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Climate Adaptation component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Completed template listing the design strategies that the project is pursuing and a narrative describing how each will be implemented.
- A signed letter from the Architect declaring that the requirements will be met.

CLIMATE ADAPTATION

CA Credit 1.3: On Site Backup Power **3 points**

Requirement
Design for protection from power outages from the grid, through strategies including permanent back-up power, switching gear and/or power hook-ups, and infrastructure for temporary generators to provide power for critical utilities such as HVAC and the electrical component of heating systems, potable water supply and security. Back up power must be provided for a duration of four consecutive days, 24 hours a day.

Intent

To mitigate the impact of power outages for occupants by preventing reduced functionality of building heating and cooling systems, and ensuring access to potable water, adequate ventilation, and maintenance of the security system.

Rationale

Power outages are increasing during severe weather events. Site backup power can provide a level of resilience and safety for occupants.

Recommended Strategies

- Determine the critical loads. Consider: the operation of electrical components of heating systems, sufficient ventilation and/or cooling, water pumps, minimum lighting level, wireless and telecommunication systems.

Resources

- *The RELi™ 2.0 Rating System (RELi 2.0)* is a holistic, resilience-based rating system that combines innovative design criteria with the latest in integrative design processes for next-generation neighborhoods, buildings, homes and infrastructure.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Climate Adaptation component area in residential buildings.
- *A Case Study on Emergency Backup Power with Renewable Energy* provides information on code verses resiliency back up power.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the electrical consultant stating that the requirements will be met.
- Calculations showing the critical loads being served.
- Drawings showing back up power equipment.

PLACE AND EXPERIENCE

P&E P1: Project Community Amenity Spaces — Precondition

Requirement

Provide community amenity spaces for residents including:

- Outdoor spaces for residents which allow for opportunities for both quiet and social gathering activities, minimum one area for each activity; **and**
- A multi-purpose indoor space designed to support community activities and meeting the following requirements: Located on the ground floor with direct access to the outdoors; includes an accessible washroom; and has a minimum floor area of 37.16 m² (400 sq ft).

Intent

To support livability and social interaction by offering a variety of convenient, attractive, and functional indoor and outdoor community amenity spaces.

Rationale

Well-designed, innovative indoor and outdoor amenity spaces enhance the livability of housing and quality of life for occupants. Common amenity spaces are used for social gatherings and support casual encounters with neighbours help build a sense of community.

Definitions

- *Amenity*: Any feature, beyond the bare necessities within a dwelling unit, building, or neighbourhood which provides comfort, convenience, enjoyment, or recreation. Amenities are positive elements that contribute to the overall character and livability of a place and may influence positive social effects.

Recommended Strategies

- Design for inclusive communities. Accommodate changes in population, demographics, and residents' cultures by incorporating flexible, age-friendly, and adaptable features within amenity spaces.
- Optimize the function and usefulness of spaces through creative and innovative amenity designs, including rooftops, where possible.
- Provide a strong physical and/or visual relationship between indoor and outdoor amenity spaces to increase times spent outdoors and promote convenient access.

Resources

- Happy City. (2018). Designed to Engage: Policy recommendations for promoting sociability in multi-family housing design.
- City of Toronto. (2017). Planning for Children in New Vertical Communities.
- City of Vancouver. (1992). High-Density Housing for Families with Children Guidelines.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Place and Experience component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- A letter signed by the Architect declaring that the requirements have been met. Including a description of the rationale, strategies used, and programming possibilities for the amenity spaces.

PLACE AND EXPERIENCE

P&E Credit 1.1: Project Exemplary Community Amenity Spaces **5 points**

Requirement

Install indoor and outdoor community amenities from the list below.

- Each listed amenity is awarded **1 or 2 points**, for up to 5 points in total.
- If more than 2 points are targeted, a minimum of one indoor amenity and one outdoor amenity is required.

Indoor Amenities:

- Family friendly community spaces (additional to PE P1) within or adjacent to enhanced lobbies or multi-purpose rooms such as a community play area or youth friendly space. The total area should be minimum 91.44 m² (300 sq ft). **— 2 points**
- A shared utilitarian multi-purpose space for messy or noisy activities such as a workshop space, pet wash, community mudroom, or small kitchen area etc. **— 1 point**
- A secure community storage area on the ground floor for baby strollers with a minimum of one storage space per ten units. Strollers are used by young families on a daily basis and are often bulky to keep in the home. **— 1 point**
- Small-scale gathering spaces within circulation routes or the end of corridors on different floors to increase opportunities for relaxing, studying, and meetings or social activities. The total area should be minimum 91.44 m² (300 sq ft). **— 2 points**
- A bookable guest suite within the building near the lobby. **— 2~~1~~ points**
- A community space for secure package delivery (in response to online shopping and food delivery services). **—1 point**
- A new innovative community indoor amenity (additional to PE P1) that supports a range of intergenerational social and recreational opportunities. **— 1 point**
- Pet friendly washable flooring finishes installed for indoor common spaces. **— 1 point**

Outdoor Amenities:

- One accessible outdoor wash station for bikes and pets with a concrete pad, water source and good drainage. **— 1 point**
- A variety of outdoor spaces for small quiet gatherings to increase recreational choices and activities such as a BBQ area, fireplace, and comfortable seating and picnic tables etc. There must be a minimum of two defined spaces. **—1 point**
- Roof top social spaces outfitted with comfortable seating and planters. The space would be able to comfortably accommodate a minimum of 10 people. **—2 points**
- A small child friendly play area with complementary seating for adults. **— 1 point**
- A new innovative community outdoor amenity that supports a range of intergenerational social and recreational opportunities. **— 1 point**

Intent

To support livability and social interaction by offering a variety of convenient, attractive, and functional indoor and outdoor community amenity spaces.

Rationale

Well-designed, innovative indoor and outdoor amenity spaces enhance the livability of housing and quality of life for occupants. Common amenity spaces are used for social gatherings and support casual encounters with neighbours help build a sense of community.

Definitions

- *Exemplary Design*: Exemplary design exceeds expectations from the current norm or standard of design. UBC is constantly changing and there is an ongoing opportunity to learn from past experiences as well as to test new amenity designs to meet the needs of the community. The exemplary design should positively influence the spirit of a place within buildings and neighborhoods. The design should deliver exceptional functionality and support livability.
- *Livability*: Livability enhances the qualities of a place that contribute to the daily experiences of community residents. Livability includes aspects of the built and natural environment and how a place makes someone feel at home and a part of the community.

