THE UNIVERSITY OF BRITISH COLUMBIA
Campus + Community Planning

~~RESIDENTIAL ENVIRONMENTAL ASSESSMENT PROGRAM~~

~~REFERENCE GUIDE~~

~~VERSION 3.3~~

Reference Guide

UBC REAP Version 4.0

For public Review

Residential Environmental Assessment Program

~~JUNE 2023~~

Vision:

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

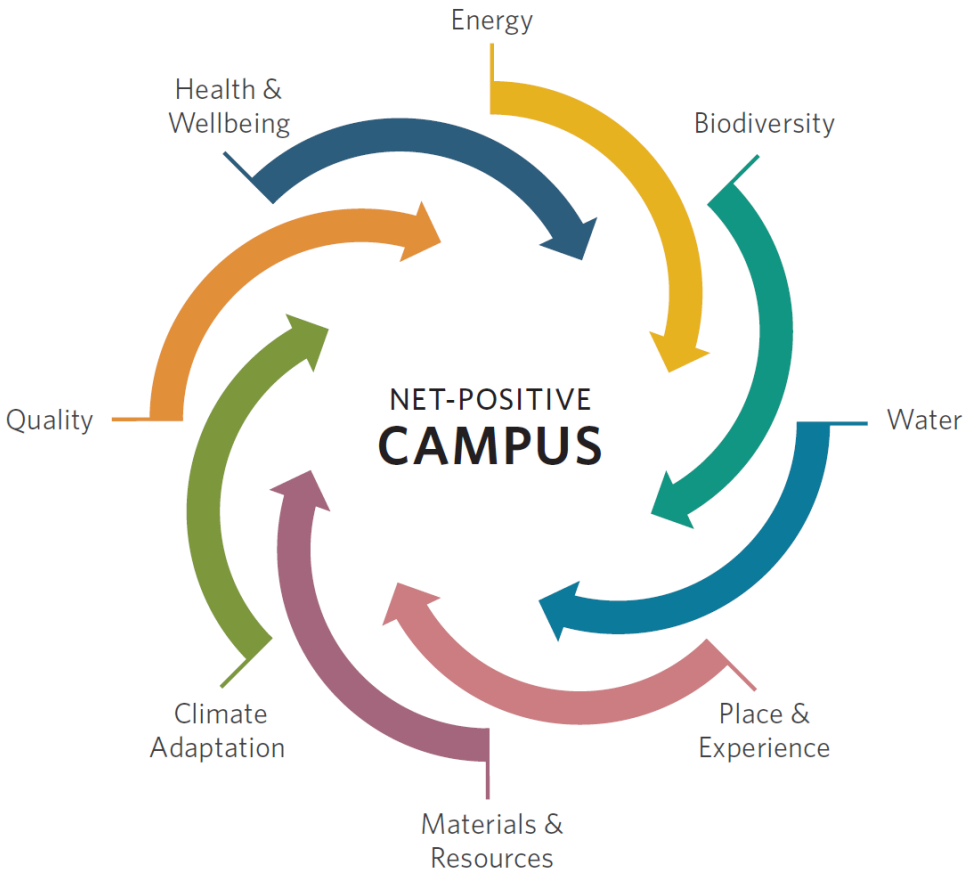

Table of Contents

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

(d) "**Reference Guide**" means the details of the preconditions and 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 UBC 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.

(c) The REAP Performance Levels, Checklist and the Reference Guide amendments shall follow the Land Use Policy process. 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.

(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 designate).

(g) If this Land Use Rule, the UBC 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.

~~(h)~~(i) A single REAP submission may be made for multiple buildings if all the buildings are all covered under one building permit. If more than one building permit is required for project buildout, each building or buildings that require a separate building permit must make a separate REAP submission

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. UBC REAP documentation submission requirements are integrated into the permitting process administered by Campus & Community Planning pursuant to the Development Handbook.

UBC REAP certification involves 5 stages:

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

(a) **UBC 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) **UBC 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: UBC REAP Checklist
~~**Format:** Electronic format (REAP Checklist Excel spreadsheet)~~
Submit to: Campus & Community Planning

(c) **UBC REAP Submission with Building Permit Application:** The architect (or other responsible party) is required to submit an updated UBC REAP Checklist and all the UBC ~~required Building Permit documentation~~REAP Building Permit phase required 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~~ could be achieved. The REAP BP Checklist and documentation can be submitted a maximum of 3 times. The REAP Submission with Building Permit Application must be complete prior to Building Permit issuance.

Submission: updated **UBC** REAP Checklist, all documentation identified throughout this document as "Documentation: Submit at the Building Permit Phase"~~, updated Sustainability Statement~~
Format: Electronic format (UBC 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 for each submission

(d) **UBC REAP Submission with Occupancy Permit Application:** The architect (or other responsible party) is required to submit an updated UBC REAP Checklist and all the UBC ~~required Occupancy Permit documentation~~ REAP Occupancy Permit phase required documentation~~as well as an updated Sustainability Statement~~ at, or prior to, ~~the~~ time that Occupancy Permit applications are made to Campus & Community Planning. If a~~n Occupational~~ UBC REAP Occupancy Permit phase application contains a substantive amount of information yet portions of the ~~credit~~ documentation are not available ~~by~~ at the ~~time~~ of Occupancy Permit application, then a written statement must be submitted with such Occupational Permit phase 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 be sufficient to provide the documentation necessary for Sustainability and Engineering, Campus & Community Planning, to verify compliance with the preconditions ~~mandatory~~ and optional credits that have been incorporated into the project, and to verify that, at minimum, REAP Gold could~~will~~ be achieved. All UBC REAP documentation must be submitted within one month of occupancy being granted. When all REAP submissions are complete and compliant, certification will be awarded. The REAP Occupancy Permit Checklist and documentation can be submitted a maximum of three times.

Submission: updated **UBC** REAP Checklist, all documentation identified as "Documentation: Submit at the Occupancy Permit Phase", updated Sustainability Statement
Format: Electronic format (UBC 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 for each submission

(e) **UBC 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 acceptable, 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.
Building projects need to achieve ***all*** of the preconditions within each component area, including Innovation and Research, 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 4.0~~3.3~~ CHECKLIST

ENERGY & EMISSIONS

The following are preconditions that must be met:

☐ **P1** Energy Step Code Compliance (Step 3)

☐ **P2** Zero Carbon Step Code Compliance (EL-4)

☐ **P3** Eliminate Combustion-Based Supplemental Heating

☐ **P4** Energy Star Appliances

☐ **P5** Programmable Thermostats

☐ **P6** Energy Commissioning

☐ **P7** Energy Systems Maintenance Contact

☐ **P8** Building Level Energy Metering and Reporting

☐ **P9** Domestic Hot Water Energy Use Sub-Metering and Reporting

☐ **P10** Refrigerant Emission Reporting

☐ **P11** Electric Vehicle Charging Infrastructure

No.	Credits	Max. Points	Attempted
1.1	Optimized Energy Performance (Step Code 4/PH)	10	
2.1	Renewable Energy	4	
3.1	Enhanced Energy Sub-Metering and Reporting	4	
4.1	Smart Thermostat	1	
5.1	Electric Vehicle Charging Stations	3	
	Total:	**22**	

CLIMATE ADAPTATION

The following are preconditions that must be met:

☐ **P1** 2050 Climate Thermal Comfort Modelling and Design

☐ **P2** 2050 Climate Ready Energy Efficient Design

☐ **P3** Design for Wildfire Risk Reduction

No.	Credits	Max. Points	Attempted
1.1	2050 Climate Ready Energy Efficient Design	5	
2.1	Enhanced Design for Wildfire Risk Reduction	3	
3.1	Refuge Area & Back-up Power	3	
4.1	Design for Social Connection	2	
5.1	Urban Heat Island Mitigation	2	
	Total:	**15**	

MATERIALS AND RESOURCES

The following are preconditions that must be met:

☐ **P1** Zero Waste Ready

☐ **P2** 10% Embodied Carbon Reduction

☐ **P3** Construction and Demolition Waste Reduction

No.	Credits	Max. Points	Attempted
1.1	Responsible Materials	4	
2.1	Embodied Carbon Optimization	10	
3.1	Mass Timber/Hybrid Superstructure	2	
4.1	Healthy Building Materials	1	
	Total:	**17**	

WATER

The following are preconditions that must be met:

☐ **P1** Low-flow Plumbing Fixtures

☐ **P2** Outdoor Water Use Reduction

☐ **P3** Water Efficient Appliances

☐ **P4** Rainwater Management

No.	Credits	Max. Points	Attempted
1.1	Total Water Use Reduction	9	
2.1	On-Site Rainwater Management	6	
	Total:	**15**	

BIODIVERSITY

The following are preconditions that must be met:

☐ **P1** Ecological Planting

☐ **P2** Light Pollution Reduction

☐ **P3** Bird Friendly Design - Basic

No.	Credits	Max. Points	Attempted
1.1	Planting for Biodiversity and Ecosystem Health	3	
2.1	Site Green Space	1	
3.1	Bird Friendly Design – Enhanced	3	
4.1	Food Growing Opportunity	1	
	Total:	**8**	

PLACE AND EXPERIENCE

The following are preconditions that must be met:

☐ **P1** Project Community Amenity Spaces

No.	Credits	Max. Points	Attempted
1.1	Project Exemplary Community Amenity Spaces	5	
	Total:	**5**	

HEALTH AND WELLBEING

The following are preconditions that must be met:

☐ **P1** Bicycle Parking

☐ **P2** Low-Emitting Products

☐ **P3** Construction Indoor Air Quality Management

☐ **P4** Air Filtration

No.	Credits	Max. Points	Attempted
1.1	IAQ Assessment	1	
2.1	Additional Bicycle Facilities	2	
3.1	Low-Emitting Products	2	
4.1	Connection to Nature	2	
5.1	Daylight Access	2	
6.1	Active Living	2	
	Total:	**11**	

QUALITY

The following are preconditions that must be met:

☐ **P1** Sustainability Commitment

☐ **P2** Educate the Homeowner

☐ **P3** Educate the Sales & Leasing Staff

☐ **P4** Green Building Specialist

☐ **P5** Design for Security and Crime Prevention

☐ **P6** Integrated Design Workshop

No.	Credits	Max. Points	Attempted
1.1	Durable Building	4	
2.1	Education and Awareness	3	
	Total:	**7**	

INNOVATION AND RESEARCH

The following are preconditions that must be met:

☐ **P1** Contribution to Low Carbon Mobility and Research

No.	Credits	Max. Points	Attempted
1.1	Exemplary Performance	2	
2.1	Innovation	3	
3.1	Research	5	
	Total:	**10**	

Y	?	N	Energy & Emissions (E&E)		/30
precondition			**P1**	Energy Step Code Compliance (Step 3)	-
precondition			**P2**	Zero Carbon Step Code Compliance (EL-2)	-
precondition			**P3**	Energy Star Appliances	-
precondition			**P4**	Programmable Thermostats	-
precondition			**P5**	Energy Modeling Workshop	-
precondition			**P6**	Energy Commissioning	-
precondition			**P7**	Energy Systems Maintenance Contract	-
precondition			**P8**	Building Level Energy Metering and Reporting	-
precondition			**P9**	Domestic Hot Water Energy Use Sub-metering and Reporting	-
precondition			**P10**	Refrigerant Emission Reporting	-
precondition			**P11**	Electric Vehicle Charging Infrastructure	-
0		15	**1.1**	Optimized Energy Performance (Step 4/PH)	15
0		6	**2.1**	Renewable Energy	6
0		5	**3.1**	Enhanced Energy Sub-metering and Reporting	5
0		1	**4.1**	Smart Thermostat	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)		**/11**
precondition			**P1**	Zero Waste Ready	-
precondition			**P2**	Embodied Carbon Reporting	-
precondition			**P3**	Construction and Demolition Waste	-
0		2	**1.1**	Responsibly Sourced Materials	2
0		6	**1.2**	Embodied Carbon Target	6
0		2	**1.3**	Mass Timber Superstructure	2
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 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
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	4.1	Connection to Nature	2
0		2	5.1	Daylight Access	2
0		2	6.1	Active Living	2
Y	?	N	Quality (Q)		/7
precondition			P1	Sustainability Commitment	-
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			P6	Integrated Design Workshop	-
0		4	1.1	Durable Building	4
0		3	2.1	Education and Awareness	3
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) **Precondition**

Requirement

Design and construct buildings to comply with Section 10.2 Energy Efficiency of the BC Building Code and:~~,~~

1. ~~to c~~Conform to the following BC Energy Step Code energy performance requirements:
    - **Residential Buildings, Step 3**: ~~120 kWh/m2-yr (TEUI) and 30 kWh/ m2-yr (TEDI)~~ as specified by the ~~Energy Step Code Regulation~~ BC Building Code (Division B, Table 10.2.3.3.-H).
    - **Offices and Other Businesses, Step 2** as specified by the ~~Energy Step Code Regulation~~ BC Building Code (Division B, Table 10.2.3.3.-I and Table 10.2.3.3.-J)
1. Use an infiltration rate of 0.20 L/s/m2 for energy modelling OR contact UBC Sustainability and Engineering to receive approval to use a lower infiltration rate for modelling
2. Provide an airtightness plan that includes mid-construction testing and reporting.
3. Hold a mid-construction meeting with UBC Sustainability and Engineering to review the airtightness plan and mid-construction testing results.

Intent

To reduce building total energy usage and thermal demand by ensuring that the 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~~to fulfill the objectives of the UBC ~~Community Energy & Emissions~~Neighbourhood Climate Action Plan. To improve building performance outcomes, 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 conditioned floor area, per year, expressed in kWh/(m^2~~-~~-y~~ea~~r). ~~-~~It is determined as defined by the BC ~~Energy Step Code Regulation~~Building Code.
- *Thermal Energy Demand Intensity (TEDI):* Metric of the annual heating required by the building for space conditioning and for conditioning of ventilation air, estimated by using an energy model. ~~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~~-~~-y~~ea~~r). TEDI is determined as defined by the BC ~~Energy Step Code Regulation~~Building Code.
- *Energy Step Code Step 3 Targets for Residential Occupancies*: 120 kWh/m^2~~-~~yr (TEUI) and 30 kWh/~~-~~m^2-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~~is required in accordance with the BCBC Division B, 10.2.3.5.

Recommended Strategies

Many energy efficiency strategies can be employed ~~in order to~~to meet Energy 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).
- For buildings connected to district energy, contact UBC Sustainability and Engineering for system efficiency.

Resources

- The BC Energy Step Code resources for designers and builders.
- *BC Energy Step Code requirements*.
- The *Step Code Part 3 Design Checklist* is the Energy BC ~~-~~reporting template~~-~~.
- 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 preliminary energy modeling report with model parameters and inputs, 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 preliminary Step Code Part 3 Design Checklist in Excel file format.
- A preliminary REAP Building Enclosure R-Value Calculator report.
- For buildings supplied by district energy, provide documentation that a signed Energy Services Agreement has been completed.

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 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.
- An as-built Step Code Part 3 Design Checklist in Excel file format.
- Air tightness test results as specified by Section 10.2.3.5 of the BC Energy Step Code.
- An as-built REAP Building Enclosure R-Value Calculator report.
- Minutes from mid-construction meeting to review airtightness plan and mid-construction testing results.

ENERGY & EMISSIONS

E&E P2: Zero Carbon Step Code Compliance (EL-~~24~~24)	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-~~24~~24** for **Residential, Business and Personal Services and Mercantile Major Occupancies** found in Table 10.3.1.3.

Intent

To reduce building operational 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~~Establishing an emission requirement for GHG emissions ~~is required for~~supports meeting the emission reduction targets for buildings set out in the UBC ~~Community Energy and Emissions Plan emissions reporting~~Neighbourhood Climate Action Plan. ~~-~~For district energy connected buildings, the timing of the transition to low-carbon energy supply will be dependent on a third-party energy provider and will be subject to BC Utilities Commission approval. Campus and Community Planning will provide the low-carbon emission factor for district energy, providing certainty to building design team and developers.

Definitions

- *Greenhouse Gas ~~Emission Level~~Intensity (GHGI):* A measure of greenhouse gas emissions target expressed in ~~tonnes~~kilograms of CO2 equivalent per square meter ~~on an annual basis~~per year.
- *Zero Carbon Step Code (ZCSC):* A provincial standard for reducing emissions in new buildings which local governments may reference to require or encourage lower c
- Zero Carbon Step Code Emission Level ~~24~~24 target: ~~7 tonnes~~1.8 kg 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 *Step Code Part 3 Design Checklist* 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.

Required Documentation: Submit at the *Building Permit* phase

- A preliminary Step Code Part 3 Design Checklist ~~-~~ in Excel file format.

Required 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 Step Code Part 3 Design Checklist ~~-~~ in Excel file format.

