Pathway to a Net Positive Campus

UBC GREEN BUILDING ACTION PLAN

APPROVED BY THE UBC BOARD OF GOVERNORS ON SEPTEMBER 27TH, 2018

ACKNOWLEDGMENT

We acknowledge that the Vancouver campus is situated on the traditional, ancestral, and unceded territory of the xʷməθkʷəy̓əm (Musqueam) people.

sʔiːɬqəý qeqən (Double-Headed Serpent Post)"
Brent Sparrow Jr., Musqueam
PHOTOGRAPHER: UBC BRAND & MARKETING /HOVER COLLECTIVE

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Executive Summary

PATHWAY TO A NET POSITIVE CAMPUS

The University of British Columbia's (UBC's) Green Building Action Plan (GBAP) outlines a holistic pathway for academic and residential buildings at the UBC Vancouver campus to advance towards making net positive contributions to human and natural systems by 2035.

The GBAP plays a key role in pursuit of an exceptional built environment, one that will support the academic mission of teaching, learning and research and contribute to our sustainability goals on the academic campus and within residential neighbourhoods.

To implement the GBAP a series of goals, targets and actions have been developed that will direct staff to work towards achieving the GBAP vision: *By 2035, UBC's buildings will make net positive contributions to human and natural systems.*

THE SCOPE

The scope of the Green Building Action Plan covers institutional buildings on academic lands and residential and mixed use buildings in neighbourhoods at the Vancouver campus. Currently, on this campus, UBC owns and operates over 342 institutional buildings,[1] and its residential neighborhoods house 12,000 people in 73 multi-unit residential and mixed-use buildings. UBC is growing rapidly, and it is expected to significantly increase the number of new building projects and existing-building retrofit projects over the next 20 years. How these buildings are designed, constructed and operated will have significant impact on sustainability of the campus and the wellbeing of the people who study, work and live there. The GBAP is intended to provide guidance to ensure the design and construction of new buildings, renovations and retrofits achieve higher levels of performance that advance toward the net positive goal for human and ecological wellbeing and lower total cost of ownership for UBC.

[1] *With an area of over 500m².*

PLAN STRUCTURE AND COMPONENT AREAS

For both institutional and residential buildings, the GBAP provides ambitious goals, targets and actions in eight distinct but interrelated component areas: energy, water, materials and resources, biodiversity, health and wellbeing, quality, climate adaptation, and place and experience. The component areas represent an integrated approach to building design which promote whole systems thinking and leverage multiple benefits for single investments. Incremental improvements in each of these component areas will advance UBC towards a net positive campus.

In order to achieve the goals and targets in each of the component areas, a series of actions for UBC planning and operations staff are outlined with a delineation of roles and responsibilities across departments that were defined through consultation. The actions follow a structured cycle of research, benchmarking, piloting, implementation and monitoring to help inform policy and enable continuous improvement of UBC buildings.

In its ongoing work to advance sustainability and green building on campus, UBC has already progressed in some component areas, particularly energy, water, quality and some aspects of materials and resources. This progress has been integrated into existing policies and will be further advanced through the GBAP. However, other component areas such as biodiversity, materials and resources, climate adaptation, and health and wellbeing are emerging in nature. These component areas require foundational work to determine best practices to address the challenges and opportunities in an effective manner.

The Green Building Action Plan is based on a holistic approach which recognizes that energy efficiency and climate adaptation are priority considerations at UBC. Building energy efficiency has long been a focus at the University, and through the GBAP, further improvements in long-term cost savings and reduced greenhouse gas emissions will be achieved. The impacts associated with climate change on buildings are becoming more pressing with long term warming, more extreme weather events and changing precipitation patterns. Climate adaptive design is now recognised as an important direction for sustainability policy and green building at UBC. By integrating climate adaptability and resilience into the built environment, UBC will prepare for the climate impacts of rising temperatures and increased extreme weather events while generating co-benefits across component areas such as health and wellbeing.

Left-1: Rainwater Management Features on University Blvd.
PHOTOGRAPHER: DON ERHARDT
Left-2: Centre for Interactive Research in Sustainability - Living Wall
ARCHITECT: PERKINS+WILL
PHOTOGRAPHER: PHILIP BERTOGG

Operations Linked to Teaching, Learning and Research

The Green Building Action Plan provides an opportunity to harness expertise not only from various operational units but also from academic research. Teaching, learning and research opportunities have been identified within the GBAP's framework to help frame policy and investigate technical issues and large scale challenges such as climate change. Additionally, through the Campus as a Living Lab approach, UBC provides unique opportunities for academic engagement with buildings via the processes of planning, design, construction and operations which can help provide innovative operational solutions.

Policy and Process

Key to implementation of the GBAP is UBC's unique governance; the University has powers through the Board of Governors to manage the development and operation of campus buildings, landscapes and infrastructure. This form of governance allows for the implementation of forward looking plans such as the GBAP.

The Green Building Action Plan works across different scales, from building to district, in conjunction with other UBC plans that together support UBC's strategic goals. The implementation of the GBAP will be informed and complemented by these other UBC plans, such as the Campus Plan and Climate Action Plan, as well as relevant provincial and federal policies. At the same time, the GBAP will provide direction to future UBC policies.

Institutional Policies and Implementation Measures

Academic building development is guided in a significant way by the Vancouver Campus Plan. The Campus Plan Design Guidelines, which integrate sustainability best practices, will need to be reviewed and updated in the next amendment to align with the Green Building Action Plan goals in all component areas.

Existing building renovations and retrofits offer a significant impact in terms of achieving the goals of the GBAP because of the extent of the existing building stock. The GBAP clarifies performance targets and expectations for the renovation and retrofit of existing buildings.

The UBC Technical Guidelines will be the major guiding document to ensure that GBAP objectives for institutional projects are met in all component areas. These guidelines were created to ensure the quality and performance of design, construction, renovation and retrofit of institutional buildings, landscape and infrastructure. Since the guidelines are updated annually, this provides an opportunity to ensure annual integration and alignment with the GBAP.

All new campus construction and renewals at UBC are currently mandated by the Province of BC to be LEED Gold certified. Over the timeframe of the GBAP, necessary updates to the UBC LEED Implementation Guide and consideration of alternative certifications that align with UBC policy objectives (for example, Passive House and Well Building Standard certification) will be pursued.

Above: Earth Sciences Building Shades & Overhang
ARCHITECT: PERKINS+WILL
PHOTOGRAPHER: PHILIP BERTOGG

The Sustainability Process, which supports an integrated design process for institutional building projects, was introduced in 2013 to ensure more consistent integration of sustainability measures and to ensure key design disciplines are brought together to achieve a high level of sustainability performance in a streamlined manner. Integrated design is critical for the success of the GBAP to encourage whole-systems thinking early in the design process.

The Major Project Delivery Process at UBC is currently finalizing improvements. A priority action for the GBAP is for better integration of the Sustainability Process into the overall Major Capital Project Development Process in support of a more streamlined process for proponents.

Some areas of policy are emerging and will become integrated with policy over the life of the GBAP. In the areas of biodiversity, health and wellbeing, and climate adaptation, individual policies will be developed that will provide direction to and be informed by the GBAP.

Residential Policies and Implementation Measures

Neighbourhood plans govern development of UBC's campus residential areas. The plans establish specific requirements for the form of building development, density, park space, recreation and transportation land use, all consistent with UBC's Land Use Plan. Future neighbourhood plans at UBC, such as Stadium Road[2] and Acadia Park, will reflect the requirements set forward in the GBAP.

The Residential Environmental Assessment Program (REAP) is a UBC-specific green building rating system that applies to multi-unit residential buildings. REAP building requirements support the movement towards a net positive position—and a reduction of environmental impact at the building site and neighbourhood scales—incrementally, over time. All new residential projects, including private developments and rental housing, are required achieve a minimum REAP Gold certification. The GBAP proposes four amendments to REAP: REAP 3.1, REAP 3.2, REAP 4.0 and REAP 4.1.

REAP 3.1 is intended to apply to Wesbrook Place neighbourhood and refines measures that reduce energy demand at the building scale while pursuing low-carbon energy supply through the Neighbourhood District Energy System (NDES). Electric vehicle charging station requirements will also be updated to further support the use of zero-emission vehicles. The main purpose of this update is to align REAP with the British Columbia Building Code Energy Step Code (BC Energy Step Code). Enacted in 2017, the BC Energy Step Code allows municipalities to mandate the incremental steps of the code in regulations if they wish to require higher performance than code. Although UBC is not technically a municipality, Campus and Community Planning has determined that the best approach, legally and politically, is to align REAP energy credits with the BC Energy Step Code to ensure consistency with the rest of the province.

REAP 3.2 will update the weighting of impact areas within REAP (for example, energy, water, materials and resources, or innovation) to align with UBC's current policies. REAP 4.0 will be in place for the Stadium Road neighbourhood, and it will fine tune energy requirements and add credits for health and wellbeing, climate adaptation and biodiversity. REAP 4.1 is anticipated to add incremental improvements in each component area.

There are currently few policies, strategies or programs to guide the retrofitting of buildings within the UBC neighborhoods. As existing residential buildings age, they will require upgrades and retrofits, and this presents an opportunity to set forward performance requirements that achieve the goals of the GBAP for the extensive existing building stock. UBC will continue to work with the University Neighbourhood Association (UNA) and existing residential stratas to develop a retrofitting strategy for the neighbourhoods, which will align with the residential GBAP for UBC-owned-and-operated buildings.

[2] *Stadium Road Neighbourhood Plan is currently under development.*

Above: Wesbrook Neighbourhood **PHOTOGRAPHER:** PHILIP BERTOGG

Costs and Benefits Associated with the Plan

The financial case for the GBAP is growing rapidly, acknowledging the complexity of building development, policy and climate change. An investment in green, resilient buildings will pay long-term economic dividends through reducing carbon liabilities, improving human productivity and using resources efficiently.

For all component areas, efforts will be made to pilot and monitor all measures before adopting them as a policy to ensure that they can be achieved within the capital budgets allocated to building projects. For some component areas in the GBAP, third-party studies have been used to help provide cost inputs.

Energy and carbon are priorities in terms of reducing cost and impacts. Two UBC energy costing studies, one for institutional buildings and the other for residential buildings, have been completed to better understand cost effective energy efficiency measures.

Above all, the GBAP supports the achievement of sustainable environments that enhance wellbeing for people at UBC and beyond in support of UBC's fundamental academic mission.

Making It Happen

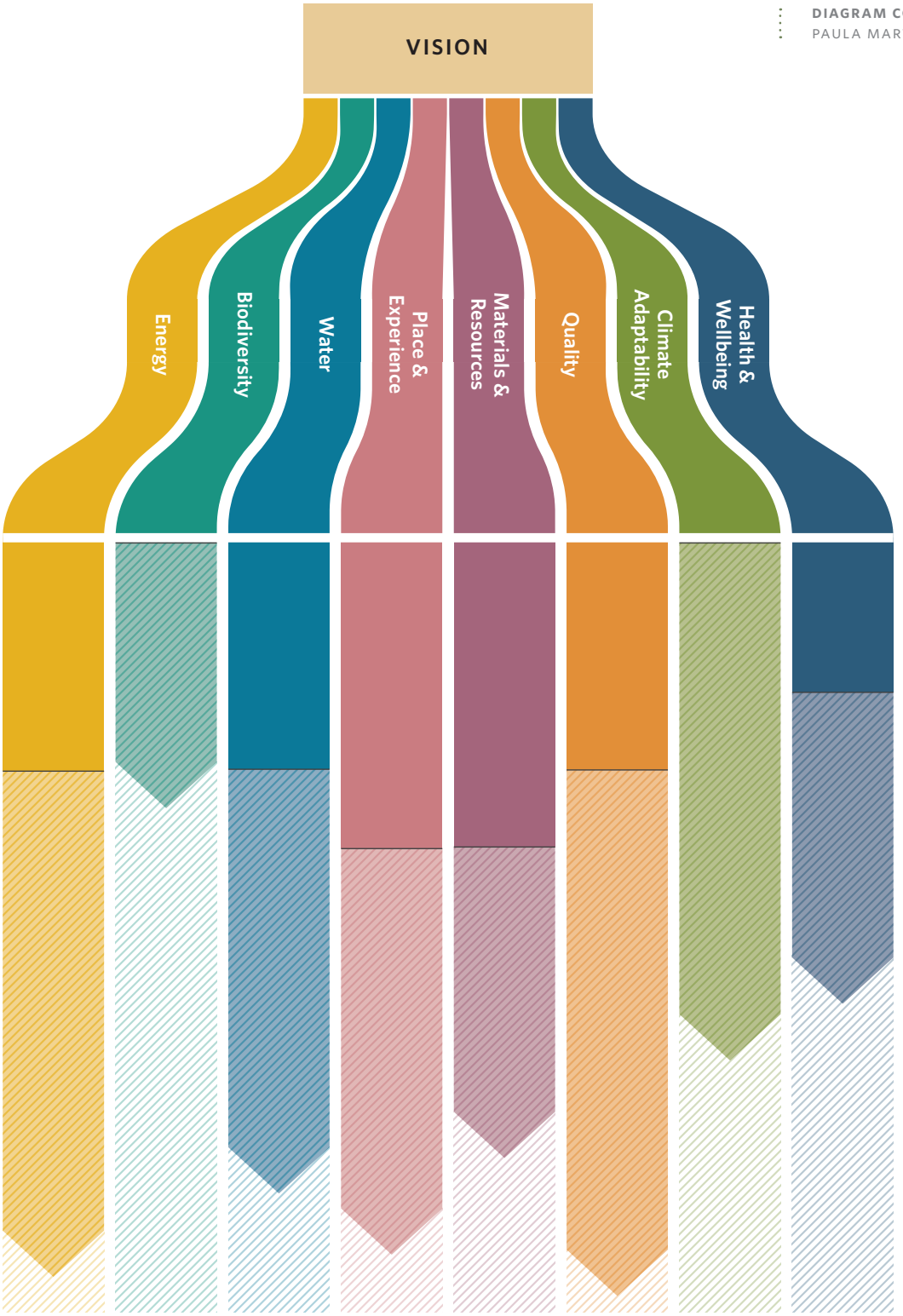
The development of the GBAP has included extensive engagement with UBC students, faculty, staff and residents as well as green building experts and government representatives to develop ideas for the future and better understand stakeholder aspirations linked with green building practices. With continued engagement, the implementation of the GBAP will be an ongoing and evolving process over the next 20 years, involving collaborations between multiple planning and operational departments at UBC and with academic researchers and external partners in order to implement new or update existing policies.