Recommended Strategies

- Design for inclusive communities. Accommodate changes in population, demographics, and residents' cultures by incorporating flexible, age-friendly, and adaptable features within amenity spaces.
- Optimize the function and usefulness of spaces through creative and innovative amenity designs, including rooftops, where possible.
- Provide a strong physical and/or visual relationship between indoor and outdoor amenity spaces to increase times spent outdoors and promote convenient access.

Resources

- Happy City. (2018). Designed to Engage: Policy recommendations for promoting sociability in multi-family housing design.
- City of Toronto. (2017). Planning for Children in New Vertical Communities.
- City of Vancouver. (1992). High-Density Housing for Families with Children Guidelines.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Place and Experience component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- A letter signed by the Architect declaring that the requirements have been met, including a list of the chosen amenities, a narrative description of each amenity, and programming possibilities.
- Drawings showing the implementation of each amenity.

HEALTH AND WELLBEING

H&W P1: Bicycle Parking & Storage Room(s) — Precondition

Requirement

Provide the bicycle storage and facilities below:

- Provide Class 1 bicycle storage facilities at a rate of: 1.5 spaces per studio or one bedroom unit; 2.5 spaces per 2 bedroom unit; and 3 spaces per 3 or 4 bedroom units. (Requirements include 10% oversize spaces, and one electrical outlet per two spaces); **and**
- An in building bicycle repair station; **and**
- 0.5 Class 2 bicycle storage spaces per dwelling unit; **and**
- A 2 x 3 m concrete pad outside the building, close to the building entrance, with a standard outlet or conduit for electrified bike share.

All bicycle parking and storage to be provided in accordance with the UBC Development Handbook.

Intent

To encourage bicycle use, which contributes to reducing land development impacts and pollution associated with private automobile use and contributes to occupants' health and wellbeing.

Rationale

Bicycling is a healthy and sustainable alternative to the car for short commuter distances. Providing accessible and secure bicycle facilities promotes the use of bicycles as an alternative mobility option.

Definitions

- *UBC Class I Bicycle Parking:* Intended for long-term use of residents or employees, and may consist of attended facilities, inside bicycle lockers, or restricted access parking.
- *UBC Class II Bicycle Parking:* Intended for short-term use of patrons or visitors, and may consist of bicycle racks located with natural surveillance in an accessible outside location.
- *Bicycle Repair Station:* A station which includes tools for bike repair and a tire pump.

Recommended Strategies

- Consider constructing storage rooms with solid walls.
- Consider motion-activated, tamper-proof security lighting.
- Provide adequate indoor space for proper storage: Ideally, rooms should provide at least 1.8m of headroom and stalls should be at least 1.8 m long for horizontal bicycles, 0.9 m wide if placed vertically.
- Provide bicycle racks with two points of contact, to allow convenient locking for a variety of sizes and styles.

Resources

- *The UBC Development Handbook:* The Handbook describes the development approval process for UBC neighbourhoods. See section 7.6 'Parking Requirements for Bicycles'.
- *UBC SEED's* Studies explore issues around bicycle parking at the University: Smith, Cail. (2017). Making Spaces: Bicycle Storage in Multi-Unit Residential Buildings on the University of British Columbia Campus.
- *HUB* is a Metro Vancouver charitable organization that promotes cycling in the Lower Mainland.
- *HUB End of Trip Amenities Study:* Not just bike racks: Informing design for end of trip cycling amenities in Vancouver real estate.
- *Commercial "Packaged" Repair Stations:* Urban Racks, Dero Fixit
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Health and Wellbeing component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Architect declaring requirements will be met.
- Numbers and plan showing the location of bicycle storage facilities.

H&W P2: Low-Emitting Products

Precondition

Requirement

Specify and use:

- Adhesives, sealants and sealant primers that have been tested and found compliant with the California Department of Public Health Standard Method V1.1–2010, using CA Section 01350, Appendix B, New Single-Family Residence Scenario, for emissions testing guidance.
- Paints and coatings rated at a minimum GPS-2 by the Master Painter's Institute on the interior of the building.
  ~~Carpet and carpet cushion that are certified by the Carpet and Rug Institute Green Label Plus, or use products that have been tested and demonstrate compliance with the California Department of Public Health (CDPH) Standard Method v1.2–2017 and comply with the VOC limits in Table 4-1 of the method.~~

Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

Rationale

Volatile organic compounds (VOCs) emitted from adhesives, sealants, paints, and carpets based on polymers, solvents or plasticizers can compromise human health and the earth's atmosphere. VOCs contribute to both smog and poor indoor air quality.
Paints and coatings contain organic and inorganic compounds or materials that may adversely impact human health and the atmosphere by releasing solvents or other toxic materials at various stages of the product life cycle.

Definitions

- *Low-Emitting Materials:* Materials containing compounds that do not evaporate at room temperature.
- *Volatile Organic Compounds (VOC):* Carbon-containing compounds that evaporate readily at room temperature

Recommended Strategies

- Ensure specifications are clearly stated in each section where paints are addressed.
- Schedule field monitoring to ensure that only paints and coatings meeting the criteria are used.
- If there is no alternative, and a small quantity of a coating that exceeds the GPS-2 VOC limit is used, use a VOC budget to demonstrate that the overall average of VOC in all coating products meets the 50 g/L limit.
  ~~Specify low-VOC carpets in construction documents.~~
  ~~Ensure that VOC limits are clearly stated in each specification section where carpets are addressed.~~
  ~~Tack in-suite carpets instead of gluing. Carpet in public/common areas should be adhered using low-VOC adhesives.~~

Resources

- *Master Painter's Institute* provides information on the practical and technical aspects of paints and coatings and their professional application. The 'Specify Green' section contains the MPI "Green Performance Rating Standard" system for identifying low-emitting paints.
- ~~*Carpet and Rug Institute Green Label Indoor Air Quality Test Program* designates products that have been tested by an independent laboratory and have met criteria for very low emissions. The program encompasses carpets, cushions and adhesives.~~
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Health and Wellbeing component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by Architect declaring that the requirements have been met.
- Manufacturer's cut sheets indicating VOC content of all adhesives, sealants and sealant primers used in the project.
- Manufacturer's cut sheets indicating VOC content of all paints and coatings used on the interior of the building.
- Calculations of VOC budget showing that the total average of VOC in all coating products based in litres applied meets the GPS-2 VOC limit of 50 g/L.
- Certification documentation for products selected.