ENERGY & EMISSIONS

E&E P3: Eliminate Combustion-Based Supplemental Heating

Precondition

Requirement

Design and construct building without any supplemental or redundant, combustion-based heating systems that provide primary domestic hot water or indoor space heating (e.g. natural gas fireplaces).

Intent

To eliminate inefficient and GHG emissions intensive systems from buildings and improve indoor air quality.

Rationale

Supplemental combustion-based heating systems, such as natural gas fireplaces, can be a significant source of GHG emissions and energy use in buildings. Avoiding such systems will support meeting emission targets in the UBC Neighbourhood Climate Action Plan.

Fossil fuel combustion releases pollutants when burned, including nitrogen oxides and carbon dioxide[1]. These pollutants can cause or worsen respiratory illnesses and cardiovascular diseases[2]. Even before combustion, there are health concerns associated with combustion fuels. Natural gas contains methane and volatile organic compounds, which can be released through leaks in the supply system[3] or as part of incomplete combustion products. In addition to helping meet UBC's emissions reduction targets, eliminating combustion-based supplemental heating systems helps to improve indoor air quality and protect residents.

Definitions

- *HVAC:* Heating, ventilation and air-conditioning.

Recommended Strategies

For buildings connecting to the Neighbourhood District Energy System (NDES), comply with the Energy Services Agreement, which prohibits any on-site system that would displace thermal energy provided from the NDES for primary domestic hot water and/or indoor space heating.

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[1] Natural Resources Canada. (2025). All About Gas Fireplaces. https://natural-resources.canada.ca/energy-efficiency/energy-star/all-about-gas-fireplaces

[2] Liang, K. E., Barzelai, L., Hale, I., & McKeen, K. (2024). Unhealthy, unnatural gas. *BCMJ, 66*(1), https://bcmj.org/council-health-promotion/unhealthy-unnatural-gas

[3] Michanowicz, D. R., Dayalu, A., Nordgaard, C. L., Buonocore, J. J., Fairchild, M. W., Ackley, R., Schiff, J. E., Liu, A., Phillips, N. G., Schulman, A., Magavi, Z., & Spengler, J. D. (2022). Home is Where the Pipeline Ends: Characterization of Volatile Organic Compounds Present in Natural Gas at the Point of the Residential End User. *Environmental Science & Technology, 56*(14), https://pubs.acs.org/doi/10.1021/acs.est.1c08298

For all other buildings, exclude any supplemental combustion-based heating systems from the HVAC design.

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 *Building Permit* phase

- Letter signed by the Mechanical Engineer or responsible party declaring that the requirements ~~have been~~will be met.

ENERGY & EMISSIONS

E&E ~~P3~~P4: 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 *Building Permit* phase

- Letter signed by the Architect or responsible party declaring that the requirements ~~have been~~will be met.

Required Documentation: Submit at the *Occupancy Permit* phase

- 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.

ENERGY & EMISSIONS

E&E ~~P4~~P5: 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 ~~have been~~will be met.

Required Documentation: Submit at the *Occupancy Permit* phase

- Cut sheet from the manufacturer of the thermostat supplied and description of the thermostat locations.
- ~~.~~ Supporting documentation to prove that any non-Energy Star certified appliances installed meet the Energy Star key product criteria.

ENERGY & EMISSIONS

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 Sustainability and Engineering, and contractor to evaluate the results and optimize the design of the building AND
Provide a draft energy modelling report to the UBC Sustainability and Engineering representative at least one week prior to the workshop..

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 building energy analysis software to model the building's design for code compliance 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.

ENERGY & EMISSIONS

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, or ASHRAE Guideline 0-2005 and 1.1-2007, 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 intended. The Commissioning Authority, hired as a third party directly by the developer, helps to offer an unbiased quality control step during design and construction.

Definitions

- *Commissioning Authority:* Professional hired by the developer or building owner to report that 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 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)*~~Canadian Standards Association (CSA) Standard Z5000-18 ~~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.

- *ASHRAE Guideline 0-2005* describes the procedures, methods, and documentation requirements in this guideline describe each phase of the project delivery and the associated Commissioning Processes from pre-design through occupancy and operation.
- *ASHRAE Guideline 1.1-2007* described the technical requirements for the application of the commissioning process described in ASHRAE Guideline 0-2005 that will verify that the heating, ventilating, air-conditioning, and refrigerating (HVAC&R) systems achieve the Owner's Project Requirements.
- *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 commissioning report, detailing the commissioning process and commissioning results at the time of building occupancy.
- A letter from the Developer stating that the final commissioning report, all operating and maintenance manuals and any required training for building managers 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~~s~~ 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 operate 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.

ENERGY & EMISSIONS

E&E P8: Building Level Energy Metering and Reporting — Precondition

Requirement

Support 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~~**OR**
- Sharing ESPM account(s) with 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~~Neighbourhood Climate Action 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 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 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 common area utility meters on mechanical or electrical drawings and identify the major use classes and building typologies that they are associated with. Drawings showing the location of in-suite electricity meters are not required.
- Letter signed by Mechanical Engineer declaring that utility meters are associated with each building major use class and typology.

Required Documentation: Submit at the *Occupancy Permit* phase

- ~~Confirmation~~ For strata-owned buildings, 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 Sustainability and Engineering Community Energy Manager or other designated individual.
- For rental buildings, a letter stating that required permissions will be provided after building occupancy.
- ~~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.~~

ENERGY & EMISSIONS

E&E 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 Sustainability and Engineering.

Intent

To allow for the 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 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~~Neighbourhood Climate Action 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 Sustainability and Engineering upon request.

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 kgCO2e.

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 kgCO2e 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. Identify the quantity of each refrigerant in the report.

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. Identify the quantity of

each refrigerant in the report.

ENERGY & EMISSIONS

E&E P11: Electric Vehicle Charging Infrastructure **Precondition**

Requirement

Provide ~~a minimum of one~~ energized level 2 outlet~~s per residential unit for which parking is provided.~~as follows:

~~parking~~

.1 Each residential parking stall, including accessible parking stalls.

.2 Each assigned parking stall for car share, as required by car share provider.

.3 10% of commercial parking stalls.

.4 50% of commercial accessible parking stalls, at a minimum of one stall per parking area.

All Level 2 charging ~~capacity that provides~~must provide a minimum of 40A service and a minimum performance level of 12 kWh per stall, over ~~an~~ eight (8) hour~~s period must be provided~~. ~~-~~Load sharing (up to four-way) and load management systems may be utilized except for short term commercial stalls that require a minimum performance of 48 kWh per stall. 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 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 vehicles can reduce greenhouse gas emissions from vehicle operation by approximately 99% in British 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 vehicle(s):* Vehicle(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 charging:* 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 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)*.
- *"EV Ready" Requirements for New Buildings: A Best Practice Guide for BC Local Governments* provides guidance on establishing electric vehicle requirements for new construction.
- *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 Credit 1.1: Optimized Energy Performance (Step Code 4/PH) **1~~5~~0 points**

Requirement

Design and construct buildings to comply with Section 10.2 Energy Efficiency of the BC Building Code and~~:~~.

1. ~~to c~~Conform to the following BC Energy Step Code energy performance requirements:
   - Residential, Step 4 ~~100 kWh/m2 yr (TEUI) and 15 kWh/ m2 yr (TEDI) targets~~ as specified by the BC ~~Energy Step~~Building Code (Division B, Table 10.2.3.3.-H);
     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) ~~– **7 points** or~~

1. Use an infiltration rate of 0.20 L/s/m2 for energy modelling OR contact UBC Sustainability Engineering to receive approval to use a lower infiltration rate for modelling.
2. Provide an airtightness plan that includes mid-construction testing and reporting ~~OR~~
3. Hold a mid-construction meeting with UBC Sustainability and Engineering to review mid-construction testing results and the airtightness plan – **7 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 Energy Step Code Regulation. ~~–15~~ **10 points**

Intent

To reduce building total energy usage and thermal demand by ensuring that the 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~~Neighbourhood Climate Action Plan. To improve building performance outcomes, REAP references the province of BC's Energy Step Code energy use intensity targets.

High performance buildings
have been shown to improve passive survivability during power outages during extreme

weather events, enabling residents to more safely shelter in place[4].

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.

[4] Pacific Northwest National Laboratory. (2023). Enhancing Resilience in Buildings Through Energy Efficiency. US Department of Energy. https://www.energycodes.gov/sites/default/files/2023-07/Efficiency_for_Building_Resilience_PNNL-32727_Rev1.pdf

Recommended 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~~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 resources for designers and builders.
- *BC Energy Step Code requirements*.
- The *Step Code Part 3Design Checklist* 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.
- 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 preliminary energy modeling report with model parameters and inputs, 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 preliminary Step Code Part 3 Design Checklist.
- A preliminary REAP Building Enclosure R-Value Calculator 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.

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 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 Step Code Part 3 Design Checklist.
- Air tightness test results as specified by Section 10.2.3.5 of the BC Energy Step Code.
- An as-built REAP Building Enclosure R-Value Calculator report.
- 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.

ENERGY & EMISSIONS

E&E Credit 2.1: Renewable Energy — ~~6~~4 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. On-site energy production also diversifies energy supply to the site, which can reduce the disruption of grid-level power outages. This may increase~~s~~ building resilience and provide~~s~~ a low-carbon energy source to maintain critical systems.

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 decisions 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.

Required Documentation: Submit at the *Occupancy Permit* phase

- Specification sheet for technologies being installed including system capacity.
- Estimated annual electricity production and annual offset of total building electricity consumption
-

ENERGY & EMISSIONS

E&E Credit 3.1: Enhanced Energy Sub-metering and Reporting ~~54~~ points

Requirement

Install energy metering as follows~~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 Sustainability and Engineering.~~

- ~~Major end and space use s~~Sub-metering for 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). **– ~~21~~ ~~P~~Points~~s~~ ~~and/or~~AND/OR**
- Suite level thermal energy sub-metering for ~~. – 3 Points~~
  - domestic hot water – 1 point
  - space heating – 1 point
  - space cooling – 1 point
- ~~o~~ Report energy use to Sustainability and Engineering.

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 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)~~Neighbourhood Climate Action 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 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 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 occupant'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.
https://www.energystar.gov/products/smart_thermostats

Digital trends provides a blog that explains how smart thermostats work and save money.
https://www.digitaltrends.com/home/what-is-a-smart-thermostat/

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.

ENERGY & EMISSIONS

E&E Credit 5.1: Electric Vehicle Charging Stations — 3 points

Requirement

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

- One dedicated charging connector for visitor or shared use per 100 units. **– 1 point AND/OR**
- A dedicated charging connector for 5% of residents' parking stalls. **– 1 point OR**
- A dedicated charging connector for 10% of residents' parking stalls. **– ~~1~~2 point~~s~~**

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 electric vehicles can reduce greenhouse gas emissions from vehicle operation by more than 99% in British Columbia compared to conventional petroleum-powered vehicles. Level 2 charging stations will provide sufficient charging capacity for overnight charging of electric vehicles.

Definitions

- *Electric vehicle(s):* Vehicles 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 charging connector:* 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 or responsible party declaring that the requirements will be met.
-

Required Documentation: Submit at the *Occupancy Permit* phase

- Plan showing location of parking spots equipped with charging stations for electric vehicles.
- Cut sheet from manufacturer of charging stations that will be installed.

CLIMATE ADAPTATION

CA P1: 2050 Climate Thermal Comfort Modelling and Design

Precondition

Requirement

The building design must meet thermal comfort requirements for 2050's. Buildings with mechanical cooling systems must use the 2050's summer design temperature specified in Section 2.4 of the UBC Indoor Thermal Environment Technical Guidelines (Vancouver November 2023) and report maximum hours exceeding acceptability limits using a 2050's weather file with the mechanical cooling disabled OR

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 future climate weather files for the 2050's (RCP 8.5 scenario).

Intent

To meet summertime thermal comfort requirements for future climate conditions and avoid experiencing significant overheating over the building lifetime and to provide information on future overheating risks to inform design and UBC policy.

Rationale

The UBC Indoor Thermal Environmental Technical Guidelines provide future shifted summer design temperatures, ensuring that cooling system designs will meet future climate conditions. In addition, 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. 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. CWEC files are provided by Natural Resources Canada and based on measured historical weather data.
- *Pacific Climate Impacts Consortium (PCIC) Weather Files*: PCIC provides weather datasets based on the CWEC files that have been future-shifted to represent projected future climate conditions under an RCP 8.5 scenario. The 2050's file reflects projected typical conditions for the 2040-2070 time period.

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. An alternate future weather file, representing a typical meteorological year for a similar future time period, may be used with the approval of UBC Sustainability and Engineering.

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.
- *BCBC Technical Bulletin B24-08* discusses strategies on passive cooling and additional context on code cooling requirements.
- *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.
- A preliminary BC Step Code Part 3 Design Checklist using 2050's weather files in Excel format.

Required Documentation: Submit at the *Occupancy Permit* phase

- A letter signed by the Architect or Engineer declaring that the building design will meet summertime thermal comfort requirements for 2050's.
- Report showing results of future climate modelling and design strategies used for the as-built building design.
- An as-built BC Step Code Part 3 Design Checklist using 2050's weather files in Excel format.

CLIMATE ADAPTATION

CA P2: 2050 Climate Ready Energy Efficient Design — Precondition

Requirement

Meet a Cooling Energy Demand Intensity (CEDI) target 25 kWh/m^2-yr using 2050 future climate weather files (RCP 8.5) and following Energy Step Code energy modelling requirements.

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 with passive design measures in place are expected to experience reduced risk of overheating in a power outage.

Definitions

- *Cooling Energy Demand Intensity (CEDI)*: The annual cooling energy demand for space conditioning and conditioning of ventilation air per unit area. This includes both latent and sensible cooling output from cooling equipment. CEDI does not consider 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 P3: Design for Wildfire Risk Reduction — Precondition

Requirement

Implement the following design, construction and operation measures to reduce risk from wildfire events:

1. Design building entry and exits that can be operated manually
2. Roof materials should satisfy Class A of CAN/ULC-S107, standard test methods for Fire Tests of Roof coverings
3. Cladding materials must be ignition-resistant, with a flame spread rating of less than 25, and all penetrations in the exterior wall cladding should be sealed with no gaps greater than 3 mm
4. Glazing must have minimum one pane of tempered or heat-strengthened glass
5. Exterior doors must be made of non-combustible assemblies
6. Finishes for eaves, soffits and roof projections must be non-combustible materials
7. Vents must resist the intrusion of flames and embers and should be screened with non-combustible wire mesh (openings no larger than 3 mm)
8. Decks, balconies and other building attachments must be constructed from materials that are non-combustible (or combustible materials, such that construction is solid and continuous without slots or other openings larger than 3 mm)
9. Screens, rails and shelters within 10 m of the building should be constructed using non-combustible materials
10. Landscaping within 1.5 m from the building face should include plants selected from FireSmart BC's fire-resistant plant list wherever possible
11. Irrigation systems should be in good working order and operational beyond the plant establishment period
12. Landscape maintenance must include the removal of all combustible debris from planting beds as part of regular landscape maintenance

Intent

To limit the probability of building ignition and minimize damage to building structure or components from- wildfires and to establish fuel management measures around buildings.

Rationale

Extreme wildfire risk in western Canada continues to increase due to warmer temperatures and summer drought conditions. This is expected to contribute to an increase in the length of fire seasons and increased wildland fire risk in areas that have not historically experienced significant wildland fire hazards. Human- and lightning-caused fire occurrence and area burned by wildland fires are expected to increase (given environmental and population changes), as are incidences of larger, more intense wildland fire events. Fire seasons are becoming longer, starting earlier, and exhibiting more frequent extreme fire hazard weather. Further, an increase in WUI fires places greater stress on wildland firefighting capacity, particularly when significant investments are at risk of being destroyed by fire and critical infrastructure becomes vulnerable.

Incidents of unmanageable fires and the number of fires that escape initial attack are further expected to increase under changing climate conditions.

WUI fires can result in the ignition of numerous structures over a short period of time through the spread of flames, radiant heat and burning embers. Implementing design and construction measures to new buildings provides mitigation against potential ignition and/or damage during local wildfire event, which will protect residents and infrastructure. Additionally, implementing measures to manage vegetation surrounding buildings can significantly reduce the risk of fires spreading.