The success of the Green Building Action Plan is dependent on creating capacity with key agents of change, including developers and UBC departments. The GBAP lays the foundation, but continued stewardship is required and successful implementation will require sustained leadership, activity and investment.

Long-term Vision of Success

By 2035, the UBC Vancouver campus buildings will contribute towards a vibrant and sustainable campus that supports the academic mission. The physical campus will exhibit Campus as a Living Lab demonstration projects firmly tied to teaching, learning, and research, with an increased potential to lead to broader market transformation. A trajectory will be set for the building design, construction and operation along the pathway to achieving a net positive campus for human and natural systems. The GBAP will pay dividends in the long-term with lower energy bills, avoided control and damage costs of the environmental impacts of inaction, and reduced health costs. An iterative process that incorporates learning and experience between projects, will be established to advance performance targets and try new ideas, reinforcing an adaptive long term approach to operational planning. UBC will be a global leader in innovative green building design and construction and make net positive contributions to human and natural systems.

DIAGRAM CONCEPT:
PAULA MARTINEZ RUBIO



NET POSITIVE CAMPUS

Progress through existing sustainability policies as of 2018

Estimated progress through GBAP up to 2035

Remaining progress towards Net-Positve Campus

Vision and Roadmap

1. What is the Green Building Action Plan?

GREEN BUILDING ACTION PLAN VISION

By 2035, UBC's buildings will make net positive contributions to human and natural systems.

OVERVIEW

The University of British Columbia's (UBC's) Green Building Action Plan (GBAP) is a policy framework that will drive incremental improvements for buildings towards a vision of net positive ecological and human health in pursuit of an exceptional built environment that supports the academic mission of teaching, learning and research.

To implement the GBAP, component goals, targets and actions have been developed that will direct university staff to work towards achieving the vision: *By 2035, UBC's buildings will make net positive contributions to human and natural systems.*

UBC has a 25-year track record of advancing sustainability on campus, and through that experience has developed a keen understanding of the important role and impact of buildings in environmental and human wellbeing. The GBAP sets an ambitious vision for the campus, while providing processes and iterative steps to achieve it through the development of goals and targets in eight critical component areas of building design: energy, water, materials and resources, biodiversity, health and wellbeing, quality, climate adaptation, and place and experience.

The GBAP has been developed to help align campus development with UBC's strategic directions. The UBC Climate Action Plan 2020 first called for the development of a green building plan as a key opportunity to improve energy use and greenhouse gas emissions. The GBAP vision aligns with both the UBC 20-Year Sustainability Strategy, to embed regenerative sustainability[3] across the University, and the UBC Strategic Plan 2018–2028, to create buildings and environments that inspire people, ideas and actions for a better world.

The financial case for the GBAP[4] is growing rapidly, acknowledging the complexity of building development, policy and climate change. Indications are that an investment in green, resilient buildings will pay long-term economic dividends as carbon pricing, health impact costs and future climate change adaptation costs are assessed within the market.

The GBAP Scope

The 402-hectare Vancouver campus is a mix of institutional academic lands and residential neighbourhoods. Provincial legislation gives UBC's Board of Governors unique powers to manage the development and operation of campus buildings, landscapes and infrastructure. This includes the ability to guide future campus development through policy and to set goals and targets for performance in campus plans such as the Green Building Action Plan.

[3] *For the purposes of the GBAP, regenerative sustainability is defined as "net positive contributions to human and natural systems."*
[4] *See Costing on Page 39.*

As an academic institution, UBC has a tremendous opportunity for innovation. By combining its core academic mandate of teaching and research with building design and operations, UBC can leverage the expertise of faculty, staff, students and partners to help create solutions to challenges on campus and in the wider community.

In institutional areas, UBC is the owner, operator and regulator of all buildings. In residential neighbourhoods, UBC is the regulator and landowner, and the owner and operator of many multi-unit residential and commercial buildings, with other strata buildings owned by stratas with 99-year leases with UBC. For both areas, UBC serves as the authority having jurisdiction for administering and enforcing the BC Building Code.

The scope of the GBAP includes both institutional and neighbourhood residential buildings at the Vancouver campus (it does not include the Okanagan campus) and provides guidance for the design of the following:

1. **Institutional building projects[5]:**
   a. New construction
   b. Existing building renovations and retrofits (construction costs over $1 million)
   c. Landscaping and municipal infrastructure within defined boundaries of a building project

2. **Neighbourhood residential and mixed-use residential building projects:**
   a. Private housing developments on land leased from UBC
   b. Residential rental units (including Faculty and Staff Housing)
   c. Landscaping and infrastructure within defined boundaries of a building project

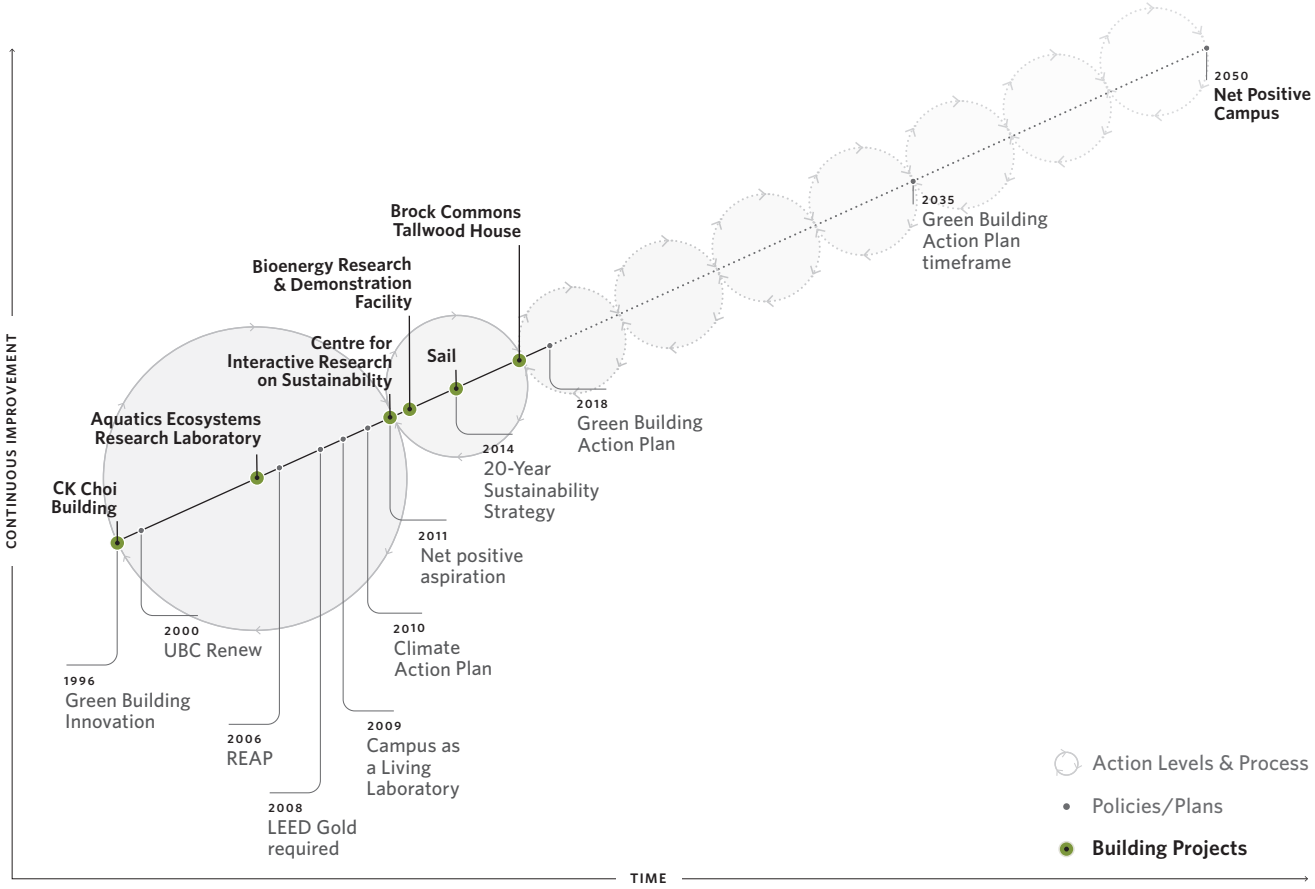


Figure 1. A timeline of UBC's innovation and pilots leading towards the vision of a net positive campus.

[5] *Including student residences.*

Building on Momentum

Currently, at the Vancouver campus, UBC owns and operates over 342 institutional buildings[6], including academic facilities, cultural venues, sports and recreation facilities and student residences. The residential neighbourhoods house 12,000 people in 73 multi-unit residential and mixed-use buildings. UBC is growing rapidly and is expected to significantly increase the number of new building projects and existing-building retrofit projects over the next 20 years. How these buildings are designed, constructed and operated will have significant impact on the sustainability of the campus and wellbeing of the people who study, work and live there.

The ambitions for the next stage of growth at the Vancouver campus are grounded in over 20 years of experience in green building and sustainable projects and policies. Starting in the mid-1990s, UBC was piloting green building projects, like the C.K. Choi building, with the innovative ideas of the time and was establishing the staff expertise and policy frameworks to enable them. This process has advanced over time, with projects like the Bioenergy Research and Demonstration Facility, which responded to low-carbon energy infrastructure needs for the entire campus, and the Centre for Interactive Research on Sustainability, which sought to operationalize regenerative sustainability concepts around environmental and human wellbeing. In the neighbourhoods the Sail project achieved REAP platinum demonstrating advances in multi-unit residential design. The more recent Brock Commons Tallwood House has demonstrated innovation in building design and construction techniques, featuring the use of engineered wood products in tall buildings and replicable prefabrication techniques. These projects have continued to inform campus policy and practices over the years, along with requirements like LEED Gold as a minimum standard for academic buildings and equally important operational and retrofit initiatives, like UBC Renew, which have improved the performance of existing buildings.

UBC's leading green building projects are pilots in an iterative approach that allows the testing of innovation and integration of research and teaching with the University operations. They help UBC capture new ideas that inspire people and actions in the move towards a net positive campus, and they provide a growing body of practical knowledge and experience about how to advance green building performance and practices. Recognizing that green buildings offer significant benefits in addition to their contributions to a net positive campus, UBC also acknowledges that there can be significant challenges in their design, construction and operation. The GBAP seeks to address these challenges by using UBC's policies and practices to remove barriers and enable project teams and university staff to create innovative, healthful and sustainable buildings.

Building on this momentum, the development of the Green Building Action Plan has included extensive engagement with UBC students, faculty, staff and residents as well as green building experts to develop ideas for the future and better understand stakeholder aspirations linked with green building practices.

GBAP ENGAGEMENT PROCESS

- **Late 2016:** 15 contributor interviews were conducted to better understand the issues and opportunities.
- **January 2017:** Two ideas workshops, with both residential and institutional contributors, were held to gain input and ideas for the development of the GBAP.
- **2017–2018:** Over 30 focus groups were held to develop the goals and actions that make up the plan, building on the ideas from the interviews and workshops.
- **2017–2018:** The GBAP was refined through communication with technical groups, the steering committee and senior leadership and through faculty and peer review.

For a full list of participants see Acknowledgements on Page 79.

[6] *With an area of over 500 m².*

Teaching, Learning and Research

The Green Building Action Plan provides an opportunity to harness expertise not only from various operational units but also from academic research. Teaching, learning and research opportunities have been identified within the framework of the GBAP to help frame policy and investigate technical issues.

Through the Campus as a Living Lab approach, UBC provides unique opportunities for academic engagement with buildings via the processes of planning, design, construction and operations as well as performance monitoring and inhabitant wellbeing, which can help provide innovative operational solutions. Equally important, the expertise of academic faculty can be leveraged to help create solutions to large scale challenges, such as climate change adaptation and the support of biodiversity in urban areas, which can be piloted, assessed and used to inform future projects and policies at UBC and beyond.