H&W P3: Construction Indoor Air Quality Management

Precondition

Requirement

Prepare and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy phases of the building. During construction, meet or exceed all applicable recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd edition, 2007, ANSI/SMACNA 008–2008, Chapter 3.

Intent

To prevent indoor air contamination resulting from the construction process that is odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

Rationale

Building construction inherently includes activities that can contaminate buildings and subsequently impact indoor air quality well after the building is occupied. Construction management strategies and procedures can be instituted during construction that can reduce levels or indoor air contamination.

Definitions

- *Indoor Air Quality Management Plan*: A document specific to a building project that outlines measures to minimize contamination in the building during construction.
- *Absorptive Construction Materials*: Porous construction and finishing materials that can collect air pollutants and later release them into occupied spaces.

Recommended Strategies

- Protect the ventilation system ducting during construction, control pollutant sources, and interrupt pathways for contamination.
- Protect stored on-site or installed absorptive construction materials from moisture damage, and sequence installation to avoid contamination of absorptive materials such as carpets.
- Require a cessation of indoor smoking site policy as soon as drywall is delivered.
- Clean interiors, building cavities, ventilation systems and components, and replace filtration media prior to occupancy.

Resources

- *Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction 2nd Edition 2007* provides an overview of air pollutants associated with construction and a range of control measures.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Health and Wellbeing component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by the Contractor declaring that the requirements have been met.
- Copy of Indoor Air Quality Management Plan.

HEALTH AND WELLBEING

H&W P4: Air Filtration — Precondition

Requirement

Ventilation systems will be designed to include filtration devices with a *Minimum Efficiency Reporting Value* (MERV) of 13, as defined by ANSI/ASHRAE 52.2 to protect against airborne fine particulate matter, viruses and bacteria.

Intent

To provide air filtration for the building ventilation system to address particulate matter pollution, primarily from wildfire smoke.

Rationale

Increasing wildfires in British Columbia due to climate change is resulting in periods high concentrations of harmful high particulate matter across the province, including UBC's Point Grey campus. MERV 13 rated filters reduce particulate matter significantly and are readily available for use in building ventilation systems.

Definitions

Minimum Efficiency Reporting Value (MERV) is a measurement scale designed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) to report the effectiveness of air filters.

Recommended Strategies

Design building ventilation systems that will accommodate MERV 13 filtration.

Resources

- A filtration study prepared for the City of Vancouver provides background and technical information. https://vancouver.ca/files/cov/filtration-best-practices-study.pdf

Required Documentation: Submit at the *Building Permit* phase

- Letter from the Mechanical Consultant declaring that the requirements will be met.

Required Documentation: Submit at the *Occupancy Permit* phase

- Cut sheets from the filter manufacturer and a description of filter locations.

HEALTH AND WELLBEING

H&W Credit 1.1: IAQ Assessment — 1 point

Requirement

After construction has ended and the building has been completely cleaned, prior to occupancy, complete one of the following:

- Install new filtration media and flush out the building by supplying an outside air volume of 4,267,14 litres per square metre of gross floor area; **or**
- Conduct a Baseline Indoor Air Quality Test.

Intent

To reduce the concentration of indoor air contaminants produced during construction prior to occupancy.

Rationale

Building construction inherently includes activities that produce air contaminants, which can subsequently impact indoor air quality into occupancy. Flushout procedures undertaken before occupancy expel contaminants that may have accumulated in the building during construction.

Definitions

- *Flushout*: Sustained ventilation of the building after the end of construction and prior to occupancy with new filtration media and outdoor air.
- *Baseline IAQ test:* An indoor air quality testing procedure that randomly selects sampling points to measure the maximum concentration levels for the following contaminants:
  - *Formaldehyde:* 27 ppb.
  - *Particulates (PM10):* 50 mg per cubic meter.
  - *TVOC:* 500 mg per cubic meter.
  - *4-PCH*: 6.5 mg per cubic meter.
  - Carbon monoxide 9 parts per million.

Recommended Strategies

- Decide on a flushout plan or an IAQ testing prior to construction start.
- Develop the construction schedule to accommodate flushout or IAQ testing prior to occupancy.
- Include flushout or IAQ testing requirements in tender documents.
- Prior to IAQ testing reduce indoor air contaminants in order to achieve baseline. Retest non compliant areas.

Resources

- *The US Environmental Protection Agency* provides protocols for environmental requirements for air quality.
- *Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guideline for Occupied Buildings under Construction, 1995* provides an overview of air pollutants associated with construction and a range of control measures.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Health and Wellbeing component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by the Contractor declaring that the requirements have been met
- Copy of specifications showing requirement for flushout and results of IAQ testing.

HEALTH AND WELLBEING

H&W Credit 2.1: Additional Bicycle Facilities — 2 points

Requirement

In addition to the requirements for bicycle parking in H&W P1, provide one of the following:

- Provide an additional 0.25 Class I bicycle storage per bedroom; **or**
- Provide an at grade, Class I bicycle storage room for at least 50% of the Class I spaces with a bike specific entrance; **or**
- Provide points for giving each unit an on-campus bike share membership for the duration of their stay in the building.

Intent

To encourage bicycle use, which contributes to reducing land development impacts and pollution associated with private automobile use and contributes to occupants' health and wellbeing.

Rationale

Bicycling is a healthy and sustainable alternative to the car for short commuter distances. Providing accessible and secure bicycle facilities promotes the use of bicycles as an alternative mobility option.

Definitions

- *UBC Class I Bicycle Parking:* Intended for long-term use of residents or employees, and may consist of attended facilities, inside bicycle lockers, or restricted access parking.