Definitions

- *Wildland Urban Interface (WUI):* area where various structures, usually private homes, and other human developments meet or are intermingled with wildland (vegetative) fuels or can be impacted by the heat transfer mechanisms of a wildfire, including ember transport. In British Columbia, WUI mapping considers a minimum 2 km buffer zone representing the distance that wildfire embers could reasonably travel to a structure.
- *WUI fire:* a wildfire that has spread into the WUI, which may or may not include ignition and burning of structures.
- *Ignition-resistant:* [in relation to building materials] resists ignition or sustained flaming combustion sufficiently to reduce losses from WUI conflagrations under worst-case weather and fuel conditions with WUI fire exposure of burning embers and small flames
- *Non-combustible:* [in relation to building materials] meets the acceptance criteria of CAN/ULC-S114, “Test for Determination of Non-Combustibility in Building Materials”
- *Fire-resistant plants:* do not provide significant fuel or increase fire intensity. They feature:
    - -Moist and supple leaves that ignite and burn slower.
    - -Little dead wood or accumulated dead material.
    - -Open branching habits that allow more debris to fall to the ground, allowing for easier removal of fuel.
    - -Fewer total branches and leaves (less fuel).
    - -Slow growing habits, reducing pruning requirements.
    - -Water-like sap with little or no odour.
    - -A low amount of sap or resin material
-

Recommended Strategies

Select appropriate building materials to meet the building construction requirements. Examples of relevant testing methodologies that materials could comply with can be found in Chapter 3 of NRC's "National Guide for Wildland-Urban Interface Fires".

While completing requirements for BIO P1: Ecological Planting precondition, layer on considerations to select fire-resistant plants and materials (e.g. mulch), adjust plant spacing and reduce spaces where embers can accumulate.

Devise a clear ~~WUI fire risk reduction~~ landscape maintenance plan which includes WUI fire risk reduction to pass on to maintenance contractors/stratas that establishes measures to reduce risky vegetative fuel on the building site.

Resources

- National Guide For Wildland-Urban Interface Fires is intended to mitigate the growing risk of damage and loss due to WUI fires by improving the resilience of buildings, infrastructure and communities to wildfire.
-
- *FireSmart BC's Fire-resistant Plant Tool* includes tables of plants that do not provide significant fuel or increase fire intensity, as well as a list of fire hazard plants that should be avoided on site.
- *FireSmart BC Landscaping Guide* provides a comprehensive overview of landscaping design and maintenance practices to increase the wildfire resiliency of properties.
-
- *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

- Architectural and landscape drawings and/or cut sheets showing how the requirements will be met for each design or construction measure.
- A signed letter from the Architect with a narrative describing how the measures have been implemented and declaring that the requirements will be met.
- Letter signed by the Landscape Architect declaring that the requirements will be met.

Required Documentation: Submit at the *Occupancy Permit* phase

- Copy of the Landscape Maintenance Plan specifying fuel management measures, directed to the landscape maintenance contractor/strata.

CLIMATE ADAPTATION

CA Credit 1.1: 2050 Climate Ready Energy Efficient Design — 5 points

Requirement

Meet a Cooling Energy Demand Intensity (CEDI) target using 2050 future climate weather files (RCP 8.5), and following BC Energy Step Code energy modelling requirements as follows:

- ~~20 kWh/m2-yr – **2 points**~~
- 20 kWh/m2-yr – 4**2 points OR**
- 15 kWh/m2-yr – ~~7~~**5 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 with passive design measures in place are expected to experience reduced risk of overheating in a power outage.

Definitions

- *Cooling Energy Demand Intensity (CEDI)*: The annual cooling energy demand for space conditioning and conditioning of ventilation air per unit area. This includes both latent and sensible cooling output from cooling equipment. CEDI does not consider 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.
- ~~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 2.1: Enhanced Design for Wildfire Risk Reduction — 3 points

Requirement

Comply with NRC's "National Guide for Wildland-Urban Interface Fires" Chapter 3 3.1-3.4 by using consultation from a qualified professional and implementing recommended strategies.

Intent

To limit the probability of building ignition and minimize damage to building structure or components from wildfires and to establish fuel management measures around buildings.

Rationale

Extreme wildfire risk in western Canada continues to increase due to warmer temperatures and summer drought conditions. This is expected to contribute to an increase in the length of fire seasons and increased wildland fire risk in areas that have not historically experienced significant wildland fire hazards. Human- and lightning-caused fire occurrence and area burned by wildland fires are expected to increase (given environmental and population changes), as are incidences of larger, more intense wildland fire events. Fire seasons are becoming longer, starting earlier, and exhibiting more frequent extreme fire hazard weather. Further, an increase in WUI fires places greater stress on wildland firefighting capacity, particularly when significant investments are at risk of being destroyed by fire and critical infrastructure becomes vulnerable. Incidents of unmanageable fires and the number of fires that escape initial attack are further expected to increase under changing climate conditions.

WUI fires can result in the ignition of numerous structures over a short period of time through the spread of flames, radiant heat and burning embers. Implementing design and construction measures to new buildings provides mitigation against potential ignition and/or damage during local wildfire event, which will protect residents and infrastructure. Additionally, implementing measures to manage vegetation surrounding buildings can significantly reduce the risk of fires spreading

Definitions

- *Wildland Urban Interface (WUI):* area where various structures, usually private homes, and other human developments meet or are intermingled with wildland (vegetative) fuels or can be impacted by the heat transfer mechanisms of a wildfire, including ember transport. In British Columbia, WUI mapping considers a minimum 2 km buffer zone representing the distance that wildfire embers could reasonably travel to a structure.
- *WUI fire:* a wildfire that has spread into the WUI, which may or may not include ignition and burning of structures.

Recommended Strategies

~~.~~Following the National Guide F~~f~~or Wildland-Urban Interface Fires consult an experienced wildfire resilience expert to develop project specific recommendations~~-~~ and implement recommended strategies.

Resources

- *National Guide For Wildland-Urban Interface Fires* is intended to mitigate the growing risk of damage and loss due to WUI fires by improving the resilience of buildings, infrastructure and communities to wildfire.

- ~~*FireSmart BC's Fire-resistant Plant Tool* includes tables of plants that do not provide significant fuel or increase fire intensity, as well as a list of fire hazard plants that should be avoided on site.~~
- ~~*FireSmart BC Landscaping Guide* provides a comprehensive overview of landscaping design and maintenance practices to increase the wildfire resiliency of properties.~~
- *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

- ~~t~~A signed letter from the Architect declaring that the requirements will be met.
- Copy of the qualified professional's report.

Required Documentation: Submit at the *Occupancy Permit* phase

- Narrative and documentation explaining how the qualified professional's recommendations have been implemented.

CLIMATE ADAPTATION

CA Credit 3.1: Refuge ~~Space~~ Area & Back-up Power — 3 points

Requirement

Ensure the multi-purpose indoor space required as part of REAP P&E P1 (Project Community Amenity Spaces) is equipped to serve as a refuge space. The space should be a separate room that includes operable windows, access to electrical outlets, and basic kitchen amenities including refrigeration and cooking appliances. **AND**

Provide a minimum of 72 hours of back-up power to the refuge area ensuring access to electricity as well as heating, cooling, and potable water. Design for protection from power outages from the grid, through strategies including switching gear and/or power hook-ups. Back-up power provision should be provided by either:

- Infrastructure for temporary generators **– 2 points; OR**
- Installed, on-site generator or combined supply from on-site generator and on-site renewable energy and storage system (on-site renewable energy limited to maximum 50% of supply) **- 3 points**

Intent

To mitigate the impact of power outages for occupants by providing a safe gathering place with access to power for essential services including lighting, heating and cooling systems,- potable water, and adequate ventilation.

Rationale

Climate change is increasing the severity and frequency of extreme weather events, which frequently result in power outages. An indoor community refuge area provides a designated space for vulnerable residents to gather during power outages or other emergency events. Backup power to the refuge space provides for services essential to occupant well-being allowing residents to remain safe and relatively comfortable in the refuge space for at least 72 hours.

A refuge space with backup power enables residents to gather in a temperature-controlled space to share information and access critical resources allowing during the event. This includes electrical outlets to charge electronics, internet access, refrigeration to safety store medication and food items, potable water supply, and basic food preparation equipment.

Definitions

- *Refuge space*: room designated as safe, gathering place for building residents that provides access to essential services.
- *Back-up power:* backup power is provided to meet non-life safety requirements that are considered essential for occupant well-being (e.g. water supply, heating, cooling), such that occupants can remain in spaces safely and with a degree of comfort for at least 72 hours.

Recommended Strategies

- Consider locating the refuge space in a north-facing area of the building to reduce cooling demands during summer.
- Consider occupancy limits in the refuge space and provide guidance for future property management teams on how to coordinate access. Access should be prioritized for most vulnerable building residents, with the intention for temporary use to access services not available in individual units.
- 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

- City of Toronto's *Minimum Backup Power Guidelines for MURBs* is a guideline highlighting practical solutions to provide essential backup power for MURB residents in the event of area-wide power outages.
- *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 or connection point for temporary generators.

CLIMATE ADAPTATION

CA Credit 4.1: Design for Social Connection — 2 points

Requirement

Implement at least four design strategies to promote social design outcomes from the "Building Social Connections Toolkit" in the categories of "Social Building Edges" and "Social Circulation" (Parts 4 and 5).

Intent

To improve community resilience by supporting~~To support~~ social wellbeing and a sense of place by offering safe, welcoming, and human-scale experiences with well-designed transition and/or circulation areas.

Rationale

A connected community is a resilient community. During climate emergency events, community-led actions, such as checking in on neighbours can help prevent some of the worst outcomes. Isolation is one of the biggest risk factors during climate emergency events. For example, during British Columbia's 2021 heat dome event, 56%[5] of those who died lived alone. Knowing who your neighbours are and who's vulnerable will help community members better protect themselves and others. Beyond emergency preparedness, increasing social connection will contribute to improved wellbeing and happiness among neighbourhood residents.

Building edges and circulation or transition spaces – like building entrances, lobbies, corridors, stairs, and publicly accessible spaces – are important for the social wellbeing and connection for residents. Around 1 in 4 residents make social connections in circulation spaces like lobbies, corridors, and elevators, and 1 in 5 residents connect in transition areas that provide private, semi-private, and public spaces. These areas should be designed to allow for opportunities for friendly, positive interactions between neighbours. The casual and repeated encounters encouraged by these spaces are critical to increasing social connectedness, which can eventually foster the types of connection that will bring about mutual support during climate emergency events.

Definitions

- *Building Edge:* The zone, boundary, or perimeter of the exterior of the building and transition between public and private space. This includes transition zones like building entrances.
- *Circulation Spaces:* Circulation spaces are areas that allow people to move around, including corridors, hallways, lobbies, foyers, atriums, elevators, and stairways.~~,~~

Recommended Strategies

- Careful attention to design and detail is necessary for building edges to feel friendly and human-scale.

[5] BC Coroners Service. (2022). 2021 Heat Dome Report. https://www.chf.bc.ca/2021-heat-dome-report/

- Provide visual variation through interesting opening design, materiality, and textures. Use architectural and landscape elements to contribute to both private and public spaces that allow for residents to interact.
- Provide comfortable seating areas, where shaded and/or places where occupants can rest their backs.
- Consider larger lobby spaces to provide social spaces for residents.
- Create accessible and comfortable circulation spaces that allow for social interaction.

Resources

- *Happy Cities Building Social Connections Toolkit* provides design strategies to help maximize social wellbeing and connection.
- *Happy Cities Building Social Connections Case Studies* provide examples of sociable design in multi-unit residential buildings, showing a wide range of design and policy approaches.
- *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

- Letter signed by the Architect stating that the requirements ~~have been~~will be met.
- Plans indicating the implementation of at least four social connection design strategies.

CLIMATE ADAPTATION

CA Credit 5.1: Urban Heat Island Mitigation — 2 points

Requirement

Nonroof and Roof Measures – **1 point**

Employ a combination of strategies for both nonroof and roof areas that meet the following criteria:

Area of Nonroof Measures/0.5 + Area of High-Reflectance Roof/0.75+ Area of Vegetated Roof/0.75 ≥ Total Site Paving Area + Total Roof Area

Options for Nonroof Measures:

• Use the existing plant material, and/or install plants or vegetated structures that provide shade over paved areas. Plants must be in place at the time of occupancy permit. Vegetated planters may be included; artificial turf is not permitted.

• Install architectural structures that provide shade. If the structure is a roof, an Aged Solar Reflectance (SR) ≥ 0.28 is required. For non-roof structures, an initial SR ≥ 0.33 is required. Shade structures which incorporate energy generation systems (e.g., photovoltaics) are exempt from SR requirements. SR values must be measured in accordance with ANSI/CRRC S100.

• Use paving materials with an initial solar reflectance (SR) value ≥0.33.

Options for Roof Measures:

Apply roofing materials with the following Solar Reflectance Index (SRI) values:

- Low-sloped roof (≤ 2:12 slope): Initial SRI of 82 OR aged SRI of 64.
- Steep-sloped roof (>2:12 slope): Initial SRI of 39 OR aged SRI of 32.
- Vegetated (Green) Roof: Install a vegetated roof using native or adapted plant species.

AND / OR

Wall Measures – **1 point**

Surface at least 60% of the building's gross exterior wall area (including vertical fenestration) with a 'cool-wall material'. The 'cool-wall material' must meet the following criteria:

• Initial solar reflectance (SR) ≥ 0.60.

• Initial thermal emittance ≥ 0.75.

• Must be opaque to sunlight.

• No more than 25% of the cool-wall area may be placed on the north-facing wall.

Intent

To reduce the urban heat island effect by mitigating heat absorption across building surfaces (walls, roofs, and nonroof areas), enhance climate resilience, reduce energy consumption, and improve comfort for building occupants and surrounding microclimates.

Rationale

Heat islands form when natural land cover is replaced by hardscape, which absorbs and retains heat, raising temperatures and energy demands. Reducing heat islands through reflective materials, shading, and vegetation helps to lower temperatures, improve indoor and outdoor

thermal comfort, and decrease cooling energy needs. Cool walls, which reflect sunlight and emit heat, are particularly effective in enhancing energy efficiency and building resilience in warmer climates.

Definitions

- *Roof Measures:* Strategies focused on roofing materials and structures that minimize heat retention, including high-reflectance and vegetated roofs. These measures aim to reduce heat absorption, enhance energy efficiency, and mitigate heat islands by increasing solar reflectance and cooling capacity.
- *Nonroof Measures:* Measures targeting ground-level surfaces such as pavements, walkways, and playgrounds to reduce solar heat absorption through shading and high-reflectance materials, contributing to overall site cooling.
- *(Initial) Solar Reflectance (SR):* Measures a material's ability to reflect solar energy from its surface, expressed as a value between 0 and 1, with higher values indicating better reflectance (e.g., a value of 0.60 indicating it reflects 60% of sunlight).
- *Aged Solar Reflectance:* The solar reflectance of a material after three (3) years; typically lower than the initial solar reflectance value.
- *Solar Reflectance Index (SRI):* A combined measure of solar reflectance and thermal emittance for roofs, typically expressed as a value between 0 and 100 (although values outside this range are possible).
- *Thermal Emittance:* A measure of a material's ability to emit absorbed heat. A value of 0.75 indicates that a material can emit 75% of the thermal radiation that a perfect black body would emit at the same temperature (note: A perfect black body absorbs 100% of the radiation that hits it).
- *Cool-Wall Material:* A wall material that reflects sunlight and emits thermal radiation, reducing heat buildup on building surfaces.

Recommended Strategies

Nonroof Measures:

Use native, drought-tolerant plants or shade structures to cool paved areas like walkways and courtyards. Select native or drought-tolerant species to reduce water use, and ensure trees or plants are mature enough to provide significant shade within 10 years. Use open-grid pavement systems (at least 50% unbound) to increase site permeability, support vegetation growth, and enhance site cooling. This system allows greenery to infiltrate paved areas, reducing heat retention and improving stormwater management.

Alternatively, a solar reflectance index (SRI) and solar reflectance (SR) weighted average approach may be used to calculate compliance.

Roof Measures:

Use native or adapted plant species for vegetated roofs to create a natural cooling system through shading and evapotranspiration. Vegetated roofs reduce peak cooling loads in summer and provide insulation year-round. For reflective roofs, suggested materials compatible with

SBS roofing (common on UBC residential buildings) include elastomeric, acrylic, silicone, and polyurethane coatings. Always verify product specifications to ensure compatibility with SBS membranes.

Roof areas intended for functional use (e.g., recreation courts) may follow nonroof measure requirements. Applicable roof area excludes roof area covered by mechanical equipment, solar energy panels, skylights, and any other appurtenances.

Alternatively, a solar reflectance index (SRI) and solar reflectance (SR) weighted average approach may be used to calculate compliance.

Walls:

Avoid concentrating cool wall materials on north-facing facades; instead, apply to the south and west facades to maximize cooling where solar heat gain is greatest. In wildfire-prone areas, choose fire-resistant plants and maintain vegetated walls carefully to enhance cooling benefits while mitigating fire risk in Vancouver's dry summer months. Vegetated walls may qualify as 'cool walls' for compliance purposes.