Above: Ideas Workshop

TEACHING, LEARNING AND RESEARCH LEVELS

The GBAP relies on the unique opportunities available at UBC to tie the plan for the built environment to teaching, learning and research at three different levels:

Level 1: Educational and engagement activities:

These are actions driven by the needs of the Green Building Action Plan and focused on educating and engaging the campus community and external partners in the aspirations, goals, strategies and actions of the GBAP. Examples include website information, green building tours, art projects, signage, student events or workshops.

Level 2: Small scope research studies:

These are discrete research projects that answer specific questions or address specific gaps in knowledge that are needed to develop policy or guidelines for the GBAP. Developed by Sustainability and Engineering staff (or other staff-leads identified in the actions) and supported by UBC, project examples include SEEDs and Sustainability Scholars projects, or using academic courses to explore specific options.

Level 3: Large-scale or long-term research projects:

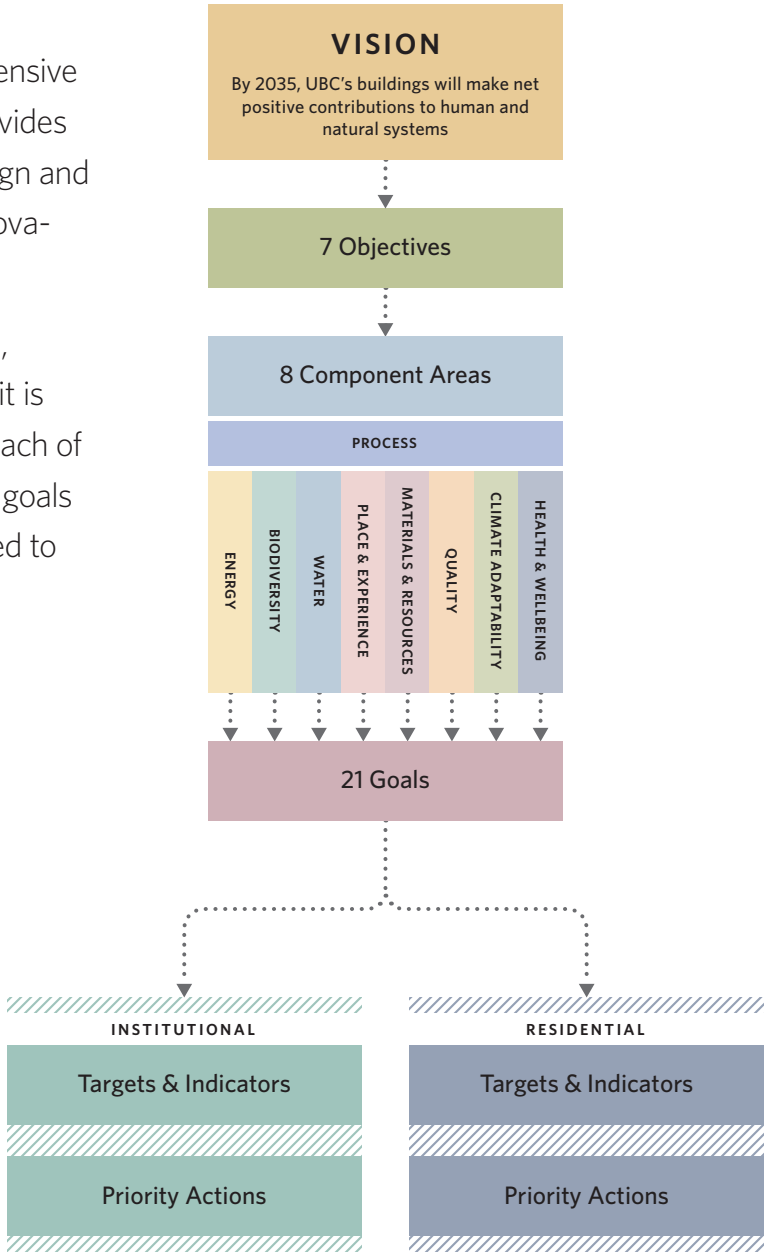
These are research projects with sustained academic involvement that tackle more complex questions or issues, especially in the emerging themes within the GBAP or opportunities around innovative pilot projects. These would provide opportunities for interdisciplinary and applied research projects that could be eligible for external research funding. Lessons and results could be applicable to the region and building industry beyond UBC.

2. Overview

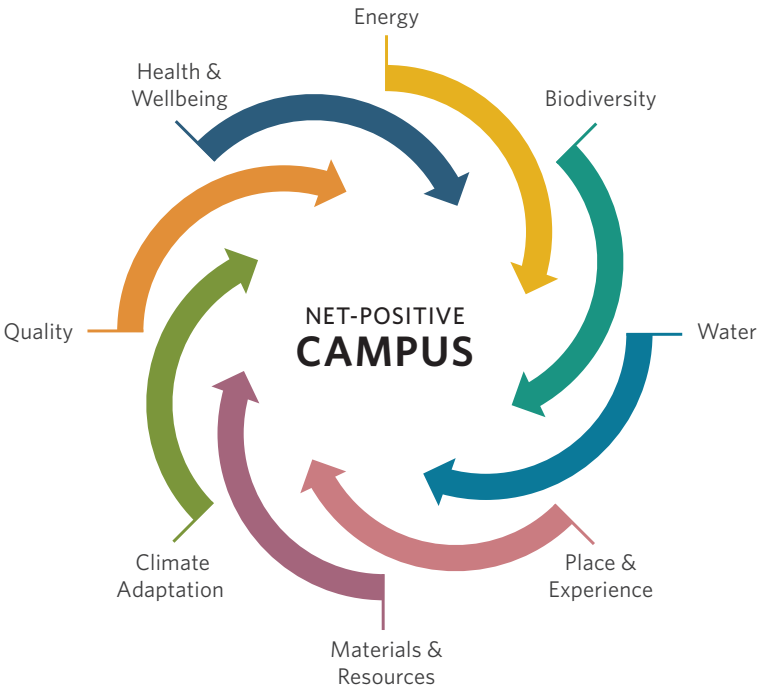
THE PLAN: **STRUCTURE**

The Green Building Action Plan is intended to be used as a comprehensive and collative document, which provides guidance and direction on the design and construction of new buildings, renovations and retrofits at UBC.

Working towards the overall vision, and to achieve specific objectives, it is organized into component areas, each of which include specific component goals and the targets and actions required to achieve them.



The component areas represent an integrated approach to building design which promote whole systems thinking and leverage multiple benefits for single investments. Incremental improvements in each of these component areas will advance UBC towards a net positive campus. The eight components areas are illustrated in the diagram below.



In addition, process (referring to the project development processes and procedures at UBC) is critical to the plan's success and is addressed as a cross-cutting initiative that influences and enables actions in all other component areas.

For both residential and institutional projects the GBAP introduces goals in each of the eight component areas, which are intended to work in combination to achieve the overall vision for the campus.

Targets and indicators have been developed for component areas to hold UBC accountable by monitoring its practices and performance towards the component goals. Targets are SMART (specific, measurable, assignable, realistic and time-related) while indicators measure progress in a more general manner.

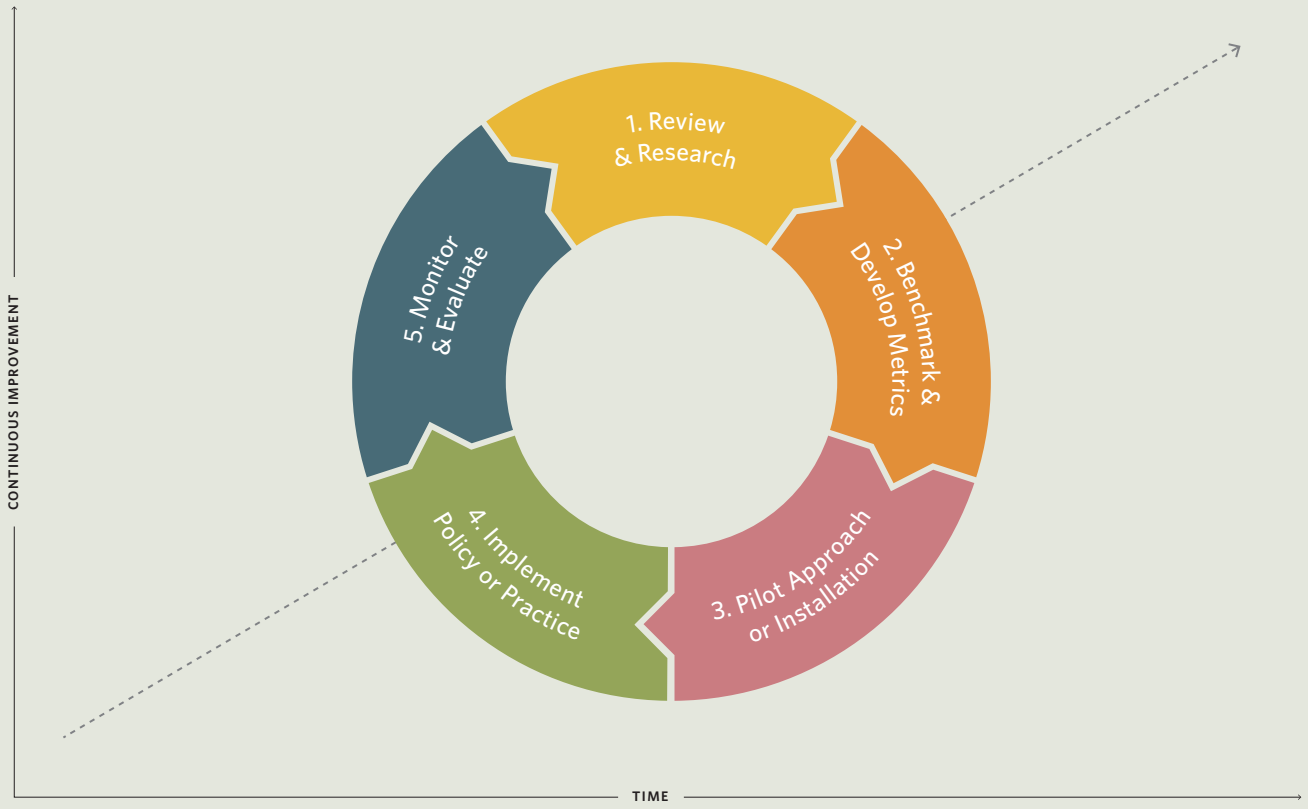
In order to achieve the goals and targets in each of the eight component areas, the GBAP outlines a series of actions to be taken by UBC planning and operations staff alongside engagement with academic researchers and students.

Actions within each component area are sorted, with highest-priority actions intended to be completed within five years (short term). The actions follow a structured cycle of research, benchmarking, piloting, implementation and monitoring to help inform policy and enable continuous improvement of UBC buildings.

Benchmarking, monitoring and evaluating are critically important to the success of the GBAP and UBC is committed to benchmarking building performance to encourage continuous improvement in relation to industry standards support implementation of the plan.

CONTINUAL IMPROVEMENT PROCESS

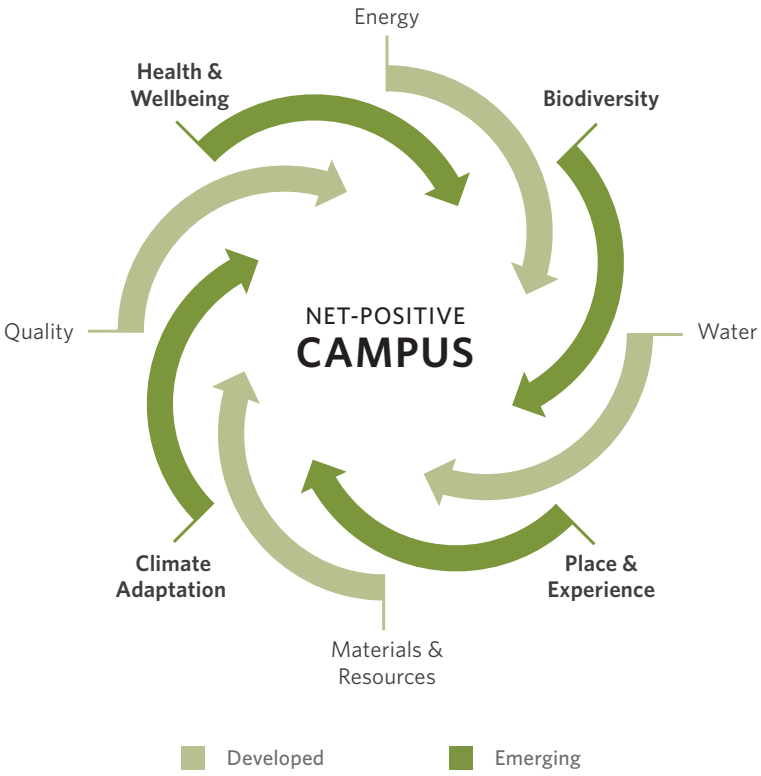
1. **Research and Review**
   to advance knowledge of the component area through staff reviews of international best practices, academic research projects and consultant work.
2. **Benchmark and develop metrics**
   to establish standards of measurement for the component area and set levels of performance.
3. **Pilot new approaches and installations**
   to test, learn and inform the development of policy and practices.
4. **Implement policy and practices**
   to put the experiences of steps 1 to 3 into action and introduce new policy or strengthen existing policy.
5. **Monitor and Evaluate**
   to learn from experience and encourage continuous improvement in UBC's buildings.



Emerging Component Areas

Sustainability in building policies and practices has been a priority for UBC for over 20 years.