Example

Type of Unit	Number of Units	H&W P1	H&W Credit 2.1 (add)	Total Bicycle Parking
Studio	8	8 x 1.5 = 12	8 x 1 x 0.25 = 2	14
1 Bedroom	25	25 x 1.5 = 37.5	25 x 1 x 0.25 = 6.25	44
2 Bedroom	42	42 x 2.5 = 105	42 x 2 x 0.25 = 21	126
3 Bedroom	32	32 x 3 =96	32 x 3 x 0.25 = 24	120
TOTALS	**107**	**250.5**	**53.25**	**304**

Resources

- *The UBC Development Handbook:* The Handbook describes the development approval process for UBC neighbourhoods. See section 7.6 'Parking Requirements for Bicycles'.
- *UBC SEED's* Studies explore issues around bicycle parking at the University: Smith, Cail. (2017). Making Spaces: Bicycle Storage in Multi-Unit Residential Buildings on the University of British Columbia Campus.
- *HUB* is a Metro Vancouver charitable organization that promotes cycling in the Lower Mainland.
- *HUB End of Trip Amenities Study:* Not just bike racks: Informing design for end of trip cycling amenities in Vancouver real estate.
- *Commercial "Packaged" Repair Stations:* Urban Racks, Dero Fixit
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Health and Wellbeing component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by Architect declaring that the requirements will be met, including:
  - Number and plan location of bicycle parking facilities.
  - Plan of the bicycle repair station.

HEALTH AND WELLBEING

H&W Credit 3.1: Low-Emitting Products — 2 points

Requirement

Specify and install products that meet the following requirements:

- Carpets and carpet cushions: Carpet and Rug Institute Green Label Plus or has been tested according to California Department of Public Health (CDPH) Standard Method v1.2–2017 and can demonstrate compliance with the VOC limits in Table 4-1 of the method. **— 1 point**
- Interior composite wood products, such as cabinetry doors and boxes, flooring, doors, trim, etc.: CARB ultra low emitting or have no added urea formaldehyde. **— 1 point**

Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating or harmful to the comfort and health of installers and occupants.

Rationale

Carpets are sources of volatile organic compounds (VOCs), dust, and fibre release.

Urea formaldehyde is a volatile organic compound (VOC) that a product can off-gas over its lifetime. The International Agency for Research on Cancer (IARC) considers formaldehyde a human carcinogen, a key factor in the material's implications for human health over the long-term. VOC's have short-term health implications as well, such as eye, nose and throat irritation, and headaches and nausea.

Definitions

- *Volatile Organic Compounds (VOC):* Carbon-containing compounds that evaporate readily at room temperature.
- *Carcinogen:* A substance that is an agent in directly causing cancer.

Recommended Strategies

- Specify low-VOC carpets in construction documents.
- Ensure that VOC limits are clearly stated in each specification section where carpets are addressed.
- Tack in-suite carpets instead of gluing. Carpet in public/common areas should be adhered using low-VOC adhesives.
- Contact local suppliers early to determine availability of cabinetry that is urea-formaldehyde free.
- Consider using low-VOC finishes for all cabinetry sealants, finishing materials, and millwork.
- Ultra-low-emitting or no added formaldehyde resins are acceptable (as defined by the California Air Resources Board, Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products regulation).

Resources

- *Carpet and Rug Institute Green Label Indoor Air Quality Test Program* designates products that have been tested by an independent laboratory and have met criteria for very low emissions. The program encompasses carpets, cushions and adhesives.
- *Composite Panel Association and Composite Wood Council* provides comprehensive information on composite panel and wood.
- *International Agency for Research on Cancer (IARC)* promotes international collaboration in cancer research.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Health and Wellbeing component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by the Architect declaring that the requirements have been met.
- Certification documentation for products selected.
- Manufacturer's cut sheet indicating each product selected contains no added urea formaldehyde.

HEALTH AND WELLBEING

H&W Credit 4.1: Connection to Nature — 2~~1~~ points

Requirement

Demonstrate connections to nature through direct visual connections to plants, sunlight, and views of nature and/or, indirect connections to nature through the use of natural materials, patterns, colours, or images. Ensure connections to nature in:

- 95% of units, with nature visible from the living room and at least one bedroom.
- All occupied amenity spaces and lobbies; and 90% of building corridors.

Intent

To enhance overall mental and physical well-being of occupants by relieving stress and mental fatigue through nature.

Rationale

Regular exposure to plants and natural elements has measured, positive impacts on the psychological wellness and physiological health of people. Connections to nature can restore cognitive functions such as one's ability to think, learn, and be creative. It also lowers levels of tension and anxiety and improves physical comfort by lowering diastolic blood pressure, stress hormone levels, and relaxation of the muscles. Direct access to nature enhances positive moods and facilitates social trust when green space functions as a place for community gathering.

Recommended Strategies

- Plan space layouts in common areas to encourage encounters with and views of nature.
- For units facing streets or built structures, views of nature directly parallel to the unit's window must include more than 2 trees.
- Ensure that long corridors have windows to allow sunlight access and views of nature.
- Views of nature must have a diversity of plant species (i.e. Trees, shrubs, grasses, flowering plants) rather than monoculture. The richness of plant species positively increases recovery from stress. [8]
- Where direct connections are not possible use:
    - Biomorphic forms and patterns, natural materials (ie. Woodwork, stonework, natural colors, fossil textures, bamboo, or dried grasses).
    - Art and photos of nature.
- Design lighting to be dynamic rather than uniform. Use lighting from multiple angles, seasonal light, low glare lighting, ambient diffuse lighting, accent lighting, and circadian lighting.

Resources

- *Terrapin Bright Green*. (2014). Patterns of Biophilic Design: Improving Health and Well-being in the Built Environment.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Health and Wellbeing component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by Architect declaring that the requirements will be met, including a list and narrative of the strategies employed to achieve the credit.

[8] Lindemann-Matthies, P., & Matthies, D. (2018). The influence of plant species richness on stress recovery of humans. *Web Ecology, 18*(2), 121-128.

- Floor plans showing connections to nature.

HEALTH AND WELLBEING

H&W Credit 5.1: Daylight Access — 2~~1~~ points

Requirement

Ensure adequate levels of daylight within each unit by achieving the following requirements:
- Transparent envelope glazing area is a minimum of 7% of the unit floor area.
- Visible light transmittance (VLT) of envelope glazing is greater than 40%.
- 30% of the area is within 6 m (20 ft) of transparent envelope glazing.

Intent

To ensure that indoor environments provide healthy levels of daylight in support of circadian rhythms which regulate body processes for sleep, digestion, and the release of certain hormones.