Resources

- *CRRC Rated Roof Product Directory* resources for selecting roof materials with certified solar reflectance and thermal emittance ratings.
- *CRRC Rated Wall Product Directory* resources for selection wall materials with certified solar reflectance and thermal emittance ratings.
- *ANSI/CRRC S100 Standard (formerly CRRC-1 Standard)* an American National Standard developed through a consensus process in accordance with ANSI and CRRC requirements that provides a consistent reference in energy and building codes regarding the measurement of the surface radiative properties of roofing materials. The standard covers specimen preparation and test methods for measuring the initial and aged solar reflectance and thermal emittance of roofing products.

Example tables that could be used to provide documentation are provided below.

1. Sample documentation of cool wall materials

Material #	Manufacturer	Model	Description	Initial solar reflectance[1](must be ≥ 0.60)	Initial thermal emittance[2] (must be ≥ 0.75)	Wall area covered (m^2)
1	Acme	Vanilla White	White acrylic paint field applied to fiber-cement walls at a dry film thickness of ~100 µm	0.61	0.90	800
2	-	-	-	-	-	-

[1] Solar reflectance shall be measured in accordance with (a) ASTM Standard E903-20 (https://doi.org/10.1520/E0903-20), weighting solar spectral reflectance with the solar spectral irradiance for a sun-facing vertical surface specified by ASTM Standard G197-14 (https://doi.org/10.1520/G0197-14);

(b) ASTM Standard C1549-16 (https://doi.org/10.1520/C1549-16), using instrument output AM1.5GV (labeled "1.590") based on the aforementioned solar spectral irradiance; or (c) Appendix 9 of the CRRC-1 Program Manual (https://coolroofs.org/documents/CRRC-1_Program_Manual.pdf), using instrument output "G197GT90" of the Surface Optics 410-Solar-i directional-hemispherical portable reflectometer (also based on the aforementioned solar spectral irradiance).

[2] Thermal emittance shall be measured in accordance with ANSI/CRRC Standard S100-2021 (https://coolroofs.org/product-rating/ansi-crrc-s100).

2. Sample documentation of cool wall coverage

A	Whole-building gross exterior wall area (m^2)	1,000
B	Whole-building cool-wall area (m^2)	800
C	Whole-building cool-wall area on north-facing wall (m^2)	200
D	Fraction of gross exterior wall area surfaced with cool-wall materials (D=B/A; must be ≥ 0.60)	80%
E	Fraction of cool-wall area sited on north-facing wall (E=C/B; must be ≤ 0.25%)	25%

Required Documentation: Submit at the *Building Permit* phase

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

Tier 1: Nonroof and Roof Measures:

- A report detailing the design strategies used for heat island mitigation, including shading, materials, and SR/SRI values for nonroof and roof measures.

Tier 2: Walls:

- Report for each cool-wall material its manufacturer, model, description, initial solar reflectance, initial thermal emittance, and wall area covered.
- Report gross wall and cool wall areas.

~~**Required Documentation: Submit at the *Occupancy Permit* phase**~~

- ~~Final report confirming as-built compliance with urban heat island mitigation strategies, including material certifications and verification of vegetated areas.~~

Required Documentation: Submit at the *Occupancy Permit* phase

- Final report confirming as-built compliance with urban heat island mitigation strategies, including material certifications and verification of vegetated areas.

MATERIALS AND RESOURCES

M&R P1: Zero Waste Ready — Precondition

Requirement

1. Design buildings to be zero waste ready by providing dedicated *resident recycling areas* for the collection and storage of waste, recyclable materials and organics as follows:
    - Design the areas in accordance with the Metro Vancouver Technical Specifications (see link in Resources section). Include a hand sanitizer station in each recycling and garbage area.
    - 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. Minimize the number of doors that need to be opened on the ~~the~~ travel route to recycling areas.
    - 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 to provide equal convenience for each waste material.
    - Provide clear visual cues and signage in appropriate languages to support residents in correct sorting of waste materials.
2. 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. Ensure bins are returned to recycling areas in a timely manner.
3. Provide a recycling and organics collection guide in the homeowner's guide and in the resident recycling areas in appropriate languages.

AND

4. Provide for the adequate collection of the following materials by contracting with a waste management services provider, ensuring adequate servicing frequency to prevent bin overflows, and maintain cleanliness of recycling areas:
    - Mixed paper, cardboard, mixed containers and glass.
    - Food scraps and accepted organic materials.
    - Optional collection: soft plastics, styrofoam, dog waste 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. Composting organic waste reduces the volume of materials sent to municipal landfills, reducing landfill greenhouse gas emissions and providing organic material to enrich soils. Decisions to relegate many materials to the waste stream occur at the household level. By

making it easier to recycle or compost materials, 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~~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 information on the available services and the number, type, and size of recycling bins that will be needed. This should be done 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.
- *https://www.myuna.ca/sustainability/* Includes information 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 resident recycling areas in the building.
- Letter signed by the Architect declaring that the resident recycling area requirements will be met including a narrative describing how the requirements will be met.

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.

MATERIALS AND RESOURCES

M&R P2: 10% Embodied Carbon Reduction

Precondition

Requirement

Perform a Whole Building Life Cycle Assessment (wbLCA) to ~~of the project's structure and enclosure and following the~~ demonstrate a reduction of at least 10% in global Warming Potential (embodied carbon). The wbLCA shall be completed in accordance with UBC's ~~Whole Building Life Cycle Assessment~~ Embodied Carbon Guidelines ~~v1.1~~ v2.0. ~~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 cradle-to-grave impacts, excluding operational energy and water use and addressing optional 'beyond system boundary' impacts separately.~~

Intent

To encourage life cycle thinking in designing multi-unit residential buildings, reduce embodied carbon from cradle to grave stages and ~~to~~ support continued evaluation of benchmarks for embodied carbon emissions and other environmental impact categories.

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 future 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.

Environmental impact 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 wbLCA practitioners with expertise in conducting wbLCA 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.
- Minimize ~~-~~parking in the basement to reduce substantial materials in walls around the parking spaces.
- Reduce unnecessary finish materials, like flooring and ceiling products, where possible
- Invest in durable and suitable windows, roofing and other materials to reduce emissions related to maintenance and replacement.
- Reduce waste through careful specification and buying with takeback agreements.

Resources

- UBC Embodied Carbon Guidelines v2.0 provides guidelines for conducting whole building life-cycle analysis for proposed and baseline design.
- National Whole-Building Life cycle ~~Asssessment~~Assessment Practitioner's Guide ~~-~~provides guidance for reporting of embodied carbon in Canadian Building Construction.
- *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.

- *Carbon leadership Forum's Low Carbon Material Sourcing* provides links to low carbon products with EPD's in British Columbia.

Required Documentation: Submit at the *Building Permit* phase

- WbLCA report and the submittals listed in the UBC Embodied Carbon Guidelines v2.0.
- A letter signed by the developer declaring credit requirements will be met.

MATERIALS AND RESOURCES

M&R P3: Construction and Demolition Waste Reduction — 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: Responsible Materials — 4 points

Requirement
Meet one or more of the following selection criteria:
Product transparency- 1 point
Use at least 20 different, permanently installed products sourced from at least five manufacturers that have published Environmental Product Declarations (EPD's) conforming to ISO 14025, ISO 21930, or EN 15804. EPD's must report LCA Modules A1-A3 (Cradle-to-Gate) at a minimum. EPD's shall be non-expired, or can be shown to have been valid at the time of relevant material procurement.
AND/OR

Responsibly sourced wood- 1 point
~~**AND/OR**~~
50% of wood products must be FSC, CSA Z809, or salvaged.

AND/OR
Local Materials –2~~1~~ points
20% or more of the materials must be local, based on cost of the total materials value.

Intent
To encourage transparency and the use of products and materials for which life-cycle information is available, encourage environmentally responsible forest management and to support regional economies.

Rationale

For buildings to have lower environmental impact and promote human wellbeing the building products need to be carefully selected. In addition to ~~chossing~~choosing lower carbon products other aspects are important to material selection including product transparency, responsible sourcing and local ~~materail~~material selection.

Definitions

Product transparency: is the practice of being honest and clear about a product, including its ingredients, sourcing, and sustainability.

Local materials: must be extracted, harvested or recovered, and manufactured within 1000 kilometers of construction site.

Responsibly sourced wood: comes from forests that are managed sustainably and ethically. This means that the wood is harvested in a way that minimizes environmental impact and protects wildlife and communities.

Recommended Strategies

- Contact manufacturers as early as possible to ask for documentation.
- Select products that have published EPD'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.

Manufacturer's cut sheets for each material selected ~~to meet the credit requirements~~.

- Materials construction costs and calculations showing how credit requirements are being met.

MATERIALS AND RESOURCES

M&R Credit 2.1: Embodied Carbon Optimization — 10 points

Requirement

Perform a Whole Building Life Cycle Assessment (wbLCA) in accordance with UBC's Embodied Carbon Guidelines v2.0 and demonstrate a reduction in Global Warming Potential (embodied carbon) of at least:

20% - 2 points; 25% - 4 points; 30% - 6 points; 35% - 8 points; 40% - 10 points

AND/OR

Modules A1-A3 Materials Actuals (EPD's) - 1 Point

For the 10 materials with the highest LCA Module A1-A3 impacts within the wbLCA, compile EPD's (as defined in M&R 1.1) for the specific products being installed and update wbLCA accordingly.

AND/OR

Modules A1-A3 Materials Actuals (Quantities) – 2 Points

For the 5 materials with the highest LCA Module A1-A3 impacts within the wbLCA, compile actual quantities of the specific products delivered to site and update wbLCA accordingly.

AND/OR

Module A4 Transportation Actuals - 1 Point

For the 5 materials with the highest LCA Module A4 impacts within the wbLCA, document actual primary shipping routes, distances, and mode(s) of transportation, and update wbLCA accordingly.

AND/OR

Module A5.2 Construction Activities Actuals- 1 Point

Document actual energy (electricity & fuel) usage required for key on-site Construction activities (Excavators, Crane(s), Temporary Heating, & Temporary Power) that are under the direct control of the primary Contractor and/or a single major subcontractor and update wbLCA accordingly.

AND/OR

Module A5.3 Construction Waste Actuals - 1 Point

Utilizing the waste data gathered for M&R P3 Construction and Demolition Waste Reduction, update wbLCA accordingly.

AND/OR

Inclusion of Non-Required Elements within wbLCA – up to 5 Points from below;

Expand the scope of the wbLCA to include:

Interiors (Interior Construction, Interior Finishes, & Millwork) – 2 Points

Services (Conveying, Plumbing, HVAC [Including Refrigerants], Fire Protection, & Electrical) - 4 Points Sitework (Site Preparation & Site Improvements) – 1 Point

A maximum of 10 points are available for this credit using a combination of approaches.

Intent

To encourage life cycle thinking in designing multi-unit residential buildings, reduce embodied carbon from cradle to grave stages and ~~to the~~ support continued evaluation of benchmarks for embodied carbon emissions and other environmental impact categories.

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 future 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 (~~WB~~wbLCA):* A technique to assess environmental impacts associated with the stages of a product's life.
- *Environmental Impact 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 practitioners with expertise in conducting wbLCA 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.
- Minimize parking in the basement to reduce substantial materials in walls around the parking spaces.
- Reduce unnecessary finish materials, like flooring and ceiling products, where possible.
- Invest in durable and suitable windows and roofing materials to reduce emissions related to maintenance and replacement.
- Reduce waste through careful specification and buying with takeback agreements.

Resources

- UBC Embodied Carbon Guidelines v2.0 provides guidelines for conducting whole building life-cycle analysis for proposed and baseline design.
- National Whole-Building Life cycle ~~Assessment~~Assessment Practitioner's Guide provides guidance for reporting of embodied carbon in Canadian Building Construction.
- *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.
- *Carbon leadership Forum's Low Carbon Material Sourcing* provides links to low carbon products with EPD's in British Columbia.

Required Documentation: Submit at the *Building Permit* phase

- WbLCA report and the submittals listed in the UBC Embodied Carbon Guidelines v2.0.
- A letter signed by the developer declaring credit requirements will be met.

MATERIALS AND RESOURCES

M&R Credit 3.1: Mass Timber/ Hybrid Superstructure — 2 points

Requirement
Specify and install a building superstructure consisting of at least 50% mass timber ~~manufactured in BC~~ by mass or value of the total superstructure.

Intent

To encourage the use of mass timber construction and promote value added wood products.

Rationale

For high-rise buildings mass timber can provide a pathway to reduced embodied emissions, with the added benefits of improved thermal performance, enhancement of occupant well-being (biophilic benefits) and increased prefabrication opportunities. Promotion of mass timber can help move engineered wood solutions into the mainstream as a structural choice for buildings.

Definitions

Superstructure: floor structural frame, floor decks, slabs and toppings: balcony floor construction, mezzanine floor construction; ramps; roof structural frame, roof decks, slabs and sheathing, canopy construction; stair construction, stair soffits.

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 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 *Building Permit* phase

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

Required Documentation: Submit at the *Occupancy Permit* phase

- Total value of the superstructure and the BC manufactured mass timber construction materials.

MATERIALS AND RESOURCES

M&R Credit 4.1: 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.

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~~Metro Vancouver, 40% of residential water use comes from indoor use, and approximately 19% of the total indoor water use ~~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 l~~L~~ow-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~~ conservation tips for the residential sector, including the adoption of non-potable water systems.
- *BC Hydro*: ~~Through the Power Smart at Home program,~~ BC Hydro provides resources on a wide range of energy and water saving strategies, including installing low-flow showerheads and aerators.

- *Non-Potable Water Systems - A Guidebook for the Metro Vancouver Region* provides an outline of best practices and resources to support an increase of non-potable water systems installations and the longevity of systems.
- *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.

Required Documentation: Submit at the Occupancy Permit phase

- Cut sheet from the fixture 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 using the WaterSense Water Budget Tool spreadsheet.

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 uses 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 WaterSense Water Budget Tool i*s used to calculate a baseline landscape water requirement (LWR).
- *The Irrigation Industry Association of British Columbia* fosters and promotes information exchange on a range of issues related to irrigation in BC.
- *EPA: WaterSense Labeled Controllers* provides information on two types of WaterSense labelled irrigation controllers.
- *Metro Vancouver* has outdoor water conservation 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 Water 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~~ with 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 appliances, such as 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.~~

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

In alignment with UBC's Integrated Rainwater Management Plan, detain the future 1:10 year condition and discharge at the lesser of 50% of the current 1:10 year peak flow or 100% of the current 1:5 year peak flow occurring during a 24-hour storm duration either on site or at a designated central facility, using low-impact development and green infrastructure as far as possible;

AND

Permeable surfaces should constitute at least 10% of the site area. The following surfaces are eligible: grass with 12" topsoil, planting areas with 24" topsoil, rain gardens, extensive vegetated roofs, swale, and pervious paving.~~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 now and in the future, 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~~system and promotes the health of nearby ecosystems and estuaries. UBC has developed a campus-wide Rainwater Management Plan which defines the site rainwater management requirements.

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 rather than building detention tanks.
- Provide a subsurface infiltration trench below permeable paving to enhance water infiltration into soils.
- Optimize infiltration and plant health with deep ~~a~~ soil layers that ~~is~~are 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.
- Obtain approval for Stormwater ~~Mangement~~Management Plan from UBC's Green Infrastructure Engineer

Resources

- ~~*Stormwater management at UBC*~~.
- *UBC's Integrated Stormwater Management Plan* ensures new developments are responding to the ecological needs of the local lands to help maintain or enhance water quality, meeting or exceeding municipal best practices. It provides implementation recommendations to reduce the flow of water and impacts of stormwater flows.
- *Government of British Columbia*: *Local government Stormwater Infrastructure* provides information and resources for integrated stormwater management practices, designs, and strategies.
- *U.S. EPA Technical Guidance on Implementing the Rainwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act* provides guidance for natural hydrology alterations and stormwater control and management.
- *The UBC Green Building Action Plan (GBAP)* provides goals and policy resources for the Water component area in residential buildings.
- *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.
- *SITES v2 Rating System For Sustainable Land Design and Development* is a rating system administered by the Green Business Certification Inc., which provides performance-based measures for sustainable and resilient landscape design.

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~~9 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~~2 point~~s~~**
- 40% reduction from baseline. – **~~2~~3 points**
- 45% reduction from baseline. – **~~3~~4 points**
- 50% reduction from baseline. – **~~4~~6 points**
- 55% reduction from baseline. – **~~7~~9 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 practi~~s~~ce 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 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~~cost-effective strategy.