During that time, UBC has already progressed in some of the component areas, particularly energy, water and quality as well as some aspects of the materials and resources component. This progress has been integrated in existing policies such as the UBC Technical Guidelines and the Campus Plan Design Guidelines. However, other component areas of the GBAP such as biodiversity, materials and resources, climate adaptation, and health and wellbeing are emerging in nature. These component areas require foundational work to determine best practices to address the challenges and opportunities within topics in an effective manner. In these emerging component areas, a five-year implementation plan will focus on the foundational studies, research and analysis to establish targets and associated actions for achieving the GBAP component goals.



Component Areas of Priority

The Green Building Action Plan is based on a holistic approach that recognizes that energy efficiency and climate adaptation are priority considerations at UBC.

Building energy efficiency has long been a focus the University, and through the GBAP, further improvements in long-term cost savings and reduced greenhouse gas emissions will be achieved. The impacts associated with climate change on buildings are becoming more pressing with long term warming, more extreme weather events, and changing precipitation patterns.

Climate adaptive design is now recognized as an important direction for sustainability policy and green building at UBC. By integrating climate adaptability and resilience into the built environment, UBC will prepare for the climate impacts of rising temperatures and increased extreme weather events while generating co-benefits across component areas such as biodiversity and water.

2. Overview

THE PLAN: **AT A GLANCE**

As a quick reference, the following pages provide a summary of the component goals, targets and indicators as well as a **sample** of key priority actions in each component area.

For more detail in each component area including a complete list of priority actions and an explanation of the context, key directions, and pathway to net positive, *see The Institutional Green Building Action Plan (Page 42)* and *The Residential Green Building Action Plan (Page 66).*

Main Mall looking south
PHOTOGRAPHER: HOVER COLLECTIVE

THE PLAN: AT A GLANCE

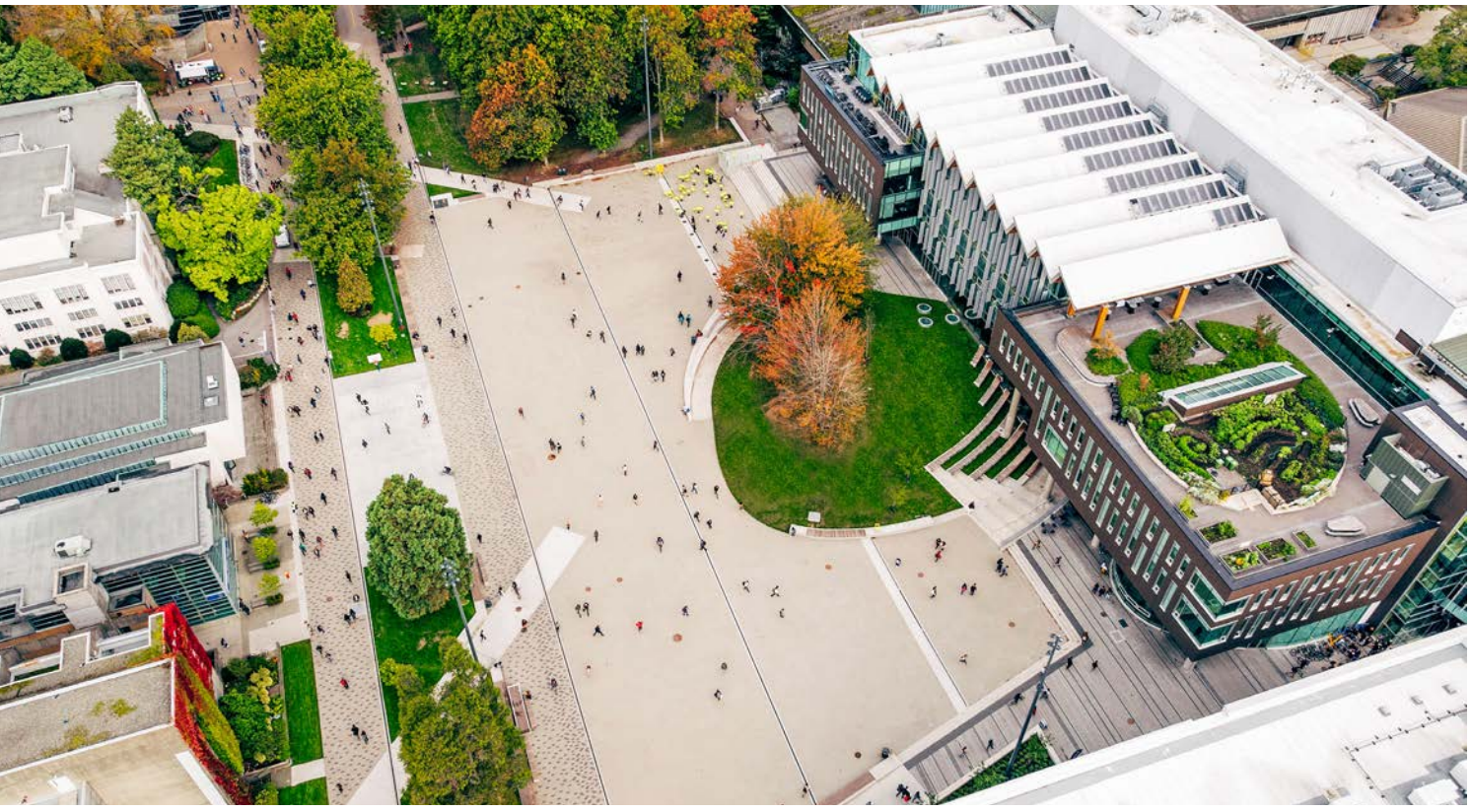
Vision

Below: AMS Student Nest
ARCHITECT: DIALOG AND B+H ARCHITECTS
PHOTOGRAPHER: HOVER COLLECTIVE

By 2035, UBC's buildings will make net positive contributions to human and natural systems.

Objectives

- Create an exceptional built environment on campus and in the neighbourhoods that will attract, engage and retain a diverse global community of outstanding students, faculty, staff and community members.
- Achieve continuous improvement to ecological and human health, driven by experience and lessons learned from previous plans and projects.
- Create a net positive pathway for the design and construction of new buildings, renovations and retrofits over the next 17 years.
- Demonstrate UBC's commitment to leadership and innovation in green buildings across social, environmental and economic dimensions.
- Support teaching, learning and research opportunities through academic engagement.
- Improve clarity and predictability of process.
- Optimize total cost of ownership for buildings.



THE PLAN: AT A GLANCE

Process

Process is a cross-cutting initiative across all component areas.

GOALS

- *UBC policies and processes will support the achievement of the GBAP component goals and targets.*
- *GBAP component goals and targets and will be communicated and easily accessible to internal and external stakeholders.*
- *UBC will integrate lessons learned from each project to improve building designs.*
- *UBC buildings will be evaluated as opportunities for research, innovation and continuous improvement.*
- *UBC will commit to monitoring and benchmarking building performance to encourage continuous improvement on campus and in relation to industry standards.*

TARGETS AND INDICATORS

INSTITUTIONAL

Target: 100% of projects will conduct life cycle costing by 2025.

RESIDENTIAL

SAMPLE KEY PRIORITY ACTIONS

INSTITUTIONAL

- Explore the implementation of a benchmarking platform for energy, emissions, water and waste reporting.
- Develop a more refined life cycle costing tool and/or an approach to better understand the total cost of ownership for the university during the design process by exploring design options.
- Develop a decision-making tool template for tier 1 and tier 3 projects to determine project priorities.
- Develop short-term and long-term strategic research opportunity plans to help connect the necessity of physical facilities to the enhancement of UBC's academic mission.
- Align the UBC Technical Guidelines with GBAP requirements through an annual review-and-update process that fully engages stakeholders.

RESIDENTIAL

- Develop a sustainability process for new residential construction.
- Develop a process to introduce GBAP requirements for retrofit and renovation projects in neighbourhoods.
- Create REAP credits for mandatory benchmarking, performance reviews and post-occupancy surveys.

THE PLAN: AT A GLANCE

Energy

COMPONENT GOALS

- *UBC buildings and landscapes will advance the campus towards net positive energy use and greenhouse gas neutrality by reducing energy demand and focusing on site-specific passive design approaches.*
- *UBC buildings will have indoor thermal environments that are comfortable and energy efficient.*
- *UBC will integrate lessons learned to improve building energy performance.*

TARGETS AND INDICATORS

INSTITUTIONAL

Target: New institutional buildings will meet incrementally reduced energy targets to be Net Positive Ready by 2030.

Target: Reduce average building thermal energy use intensity (TEDI plus DHW) for campus buildings by 50% to 75 kwh/m²/yr by 2050.

Target: Reduce the performance gap between modelled and metered energy use in new institutional buildings by 75% within three years of occupancy by 2020.

RESIDENTIAL

Target: New residential buildings will meet energy targets to be Net Zero Ready by 2032 in alignment with the BC Energy Step Code.

Indicator: Increase energy efficiency of existing residential buildings through standards and programs.

SAMPLE KEY PRIORITY ACTIONS

INSTITUTIONAL

- Implement mandatory incremental energy use intensity (EUI), thermal energy demand intensity (TEDI) and domestic hot water (DHW) targets; consider development of thermal demand (W/m²) and GHG intensity (kgCO2e/m²/yr) targets for tier 1 and 3a projects.
- Identify passive and mechanical design requirements for buildings of different uses and space criteria that achieve comfortable indoor environments under predicted future climate conditions.

RESIDENTIAL

- Develop GHG intensity targets to ensure cost-effective pathways to zero GHG emissions for buildings connected or not connected to the Neighbourhood District Energy System (NDES).
- Mandate incremental energy use intensity (EUI) and thermal energy demand intensity (TEDI) building targets that align with BC Energy Step Code requirements and support the development of the NDES renewable energy centre by 2024.
- Mandate whole building airtightness testing and energy modelling in alignment with BC Energy Step Code by 2018 and set airtightness targets by 2020.

THE PLAN: AT A GLANCE

Water

COMPONENT GOALS

- *UBC will practise responsible water management and use at the building and site scale by advancing water conservation and efficiency, exploring alternative water supply and treatment solutions and building water supply resiliency.*
- *UBC will use a low-impact development approach to rainwater management at the site scale to mitigate risk and respect the natural hydrology of the campus.*

TARGETS AND INDICATORS

INSTITUTIONAL

Target: Reduce the water use intensity on campus by 16% in 2025 and 24% in 2030 (relative to a 2017 baseline), resulting in total water consumption remaining at or below 2017 levels despite growth.

Target: Meter and report on water consumption for individual UBC buildings to enhance our ability to make strategic decisions on water conservation by: 1) ensuring all new buildings include water metering, 2) maintaining or replacing existing meters as required, and 3) adding meters where economically viable, over the next five years.

Target: Maximize rainwater management using low-impact development on building sites that are more than 300m from cliffs.

Indicator: Increase infiltration, retention and detention of rainwater on campus.

RESIDENTIAL

Target: Maximize rainwater management using low-impact development on building sites that are more than 300 m from cliffs.

Indicator: Increase infiltration, retention and detention of rainwater in the neighbourhoods.

SAMPLE KEY PRIORITY ACTIONS

INSTITUTIONAL

- Implement water metering requirements into (building) policy in alignment with the Water Action Plan.
- Develop guidelines for alternative water supply sources and systems in buildings (e.g., rainwater harvesting or water reuse systems) and on-site storage in buildings.
- Require all tier 1, 2 and 3a projects to achieve equivalent to LEED v4 Rainwater Management credit, Option 2.

RESIDENTIAL

- Develop a water metering strategy (building and suite level) for residential buildings; consider a visualization concept that concurrently educates users.
- Develop criteria and guidelines for green roof and blue roof projects, based on rainwater management capacity, co-benefits, maintenance and operation considerations for residential building typologies.
- New residential projects to achieve the same rainwater management requirements as institutional projects by 2020.

THE PLAN: AT A GLANCE

Materials & Resources

COMPONENT GOALS

- *UBC will prioritize the use of building materials that have net positive environmental impacts.*
- *UBC will support marketplace transformation by designing buildings with materials that are not harmful to human and ecological health.*
- *UBC will support the development of the circular economy by promoting the adaptation, reuse and recycling of materials and products during a building's lifetime.*

TARGETS AND INDICATORS

INSTITUTIONAL

Target: Eliminate 100% of UBC-identified building materials in new construction that are known to be detrimental to human health by 2035.

Target: Require all new buildings to be Zero Waste Ready by 2020.

Target: Divert 100% of construction and demolition waste from landfill by 2035.

Indicator: Embodied carbon is calculated for all construction projects.

RESIDENTIAL

Target: Eliminate 100% of UBC-identified building materials in new construction that are known to be detrimental to human health by 2035.

Target: Require all new buildings to be Zero Waste Ready by 2020.

Target: Divert 100% of construction and demolition waste from landfill by 2035.

SAMPLE KEY PRIORITY ACTIONS

INSTITUTIONAL

- Develop guidelines for making building material choices through research (level 2)[7] that are informed by health impacts based on a review of best practices, market supply, and stakeholder engagement (i.e., list commonly used building materials considered harmful to health in the sourcing, manufacturing, installation, occupancy or end-of-life phase).
- Implement policies for reduced embodied carbon in buildings, starting with a requirement to report embodied carbon, followed by incremental reductions.