Rationale

As human bodies have evolved along a 24-hour day and night cycle, reliance on artificial and electric light results in harmful disruptions to circadian rhythms. In particular, exposure to artificial light at night has been linked to the onset of depression, the impairment of cognitive functions, and disruptions to the nocturnal production of melatonin.[9] Designing proper levels of daylight in indoor environments can improve the biological and mental health of individuals as well as improve visual and thermal comfort.

Recommended Strategies

- Consider the orientation and shading of windows in order to balance optimal daylight levels with minimal solar heat gain.
- Consider daylight-responsive electric controls or dimmers to reduce energy use from artificial lighting.
- Increase unit ceiling heights to permit the use of taller windows and allow flexibility in devices such as light shelves which reflect light deeper into the unit.

Resources

- The *WELL Building Standard v2* Light category provides lighting strategies for visual, mental, and biological health.
- The *Illuminating Engineering Society* publishes a variety of technical documents on illumination and other lighting-related publications that encourage good lighting design.
- *Whole Building Design Guide:* The Daylighting resource page reviews technologies for daylighting, design considerations, and a list of relevant codes and standards.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Health and Wellbeing component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Architect declaring that requirements will be met.
- Floor plans showing calculations of transparent envelope glazing area to floor area.

[9] Cho, Y., Ryu, S., Lee, B. R., Kim, K. H., Lee, E., & Choi, J. (2015). Effects of artificial light at night on human health: A literature review of observational and experimental studies applied to exposure assessment. Chronobiology International, 32(9), 1294-1310.

- Shop drawings from the manufacturer showing the glazing systems' visible light transmittance

HEALTH AND WELLBEING

H&W Credit 6.1: Active Living

2~~1~~ points

Requirement

Design a secondary staircase that is safe, visually appealing, and invites regular use through the following strategies:

- Ensure the staircase services all floors of the project, excluding the parking garage, and can be accessed by all regular building occupants.
- Locate the staircase so that it is visible from the building entrance.
- Install transparent fire-rated glazing to each floor level of the staircase. The area of glazing must span at least 0.93 m^2 (10 sf) in order to increase visibility of the staircase and provide views to the interior, from inside the staircase.
- Use appealing materials and finishes.
- Install visible signage at elevators and the entrance to the staircase to encourage stair use.

Intent

To encourage daily physical activity and enhance physical wellbeing at a building scale.

Rationale

Secondary staircases are often underutilized and only function as a means of emergency egress. By designing a staircase that is welcoming and visible, it can become an enjoyable, main route through the building that incentivizes moderate daily exercise for many occupants. Increased daily physical activity can improve health outcomes for muscular and cardiorespiratory health, and reduce the risks of hypertension, heart disease, and stroke over time.[10]

Recommended Strategies

- Provide exterior views and daylight in the secondary staircase where possible.
- Consider daylight-responsive electric controls or light sensors.
- Design signage that both directs and motivates occupants to use the stairs. Emphasize the health benefits, calorie expenditures, energy savings, and the convenience of stairs.
- Incorporate gamification into the staircase design and signage.[11] Gamification combines the playful elements of games such as challenge tasks, points, and friendly competition into design. It can involve apps, fitness trackers, and more.
- Apply artwork with bright colours on the walls or risers of the staircase to encourage occupants to use the stairs as a primary mode of movement through the building.
- Consider installing hold-open devices to improve the access to and visibility of the staircase, in accordance with building security.

[10] World Health Organization. (2018). Physical Activity. http://www.who.int/mediacentre/factsheets/fs385/en/.

[11] Flynn, N. & Asquer, A. (2016). Public Sector Management. 7th ed. *SAGE*.

Resources

- The *City of North Vancouver 2015 Active Design Guidelines* details BC Building Code compliant strategies for active secondary and primary stairs.
- The *WELL Standard v2* is a rating system which focuses on advancing the health and wellbeing of building occupants. The V03 Movement Network and Circulation credit provides strategies and background information on the design of active stairs.
- The *New York City Active Design Guidelines* provides case studies for active stairs and details co-benefits for sustainable and universal design.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Health and Wellbeing component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Architect declaring that the requirements will be met, including a description of the strategies used to achieve the credit.
- A plan of the secondary staircase showing the location of the stairs, location of signage, visibility of the stairs from building floors, and the materials used.

QUALITY

Q P1: Sustainability CommitmentStatement — Precondition

Requirement

Submit a "Sustainability Statement" that describes how the development will be designed to achieve high environmental standards related to UBC's Green building Action Plan and the university's sustainability policies in the eight component areas.

AND

Provide a list of professionals or responsible parties who will sign declaration letters for meeting requirements of REAP preconditions and credits.

Intent

Ensure projects align with UBC's Green building Action Plan and the University's policies through compliance to REAP.

Resources

- C&CP website: https://planning.ubc.ca/sustainability/sustainability-action-plans

Required Documentation: Submit at the *Building Permit* phase

- SustainablySustainability Statement
- Letter signed by the Developer certifying that the "Sustainability Statement" has been followed
- Responsible Party for Implementation of REAP Preconditions and Credits checklist

QUALITY

Q P2: Educate the Homeowner — Precondition

Requirement

Provide a homeowners' manual to educate homeowners on the features of the building as well as the proper use and maintenance of facilities and equipment. Include the following details in the homeowners' manual:

- A completed checklist of REAP credits, including product manufacturers' manuals for all equipment, fixtures, and appliances with Energy Star details; **and**
- Guidance on how to minimize energy, water, and resource use in everyday activities and choices throughout the home to promote sustainable behavior; **and**
- Information on sorting and recycling in the building;

And

- Ensure the manual is incorporated into record drawings or some form that will be accessible beyond the first generation of owners/residents; **and**
- Conduct a one-hour walkthrough with the occupants and building manager(s) to educate them on all sustainable equipment and features.

Intent

To promote awareness of sustainable building performance and ensure proper operation and maintenance of various systems in the suite and building.

Rationale

Educating homeowners on sustainable building features is necessary to ensure that REAP buildings reduce resource consumption from design to occupation. A manual that explains all of the operation and maintenance information also ensures that technologies will meet their intended energy- and water-efficiency performance levels.