Resources

- ~~*Metro Vancouver*~~ *Greater Vancouver Water District Water Supply System 2023 Annual Update* provides regional goals and data on regional water use.
- *Non-Potable Water Systems - A Guidebook for the Metro Vancouver Region* provides an outline of best practices and resources to support an increase of non-potable water systems installations and the longevity of systems.
- *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 ~~m~~Mechanical ~~e~~Engineer declaring that the requirement has been met.

WATER

W Credit 2.1: On-Site Rainwater Management — ~~4~~6 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~~3 points**
- Permeable surfaces on 50% of the site. **– ~~4~~6 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

- *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.

Resources

- ~~*Stormwater management at UBC*.~~
- *UBC's Integrated Stormwater Management Plan* ensures new developments are responding to the ecological needs of the local lands to help maintain or enhance water quality, meeting or exceeding municipal best practices. It provides implementation recommendations to reduce the flow of water and impacts of stormwater flows.
- *Government of British Columbia*: Local government Stormwater Infrastructure provides guiding principles of integrated stormwater management strategies.
- *U.S. EPA*~~:~~'s: *Technical Guidance on Implementing the Rainwater Runoff Requirements for Federal Projects under Section 438 of the Energy Independence and Security Act* provides a step-by-step framework to reduce stormwater runoff, to protect water resources and

maintain pre-development site hydrology by retaining rainfall on-site through infiltration, evaporation/transpiration, and re-use. This Technical Guidance also provides background information, key definitions, and case studies.

- *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 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 will be met.
- Letter signed by the Civil Engineer or responsible party declaring requirements has been 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 and/or**
- 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 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 Sustainability and Engineering upon request. All suite-level data is to be anonymized.~~

BIODIVERSITY

BIO P1: Ecological Planting **Precondition**

Requirement

1. **Plant selection:**
   - Select native or ~~adaptive~~ resilient 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 and establish healthy landscapes.
   - ~~-~~Select plants that are suited to the microclimate, including sun and shade conditions of the site and are drought tolerant~~-~~. Consider ~~-~~wildfire resilience in plant choices.
   - ~~-~~Include plants that are pollinators and provide a food source for birds.
2. **Soil volume and topsoil:**
   - Ensure minimum soil volume requirements are met as outlined in *Table 1: Soil Volume Requirement* from the UBC Campus Plan to support long-term plant health.
   - Select suitable topsoil that offers sufficient organic matter, drainage, and nutrient retention.

Intent

To promote low maintenance, resource-efficient landscapes that are climate adaptive, resilient, drought resistant, reduce pesticide use, and foster habitats for pollinators and birds, in addition to fulfilling the design intent.~~-~~

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* and other Musqueam plantings) for groundcover and consider limiting non-drought-tolerant grasses to 50% of landscaped area to meet the Canadian Landscape Standard (refer to UBC Campus Plan for planting guidance).
- 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 (refer to *Table 1* below).
- 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-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, as well as ~~and~~ both ~~over~~on-slab and off-slab environments, to create landscapes that are both well-adapted and ~~aesthetically~~ visually appealing~~pleasing landscapes~~.
- Use a variety of plants that bloom at different months throughout the year.

Table 1: Soil Volume Requirement*

Tree Size	Min. Soil Volume (m^3)	Shared Soil Volume (m^3)
Small Tree	8.0	6.0
Medium Tree	20.0	15.0
Large Tree	35.0	30.0

* From UBC Campus Plan

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~~100 ~~hardcopy~~digital download):* 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 Urban Tree List for Metro Vancouver in a Changing Climate* provides a list of over 300 tree species that have been assessed for their suitability to the current and projected future climate.
- *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.
- *Urban Agriculture Grow Guide* is a manual to help design urban agricultural projects on City of Vancouver publicly owned land.
- *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~~.
- A list of selected plants, soil depths, and soil test results.

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 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.~~

~~Required Documentation: Submit at the *Building Permit* phase~~

- ~~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

Meet Tier 4 requirements of the Bird Friendly Building Design Requirements (see *Table 1* below).
~~Identify bird collision risks in building and landscape design; and apply appropriate strategies to:~~
~~• 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.[6] 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.[7]

Table 1: Bird Friendly Building Design Requirements (2024) Tier 4*

	Requirement Level: TIER 4 (minimum)
% Glazing To Be Treated** to Eliminate All Fly Through Conditions***	100%
% Of All Glazing to Be Treated** ****	0%

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

[7] 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.

Requirements Near Vegetation and Water	Treat all glazing, from 0-16 m, immediately adjacent to existing bird habitat (e.g. stream, natural area) or known flight paths
Interior Lighting Requirements	Install occupancy sensors and/or task lights where possible Install interior blinds
Exterior Lighting Requirements	Install Dark Sky compliant fixtures
Grade Level Ventilation Grill Requirements	Grill porosity no greater than 20 mm x 20 mm or 40 mm x 10 mm

***** These requirements are based on CSA A460:19 Bird-friendly building design
****** An alternate to glazing treatment is to cover glazing with building integrated structure.
*** From 0-16 m or 4 m above height of tallest vegetation at maturity whichever is greater (include: guardrails and glazing 5 m from building corners).
**** From 0-16 m height or 4 m above tallest vegetation at maturity, whichever is greater.
Note: For % of glazing to be treated calculation: glazing directly behind balcony guardrails that are treated (for example fritted) can be counted as having an applied bird friendly strategy.

Definitions

Fly through conditions: Conditions ~~where~~which appear as clear paths for birds to fly towards, where they have ~~a~~ sight to the sky or ~~vegetation~~ habitat 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: 50 mm x 50 mm; 4 mm in diameter for individual elements or 2 mm wide by 8 mm 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 b*~~*Building integrated structure*: ~~Building integrated structures~~ An architectural element affixed to exterior surfaces that is used to create a visible barrier that birds can see and avoid; ~~that~~ features that cover window glass, including sunshades, screens, grills, mesh and nets and shutters.

Non-vision glass: Glazing materials such as spandrel glass or shadow boxes used to hide structural components of a building or to provide privacy while allowing natural light to enter.

Dark sky compliant: Outdoor lighting that minimizes glare and light trespass with reduced blue light emission or using fully shielded fixtures.

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 1 m from the surface; made of opaque or non-reflective transparent material that has been perforated with holes no greater than 50 mm 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 19 mm x 19 mm

Recommended Strategies

- Review the UBC Bird Friendly Building Design Guidelines to identify bird collision risk elements early on in the site plan and project design ~~early on~~stages.
- Implement bird friendly strategies (such as glass treatment or installation of building integrated structure) to meet ~~the~~ Tier 4 requirements.

Resources

- 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 UBC Bird Friendly Building Design Requirements (2024) provides design levels from Tiers 1 to 4, based on the CSA A460:19 Bird-Friendly Building Design Standard. New building designs and retrofits must meet one of these four tiers.
- *The UBC Bird Backgrounder* from the SEEDS Sustainability Program aligns with the UBC Bird Friendly Building Design Guidelines. It provides bird-friendly best practices and approaches on campus.
- 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.
- *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*~~ *The Pacific Coastal Campus* journal article 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.

~~**Required Documentation: Submit at the *Building Permit* phase**~~

~~- 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 Establishment and Maintenance Plans — 1 point**
   - Develop a landscape establishment plan that ensures successful initial planting and establishment, prioritizing plant health and appropriate placement; and
   - Develop a landscape~~A~~ maintenance plan that instructs maintenance contractors on the sustainable care ~~-~~of plants over the lifetime of the building and landscape.

   AND/OR
2. **Maximize ~~Native~~ Resilient Plantings — 1 point**
   - Provide a plant list that demonstrates that ~~7~~50% of the plantings (by number of plants) are native and of that at least~~list~~ 50% ~~-~~of the native plantings support pollinators such as hummingbirds, native bees, butterflies, moths, and bats.~~-~~

   AND/OR
3. **~~Pollinator Gardens~~Increase Tree Canopy through Appropriate Tree Planting — 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.~~Plant native deciduous trees with a caliper of 8 to 10 cm and wide, spreading canopies, and/or native coniferous trees at a minimum height of 1.5 m at the time of planting. These trees are intended to expand the tree canopy area to cover 10% of the site area at maturity, approximately 7 to 10 years after planting.

1. Develop ~~a~~ Landscape Establishment and Maintenance Plans — 1 point

Intent

To ensure healthy initial establishment and planting and to reduce the need for unnecessary, costly maintenance and harmful pesticides.

Rationale

Proper establishment and 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 establishment and maintenance plans ~~to~~ for the maintenance contractors ensures that there is a ~~long term~~long-term path to establishing ecologically sound landscapes.

Definitions

A *landscape establishment plan* is a document that outlines steps and strategies to ensure successful initial planting and establishment of landscape features, focusing on promoting plant and tree health, proper placement and layout, and optimal growth conditions. This includes strategies for plant health, soil preparation, irrigation, and proper placement and layout.

A *landscape maintenance plan* is a comprehensive guide for maintenance after establishment, specifying practices and steps for ongoing care and management of plants, ensuring long-term health and lifecycle of the landscape.

Recommended Strategies

- Devise a clear landscape establishment plan to address steps to establishing a lasting landscape, as a reference document.
- 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~~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 Establishment Plan specifying instructions for initial planting.

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~~ Resilient Plantings — 1 point

Intent

To establish low maintenance, water efficient landscapes and promote the conservation and survival of native plants and promote natural pollination by providing food and habitat for native pollinators.

Rationale

Native resilient plantings ~~is~~ are essential ~~to~~ for maintaining a healthy ecosystem. They require less irrigation, ~~help store~~contribute to carbon storage, and provide shelter and food for wildlife. Native plants that support pollinators are important as their population is rapidly declining due to loss of habitat and pesticide use on non-native species.

Recommended Strategies

- ~~Choose the right plants for the site conditions~~In addition to BIO P1: Ecological Planting, ensure native/resilient plants are prioritized to enhance ecological balance, selecting at least 50% of plants to be native.
- Incorporate a diverse range of plant species, ensuring at least 50% of the native plantings support pollinators, such as hummingbirds, native bees, butterflies, moths, and bats. Choose flowers and plants with a diversity of colours, shapes, heights, and sizes to attract different pollinators.
- Avoid planting large areas of turf grass or non-native species as they provide little food or shelter for pollinators.

Required Documentation: Submit at the *Building Permit* phase

- ~~•~~ Letter signed by the Landscape Architect declaring that the requirements will be met, including a ~~.~~
- ~~•~~ p~~P~~lant list highlighting that 50% of the plantings (by number of plants) are native ~~plants~~and of that list 50% of the native plantings support pollinators, listing pollinators that will be attracted to them.

3. ~~Pollinator Gardens~~Increase Tree Canopy through Appropriate Tree Planting — 1 point

Intent

To align with UBC's *Campus Vision 2050*, maintaining and enhancing urban biodiversity and ecological resilience, reducing the impacts of increased and extreme heat, and mitigating the urban heat effect by increasing tree canopy coverage on campus. ~~To promote the natural pollination of plants and provide food and habitats for native pollinators.~~

Rationale

Trees provide essential environmental and ecosystem services, including shade, carbon storage, stormwater management, and improved health and well-being. Each tree contributes to the urban forest, and measuring tree canopy cover helps determine the forest's size and the extent of services it provides. With the effects of climate change bringing hotter, drier summers and intense rainfalls, the urban forest plays a critical role in heat management by shading streets and buildings during hot days and heat waves, reducing the heat island effect and lowering temperatures. UBC aims to increase tree canopy cover to support increased biodiversity, climate adaption and resilience, and to enhance green landscapes and pedestrian connections. ~~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

- Prioritize tree planting in the initial design and establishment stage.
- Choose a variety of tree species, including native deciduous trees and native coniferous trees.
- ~~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, ~~-~~including location of tree plantings and coverage area calculations at maturity.
- ~~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~~100 ~~hardcopy~~digital download):* 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.
- *Campus Vision 2050* provides the key visions for UBC, addressing challenges and opportunities for the future of the campus, including visions on ecological resilience and biodiversity.

BIODIVERSITY

BIO Credit 2.1: Site Green Space — 1 point

Requirement
Dedicate 30% of the total site area (including the building footprint) to green space~~.~~ with 10% of the green space area designated for trees. Eligible green spaces include grass lawns, areas with plants and trees, vegetated roofs, balcony greenery, and 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 Ecological ~~ly Sound~~ Planting credit.
- Garden spaces dedicated to food production and pollination.
- Extensive or intensive vegetated roofs.
- 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 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

Part 1 – **2 points**

Meet Tier 3 requirements of the Bird Friendly Building Design Requirements.* ~~*Treat or cover by building integrated structure* a minimum of **55%** of all glazed surfaces (e.g., window glass, glass guardrails and windbreaks) of the building and surrounding glass structures up to a height of 16m or 4m above the tallest vegetation, 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)~~

OR~~or~~

Part 2 – **3 points**

Meet Tier 2 requirements of the Bird Friendly Building Design Requirements.* ~~*Treat or cover by building integrated structure* a minimum of **85%** of all glazed surfaces (e.g., window glass, glass guardrails and windbreaks) of the building and surrounding glass structures up to a height of 16m or 4m above the tallest vegetation, 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)~~

*See *Table 1* below

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 UBC campus.[8] 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.[9]

Table 1: Bird Friendly Building Design Requirements (2024) Tier 3 & 2*

	Requirement Level: TIER 3	Requirement Level: TIER 2
% Glazing To Be Treated to**	100%	100%

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

[9] 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.

Eliminate All Fly Through Conditions* **		
% Of All Glazing to Be Treated ** ** **	55%	85%
Requirements Near Vegetation and Water	Treat all glazing, from 0-16 m, that is between 2 and 20 m from large areas of vegetation (over 100 m2) and/or water features	Treat all glazing, form 0-16 m, that is between 2 and 20 m from vegetation and/or water features
Interior Lighting Requirements	Install occupancy sensors and/or task lights where possible Install interior blinds	
Exterior Lighting Requirements	Install Dark Sky compliant fixtures	
Grade Level Ventilation Grill Requirements	Grill porosity no greater than 20 mm x 20 mm or 40 mm x 10 mm	

* These requirements are based on CSA A460:19 Bird-friendly building design
** An alternate to glazing treatment is to cover glazing with building integrated structure.
*** From 0-16 m or 4 m above height of tallest vegetation at maturity whichever is greater (include: guardrails and glazing 5 m from building corners).
**** From 0-16 m height or 4 m above tallest vegetation at maturity, whichever is greater.
Note: For % of glazing to be treated calculation: glazing directly behind balcony guardrails that are treated (for example fritted) can be counted as having an applied bird friendly strategy.

Definitions

Fly through conditions: Conditions ~~where~~which appear as clear paths for birds to fly towards, where they have ~~a~~ sight to the sky or ~~vegetation~~habitat 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: 50 mm x 50 mm; 4 mm in diameter for individual elements or 2 mm wide by 8 mm 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 b*~~*Building integrated structure*: An architectural element affixed to exterior surfaces that is used to create a visible barrier that birds can see and avoid; features that~~Building~~

~~integrated structures that~~ cover window glass, including sunshades, screens, grills, mesh and nets and shutters.

Non-vision glass: Glazing materials such as spandrel glass or shadow boxes used to hide structural components of a building or to provide privacy while allowing natural light to enter.

Dark sky compliant: Outdoor lighting that minimizes glare and light trespass with reduced blue light emission or using fully shieled fixtures.

To qualify as bird friendly treatment:

- S~~s~~unshades 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 1 m from the surface; made of opaque or non-reflective transparent material that has been perforated with holes no greater than 50 mm 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 19 mm x 19 mm.

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~~ Tier 3 and 2 requirements.

Resources

- The UBC Bird Friendly Building Design Guidelines (2019) provides a comprehensive list of cost-efficient, co-beneficial bird friendly building design strategies.
- The UBC Bird Friendly Building Design Requirements (2024) provides design levels from Tiers 1 to 4, based on the CSA A460:19 Bird-Friendly Building Design Standard. New building designs and retrofits must meet one of these four tiers.

~~*Potential Mitigation strategies for UBC*~~

- *The UBC Bird Backgrounder* from the SEEDS Sustainability Program aligns with the UBC Bird Friendly Building Design Guidelines. It provides bird-friendly best practices and approaches on campus.

- 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*~~ *The Pacific Coastal Campus* journal article 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.

~~**Required Documentation: Submit at the *Occupancy Permit* phase**~~

Required Documentation: Submit at the *Occupancy Permit* phase

- 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~~1.3 m^2 for ~~30~~10% 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 appropriate for food growing.