RESIDENTIAL

- Require incremental reductions in the environmental impact of building materials, based on pilots, best practice review and market readiness study.
- Create an integrated policy for building materials that considers reduced environmental impact, healthy material requirements, and life cycle analysis.

[7] *See page 10 for a description of teaching, learning and research levels.*

THE PLAN: AT A GLANCE

Biodiversity

COMPONENT GOALS

- *UBC will develop highly functioning landscapes at the building and site scales to contribute to biodiversity and natural ecosystem processes.*
- *UBC will engage campus teaching and research opportunities to enhance biodiversity management capacity.*

TARGETS AND INDICATORS

INSTITUTIONAL

Target: Require 100% compliance to UBC Bird Friendly Design Guidelines for Buildings for new institutional buildings by 2020.

Indicator: Increase opportunities to provide habitat for birds, pollinators and other species.

RESIDENTIAL

Target: Require 100% compliance to UBC Bird Friendly Design Guidelines for Buildings for new residential buildings by 2025.

Indicator: Increase opportunities to provide habitat for birds, pollinators and other species.

SAMPLE KEY PRIORITY ACTIONS

INSTITUTIONAL

- Develop a set of principles for landscapes and green roofs that consider the following: 1) ability to adapt to climate change, 2) ability to attract pollinators, 3) reduction of invasive species, 4)microclimate suitability (sun, shade, etc.), 5) ability to support passive solar strategies (e.g., provide shade, reduce wind), 6) campus character zones and irrigation zones (green or brown areas), and 7) regional biodiversity priorities.
- Engage a consultant(s) to conduct site assessments to identify and assess the ecological assets, endangered and vulnerable species, and environmentally sensitive areas on a campus or neighbourhood scale. Site assessment reports will be used to inform individual project designs.

RESIDENTIAL

- Further develop the UBC Bird Friendly Design Guidelines for Buildings and create a mandatory policy in order to reduce the number of bird collisions with buildings.
- Develop a set of principles for neighbourhood landscapes and green roofs that consider the following: ability to adapt to climate change, ability to attract pollinators, microclimate suitability (suns, shade, etc.), ability to support passive solar strategies (e.g., provide shade, reduce wind), irrigation zones (green/brown areas), and regional biodiversity priorities.

THE PLAN: AT A GLANCE

Health & Wellbeing

COMPONENT GOALS

- *UBC will enhance the mental, physical and social dimensions of wellbeing by making them integral to building and landscape design decisions.*
- *UBC researchers, community stakeholders and building occupants will be engaged in a meaningful and ongoing way to inform building and landscape design decisions around health and wellbeing.*
- *UBC will become a leader in enhancing wellbeing through the built environment within the context of higher education in Canada.*

TARGETS AND INDICATORS

Targets and indicators for this emergent component area to be integrated into future updates of the GBAP.

SAMPLE KEY PRIORITY ACTIONS

INSTITUTIONAL

- Develop health and wellbeing guiding principles for building design that promote physical, mental and social wellbeing (e.g., incorporating social or contemplative space, designing spaces that allow inclusion, incorporating universal design principles, promoting ease of use, incorporating ergonomic principles, developing daylighting requirements, considering acoustic requirements, etc.).
- Coordinate with UBC's Wellbeing Strategy in collaboration with UBC Wellbeing to guide how building and landscape design can nurture physical, mental and social dimensions of health and wellbeing.

RESIDENTIAL

- Identify metrics for health and wellbeing in residential buildings (e.g., temperature, indoor air quality, daylight levels, acoustic levels, views to exterior, number of indoor plants, etc.).
- Update REAP to include health and wellbeing credits.

THE PLAN: AT A GLANCE

Quality

COMPONENT GOALS

- *UBC buildings and landscapes will be durable, reliable and resilient.*

TARGETS AND INDICATORS

INSTITUTIONAL

Target: Major projects track and achieve their design brief sustainability goals by 2020 (subject to approved changes during design process).

Target: Achieve 100% compliance with UBC Technical Guidelines by 2025 (compliance allows for approved variances).

Target: Achieve 100% compliance with UBC sustainability submission requirements by 2025 (compliance allows for approved variances).

RESIDENTIAL

Target: Achieve 100% compliance with REAP Gold requirements by 2020.

SAMPLE KEY PRIORITY ACTIONS

INSTITUTIONAL

- Develop a strategy to conduct a full review of the UBC Technical Guidelines to ensure clarity and eliminate redundancies.
- Review and investigate opportunities to apply international climate resilience standards, such as the RELi resilience standard, to projects.

RESIDENTIAL

- Create a branding strategy for REAP to increase awareness of UBC's sustainable buildings.
- Work with real estate agents to ensure all buyers are aware of sustainability benefits associated with buildings.

THE PLAN: AT A GLANCE

Climate Adaptation

COMPONENT GOALS

- *UBC buildings and landscapes will have the resilience to respond to both anticipated and unpredictable changes in climate.*
- *UBC will engage with researchers in a meaningful and ongoing way to inform building policy and guidelines around climate adaptability.*

TARGETS AND INDICATORS

Targets and indicators for this emergent component area to be integrated into future updates of the GBAP.

SAMPLE KEY PRIORITY ACTIONS

INSTITUTIONAL

- Conduct vulnerability assessments of campus buildings, landscapes and infrastructure at periodic intervals.
- Coordinate with the campus-wide Resiliency Initiative and climate adaptation strategies, as they evolve based on vulnerability assessments, evaluations and best practice review, by implementing policies on a building and landscape scale that respond to key climate change impact areas (e.g., increased temperature, variable weather patterns, increased flood events, increased smoke, increased peak events, etc.).

RESIDENTIAL

- Implement policies (REAP updates, neighbourhood plans) for climate adaptability in the neighbourhood built environment.

THE PLAN: AT A GLANCE

Place & Experience

COMPONENT GOALS

- *UBC buildings and landscapes will provide opportunities for collaboration, innovation and community development to reflect the social and environmental sustainability aspirations of the University.*

TARGETS AND INDICATORS

Targets and indicators to be integrated into future updates of the GBAP.

SAMPLE KEY PRIORITY ACTIONS

INSTITUTIONAL

- Review the Public Realm Plan goals and guidelines for better coordination and compliance of building landscapes.
- Establish additional GBAP place and experience goals, in coordination with Campus and Community Planning, to help express a project's social, environmental and economic sustainability goals.
- Integrate heritage consideration early in the design through mandatory "Statements of Significance" for existing buildings.

RESIDENTIAL

- Establish GBAP place and experience goals for buildings and landscapes in coordination with Campus and Community Planning during neighbourhood development (e.g., goal: the design of the building and landscape expresses elements of UBC's social and/or environmental sustainable design initiatives).

3. Policy and Process

Policy Context

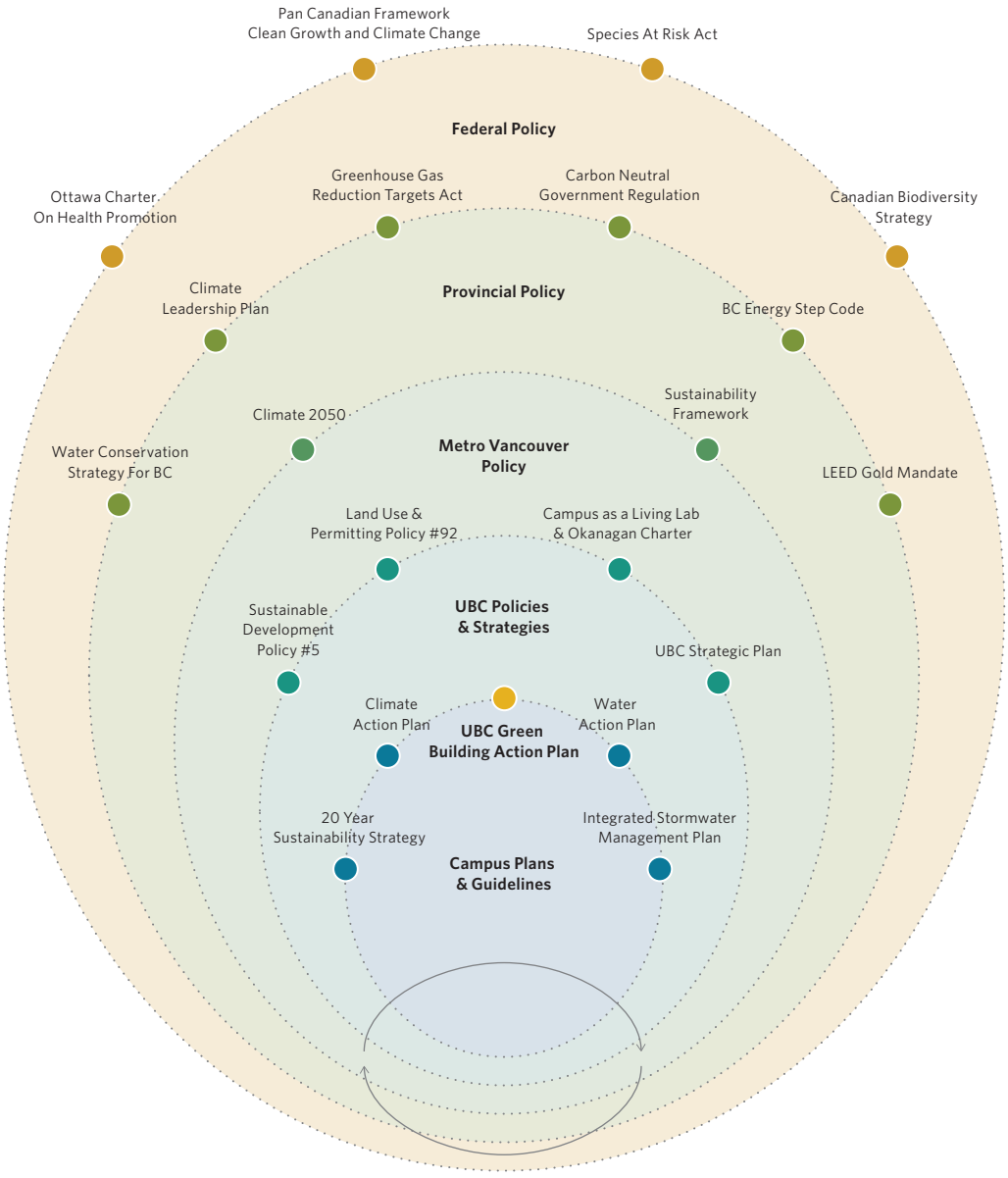


Figure 2. The Green Building Action Plan operates within a broader network of UBC, Metro Vancouver, provincial, and federal policies and plans.

The GBAP sits within a broader network of UBC, Metro Vancouver, provincial and federal polices and plans. Climate change and the need for resiliency are key concerns for all levels of government, along with other significant policies relating to the loss of biodiversity, human health and wellbeing, and resource stewardship. At UBC's Vancouver campus, development is governed specifically by provincial legislation that gives the Board of Governors unique powers to manage the development and operation of campus buildings, landscapes and infrastructure.

GOVERNMENT POLICY RESPONDING TO CLIMATE CHANGE

Federal

Canada signed the Paris Climate Change Agreement and has since committed to implement actions that mitigate greenhouse emissions in efforts to keep global average temperature increases well below 2 degrees Celsius. In 2016, Canada implemented a key step towards meeting the Paris Agreement by announcing the Pan-Canadian Pricing on Carbon Pollution. Through the new framework, a price of $50 per tonne is targeted for 2022. The federal government has committed to working with provinces and territories to develop a "Net Zero Energy Ready" model building code, with the goal that provinces and territories adopt it by 2030.

Provincial

The BC Climate Leadership Plan (CLP) states that the Province is implementing a number of policies to encourage the development of net zero buildings. On April 1, 2018, BC's carbon tax rate increased to $35 per tonne of carbon dioxide equivalent emissions. The tax rate will increase each year by $5 per tonne until it reaches $50 per tonne in 2021. British Columbia enacted the BC Energy Step Code as a voluntary performance-based code that provides local governments the option to adopt an incremental "step" or performance improvement to achieving more energy-efficient buildings that go beyond the requirements of the base BC Building Code. To date, 26 local governments across BC (including the City of Vancouver) have notified the Province on their intent to reference the BC Energy Step Code. Through the Green Building Action Plan, UBC has aligned its residential policy targets with the BC Energy Step Code and has established performance targets for the basic archetypes of institutional buildings.

Main Mall in the snow

The CLP also addresses the role that public sector buildings (such as UBC's institutional buildings) should play in demonstrating leadership by reducing emissions, creating a plan for adaptation, and promoting the use of low-carbon and renewable materials.

City of Vancouver

As a neighbour to the City of Vancouver, UBC is able to leverage the City's emerging and aggressive energy policies for buildings. For example, the City has a Zero Emissions Building Plan and Renewable City Strategy that set distinct targets for new and existing buildings. Of particular relevance to UBC are the distinct targets for buildings connected to district energy systems, emissions and energy demand targets for all buildings, and how immediate the targets are (for example, office buildings that require rezoning are to be constructed to Passive House levels of energy performance as well as certified LEED Gold).