Recommended Strategies

- Provide a comprehensive description of green features in the homeowner's manual, and address at least one credit accomplished in each impact category. Provide resources for additional information where possible.
- Provide written operational instructions for all appliances and equipment, maintenance schedules, maintenance instructions, manuals, warranties, and product descriptions.

Resources

- LEED BD+C v4 for Multifamily Midrise provides a credit for homeowner education with additional guidance on the types of green building information to include in the education package.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by the Developer certifying that the requirements have been met.
- Copy of the homeowner's manual.
- Narrative describing one-hour walk-through for occupants and building manager(s).

QUALITY

Q P3: Educate the Sales & Leasing Staff **Precondition**

Requirement
Develop marketing materials based on the environmental performance of the project and ensure the sales or leasing staff is knowledgeable about the green building features.

Intent

To help transform the residential housing market by highlighting the wide range of benefits associated with green building design as compared to conventional construction.

Rationale

Well-designed marketing materials and knowledgeable staff ensure that the benefits of green building ownership or rental are effectively communicated in a competitive housing market. Consumer demand for green buildings can be increased if more consumers are made aware of the long-term benefits of owning and occupying sustainable homes.

Recommended Strategies

- Contract with a housing marketing firm that has a sound understanding of green building principles and effective leverage points within the current housing market.
- Conduct on-site training sessions with sales or leasing staff to ensure a working knowledge of green building features and systems specific to the building. Use sample products and energy bills as teaching aids.
- Use walk-throughs and model suites as invaluable educational tools for sales staff and buyers. For example, model suites with display cutaways and wall sections can help to demonstrate energy-efficient construction practices.

Resources

- *The Canada Green Building Council* provides a rationale for building green, including increased sales.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by the Developer declaring that the requirements have been met.
- Copy of the marketing material highlighting sustainable features of the project.

QUALITY

Q P4: Green Building Specialist — Precondition

Requirement
Engage a Green Building Specialist who is an expert in green buildings and sustainable construction practices to provide advice on effective green building strategies to the design team.

Intent
To support, encourage and streamline the process of implementing green strategies into building projects.

Rationale
A green building specialist can guide the design process and maintain a focus on environmental goals throughout the project. An experienced specialist familiar with the local construction industry can greatly reduce the effort required to achieve the goals associated with sustainable building practices.

Definitions

- *Green Building Specialist:* An expert with LEED AP BD+C certification or equivalent accreditation and experience in green buildings.
- *LEED AP BD+C*: A Leadership in Energy and Environmental Design Accredited Professional is an individual who has been accredited in the LEED rating system and is capable of providing a framework for assessing building performance and meeting sustainability goals.
- *Integrated Design Process (IDP)*: IDP involves the full design team and key stakeholders from the beginning of a building project. The group works together in a comprehensive, team-based approach with the goal of producing a successful integration of environmental systems and strategies.

Recommended Strategies

- Utilize an Integrated Design Process to maximize the benefits for the whole project.
- Bring the green building specialist 'on board' early on in the project. From the project's outset, work with the green building specialist to:
  - Establish a reference from which alternative strategies can be evaluated; and
  - Set green design goals that are both challenging and reasonably attainable; and
  - Promote whole-building design strategies and raise awareness of green building benefits.

Resources

- *Better Bricks* provides further insight into the rationale for, and steps for achieving a meaningful integrated design process.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Developer identifying the expert in green buildings and construction practices who is engaged in the project.
- Explanation or CV of the expert showing how their combination of experience and education demonstrate the ability to provide advice.

QUALITY

Q P5: Design for Security and Crime Prevention — Precondition

Requirement
Demonstrate that the design has been reviewed by an expert in Crime Prevention Through Environmental Design (CPTED) and that recommendations have been followed.

Intent

To alter or enhance the built environment through design that reduces opportunities for crime activity.

Rationale

Careful environmental design can discourage and prevent residential crime, improving the quality of life for homeowners and the larger community.

Definitions

CPTED principles include:

- *Access control*: Controlling the access to a building or portion of a building, such as underground parking.
    - *Defensibility*: Markers that discourage opportunities for crime such as fencing, locks on doors and bars on windows.
    - *Surveillance*: Surveillance can be "natural" where residents observe the public areas of their neighbourhood, and "formal" where a person such as a security guard is employed to watch an area.
- *Target hardening*: Increasing the security of the building through methods including surveillance, lighting, locks and fencing.
- *Territoriality*: Using physical markers which delineate private spaces from public spaces to demonstrate ownership.

Recommended Strategies

- Undertake a review of the design by a CPTED practitioner and implement the recommendations to create a safer and more secure building for the occupants and visitors.
- Update the building design to reflect the recommendations of the CPTED practitioner.

Resources

- *BC Housing Design and Construction Standards (2019) Section 3* describes the principles provides a CEPTED checklist for housing projects.

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Architect declaring that the requirements have been met.

QUALITY

Q ~~P6Credit 1.1~~: Integrated Design Workshop **Precondition~~4 points~~**

Requirement

Beginning in pre-design and continuing throughout the design phases, i~~I~~dentify and use opportunities to achieve synergies across disciplines and building systems; **and**

Hold a preliminary ~~energy and water~~ workshop during schematic design based on the following REAP preliminary workshop design requirements:~~. Use the analyses described below to inform the design.~~

- Conduct a facilitated workshop/meeting which provides, using REAP as a basis, a focus on site conditions, building massing & orientation, building materials, embodied carbon, envelope attributes, sustainable energy and water systems, operational parameters, and climate resiliency
- Explore ideas for the project based on REAP credits as well as UBC's GBAP goals, targets and vision
- Investigate design strategy synergies that will meet project goals
- Present preliminary energy/ carbon and water budget analysis to verify targets, performance benchmarks, and potential strategies to achieve project goals
- Explore synergies among systems and components

~~**Energy-Related Systems**~~

~~Perform a preliminary "simple box" energy modeling analysis before the completion of schematic design that explores how to reduce energy loads in the building and accomplish related sustainability goals by questioning default assumptions. Assess strategies associated with each of the following, as applicable:~~