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~~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 1.2 m wide. Plots accessible from only one side should be a maximum of 0.9 m wide. ~~Length should be a minimum of 1.2m.~~ Provide good quality soil at least 45 cm deep. Ensure good drainage.
- Planters for food growing on rooftops should be a maximum of 1.2 m wide. Planters accessible from only one side should be a maximum of 0.9 m wide. ~~Length should be a minimum of 1.2m.~~ Provide good quality soil at least 60 cm deep. Ensure good drainage.
- Provide durable, high quality infrastructure and soil for the garden space to reduce the frequency of replacement.
- Food gardens ~~must~~ should 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.
- 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 *resident recycling areas* for the collection and storage of waste, recyclable materials and organics as follows:
    - Design the areas in accordance with the Metro Vancouver Technical Specifications (see link in Resources section). Include a hand sanitizer station in each recycling and garbage area.
    - 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. Minimize the number of doors that need to be opened on the the travel route to recycling areas.
    - 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 to provide equal convenience for each waste material.
    - Provide clear visual cues and signage in appropriate languages to support residents in correct sorting of waste materials.
2. 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. Ensure bins are returned to recycling areas in a timely manner.
3. Provide a recycling and organics collection guide in the homeowners guide and in the resident recycling areas in appropriate languages.

AND

4. Provide for the adequate collection of the following materials by contracting with a waste management services provider, ensuring adequate servicing frequency to prevent bin overflows, and maintain cleanliness of recycling areas:
    - 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. Composting organic waste reduces the volume of materials sent to municipal landfills, reducing landfill greenhouse gas emissions and providing organic material to enrich soils.

Decisions to relegate many materials to the waste stream occur at the household level. By making it easier to recycle or compost materials, 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 information on the available services and the number, type, and size of recycling bins that will be needed. This should be done 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.
- *https://www.myuna.ca/sustainability/* Includes information 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 resident recycling areas in the building.
- Letter signed by the Architect declaring that the resident recycling area requirements will be met including a narrative describing how the requirements will be met.

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.

MATERIALS AND RESOURCES DRAFT

M&R P2: Embodied Carbon Reductionporting **Precondition**

Requirement

Perform a Whole Building Life Cycle Assessment (wbLCA) of the project's structure and enclosure and following the demonstrate a reduction of at least 10% in global Warming Potential (embodied carbon). The wbLCA shall be completed in accordance with UBC's Whole Building Life Cycle Assessment Embodied Carbon Guidelines v1.1 v2.0. 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 cradle-to-grave impacts, excluding operational energy and water use and addressing optional 'beyond system boundary' impacts separately.

Intent

To encourage life cycle thinking and assessment in designing multi-unit residential buildings, reduce the potential environmental impactsembodied carbon from cradle to grave stages and to the support continuedestablishment evaluation of a benchmarks for embodied carbon emissions and other environmental impact .categories.

Rationale

WbbLCA 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 future 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 (wbWBLCA):* 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.
- *Environmental impact 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 wbwhole-building LCA practitioners with expertise in conducting wbhole-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. Minimize or have parking in the basement to reduce substantial materials in walls around the parking spaces.
- Reduce unnecessary finish materials, like flooring and ceiling products, where possible
- Invest in durable and suitable windows, roofing and other materials to reduce emissions related to maintenance and replacement.
- Reduce waste through careful specification and buying with takeback agreements.

Definitions

- *Whole Building Life-Cycle Assessment (WBLCA):* A technique to assess environmental impacts associated with the stages of a product's life.
- *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).

Resources

- UBC Embodied Carbon Guidelines v2.0 provides guidelines for conducting whole building life-cycle analysis for proposed and baseline design.
- National Whole-Building Life cycle Asssessment Practitioner's Guide provides guidance for reporting of embodied carbon in Canadian Building Construction.
- *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 v1.1 provides guidelines for conducting whole building life-cycle analysis for proposed and baseline design.

- Carbon leadership Forum's Low Carbon Material Sourcing provides links to low carbon products with EPD's in British Columbia.

Required Documentation: Submit at the *Building Permit* phase

- WbBLCA report and the submittals listed in the UBC Embodied CarbonWhole Building Life Cycle Assessment Guidelines v2.01.1.
- A letter signed by the developer declaring credit requirements will be met.

MATERIALS AND RESOURCES

M&R P3: Construction and Demolition Waste Reduction — 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: Responsible y Sourced Materials — 23 points

Requirement

Meet one or more of the following selection criteria:

Product transparency- 1 point

Use at least 20 different, permanently installed products sourced from at least five manufacturers that have published Environmental Product Declarations (EPD's) conforming to ISO 14025, ISO 21930, or EN 15804. EPD's must report LCA Modules A1-A3 (Cradle-to-Gate) at a minimum. EPD's shall be non-expired,or can be shown to have been valid at the time of relevant material procurement.

AND/OR

Responsibly sourced wood- 1 point

AND/OR

50% of wood products must be FSC, CSA Z809, or salvaged.

AND/OR

Local Materials –1 point

20% or more of the materials must be local, based on cost of the total materials value.

.

Specify and use 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)
- 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)

*See list of REAP recognized RSCS and EMS *Materials construction budget is defined as all materials costs and excludes labour, soft costs and land.

"Materials construction budget" is defined as all material costs and excludes labor, soft costs, and land. Declare products and salvaged materials may be counted at twice their value.*Building component examples: Floor covering, insulation, sheathing, framing, interior drywall, concrete, roofing, siding.*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 impactsTo encourage transparency and the use of products and materials for which life-cycle information is available,, and harm to ecological

health. encourage environmentally responsible forest management and to support regional economies.

Rationale

For buildings to have lower environmental impact and promote human wellbeing the building products need to be carefully selected. In addition to chossing lower carbon products other aspects are important to material selection including product transparency, responsible sourcing and local materail selection.
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

Product transparency: is the practice of being honest and clear about a product, including its ingredients, sourcing, and sustainability.

Local materials: must be extracted, harvested or recovered, and manufactured within 1000 kilometers of construction site.

Responsibly sourced wood: comes from forests that are managed sustainably and ethically. This means that the wood is harvested in a way that minimizes environmental impact and protects wildlife and communities.

*"*Materials construction budget*" is defined as all material costs and excludes labor, soft costs, and land..

- 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.
- Reclaimed material: includes salvaged, refurbished or reused materials, wood from landfill or water bodies.
- Extended producer responsibility program: Products purchased from a manufacturer (producer) that participates in an extended producer responsibility program or is directly responsible for extended producer responsibility.

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.

Contact manufacturers as early as possible to ask for documentation.

Select products that have published EPD'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 sheets for each material selected to, indicating how the material meets the credit requirements.
- Materials construction costs and calculations showing how credit requirements are being met.

MATERIALS AND RESOURCES

M&R Credit 1.22.1: Embodied Carbon Reduction Optimization **106 points**

Requirement

Perform a Whole Building Life Cycle Assessment (wbLCA) in accordance with UBC's Embodied Carbon Guidelines v2.0 and demonstrate a reduction in Global Warming Potential (embodied carbon) of at least:

20% - 2 points; 25% - 4 points; 30% - 6 points; 35% - 8 points; 40% - 10 points

AND/OR

Modules A1-A3 Materials Actuals (EPD's) - 1 Point

For the 10 materials with the highest LCA Module A1-A3 impacts within the wbLCA, compile EPD's (as defined in M&R 1.1) for the specific products being installed and update wbLCA accordingly.

AND/OR

Modules A1-A3 Materials Actuals (Quantities) – 2 Points

For the 5 materials with the highest LCA Module A1-A3 impacts within the wbLCA, compile actual quantities of the specific products delivered to site and update wbLCA accordingly.

AND/OR

Module A4 Transportation Actuals - 1 Point

For the 5 materials with the highest LCA Module A4 impacts within the wbLCA, document actual primary shipping routes, distances, and mode(s) of transportation, and update wbLCA accordingly.

AND/OR

Module A5.2 Construction Activities Actuals- 1 Point

Document actual energy (electricity & fuel) usage required for key on-site Construction activities (Excavators, Crane(s), Temporary Heating, & Temporary Power) that are under the direct control of the primary Contractor and/or a single major subcontractor and update wbLCA accordingly.

AND/OR

Module A5.3 Construction Waste Actuals - 1 Point

Utilizing the waste data gathered for M&R P3 Construction and Demolition Waste Reduction, update wbLCA accordingly.

AND/OR

Inclusion of Non-Required Elements within wbLCA – up to 5 Points from below;

Expand the scope of the wbLCA to include:

Interiors (Interior Construction, Interior Finishes, & Millwork) – 2 Points

Services (Conveying, Plumbing, HVAC [Including Refrigerants], Fire Protection, & Electrical) - 4 Points

Sitework (Site Preparation & Site Improvements) – 1 Point

A maximum of 10 points are available for this credit using a combination of approaches.

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 - 4 points **OR**
- Minimum 20% reduction for embodied carbon of the project's structure and enclosure in the proposed building compared to equivalent baseline building - 6 points
-

Intent

To encourage life cycle thinking and assessment in designing multi-unit residential buildings, reduce embodied carbon the potential environmental impacts from cradle to grave stages and to

the support continued evaluationestablishment of a benchmarks for embodied carbon emissions and other environmental impact categories.

Rationale

WbBLCA 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 future 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.
- *Environmental Impact 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 wbhole-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.
- MinimizeDo not build separate parking structures or have parking in the basement to reduce substantial materials in walls around the parking spaces.
- Reduce unnecessary finish materials, like flooring and ceiling products, where possible.
- Invest in durable and suitable windows and roofing materials to reduce emissions related to maintenance and replacement.
- Reduce waste through careful specification and buying with takeback agreements.

Resources

- UBC Embodied Carbon Guidelines v2.0 provides guidelines for conducting whole building life-cycle analysis for proposed and baseline design.
- National Whole-Building Life cycle Asssessment Practitioner's Guide provides guidance for reporting of embodied carbon in Canadian Building Construction.
- *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 *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 v1.1 provides guidelines for conducting whole building life-cycle analysis for proposed and baseline design.
- Carbon leadership Forum's Low Carbon Material Sourcing provides links to low carbon products with EPD's in British Columbia.
-

Required Documentation: Submit at the *Building Permit* phase

- WbBLCA report and the submittals listed in the UBC Whole Building Life Cycle AssessmenEmbodied Carbont Guidelines v2.01.1.
- A letter signed by the developer declaring credit requirements will be met.

MATERIALS AND RESOURCES

M&R Credit 3.1: Mass Timber/ Hybrid Superstructure — 2 points

Requirement

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

Intent

To encourage the use of mass timber construction and promote value added wood products. 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. For high-rise buildings mass timber can provide a pathway to reduced embodied emissions, with the added benefits of improved thermal performance, enhancement of occupant well-being (biophilic benefits) and increased prefabrication opportunities. Promotion of mas timber can help move engineered wood solutions into the mainstream as a structural choice for buildings.

Definitions

Superstructure: floor structural frame, floor decks, slabs and toppings; balcony floor construction, mezzanine floor construction; ramps; roof structural frame, roof decks, slabs and sheathing, canopy construction; stair construction, stair soffits.

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 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 *Building Permit* phase

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

Required Documentation: Submit at the *Occupancy Permit* phase

- Total value of the superstructure and the BC manufactured mass timber construction materials.

MATERIALS AND RESOURCES

M&R Credit 4.11.4: 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 Thermal Comfort Modelling and Design — Precondition

Requirement

The building design must meet thermal comfort requirements for 2050's. Buildings with mechanical cooling systems must follow requirementsuse the 2050's summer design temperature specified in ArticleSection 2.4 of the UBC Indoor Thermal Environment Technical Guidelines (Vancouver November 2023) and report maximum hours exceeding acceptability limits using a 2050's weather file with the mechanical cooling disabled. OR

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 future climate weather files for the 2050's (RCP 8.5 scenario).

Intent

To meet summertime thermal comfort requirements for future climate conditions and avoid experiencing significant overheating over the building lifetime and to provide information on future overheating risks to inform design and UBC policy.

Rationale

The UBC Indoor Thermal Environmental Technical Guidelines provide future shifted summer design temperatures, ensuring that cooling system designs will meet future climate conditions. In addition, Tthe 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. 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. CWEC files are provided by Natural Resources Canada and based on measured historical weather data.
- *Pacific Climate Impacts Consortium (PCIC) Weather Files*: PCIC provides weather datasets based on the CWEC files that have been future-shifted to represent projected future climate conditions under an RCP 8.5 scenario. The 2050's file reflects projected typical conditions for the 2040-2070 time period.

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. An alternate future weather file, representing a typical meteorological year for a similar future time period, may be used with the approval of UBC Sustainability and Engineering.

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.
- *BCBC Technical Bulletin B24-08* discusses strategies on passive cooling and additional context on code cooling requirements.
- *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.
- A preliminary BC Step Code Part 3 Design Checklist using 2050's weather files in Excel format.

Required Documentation: Submit at the *Occupancy Permit* phase

- A letter signed by the Architect or Engineer declaring that the building design will meet summertime thermal comfort requirements for 2050's.
- Report showing results of future climate modelling and design strategies used for the as-built building design.
- An as-built BC Step Code Part 3 Design Checklist using 2050's weather files in Excel format.

CLIMATE ADAPTATION

CA P2: Climate Ready Energy Efficient Design — Precondition

Requirement

Meet a Cooling Energy Demand Intensity (CEDI) target 25 kWh/m^2-yr using 2050 future climate weather files (RCP 8.5) and following Energy Step Code energy modelling requirements.

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 with passive design measures in place are expected to experience reduced risk of overheating in a power outage.

Definitions

- *Cooling Energy Demand Intensity (CEDI)*: The annual cooling energy demand for space conditioning and conditioning of ventilation air per unit area. This includes both latent and sensible cooling output from cooling equipment. CEDI does not consider 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 P3: Design for Wildfire Risk Reduction

Precondition

Requirement

Implement the following design, construction and operation measures to reduce risk from wildfire events:

- Design building entry and exits that can be operated manually
- Roof materials should satisfy Class A of CAN/ULC-S107, standard test methods for Fire Tests of Roof coverings
- Cladding materials must be ignition-resistant, with a flame spread rating of less than 25, and all penetrations in the exterior wall cladding should be sealed with no gaps greater than 3mm
- Finishes for eaves, soffits and roof projections must be non-combustible materials
- Vents must resist the intrusion of flames and embers and should be screened with non-combustible wire mesh (openings no larger than 3mm)
- Decks, balconies and other building attachments must be constructed from materials that are non-combustible (or combustible materials, such that construction is solid and continuous without slots or other openings larger than 3mm)
- Screens, rails and shelters within 10m of the building should be constructed using non-combustible materials
-
- Landscaping within 1.5 m from the building face should include 100% less fire-prone native plant species, wherever possible
- Trees must be planted at a minimum distance of 2 m from all building faces
- Irrigation systems should be in good working order and temporary irrigation should left in place and beyond the plant establishment period
- All combustible debris must be removed from planting beds as part of regular landscape maintenance

I Intent

To limit the probability of building ignition and reduce the risk ofminimize damage to building structure or components from local wildfires and to establish fuel management measures around buildings.

Rationale

Extreme wildfire risk in western Canada continues to increase due to warmer temperatures and summer drought conditions. In Canada, the impacts of climate change areThis is expected to contribute to an increase in the length of fire seasons and increased wildland fire risk in areas that have not historically experienced significant wildland fire hazards. Human- and lightning-caused fire occurrence and area burned by wildland fires are expected to increase (given environmental and population changes), as are incidences of larger, more intense wildland fire events . Fire seasons are becoming longer, starting earlier, and exhibiting more frequent

extreme fire hazard weather . Further, an increase in WUI fires places greater stress on wildland firefighting capacity, particularly when significant investments are at risk of being destroyed by fire and critical infrastructure becomes vulnerable. Incidents of unmanageable fires and the number of fires that escape initial attack are further expected to increase under changing climate conditions.

WUI fires can result in the ignition of numerous structures over a short period of time through the spread of flames, radiant heat and burning embers. Implementing construction and design and construction measures to new buildings provides mitigation against potential ignition and/or damage during local wildfire event, which will protect residents and infrastructure.The construction measures required will provide risk mitigation. Additionally, implementing measures to manage vegetation surrounding buildings can significantly reduce the risk of fires spreading

Definitions

- *Wildland Urban Interface (WUI):* area where various structures, usually private homes, and other human developments meet or are intermingled with wildland (vegetative) fuels or can be impacted by the heat transfer mechanisms of a wildfire, including ember transport. In British Columbia, WUI mapping considers a minimum 2 km buffer zone representing the distance that wildfire embers could reasonably travel to a structure.
- *WUI fire:* a wildfire that has spread into the WUI, which may or may not include ignition and burning of structures.
- *Ignition-resistant:* [in relation to building materials] resists ignition or sustained flaming combustion sufficiently to reduce losses from WUI conflagrations under worst-case weather and fuel conditions with WUI fire exposure of burning embers and small flames
- *Non-combustible:* [in relation to building materials] meets the acceptance criteria of CAN/ULC-S114, “Test for Determination of Non-Combustibility in Building Materials”

Recommended Strategies

Select appropriate building materials to meet the building construction requirements. Examples of relevant testing methodologies that materials could comply with can be found in Chapter 3 of NRC's "National Guide for Wildland-Urban Interface Fires".