3. Policy and Process

UBC Policy

UBC's provincially approved Land Use Plan sets the long-term direction for how the campus grows and changes. The Board of Governors approves detailed policies to carry out the Land Use Plan's vision. On institutional lands *(see Figure 3)*, these policies include the Vancouver Campus Plan, performance-oriented plans such as the Climate Action Plan and the GBAP, and detailed guidelines such as the Technical Guidelines, all of which guide academic development. In campus neighbourhoods *(see Figure 4)*, UBC's Board of Governors approves neighbourhood plans, which include specific policy requirements for residential development as well as regulatory rules such as the Residential Environmental Assessment Program (REAP). The GBAP provides direction for these other policies and plans to advance the development of green buildings on the Vancouver campus.

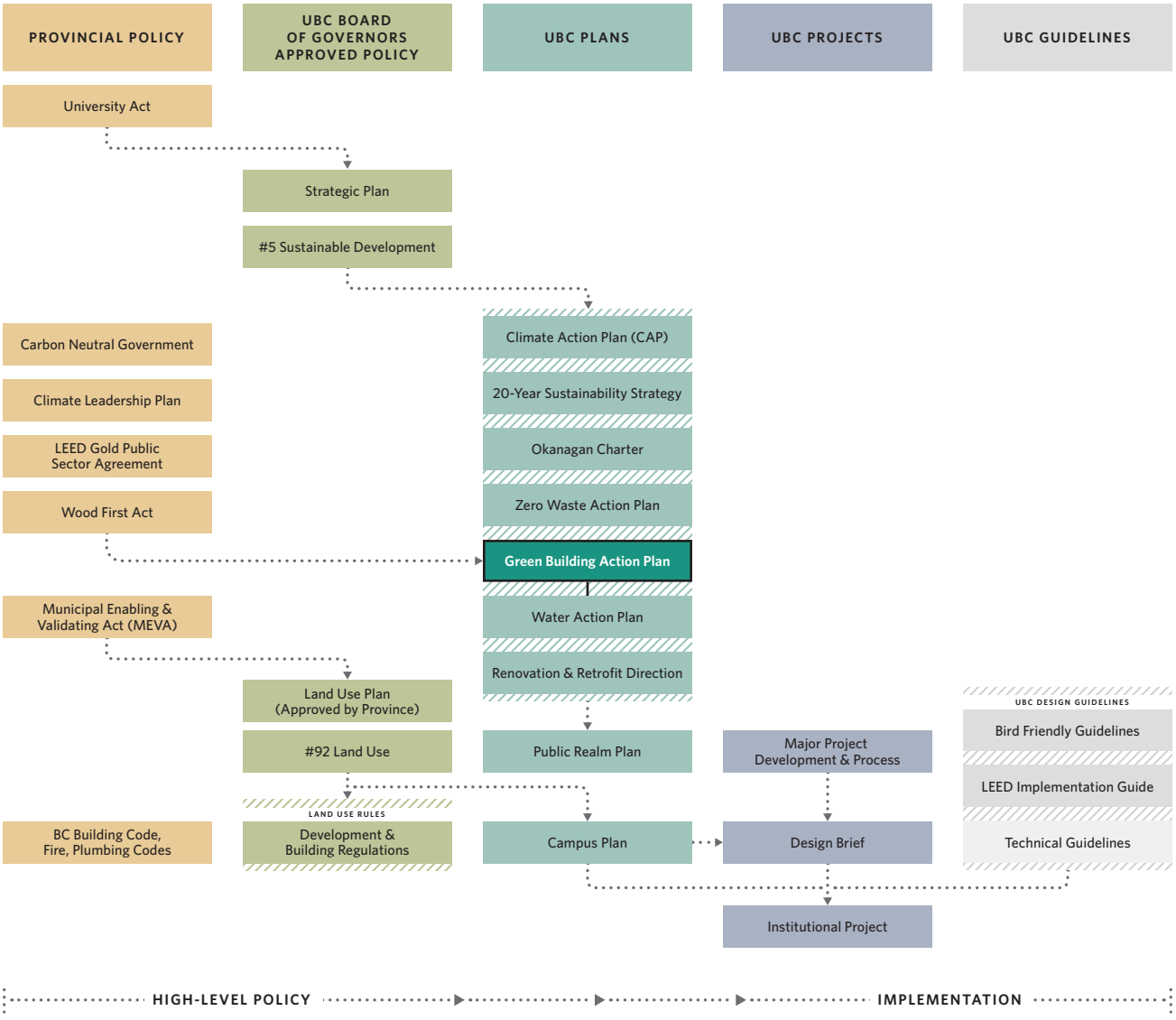


Figure 3. An illustrative diagram of existing UBC policies, strategies, and guidelines that inform the development of institutional buildings.

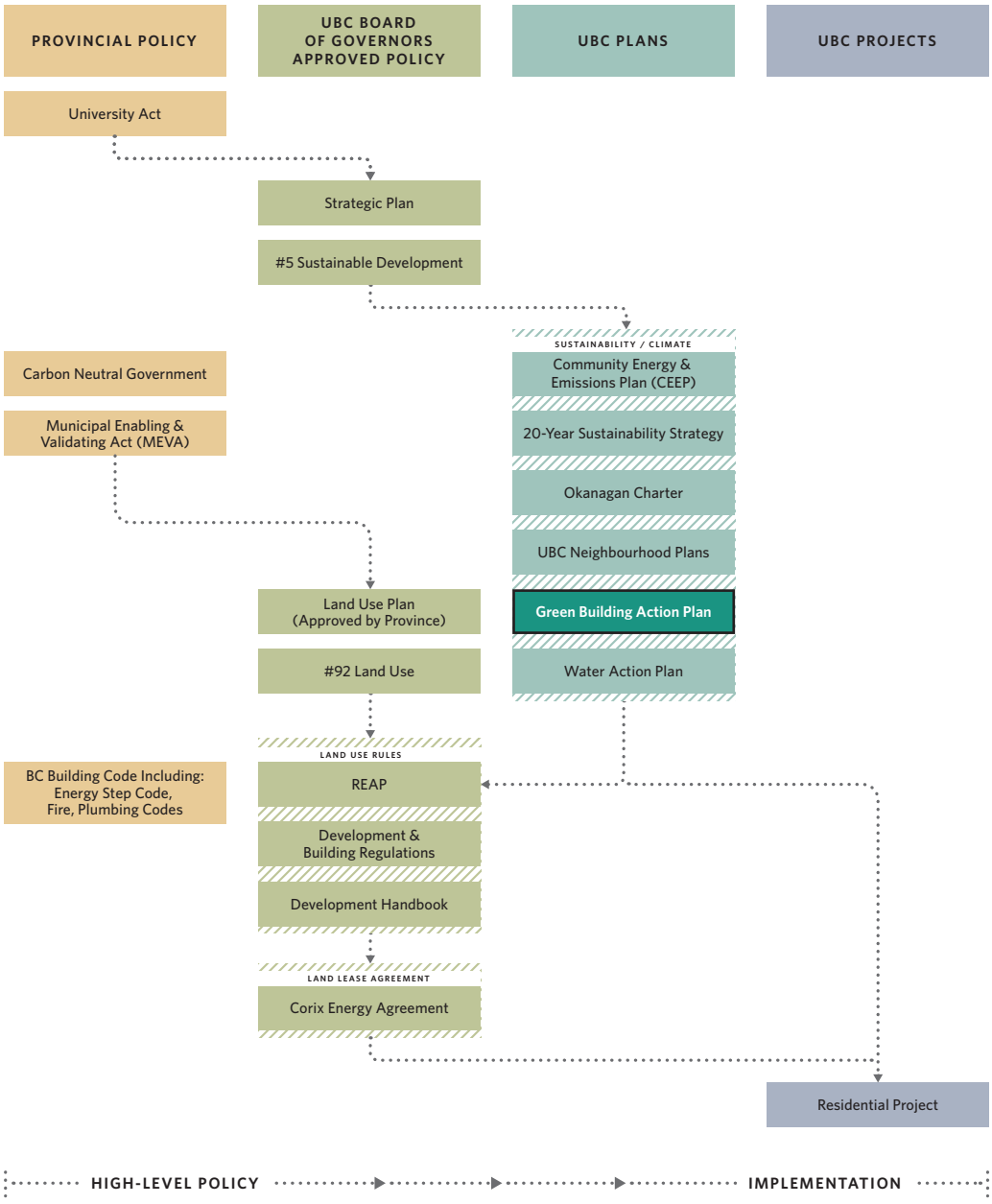


Figure 4. An illustrative diagram of existing UBC policies, strategies and guidelines that inform the development of residential buildings.

The vision of a net positive campus requires actions across scales, beyond the building footprint, and the GBAP therefore integrates with many other plans.[8] The GBAP will guide and is guided by the many other goals outlined in emerging and existing plans related to sustainable development and operations. Emerging plans that will be fully developed over the next five years will support, guide and coordinate with the GBAP in emerging component areas. Existing plans, regulations and guidelines will require coordination or alignment with the GBAP in their next amendment.

[8] *See Table 1 and Table 2 for a detailed list of policies related to each component area.*

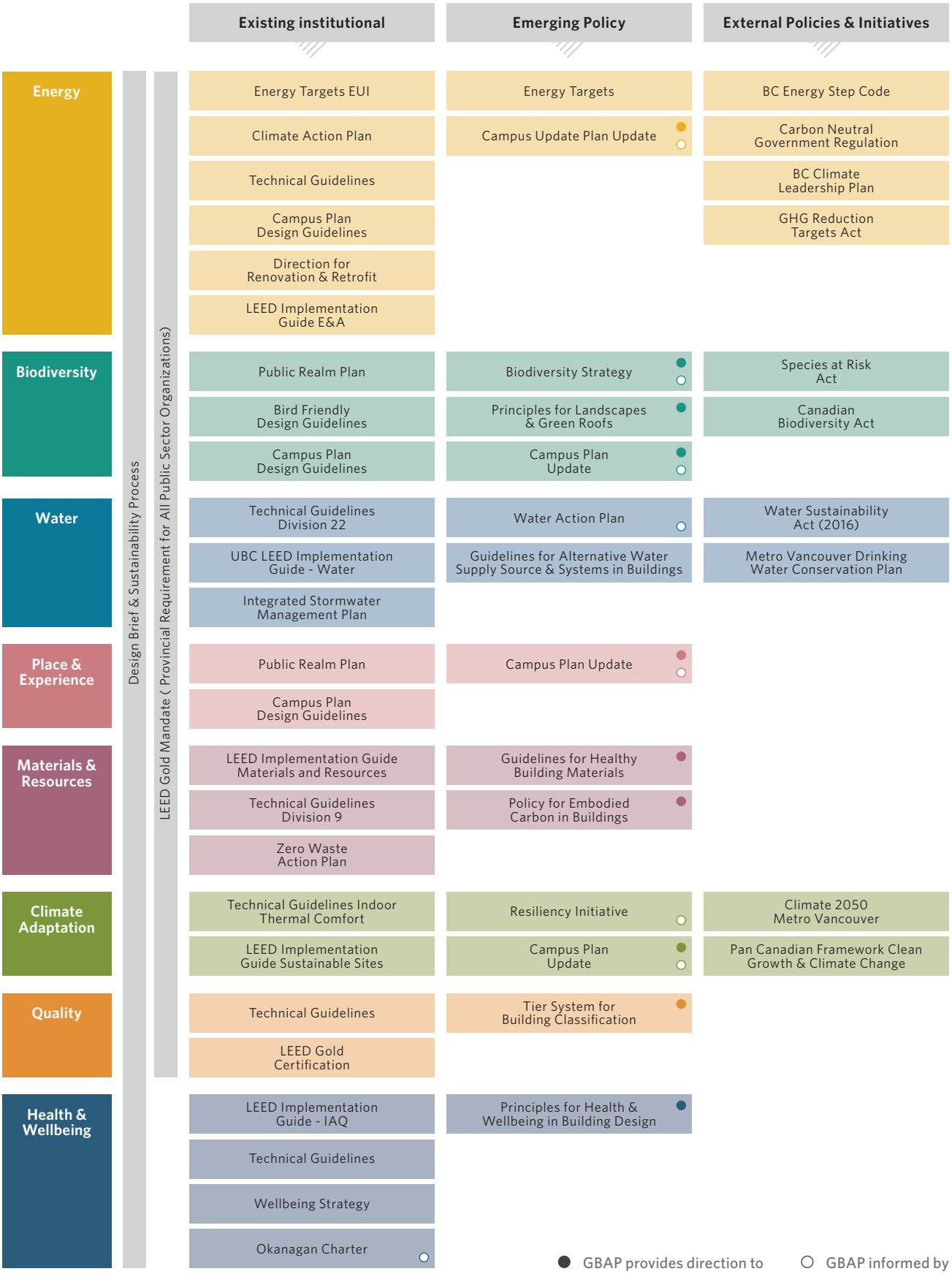


Table 1. Integration of institutional GBAP with external policies and existing and emerging UBC plans.