- ~~Proposed energy targets and Energy Step Code alignment.~~
- ~~Site conditions. Assess shading, exterior lighting, hardscape, landscaping, and adjacent site conditions.~~
- ~~Massing and orientation. Assess how massing and orientation affect HVAC sizing, energy consumption, lighting, and renewable energy opportunities.~~
- ~~Basic envelope attributes. Assess insulation values, window-to-wall ratios, glazing characteristics, shading, and window operability.~~
- ~~Lighting levels. Assess interior surface reflectance values and lighting levels in occupied spaces.~~
- ~~Thermal comfort ranges. Assess thermal comfort range options.~~

~~**AND**~~

~~**Water-Related Systems**~~

~~Perform a preliminary water budget analysis before the completion of schematic design that explores how to reduce potable water loads in the building, reduce the burden on municipal supply or wastewater treatment systems, and accomplish related sustainability goals. Assess and estimate the project's potential non-potable water supply sources and water demand volumes, including the following, as applicable:~~

~~Indoor water demand. Assess flow and flush fixture design case demand volumes.~~

~~Outdoor water demand. Assess landscape irrigation design case demand.~~

~~Supply sources. Assess all potential non potable water supply source volumes, such as on-site rainwater, and HVAC equipment condensate. Analyze how non-potable water supply~~

~~sources can contribute to the water demand components listed above.~~

Intent

To support and encourage integrated design in order to achieve low carbon, resilient and healthy buildings through the early investigation of synergies between disciplines and building systems.

Rationale

Integrated design is essential to identify and promote opportunities to achieve synergies across disciplines and building systems. Through the integrated design process, project teams can use REAP more effectively as a comprehensive tool for identifying interrelated issues and develop synergistic strategies.

Recommended Strategies

- Become familiar with the integrated design process.
- Conduct preliminary ~~energy~~ research and analysis.
- ~~Conduct preliminary water research and analysis.~~
- Convene a preliminary ~~energy and water~~ workshop that focusses on: site conditions, building massing & orientation, building materials, embodied carbon, envelope attributes, sustainable energy and water systems, operational parameters, and climate resiliency.
- Evaluate possible design~~energy~~ strategies.
- ~~Evaluate possible water strategies.~~
- Document how analysis informed building and site design ~~and building form~~.

Resources

- *Integrative Process (IP)© - ANSI Consensus National Standard Guide© - Design and Construction of Sustainable Buildings and Communities*: The Standard Identifies Requirements for the Design & Construction Community to Integrate Systems and Professionals Involved to Reduces Costs and Risk.
- *UBC Sustainability Process* for institutional projects outlines a design process and schedule for reference.

- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Quality component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- A signed letter from the Architect declaring that requirements will be met.
- Workshop meeting minutes.

QUALITY

Q Credit 2.1: Durable Building — 42 points

Requirement

Develop and implement a Building Durability Plan in accordance with the principles in CSA S478:19 - Durability in Buildings. Include: Structure, building cladding assemblies, glazing assemblies and roofing assemblies.

- Design service life is 60 years.
- Where component and assembly design service lives are shorter than the design service life, design so they can be readily replaced.
- Develop and manage a quality management program in accordance with CSA S478.
- Categories of failure are 6,7, or in table 3 use a design service life equal to the design service life.
- Categories of failure 4 or 5 in table 3 use a design service life quality to at least half of the design service life of the building.
- Qualified building science professional to develop and deliver the Building Durability Plan.

Intent

To minimize materials, use and construction waste over a building's life resulting from inappropriate material selection or premature failure of the building components and assemblies.

Rationale

A durable building — one that lasts a long time — provides a long period of time to amortize the environmental and economic costs that were incurred in building it. Creating durable buildings depends on the right knowledge and attention during design, specification, and installation.

Definitions

Building Durability Plan: A plan which provides a framework within which durability targets are set and criteria for durability performance of a building is established.

Recommended Strategies

- Develop a Building Durability Plan at the concept stage, and review the plan during design for implementation during construction.
- Components of particular relevance are major structural elements (including foundations), building cladding assemblies, roofing assemblies, and those elements likely to have significant impacts on the building's operation or performance (excluding mechanical and electrical equipment).
- Make informed decisions about the components of the building envelope (i.e., based on life cycle performance).
- To minimize premature deterioration of walls, roofs, and floors, select design strategies that are appropriate to the geographic region.
- Reduce construction problems by specifying realistic and achievable levels of workmanship that are based on practical construction methods and readily available technologies.
- Follow a building envelope commissioning process to ensure performance and durability standards are correctly established at the outset and followed through during construction and operation.

Resources

- *CSA S478:19 Durability in Buildings:* This Guideline considers the agents and mechanisms related to durability and provides advice for incorporating requirements for durability into the design, operation, and maintenance provisions for buildings and their components.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Quality component area in residential buildings.

Required Documentation: Submit at the *Building Permit* phase

- Signed letter from the Building Envelope consultant or responsible party declaring that the requirements will be met.
- Copy of the Building Durability Plan.

QUALITY

Q Credit 3.1: Education and Awareness — 2 points

Requirement

Develop the following programs to educate occupants and visitors about the benefits of the green building and the sustainable features of the project:

- A script for a guided tour of the building describing the sustainable features of the project; **and**
- A case-study highlighting the sustainable features of the project to inform the UBC community and future buildings of the successes of the project.

Intent

To promote awareness of green buildings for occupants, visitors, and the UBC community at large.

Rationale

The REAP building standards help reduce environmental impacts on the building site and community. Developing a tour or case-study takes advantage of the educational value of buildings by informing the UBC community of the actions that are being taken to reach net positive contributions to human and natural systems by 2035.

Recommended Strategies

- Develop a tour script which includes points of interest and a plan indicating convenient tour stop location(s) from which to view the building. If the building is not ~~publically~~publicly accessible, the tour can be from the exterior.
- Develop a short case study with images for inclusion on the ~~UBC~~ Campus & Community Planning website.

Resources

- The Canadian Green Building Council provides green building case studies for Zero Carbon, LEED v4, TRUE and Parksmart certified buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by Developer certifying the requirements have been met.
- A copy of the script for the guided tour.
- A copy of the 1-page, illustrated case-study ready for circulation on UBC's website.

INNOVATION AND RESEARCH

I&R P1: Contribution to Low Carbon Mobility and Research

Precondition

Requirement

Contribute to a Low Carbon Development Fund which will help resource low carbon community mobility initiatives and support REAP research projects.

Intent

To support community low carbon mobility and support innovative solutions to reduce the carbon (and other environmental) impacts associated with development through research projects.