While completing requirements for BIO P1: Ecological Planting precondition, layer on considerations to select fire-resistant plants and materials (e.g. mulch), adjust plant spacing and reduce spaces where embers can accumulate.

Devise a clear landscape maintenance plan to pass on to maintenance contractors that establishes measures to reduce risky vegetative fuel on the building site.

Resources

- *National Guide For Wildland-Urban Interface Fires* is intended to mitigate the growing risk of damage and loss due to WUI fires by improving the resilience of buildings, infrastructure and communities to wildfire.

- 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.
- *FireSmart BC's Fire-resistant Plant Tool* includes tables of plants that do not provide significant fuel or increase fire intensity, as well as a list of fire hazard plants that should be avoided on site.

- *FireSmart BC Landscaping Guide* provides a comprehensive overview of landscaping design and maintenance practices to increase the wildfire resiliency of properties.
- *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

- Architectural and landscape drawings and/or cut sheets showing how the requirements will be met for each design or construction measure.
- A signed letter from the Architect with a narrative describing how the measures have been implemeneted and declaring that the requirements will be met.
- Letter signed by the Landscape Architect declaring that the requirements will be me

Required Documentation: Submit at the *Occupancy Permit* phase

- Copy of the WUI Fire Risk Reduction Landscape Maintenance Plan specifying fuel management measures, directed to the landscape maintenance contractor/strata.

CLIMATE ADAPTATION

CA Credit 1.1: 2050 Climate Ready Energy Efficient Design — 57 points

Requirement

Meet a Cooling Energy Demand Intensity (CEDI) target using 2050 future climate weather files (RCP 8.5), and following BC Energy Step Code energy modelling requirements as follows:

- 25 kWh/m2-yr – **2 points**
- 20 kWh/m2-yr – **24 points**
- 15 kWh/m2-yr – **57 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 higherreduced risks of overheating in a power outage.

Definitions

- *Cooling Energy Demand Intensity (CEDI)*: The annual cooling energy demand for space conditioning and conditioning of ventilation air per unit area. This includes both latent and sensible cooling output from cooling equipment. Note that CEDI does not account forconsider 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.~~
- ~~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 1.22.1: Enhanced Design for Wildfire Risk Reduction Enhanced Resiliency **3 points**

Requirement

Comply with NRC's "National Guide for Wildland-Urban Interface Fires" Chapter 3 3.1-3.4 by using consultation from a qualified professional and implementing recommended strategies.

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 limit the probability of building ignition and reduce the risk ofminimize damage to building structure or components from local wildfires and to establish fuel management measures around buildings.

To establish fuel management measures around buildings toTolocal .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

Extreme wildfire risk in western Canada continues to increase due to warmer temperatures and summer drought conditions. This is expected to contribute to an increase in the length of fire seasons and increased wildland fire risk in areas that have not historically experienced significant wildland fire hazards. Human- and lightning-caused fire occurrence and area burned by wildland fires are expected to increase (given environmental and population changes), as are incidences of larger, more intense wildland fire events. Fire seasons are becoming longer, starting earlier, and exhibiting more frequent extreme fire hazard weather. Further, an increase in WUI fires places greater stress on wildland firefighting capacity, particularly when significant investments are at risk of being destroyed by fire and critical infrastructure becomes vulnerable. Incidents of unmanageable fires and the number of fires that escape initial attack are further expected to increase under changing climate conditions.

WUI fires can result in the ignition of numerous structures over a short period of time through the spread of flames, radiant heat and burning embers. Implementing construction and design and construction measures to new buildings provides mitigation against potential ignition and/or damage during local wildfire event, which will protect residents and infrastructure.The construction measures required will provide risk mitigation. Additionally, implementing measures to manage vegetation surrounding buildings can significantly reduce the risk of fires spreading

. 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.

Definitions

- *Wildland Urban Interface (WUI):* area where various structures, usually private homes, and other human developments meet or are intermingled with wildland (vegetative) fuels or can be impacted by the heat transfer mechanisms of a wildfire, including ember transport. In British Columbia, WUI mapping considers a minimum 2 km buffer zone representing the distance that wildfire embers could reasonably travel to a structure.
- *WUI fire:* a wildfire that has spread into the WUI, which may or may not include ignition and burning of structures.

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.

Following the National Guide for Wildland-Urban Interface Fires consult an experienced wildfire resilience expert to develop project specific recommendations and implement recommended strategies.

Resources

- *National Guide For Wildland-Urban Interface Fires* is intended to mitigate the growing risk of damage and loss due to WUI fires by improving the resilience of buildings, infrastructure and communities to wildfire.

- *FireSmart BC's Fire-resistant Plant Tool* includes tables of plants that do not provide significant fuel or increase fire intensity, as well as a list of fire hazard plants that should be avoided on site.

FireSmart BC Landscaping Guide provides a comprehensive overview of landscaping design and maintenance practices to increase the wildfire resiliency of properties.

- *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.

https://www2.gov.bc.ca/assets/gov/public-safety-and-emergency-services/wildfire-status/prevention/prevention-home-community/bcws_homeowner_firesmart_manual.pdf

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Required Documentation: Submit at the *Building Permit* phase

- tCompleted 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.

Copy of the qualified professional's report

Required Documentation: Submit at the *Occupancy Permit* phase

Narrative and documentation explaining how the qualified professional's recommendations have been implemented.

CLIMATE ADAPTATION

CA Credit 1.33.1: Refuge AreaSpace & Back-up Power On Site Backup Power **3 points**

Requirement

Ensure the multi-purpose indoor space required as part of REAP P&E P1 (Project Community Amenity Spaces) is equipped to serve as a refuge spacearea. The space should be a separate room that includes include operable windows, access to electrical outlets, and basic kitchen amenities including refrigeration and cooking appliances. **AND**

PProvide a minimum of 72 hours of energy storage / back-up power to the refuge spacearea ensuring access to electricity as well as heating, cooling, and potable water.
Design for protection from power outages from the grid, through strategies including permanent back-up power, switching gear and/or power hook-ups. Back-up power provision should be provided by either:

- I, and infrastructure for temporary generators **– 2 points; OR**
- Installed, on-site generator or combined supply from on-site generator and on-site renewable energy and storage system (on-site renewable energy limited to maximum 50% of supply) **- 3 points**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 providing a safe gathering place with access to power for essential services includingpreventing reduced functionality of building lighting, heating and cooling systems, and ensuring access to potable water, and adequate ventilation, and maintenance of the security system..

Rationale

Climate change is increasing the severity and frequency of extreme weather events, which frequently result in power outages. An indoor community refuge area provides a designated space for vulnerable residents to gather during power outages or other emergency events. Backup power to the refuge space provides for services essential to occupant well-being allowing residents to remain safe and relatively comfortable in the refuge space for at least 72 hours.Power outages are increasing during severe weather events. Site backup power can provide a level of resilience and safety for occupants.

A refuge space with backup power enables residents to gather in a temperature-controlled space to share information and access critical resources allowing during the event. This includes electrical outlets to charge electronics, internet access, refrigeration to safety store medication and food items, potable water supply, and basic food preparation equipment.

Definitions

- *Refuge space*: room designated as safe, gathering place for building residents that provides access to essential services.

- *Back-up power:* backup power is provided to meet non-life safety requirements that are considered essential for occupant well-being (e.g. water supply, heating, cooling), such that occupants can remain in spaces safely and with a degree of comfort for at least 72 hours.

Recommended Strategies

- Consider locating the refuge space in a north-facing area of the building to reduce cooling demands during summer.
- Consider occupancy limits in the refuge space and provide guidance for future property management teams on how to coordinate access. Access should be prioritized for most vulnerable building residents, with the intention for temporary use to access services not available in individual units.
- 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

- City of Toronto's *Minimum Backup Power Guidelines for MURBs* is a guideline highlighting practical solutions to provide essential backup power for MURB residents in the event of area-wide power outages.
- *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.

CLIMATE ADAPTATION

CA Credit 4.1: Design for Social Connection — 2 points

Requirement

Implement at least four design strategies to promote social design outcomes from the "Building Social Connections Toolkit" in the categories of "Social Building Edges" and "Social Circulation" (Parts 4 and 5).

Intent

To support social wellbeing and a sense of place by offering safe, welcoming, and human-scale experiences with well-designed transition and/or circulation areas.

Rationale

Building edges and circulation or transition spaces – like building entrances, lobbies, corridors, stairs, and publicly accessible spaces – are important for the social wellbeing and connection for residents. Around 1 in 4 residents make social connections in circulation spaces like lobbies, corridors, and elevators, and 1 in 5 residents connect in transition areas that provide private, semi-private, and public spaces. These areas should be designed to allow for opportunities for friendly, positive interactions between neighbours.

Definitions

- *Building Edge:* The zone, boundary, or perimeter of the exterior of the building and transition between public and private space. This includes transition zones like building entrances.
- *Circulation Spaces:* Circulation spaces are areas that allow people to move around, including corridors, hallways, lobbies, foyers, atriums, elevators, and stairways.

Recommended Strategies

- Careful attention to design and detail is necessary for building edges to feel friendly and human-scale.
- Provide visual variation through interesting opening design, materiality, and textures. Use architectural and landscape elements to contribute to both private and public spaces that allow for residents to interact.
- Provide comfortable seating areas, where shaded and/or places where occupants can rest their backs.
- Consider larger lobby spaces to provide social spaces for residents.
- Create accessible and comfortable circulation spaces that allow for social interaction.

Resources

- *Happy Cities Building Social Connections Toolkit* provides design strategies to help maximize social wellbeing and connection. provides design strategies to help maximize social wellbeing and connection, including indoor and outdoor social amenity spaces.
- *Happy Cities Building Social Connections Case Studies* provide examples of sociable design in multi-unit residential buildings, showing a wide range of design and policy

approaches. provide examples of sociable design in multi-unit residential buildings, showing a wide range of design and policy approaches.

- *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

- Letter signed by the Architect stating that the requirements have been met.
- Plans indicating the implementation of at least four social connection design strategies.

CLIMATE ADAPTATION

CA Credit 5.1: Urban Heat Island Mitigation

2 points

Requirement

Nonroof and Roof Measures – **1 point**

Employ a combination of strategies for both nonroof and roof areas that meet the following criteria:

Area of Nonroof Measures/0.5 + Area of High-Reflectance Roof/0.75+ Area of Vegetated Roof/0.75 ≥ Total Site Paving Area + Total Roof Area

Alternatively, a solar reflectance index (SRI) and solar reflectance (SR) weighted average approach may be used to calculate compliance.

Options for Nonroof Measures:

- Use the existing plant material, and/or install plants or vegetated structures that provide shade over paved areas (including playgrounds) on the site within 10 years of planting. Plants must be in place at the time of occupancy permit. Vegetated planters may be included; artificial turf is not permitted.
- Use shade structures that incorporate energy generation systems, such as photovoltaics or solar thermal collectors.
- Install architectural devices or structures that provide shade. If the device or structure is a roof, an aged solar reflectance (SR) of at least 0.28 is required. For non-roof devices and structures, an initial SR of at least 0.33 is required. Shade structures which incorporate energy generation systems (e.g., photovoltaics) are exempt from SR requirements. SR values must be measured in accordance with ANSI/CRRC S100.
- Use vegetated structures to provide shade over hardscape.
- Use paving materials with an initial solar reflectance (SR) value of at least 0.33.
- Install open-grid pavement systems where at least 50% of the area is unbound.

Options for Roof Measures:

- High-Reflectance Roof: Apply roofing materials with the following Solar Reflectance Index (SRI) values:
    - Low-sloped roof (≤ 2:12 slope): Initial SRI of 82 OR aged SRI of 64.
    - Steep-sloped roof (>2:12 slope): Initial SRI of 39 OR aged SRI of 32.
    - Vegetated (Green) Roof: Install a vegetated roof using native or adapted plant species.
    - Steep-sloped roof (>2:12 slope): Initial SRI of 39 OR aged SRI of 32.

- Vegetated (Green) Roof: Install a vegetated roof using native or adapted plant species. Roof areas intended for functional use (e.g., recreation courts) may follow nonroof measure requirements. Applicable roof area excludes roof area covered by mechanical equipment, solar energy panels, skylights, and any other appurtenances.

AND / OR

Wall Measures – **1 point**

Surface at least 60% of the building's gross exterior wall area (including vertical fenestration) with a 'cool-wall material'. The 'cool-wall material' must meet the following criteria:

• Initial solar reflectance (SR) of at least ≥ 0.60.
• Initial thermal emittance of at least ≥ 0.75.
• Must be opaque to sunlight.
• No more than 25% of the cool wall area may be placed on the north-facing wall.
• Vegetated walls may qualify as 'cool walls' for compliance purposes.

Intent

To reduce the urban heat island effect by mitigating heat absorption across building surfaces (walls, roofs, and nonroof areas), enhance climate resilience, reduce energy consumption, and improve comfort for building occupants and surrounding microclimates.

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

Heat islands form when natural land cover is replaced by hardscape, which absorbs and retains heat, raising temperatures and energy demands. Reducing heat islands through reflective materials, shading, and vegetation helps to lower temperatures, improve indoor and outdoor thermal comfort, and decrease cooling energy needs. Cool walls, which reflect sunlight and emit heat, are particularly effective in enhancing energy efficiency and building resilience in warmer climates.

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

Definitions

- *Roof Measures:* Strategies focused on roofing materials and structures that minimize heat retention, including high-reflectance and vegetated roofs. These measures aim to reduce heat absorption, enhance energy efficiency, and mitigate heat islands by increasing solar reflectance and cooling capacity.
- *Nonroof Measures:* Measures targeting ground-level surfaces such as pavements, walkways, and playgrounds to reduce solar heat absorption through shading and high-reflectance materials, contributing to overall site cooling.
- *(Initial) Solar Reflectance (SR):* Measures a material's ability to reflect solar energy from its surface, expressed as a value between 0 and 1, with higher values indicating better reflectance (e.g., a value of 0.60 indicating it reflects 60% of sunlight).
- *Aged Solar Reflectance:* The solar reflectance of a material after three (3) years; typically lower than the initial solar reflectance value.
- *Solar Reflectance Index (SRI):* A combined measure of solar reflectance and thermal emittance for roofs, typically expressed as a value between 0 and 100 (although values outside this range are possible).

- *Thermal Emittance:* A measure of a material's ability to emit absorbed heat. A value of 0.75 indicates that a material can emit 75% of the thermal radiation that a perfect black body would emit at the same temperature (note: A perfect black body absorbs 100% of the radiation that hits it).
- *Cool-Wall Material:* A wall material that reflects sunlight and emits thermal radiation, reducing heat buildup on building surfaces.

Recommended Strategies

Nonroof Measures:

Use native, drought-tolerant plants or shade structures to cool paved areas like walkways and courtyards. Select native or drought-tolerant species to reduce water use, and ensure trees or plants are mature enough to provide significant shade within 10 years. Use open-grid pavement systems (at least 50% unbound) to increase site permeability, support vegetation growth, and enhance site cooling. This system allows greenery to infiltrate paved areas, reducing heat retention and improving stormwater management.

Alternatively, a solar reflectance index (SRI) and solar reflectance (SR) weighted average approach may be used to calculate compliance.

Roof Measures:

Use native or adapted plant species for vegetated roofs to create a natural cooling system through shading and evapotranspiration. Vegetated roofs reduce peak cooling loads in summer and provide insulation year-round. For reflective roofs, suggested materials compatible with SBS roofing (common on UBC residential buildings) include elastomeric, acrylic, silicone, and polyurethane coatings. Always verify product specifications to ensure compatibility with SBS membranes.

Roof areas intended for functional use (e.g., recreation courts) may follow nonroof measure requirements. Applicable roof area excludes roof area covered by mechanical equipment, solar energy panels, skylights, and any other appurtenances.

Alternatively, a solar reflectance index (SRI) and solar reflectance (SR) weighted average approach may be used to calculate compliance.

Walls:

Avoid concentrating cool wall materials on north-facing facades; instead, apply to the south and west facades to maximize cooling where solar heat gain is greatest. In wildfire-prone areas, choose fire-resistant plants and maintain vegetated walls carefully to enhance cooling benefits while mitigating fire risk in Vancouver's dry summer months. Vegetated walls may qualify as 'cool walls' for compliance purposes.