	Existing Residential	Emerging Policy	External Policies & Initiatives
Energy	Residential Environmental Assessment Program 3.0 EA	Residential Environmental Assessment Program 3.1/3.2/4.0 ●	BC Energy Step Code
	Community Energy Emissions Plan ○	Stadium Neighbourhood Plan ● ○	BC Climate Leadership Plan
	Westbrook Place Neighbourhood Plan ○	Direction for Renovation & Retrofit ●	
Biodiversity	Westbrook Place neighbourhood Plan	Residential Environmental Assessment Program 4.0 ●	Species at Risk Act
		Stadium Neighbourhood Plan ● ○	Metro Vancouver Strategic Directions for Biodiversity Conservation
		Biodiversity Strategy ● ○	
Water	Residential Environmental Assessment Program 3.0 WE	Residential Environmental Assessment Program 3.1 SS ●	WaterSustainability Act (2016)
	Integrated Stormwater Management Plan	Water Action Plan ○	Metro Vancouver Drinking Water Conservation Plan
	Westbrook Place Neighbourhood Plan ○	Stadium Neighbourhood Plan ● ○	
Place & Experience	Westbrook Place Neighbourhood Plan	Residential Environmental Assessment Program 4.0 ●	
		Stadium Neighbourhood Plan ● ○	
Materials & Resources	Residential Environmental Assessment Program 3.0 MR	Residential Environmental Assessment Program 4.0	
	Westbrook Place Neighbourhood Plan ○	Stadium Neighbourhood Plan ● ○	
		Guidelines for Healthy Building Materials ●	
Climate Adaptation		Residential Environmental Assessment Program 4.0 ● ○	Climate 2050 Metro Vancouver
		Stadium Neighbourhood Plan ●	Pan Canadian Framework Clean Growth & Climate Change
		Resiliency Initiative ●	
Quality	Residential Environmental Assessment Program 3.0 Certification	Residential Environmental Assessment Program 3.2/4.0 ●	
	Westbrook Place Neighbourhood Plan	Stadium Neighbourhood Plan ● ○	
		Tier System for Building Classification ●	
Health & Wellbeing	Residential Environmental Assessment Program IEQ	Residential Environmental Assessment Program 4.0 ●	Ottawa Charter on Health Promotion
	Okanagan Charter	Stadium Neighbourhood Plan ● ○	
	Wellbeing Strategy	Principles for Health & Wellbeing in Building Design ●	

● GBAP provides direction to ○ GBAP informed by

Table 2. Integration of residential GBAP with external policies and existing and emerging UBC plans.

3. Policy and Process

Emerging Plans

UBC is a unique position to explore new areas of policy. The expertise of academic faculty can be leveraged to help create solutions to challenges, which can be piloted, evaluated and used to inform policies at UBC and beyond.

Three emerging areas at UBC will eventually be developed into strategies that are relevant to building and landscape design and will inform development of the GBAP: wellbeing, resiliency and biodiversity. UBC Wellbeing is developing a system-wide, holistic and proactive approach that champions physical, mental and social dimensions of health and wellbeing at the University. A Health and Wellbeing Strategy for Building and Landscape Design is being developed that will coordinate with the component goals and actions of the GBAP in the health and wellbeing component area. UBC is in the early stages of working on a Resiliency Initiative in order to prepare the campus for natural and human-made emergencies, and over the next five years more work is expected to be carried out to expand this initiative. Strategies for climate change adaptation and resiliency in buildings will be developed in coordination with the Resiliency Initiative, which will inform the GBAP's climate adaptation component area. Finally, UBC is developing a Biodiversity Strategy through the Campus Biodiversity Initiative: Research and Demonstration (CBIRD). As the Biodiversity Strategy is developed it will coordinate with and inform the component goals and actions of the GBAP in the biodiversity and health and wellbeing component areas.

The Water Action Plan (WAP) is closely linked to the GBAP and is being concurrently developed. Building-related requirements necessitated by the goals of the WAP will be channeled through to the water component area of the GBAP.

CIRS Living Wall – The deciduous vine provides shading in the summer and allows more sun to hit the windows in the winter

PHOTOGRAPHER: PHILIP BERTOGG

3. Policy and Process

Institutional **Policies**

Academic development is guided in a significant way by the Vancouver Campus Plan. The Campus Plan Design Guidelines (Part 3), which integrates sustainability best practices, will need to be reviewed and updated in the next amendment to support the GBAP goals in all component areas.

The GBAP introduces a tier system for institutional building projects to clearly and accurately identify policy and process requirements associated with new buildings, renovations, fit-outs and retrofits *(see Table 3)*.

TIER	DESCRIPTION	AREA/BUDGET
TIER 1	New Buildings – Large	>1,000 m^2, >$5M
TIER 2	New Buildings – Small	<1,000 m^2, >$5M
TIER 3	Major Project Renovations a. Renewal (includes envelope and mechanical system upgrade) b. Other (extensive interior upgrades)	>$5M
TIER 4	Partial Fit-outs	$1M – $5M
TIER 5	System Upgrades (e.g., chiller replacement, controls)	n/a

Table 3. Tier system for institutional building projects.[9]

Existing building renovations and retrofits offer a significant impact in terms of achieving the component goals of the GBAP because of the extent of the existing building stock. The tier system clarifies performance targets and expectations for the renovation and retrofits of existing buildings.

The UBC Technical Guidelines will be the major guiding document to ensure that GBAP objectives for institutional projects are met in all component areas. These guidelines were created to ensure the quality and performance of the design, construction, renovation and retrofit of institutional buildings, landscape and infrastructure. Since the guidelines are updated annually, this provides an opportunity to ensure annual integration and alignment with the GBAP.

[9] *See The Institutional Green Building Action Plan: 1.7 Quality for a table of the full tier system with green building requirements.*

Earth Sciences Building
Stone Panel Wall
ARCHITECT:
PERKINS+WILL
PHOTOGRAPHER:
PHILIP BERTOGG

All new campus construction and renewals (tiers 1 and 3) at UBC are currently mandated by the Province to be LEED Gold Certified. The UBC LEED Implementation Guide provides direction on which LEED credits are mandatory, optional, or not preferred to align institutional buildings with the University's sustainability objectives. UBC currently has 19 LEED Certified buildings, with 14 more projects under assessment and pending certification. Over the time frame of the GBAP, necessary updates to the UBC LEED Implementation Guide and consideration of alternative certifications that align with UBC policy objectives (for example, Passive House and Well Building Standard certification) will be pursued.

The Bird Friendly Building Design Guidelines provide guidance for consultants and project managers to design buildings that aim to greatly reduce bird collisions with glass, one of the largest sources of anthropogenic bird mortality in North America. The Bird Friendly Building Design Guidelines will need to evolve over time to achieve the target outlined under the GBAP's biodiversity component area.

The Sustainability Process supports an integrated design process for building projects and, was introduced in 2013 to ensure key design disciplines are brought together to achieve a high level of sustainability performance in a streamlined manner. Integrated design is critical for the success of the GBAP to encourage whole-systems thinking early in the design process.

Major projects are guided through the Sustainability Process, which includes engagement with a diverse group of stakeholders at UBC to identify performance goals in the development of the project design brief (for use by the project design team). Guidance is provided for workshops held at strategic points during design to ensure an integrated approach is followed. Project goals are tracked and reported through construction and into the post-occupancy phase.

The Major Capital Project Development Process at UBC is currently under review. A priority action for the GBAP is for better integration of the Sustainability Process into the overall Development Process.

3. Policy and Process

Residential **Policies**

Neighbourhood plans govern development of UBC's campus residential areas. The plans establish specific requirements for building features, park space, recreation and transportation, all consistent with UBC's Land Use Plan. Future neighbourhood plans at UBC are Stadium Road[10] and Acadia Park, and their development will be consistent with Green Building Action Plan policy directions.

The Residential Environmental Assessment Program (REAP) is a Land Use Rule and as such is a key policy driver in the neighbourhoods. REAP is a UBC-specific green building rating system that applies to multi-use residential and mixed-use (residential with commercial at grade) buildings. The fundamental idea behind REAP building requirements is to support the reduction of environmental impact on the building site and neighbourhood scale incrementally over time. All new residential projects, including private developments and Faculty and Staff Housing, are required to achieve a minimum REAP Gold certification.

There are currently few policies, strategies or programs to guide the retrofitting of buildings within the UBC neighbourhoods. As existing residential buildings age they will require upgrades and retrofits, and this presents an opportunity to set forward objectives that achieve the component goals of the GBAP for the extensive existing building stock. UBC will work with the University Neighbourhood Association (UNA) and existing residential stratas to develop a retrofitting strategy for the neighbourhoods, which will align with the residential GBAP for UBC-owned and-operated buildings.

[10] *Stadium Road Neighbourhood Plan is currently under development.*

3. Policy and Process

REAP Amendments

REAP requires a series of amendments in order to support the full implementation of the GBAP.

The following provides a summary of four amendments that will make incremental improvements in all component areas over time:

1. **REAP 3.1** September 2018
   This amendment is intended to apply to buildings in the Wesbrook Place neighbourhood (and phase 1 of the NDES).
   - **a.** Align with BC Energy Step Code.
     - i. Building energy targets will be updated to align with Step 2 (note: Step 3 or 4 will be considered as pilot projects and optional credits).
     - ii. Airtightness testing, currently an optional credit, will become mandatory and align with the BC Energy Step Code.
     - iii. Energy modelling, currently and optional credit, will become mandatory and align with the BC Energy Step Code.
   - **b.** Mandate building commissioning of energy systems, which is currently an optional credit.
   - **c.** Update stormwater requirements to align with the current Sustainability and Engineering regulatory requirement that all new construction projects must detain the 10-year storm volume and discharge at the 2-year rate on site or at a centralized facility using low-impact development.
   - **d.** Update electric vehicle charging requirements and align with anticipated market demands to support reduced transportation emissions.
     - i. Rental housing: infrastructure for charging stations will be installed to 50% of stalls
     - ii. Private developments: infrastructure will be installed for one charging station per dwelling unit
     - iii. Electric vehicle infrastructure will include the ability of stations to load manage and load share electricity for charging
   - **e.** Update to include housekeeping edits.

2. **REAP 3.2** anticipated 2019–2020
   - **a.** Introduce GHG building energy targets.
   - **b.** Introduce mandatory benchmarking and hot water metering (building level) as a credit.
   - **c.** Evaluate overall building insulation target to replace R values for individual building elements.
   - **d.** Review and improve Innovation and Design Process credits.
   - **e.** Rebalance REAP points to reflect UBC's current priorities.
   - **f.** Rebrand REAP with an emphasis on the quality of buildings.

3. **REAP 4.0** anticipated 2020-2022
   This amendment is intended to be in place for Stadium Road neighbourhood and phase 2 of the NDES.
   - **a.** Align with the BC Energy Step Code at optimum level in balance with NDES to achieve a low-carbon community at the lowest cost of ownership.
   - **b.** Increase compliance measures for REAP submittals, including REAP site inspections.
   - **c.** Update credits to consider change in climate and biodiversity.
   - **d.** Update building material requirements to achieve objectives related to lower embodied carbon, lower environmental impact, and the elimination of Red List materials.
   - **e.** Establish an optimal service life of buildings to minimize rebuilding and the use of new building materials (with their associated environmental impact).
   - **f.** Include health and wellbeing considerations as credits.

4. **REAP 4.1**
   - **a.** Implementation of incremental improvements in each component area.

Wesbrook Neighbourhood
PHOTOGRAPHER: PHILIP BERTOGG

4. Implementation

The implementation of the GBAP is going to be an ongoing and evolving process over the next 17 years, involving collaborations between multiple planning and operational departments at UBC as well as academic researchers.

The Institutional and Residential Green Building Action Plans describe the intentions, priorities and approaches to address each of the component areas for institutional and residential buildings. Some of these actions are iterative and interdependent, others are sequential. In some cases, the first actions are exploratory in order to determine how to proceed with developing specific targets or the best order of the actions. The series of actions proposed allows for piloting and innovation and increased institutional confidence in pursuit of the ambitious potential of the GBAP.

Summary matrices of all GBAP component goals, targets and actions are shown in Appendix A (institutional buildings) and Appendix B (residential buildings). The summaries outline how the goals and targets in each component area will be achieved through a series of detailed actions and includes department responsibilities and their associated timelines.

A monitoring program to support implementation of the GBAP will be developed and the plan will be reviewed and updated every five years.

Resourcing

Both a lead and support UBC department have been identified and resourcing requirements are indicated in separate appendix matrices. In some instances, these responsibilities may shift over time or as new processes and tools are developed as part of the implementation process.

COSTS AND BENEFITS

Various sources have been used to help provide cost input in some of the component areas in the GBAP:

- **Energy:** UBC energy costing studies for the institutional campus and the residential neighbourhood developments have been completed and peer reviewed. The studies indicate costing for incremental energy performance in buildings and have provided guidance for building energy targets.

  In institutional developments, the study results show that nearly all packages of energy efficiency measures result in positive net present value using current and forecasted utility rates over a 30-year time frame.

  On the residential side, the study shows the energy targets proposed for REAP 3.1 (BC Energy Step Code - Step 2) indicate an incremental capital cost increase of 0.1% for low-rise and 0.9% for high-rise buildings.

- **Health and Wellbeing:** A third-party study[11] conducted by the World Green Building Council shows that staff in office buildings are the most valuable resource in most organizations, typically accounting for 90% of business operating costs. As such, even a 1% improvement in productivity can have a major impact. This indicates there is likely a significant benefit to improving health and wellbeing aspects of building design and improving the health of occupants to increase productivity and learning.

- **Biodiversity:** According to an Australian third-party study,[12] implications suggest that contact with nature may provide an effective, population-wide strategy in the prevention of mental ill health, with potential application for sub-populations, communities and individuals at higher risk of ill health. With a high priority on student mental health, this study indicates that contact with nature has a strong link to student productivity and learning.