Rationale

Low carbon development requires innovative approaches. UBC is dedicated to improving community low carbon mobility initiatives (such as neighbourhood car share cars, neighbourhood level 3 charging stations) to reduce emissions as well as supporting research aimed at improving REAP policy outcomes.

Recommended Strategies

- Consult with UBC Properties Trust to make arrangements for the required contribution.
- Provide information to occupants to support lower carbon lifestyles (e.g., information on EV charging infrastructure and the community car-sharing program)
- Participate in REAP research project see I&R credit 2.1 Research.

Resources

- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Energy and Emissions component area in residential buildings.

Required Documentation: Submit at the *Occupancy Permit* phase

- Letter signed by Developer declaring that the requirements have been met.
- Documentation confirming the number of residential units and the amount contributed to the Fund.
- Confirmation payment has been made.

INNOVATION AND RESEARCH

I&R Credit 1.1: Exemplary Performance — 2 points

Requirement
Demonstrate exceptional performance above the requirements set by an existing credit, to reach the next performance level.

Intent

To provide design teams and projects the opportunity to be awarded points for exceptional performance achieving the next performance threshold above the requirements set by the UBC Residential Environmental Assessment Program criteria.

Rationale

Although the performance measures covered in the UBC Residential Environmental Assessment Program address a wide range of issues, it is important to continually foster innovation and provide opportunities for developers, designers and contractors to explore other possible advances.

Recommended Strategies

- Conduct research to identify applicable global best practices for building design, construction, commissioning, and post-occupancy evaluation.
- Consult with the design team and a green building specialist to determine where it is possible to substantially exceed a performance credit.
- Use the goal setting workshop to establish support for individual team members to take new initiatives and propose ideas for innovative strategies throughout the project, where achievable.
- Consider using the Integrated Design Process and design charrettes to identify high performance sustainable design measures that are not covered within the REAP assessment system.

Required Documentation: Submit at the *Occupancy Permit* phase

- Submit a description of the exceptional performance or the innovative design strategy. The submission should include:
  - A description of the requirement, the intent, a rationale, strategies used and documentation that supports the credit achievement.

INNOVATION AND RESEARCH

I&R Credit 1.2: Innovation or Pilot **3 points**

Requirement
Achieve significant, measurable sustainable building performance using a strategy not addressed in REAP; **or**
Pilot specific a significant, measurable strategy or strategies from UBC's Green Building Action Plan.

Intent

To provide design teams and projects the opportunity to be awarded points for innovative performance not specifically addressed by the program.

Rationale

Although the performance measures covered in the UBC Residential Environmental Assessment Program address a wide range of issues, it is important to continually foster innovation and provide opportunities for developers, designers and contractors to explore other possible advances.

Recommended Strategies

- Conduct research to identify applicable global best practices for building design, construction, commissioning, and post-occupancy evaluation.
- Use the project workshops to establish support for individual team members to take new initiatives and propose ideas for innovative strategies throughout the project, where achievable.
- Consider using the Integrated Design Process to identify high performance sustainable design measures that are not covered within the REAP assessment system.
- Identify the following: the intent of the proposed innovation credit; proposed requirements for compliance; proposed submittals to demonstrate compliance; and the design approach or strategies used to meet the requirements.
- For the pilot option describe a method by which feedback can be provided about the pilot

Resources

- The *UBC Green Building Action Plan*.

Required Documentation: Submit at the *Building Permit* phase

- Submit a description of the innovative design or pilot strategy and project requirement, the intent, a rationale, strategies used and documentation that will be submitted to support the credit achievement.

Required Documentation: Submit at the *Occupancy Permit* phase

- Submit the documentation identified in the building permit phase to support the credit achievement.

INNOVATION AND RESEARCH

I&R Credit 2.1: Research **5 points**

Requirement

Developer to ~~C~~collaborate ~~with UBC SEEDs or the CLL program~~ in a research project related to UBC neighbourhood residential building and landscape design and which has a likelihood of providing information relevant to policy outcomes for UBC and/or the broader community. The research project is to be conducted in coordination with UBC SEEDs Sustainability Program or UBC Campus as a Living Lab Initiative with a project proposal preapproved by C&CP.~~.~~

Project topic must be related to the following~~either~~:

- Climate action: reduction in operational or embodied emissions and/or adaption to current and future climate on a building or community scale. (Resilience measures towards climate change)

Goals, targets, indicator and actions in UBC's Green Building Action Plan residential section ~~or current priority area for the university; or~~

- ~~A current topic relevant to the project which has been submitted for prior approval.~~(starts page 66)

Intent

- To promote relationships amongst the development and academic communities, and support student learning and research on residential development projects.
- To collaborate on projects that will inform demonstrable policy outcomes.

Rationale

Residential development at UBC constitutes a unique and mutually beneficial opportunity to conduct research, to expand knowledge about green building practice and performance, and to build engagement~~skills~~ amongst developers, students, faculty, and the community.

Recommended Strategies

~~Contact the SEEDS Program coordinator to discuss potential research projects that involve students, faculty and university staff. The SEEDS website contains a wide array of projects that have already been completed.~~

- Review the SEEDS website which has links to a wide array of projects for inspiration and information on past projects.
- Consult with project consultants ~~architects and other professionals~~ involved in the building project to identify potential research subjects or issues of interest to the building industry.
- Preapprove topic with REAP administration team

Resources

- *SEEDS (Social, Ecological, Economic Development Studies)* Sustainability Program: Sitting within UBC's Campus + Community Planning Department, SEEDS is a long-standing Campus as Living Laboratory initiative with a mandate to advance UBC's sustainability,

climate and wellbeing commitments, UBC's Strategic Plan, and help advance the United Nations Sustainable Development Goals as they align with the University's strategic priorities through interdisciplinary partnerships, applied student research and advisory guidance~~projects bring together students, faculty and staff in projects that address sustainability issues. SEEDS projects aid the Sustainability Office in achieving its goal of developing an environmentally responsible campus that is socially and economically viable.~~

Required Documentation: Submit at the *Building Permit* phase

- Letter signed by the Developer declaring that the requirements will be met.
- Research project proposal.

Required Documentation: Submit at the *Occupancy Permit* phase

- Copy of the research project or, if the project is not complete, commitment to finalize and planned date of submission.