- 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

- *CRRC Rated Roof Product Directory* resources for selecting roof materials with certified solar reflectance and thermal emittance ratings.
- *CRRC Rated Wall Product Directory* resources for selection wall materials with certified solar reflectance and thermal emittance ratings.
- *ANSI/CRRC S100 Standard (formerly CRRC-1 Standard)* an American National Standard developed through a consensus process in accordance with ANSI and CRRC requirements that provides a consistent reference in energy and building codes regarding the measurement of the surface radiative properties of roofing materials. The standard covers specimen preparation and test methods for measuring the initial and aged solar reflectance and thermal emittance of roofing products.

Example tables that could be used to provide documentation are provided below.

- Sample documentation of cool wall materials

Material #	Manufacturer	Model	Description	Initial solar reflectance[1] (must be ≥ 0.60)	Initial thermal emittance[2] (must be ≥ 0.75)	Wall area covered (m^2)
1	Acme	Vanilla White	White acrylic paint field applied to fiber-cement walls at a dry film thickness of ~100 µm	0.61	0.90	800
2	-	-	-	-	-	-

[1] Solar reflectance shall be measured in accordance with (a) ASTM Standard E903-20 (https://doi.org/10.1520/E0903-20), weighting solar spectral reflectance with the solar spectral irradiance for a sun-facing vertical surface specified by ASTM Standard G197-14 (https://doi.org/10.1520/G0197-14); (b) ASTM Standard C1549-16 (https://doi.org/10.1520/C1549-16), using instrument output AM1.5GV (labeled "1.590") based on the aforementioned solar spectral irradiance; or (c) Appendix 9 of the CRRC-1 Program Manual (https://coolroofs.org/documents/CRRC-1_Program_Manual.pdf), using instrument output "G197GT90" of the Surface Optics 410-Solar-i directional-hemispherical portable reflectometer (also based on the aforementioned solar spectral irradiance).

[2] Thermal emittance shall be measured in accordance with ANSI/CRRC Standard S100-2021 (https://coolroofs.org/product-rating/ansi-crrc-s100).

- Sample documentation of cool wall coverage

A	Whole-building gross exterior wall area (m^2)	1,000
B	Whole-building cool-wall area (m^2)	800
C	Whole-building cool-wall area on north-facing wall (m^2)	200
D	Fraction of gross exterior wall area surfaced with cool-wall materials (D=B/A; must be ≥ 0.60)	80%
E	Fraction of cool-wall area sited on north-facing wall (E=C/B; must be ≤ 0.25%)	25%

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

Tier 1: Nonroof and Roof Measures:

- A report detailing the design strategies used for heat island mitigation, including shading, materials, and SR/SRI values for nonroof and roof measures.

Tier 2: Walls:

- Report for each cool-wall material its manufacturer, model, description, initial solar reflectance, initial thermal emittance, and wall area covered.
- Report gross wall and cool wall areas.

Required Documentation: Submit at the *Occupancy Permit* phase

- Final report confirming as-built compliance with urban heat island mitigation strategies, including material certifications and verification of vegetated areas.

Note:
This Urban Heat Island Mitigation credit for UBC's Residential Environmental Assessment Program (REAP) has been modeled off LEED's Heat Island Reduction Sustainable Sites credit and Heat Island Mitigation with Cool Walls pilot credit. Please note that the requirements for covered parking (as specified in the LEED Heat Island Reduction Sustainable Sites credit) have been omitted as they are not applicable to the UBC REAP framework.

- 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~~**AND**
- Added features in outdoor spaces to increase recreational choices and activities (such as a BBQ area, comfortable seating or picnic tables etc.) in at least two locations; **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; floor area of 0.3% x the gross floor area, ~~and has a~~ (minimum ~~floor area of~~ 37.16 m² (400 sq ft)); **AND**~~.~~
- A community space for package delivery (in response to online shopping and food delivery services).

For multi-building projects, the community amenity spaces are not required to be in every building, as long as all occupants of each building are provided access to the required amenities. For multi-phase projects, it is acceptable to guarantee ~~-~~future access to community amenity spaces as long as their completion is targeted within one year of occupancy.

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 to help build a sense of community. Social wellbeing contributes to a sense of belonging and inclusion, contributing to the overall health and happiness of residents.

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.
- In multi-phase projects, each phase should have convenient and well-connected pathways to amenity spaces for easy access.

Resources

- ~~Happy City. (2018). Designed to Engage: Policy recommendations for promoting sociability in multi-family housing design.~~
- *Happy Cities Building Social Connections Toolkit* provides design strategies to help maximize social wellbeing and connection, including indoor and outdoor social amenity spaces.
- *Happy Cities Building Social Connections Case Studies* provide examples of sociable design in multi-unit residential buildings, showing a wide range of design and policy approaches.
- ~~City of Toronto. (2017). Planning for Children in New Vertical Communities.~~
- City of Toronto's *Planning for Children in New Vertical Communities* is an urban design guideline that provides design strategies for common indoor and outdoor amenity spaces.
-
- *City of Vancouver. (1992). High-Density Housing for Families with Children Guidelines* is a document that lists guidelines for high-density housing for families, including access to common indoor amenities and open spaces.
- *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~~.~~ ~~I~~, including a description of the rationale, strategies used, and programming possibilities for the amenity spaces.
- Plans indicating the implementation of each amenity.

PLACE AND EXPERIENCE

~~For~~ 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.
- ~~•~~ For multi-building projects, the community amenity spaces are not required to be in every building, as long as all occupants of each building are provided access to the amenities. For multi-phase projects, it is acceptable to guarantee future access to community amenity spaces as long as their completion is targeted within one year of occupancy.

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)~~0.3% x the gross floor area. **— 2 points**
- A designated bookable guest suite within the building near the lobby. **— 2 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 50% of indoor common spaces. **— 1 point**

Outdoor Amenities:

- ~~One~~An 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**

~~amenities. For multi-phase projects, it is acceptable to guaraentee future access to community iamenity spaces as long as their completion is targeted within one year of occupancy.~~

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. Social wellbeing contributes to a sense of belonging and inclusion, contributing to the overall health and happiness of residents.

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~~It 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.~~

- *Happy Cities Building Social Connections Toolkit* provides design strategies to help maximize social wellbeing and connection, including indoor and outdoor social amenity spaces.
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-
- *City of Vancouver. (1992). High-Density Housing for Families with Children Guidelines* is a document that lists guidelines for high-density housing for families, including access to common indoor amenities and open spaces.
- ~~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~~Plans ~~showing~~indicating the implementation of each amenity.

HEALTH AND WELLBEING

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

Requirement

Provide ~~the~~ bicycle parking according to the following:~~storage and facilities below:~~

- Provide Class ~~1~~I bicycle parking ~~storage facilities~~ at a rate of: 1.5 spaces per studio or one bedroom unit; 2.5 spaces per two~~2~~ bedroom unit; and 3 spaces per ~~3~~three or ~~4~~four bedroom unit~~s~~.
  - ~~(Requirements include~~ 10% of spaces to be oversize spaces~~,~~ to accommodate cargo bikes of other~~and one electrical outlet per two spaces)~~; **and**
  - One electrical outlet per 0.05 spaces with a minimum of two electrical outlets per room.
- ~~An in building~~At least one bicycle repair station in one of the Class I parking rooms; ~~**and**~~
- ~~0.5~~ Class ~~2~~II bicycle parking ~~storage~~ spaces at a rate of 0.2 spaces per dwelling unit; ~~**and**~~
- A ~~2 x 3 m~~ concrete pad outside the building, close to the building entrance, with a power supply~~standard outlet or conduit~~ for electrified bike share.
- All bike racks to be installed in accordance with details provided in UBC Campus Design Guidelines.

- ~~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~~ while ~~contributes~~ promoting ~~to~~ occupants' health and wellbeing.

Rationale

Bicycling is a healthy and sustainable alternative to ~~the~~ cars for short commute~~r distance~~s. Providing accessible and secure bicycle facilities promotes the use of bicycles as a~~n~~ viable~~alternative~~ mobility option. Bicycle parking and storage facilities also provide opportunity for spontaneous social interactions between small groups of neighbours helping strengthen social connection, wellbeing and resilience.

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 1.8 m 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.

- Include spaces that do not require people to lift their bike.

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.
- Happy Cities Building Social Connections Toolkit provides design strategies to help maximize social wellbeing and connection, including recommendations for bike facilities
- *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.

HEALTH AND WELLBEING

H&W P2: Low-Emitting Products

Precondition

Requirement

On the inside of the buildingS, inside the air barrier, 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.~~are EcoLogo certified or do not exceed the current VOC limits in the South Coast Air Quality Management District (SCAQMD) Rule #1168 ~~on the interior of the building~~.
-
- Paints and coatings rated at a minimum GPS-2 by the Master Painter's Institute (MPI) ~~on the interior of the building~~.
  -If no VOC limit is indicated for the product under GPS-2, show compliance with GPS-1.
  - For GPS-1 and GPS-2 ratings, if the paint or coating is not on the MPI approved products list, compliance to VOC content and chemical component restrictions must be shown by submitting product information sheets.

Intent

To reduce the quantity of indoor air contaminants that are odorous or potentially irritating and ~~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.
- *GPS-1 and GPS-2:* are the Master Painter's Institute~~MPI's~~ Green Performance Standard level 1 and level 2. The performance levels indicate the environmental friendliness of paints and coatings.. ~~GPS-1's VOC levels are generally aligned with LEED and SCAQMD requirements.~~
- ~~GPS-2: MPI's Green Performance Standard level 2.~~

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.

Resources

- *Master Painter's Institute* provides information on the practical and technical aspects of paints and coatings and their professional application. The link provides the MPI Approved Products List (APL).
- *Master Painter's Institute Environmental ~~Performace~~Performance* provides information on the ~~The 'Specify Green' section contains the~~ MPI "Green Performance ~~Rating~~ Standard" system for identifying low-emitting paints and GPS definitions.
- *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.

HEALTH AND WELLBEING

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 wildfire smoke, ~~airborne fine particulate matter, viruses and bacteria.~~traffic-related air pollution, and airborne pathogens.

Filter depth should be sufficient to enable building operators to switch to filters with a MERV 16 rating during wildfire smoke events.

Intent

To provide air filtration for the building ventilation system to address particulate matter pollution, including from wildfire smoke, traffic-related air pollution and airborne pathogens ~~primarily from wildfire smoke~~.

Rationale

Indoor air quality is impacted by a variety of particulate matter, including wildfire smoke, traffic-related air pollution, dust, pollen and airborne pathogens. Filtration systems can be very effective at removing particulate matter from outdoor air thus improving indoor air quality for building residents. MERV 13 rated filters significantly reduce particulate matter from dust and traffic-related air pollution and are readily available for use in building ventilation systems

Wildfire smoke brings strong odours and a significant concentration of harmful particulate matter. Climate change is increasing the frequency and severity of wildfires, as well as occurrences of wildfire smoke in British Columbia ~~Increasing wildfires in British Columbia due to climate change is resulting in periods high concentrations of harmful high particulate matter across the province~~, including at UBC's Point Grey campus. ~~MERV 13 rated filters reduce particulate matter significantly and are readily available for use in building ventilation systems~~. Although MERV 13 rated filters ~~are effective~~provide good overall protection from outdoor air pollutants, they are only about 50% efficient at filtering out wildfire smoke particles. MERV 16 rated filters however are capable of filtering 95% of wildfire smoke particles. There are significant up-front and operating costs associated with MERV 16 filters, and wildfire smoke events are isolated, seasonal events. Considering this, filtration systems should ~~systems should~~ enable the option to switch to MERV 16 rated filters ~~in case of~~during wildfire smoke events to ~~further reduce smoke, pollution, and airborne pathogens~~more effectively protect residents from wildfire smoke.

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 both MERV 13 and 16 ~~filtrations~~filters. Consider using deeper filters instead of pleated panel filters, which will enable building operators to temporarily install MERV 16 filters during a wildfire smoke event.

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:

- Before occupancy: Install new filtration media and flush-out the building by supplying an outside air volume of 4,267,140 litres per square metre of gross floor area; **OR** ~~**or**~~
- **During occupancy:** If occupancy is desired before the flush-out is completed, the space may be occupied only after delivery of a minimum of 1,066,260 liters of outdoor air per square meter of gross floor area. Once the space is occupied, it must be ventilated at a minimum rate of 1.5 liters per second per square meter of outdoor air. During each day of the flush-out period, ventilation must begin at least three hours before occupancy and continue during occupancy. These conditions must be maintained until a total of 4,-267, 140 liters of outdoor air per square meter has been delivered to the space; **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. Flush-out procedures undertaken before occupancy expel contaminants that may have accumulated in the building during construction.

Definitions

- *Flush-out*: 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 flush-out plan or an IAQ testing prior to construction start.
- Develop the construction schedule to accommodate flush-out or IAQ testing prior to occupancy.
- Include flush-out 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 flush-out 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~~parking at a rate of 0.25 spaces per bedroom; **or**
- Provide an at grade, Class I bicycle ~~storage~~parking 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.
- *Happy Cities Building Social Connections Toolkit* provides design strategies to help maximize social wellbeing and connection, including recommendations for bike facilities.
- *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 points

Requirement

Demonstrate connections to nature through direct visual connections (for example, glazing) 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 direct visual connections to nature visible from the living room and at least one bedroom.
- All ~~occupied~~ amenity spaces, ~~and~~ lobbies~~;~~, and 90% of building corridors above parkade level, with direct and/or indirect connections to nature.
- Long corridors over 10 m in length with direct visual connections to allow sunlight access and views of nature.

Intent

To enhance overall mental and physical well-being of occupants by relieving stress and mental fatigue through visually connecting to 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.[10]
- 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.

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

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.
- Floor plans showing connections to nature.

HEALTH AND WELLBEING

H&W Credit 5.1: Daylight Access — 2 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.[11] 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

[11] 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.

- Letter signed by the Architect declaring that requirements will be met.
- Floor plans showing calculations of transparent envelope glazing area to floor area.
- Shop drawings from the manufacturer showing the glazing systems' visible light transmittance.

HEALTH AND WELLBEING

H&W Credit 6.1: Active Living — 2 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~~ S~~s~~taircases 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 and helps to provide opportunities for social connection. 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.[12] Increased social connection provided by well-planned stairs helps increase ~~occupants~~

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

~~occupants'~~ mental wellbeing. Glazing in the stairwells provides natural lighting, which increases occupant safety during power outage events.

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.[13] 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.

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.

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

QUALITY

Q P1: Sustainability Commitment — Precondition

Requirement

Submit a "Sustainability Statement" that describes how the development will be designed to achieve high environmental standards related to UBC's Green ~~b~~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 ~~b~~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

- Sustainability 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~~**AND**
- Guidance on how to minimize energy, water, and resource use in everyday activities and choices throughout the home to promote sustainable behavior; ~~and~~**AND**
- Information on sorting and recycling in the building; **AND**
- Information on building resilience features and emergency information, such as refuge areas, evacuation measures, and exit locations;

~~And~~**AND**

- Ensure the manual is incorporated into record drawings or some form that will be accessible beyond the first generation of owners/residents; ~~and~~**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 including a narrative as to how CPTED recommendations have been implemented.
- Copy of CPTED practitioner review document.

QUALITY

Q P6: Integrated Design Workshop **Precondition**

Requirement

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

Hold a preliminary workshop during schematic design which meets the following~~based on the following REAP preliminary workshop design~~ requirements:

- Workshops should be~~Conduct a~~ facilitated ~~workshop/meeting which provides~~, and use~~ing~~ 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 analysis and water budget analysis to verify targets, performance benchmarks, and potential strategies to achieve project goals.
- Explore synergies among systems and components.
- Invitees to the workshop should include, appropriate members of the design team, a representative from UBC Sustainably & Engineering and the project manager.

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 developing synergistic strategies.

Recommended Strategies

- Become familiar with the integrated design process.
- Conduct preliminary research and analysis.
- Convene a preliminary workshop that focus~~s~~es 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 strategies.
- Document how analysis informed building and site design.

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 1.1: Durable Building — 4 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 2.1: Education and Awareness — 3 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~~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 publicly accessible, the tour can be from the exterior.
- Develop a short case study with images for inclusion on the 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 Sustainability & Engineering ~~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~~**OR**
Pilot ~~specific~~ a significant, measurable strategy or strategies from UBC's Green Building Action Plan, ~~the~~ the LEED Innovation Catalog or the LEED Pilot Credit Catalog.

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*.
- LEED Pilot Credits
- LEED Innovation Catalog

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 collaborate 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 SEEDsS 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~~:

- ~~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)~~
- gGoals, targets, indicator and actions in UBC's Green Building Action Plan: residential section (starts page 66) and the UBC Neighbourhood Climate Action Plan.

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 amongst developers, students, faculty, and the community.

Recommended Strategies

- Review the SEEDS website which has links to a wide array of projects for inspiration and information on past projects.
- Consult with project consultants 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.
The *UBC Green Building Action Plan*.

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.

Version 4.0
Residential Environmental Assessment Program