For all component areas, efforts will be made to pilot and monitor all measures before adopting them as a policy to ensure that they can be achieved within the capital budgets allocated to building projects. Costing of specific measures will be completed over the GBAP time frame and will be vetted through the GBAP Steering Committee prior to implementation of policy changes. At the current time, an overall costing exercise is not a part of the plan.

Given the GBAP will pay dividends in the future with lower energy bills, avoided control and damage costs of the environmental impacts of inaction, and reduced health costs, there is a good argument for the upfront investments now.

[11] *World Green Building Council. Building the Business Case: Health, Wellbeing and Productivity in Green Offices (2016).*

[12] *Maller, C., Townsend, M., Pryor, A., Brown P & St Leger, L. Healthy nature healthy people: 'contact with nature' as an upstream health promotion intervention for populations (2006).*

Long-term Vision of Success

By 2035, the UBC Vancouver campus buildings will contribute towards a vibrant and sustainable campus that supports the academic mission. The physical campus will exhibit Campus as a Living Lab demonstration projects firmly tied to teaching, learning, and research, with an increased potential to lead to broader market transformation. A trajectory will be set for the building design, construction and operation along the pathway to achieving a net positive campus for human and natural systems (see Figure 5). The GBAP will pay dividends in the long-term with lower energy bills, avoided control and damage costs of the environmental impacts of inaction, and reduced health costs. An iterative process that incorporates learning and experience between projects, will be established to advance performance targets and try new ideas, reinforcing an adaptive long term approach to operational planning. UBC will be a global leader in innovative green building design and construction and make net positive contributions to human and natural systems.

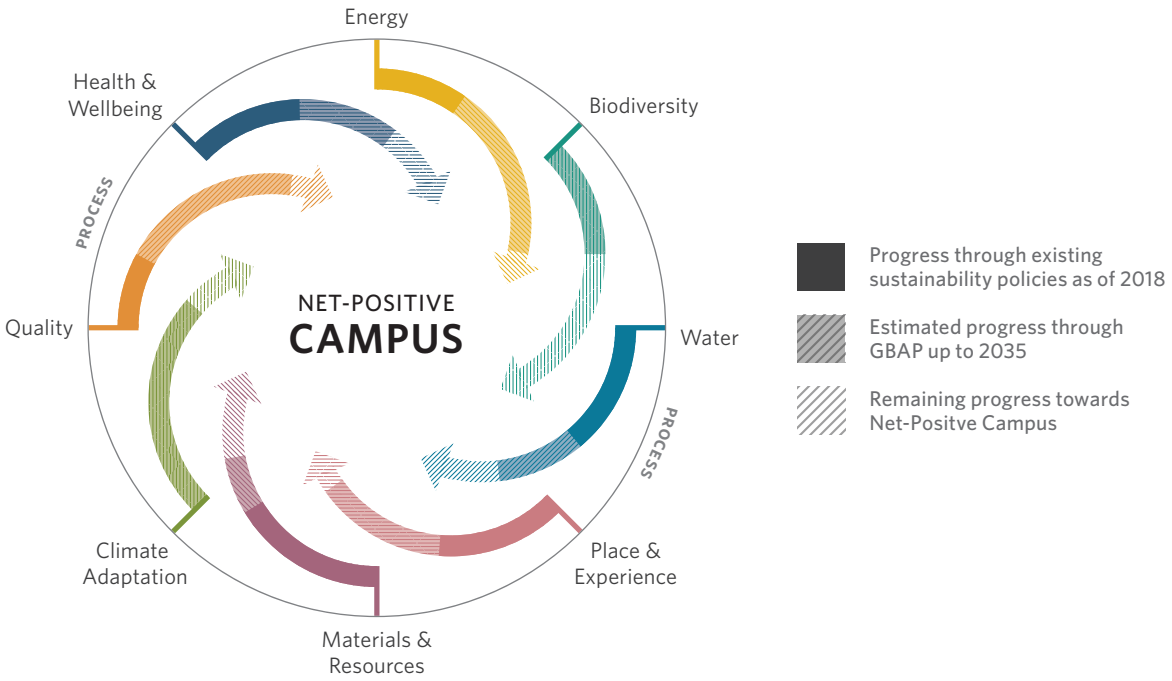


Figure 5. An illustrative diagram of the current level of progress on each GBAP component area and the estimated progress needed to achieve a net positive campus.

The Institutional **Green Building Action Plan**

The following pages provide an in depth description of the context and direction of all eight component areas as well as the process improvements required. In each component area, goals, short term priority actions, targets and indicators are shown with an explanation of the context and key directions.

A complete list of UBC's short, medium and long term actions for the institutional action plan are shown in Appendix A.

Earth Sciences Building Shades & Overhang
ARCHITECT: PERKINS+WILL
PHOTOGRAPHER: PHILIP BERTOGG

Process

COMPONENT GOALS

01 UBC policies and processes will support the achievement of the GBAP component goals and targets.

02 GBAP component goals and targets and will be communicated and easily accessible to internal and external stakeholders.

03 UBC will integrate lessons learned from each project to improve building designs.

04 UBC buildings will be evaluated as opportunities for research, innovation and continuous improvement.

05 UBC will commit to monitoring and benchmarking building performance to encourage continuous improvement on campus and in relation to industry standards.

CONTEXT

Effective and efficient process is a foundational aspect of planning at UBC.

Key Directions

To ensure success of the GBAP, UBC commits to monitoring and benchmarking building performance to encourage continuous improvement in relation to industry standards.

- The GBAP will be achieved by ensuring effective and efficient processes are upheld. Green building requirements will be clearly accessible for stakeholders through a web page linking to relevant requirements.
- During project development, UBC has recognized (through review of the Major Capital Project Development Process) that increased emphasis on reducing the total cost of ownership for UBC's buildings, as well as on many other green building objectives, is an important approach that will benefit UBC in the long run.
- Following the success of Campus as a Living Lab and SEEDS, the idea of considering each building project as an opportunity for teaching, learning and research will help connect the necessity of physical facilities to the enhancement of UBC's academic mission.

AMS Student Nest
ARCHITECT: DIALOG AND BH ARCHITECTS
PHOTOGRAPHER: MARTIN DEE / UBC COMMUNICATIONS & MARKETING

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Explore the implementation of a benchmarking platform for energy, emissions, water and waste reporting.
- Create a GBAP requirements web page that links to all relevant policies and tools for easy accessibility by stakeholders.
- Develop a more refined life cycle costing tool and/or approach to better understand the total cost of ownership for the university during the design process by exploring design options.
- Ensure the Major Capital Project Development Process achieves the process and sustainability objectives of the GBAP by improved integration of the current Sustainability Process.
- Relate level 3 research opportunities to GBAP component goals to increase alignment of research and operations by creating a list of potential opportunities.
- Develop a decision-making tool template for tier 1 and tier 3 projects to determine project priorities.
- Develop short-term and long-term strategic research opportunity plans to help connect the necessity of physical facilities to the enhancement of UBC's academic mission.
- Ensure that project design briefs (which describe UBC's project goals to consultants) are developed by an appropriate stakeholder group so that lessons learned by Building Operations are incorporated into building design.
- Align the UBC Technical Guidelines with GBAP requirements through an annual review and update process that fully engages stakeholders.
- Update UBC Advisory Urban Design Panel requirements to include sustainability objectives and targets.
- Develop a program to conduct post-occupancy surveys and introduce standard post-occupancy evaluation (in coordination with the Major Project Improvement Process) to better understand occupants' concerns.

TARGETS AND INDICATORS

Target: 100% of projects will conduct life cycle costing by 2025.

Energy

COMPONENT GOALS

01 UBC buildings will advance the campus towards net positive energy and greenhouse gas neutrality by reducing energy demand and focusing on site-specific passive design approaches.

02 UBC buildings will have indoor thermal environments that are comfortable and enhance health and wellbeing.

03 UBC will integrate lessons learned to improve building energy performance.

CONTEXT

Buildings are the greatest sources of energy use and greenhouse gas emissions (GHG) on campus. Reducing building energy use will lower costs for the University (energy costs and carbon offset costs) and reduce GHG emissions, aligning with UBC's Climate Action Plan (CAP).

The Academic District Energy System (ADES) is one of UBC's signature initiatives to substantively reduce greenhouse gas (GHG) emissions. The original aging steam heating system at this campus was replaced with a hot water–based system that will heat approximately 130 buildings. The Bioenergy Research and Demonstration Facility, built in 2012, houses the process of using renewable biomass to generate thermal energy for heating campus buildings. The Campus Energy Centre is the primary energy source for the hot water district energy system, producing thermal energy (hot water).

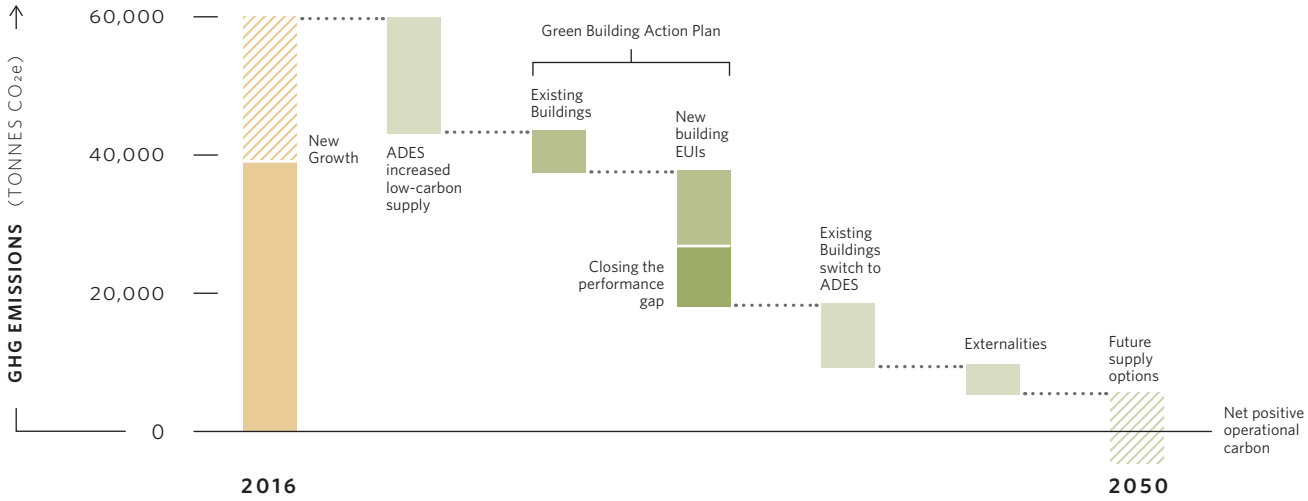


Figure 6. An illustrative graph of UBC's greenhouse gas (GHG) emissions in institutional developments and the role of the GBAP in reaching net positive operational carbon by 2050.

Through its evolving Climate Action Plan, UBC will continue to advance towards an ambitious greenhouse gas emission reduction target of 67% by 2020 and 100% by 2050. Reductions in building energy use and associated greenhouse gas emissions are a key aspect of the Green Building Action Plan, and the plan will be a leader in shifting the marketplace to low-carbon solutions.

Renewable biomass delivered to the Bioenergy Research Demonstration Facility generates thermal energy for the ADES
PHOTOGRAPHER: DON ERHARDT

Key Directions

UBC's new buildings and renewal projects (tier 1, 2 and 3a) will incrementally use less energy over time and achieve net positive GHG emissions by decreasing energy demand through passive design, increasing energy efficiency and meeting energy needs with renewable energy supply through the ADES. Energy targets for different building types and the anticipated incremental reduction over time is shown in Table 4.

Energy targets will be developed individually for each project to reflect the mixture of uses and refined during design development. Existing building retrofits (tiers 3b, 4 and 5) and ongoing operations will look to increasing energy efficiency and switching fuel to lower-carbon sources where possible.

UBC is committed to improving building performance by understanding occupant behavior and operator concerns and by increasing the stringency of compliance measures (such as requirements for airtightness testing and improved modelling of thermal bridging) to close the gap between predicted and actual energy use. UBC Energy and Water Services monitors building energy performance and works to identify actions (such as control upgrades) to improve performance and reduce the energy performance gap.

In addition to having ambitious energy targets, designing thermally comfortable indoor environments that are resilient to climate change is necessary to provide welcoming spaces that enhance the health and wellbeing of occupants.

INSTITUTIONAL ENERGY TARGETS

	STUDENT HOUSING			HIGH-INTENSITY SCIENCE BUILDING			LOW-INTENSITY SCIENCE BUILDING			OFFICE, CLASSROOM AND/OR LIBRARY		
	TEDI	DHW	EUI	TEDI	DHW	EUI	TEDI	DHW	EUI	TEDI	DHW	EUI
CURRENT	40	30	130	65	15	380	45	15	200	40	5	140
2020	30	30	120	55	15	370	35	15	190	30	5	130
2025	20	30	110	45	15	360	25	15	180	20	5	120
2030	15	30	95	35	15	350	15	15	170	15	5	115

Table 4. Energy targets for tier 1 and 3a institutional buildings.

The Bioenergy Research & Demonstration Facility (BRDF) houses the process of producing renewable heat for the university

ARCHITECT: LARRY MCFARLAND ARCHITECTS
PHOTOGRAPHER: PHILIP BERTOGG

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Identify passive and mechanical design requirements for buildings of different uses and space criteria that achieve comfortable indoor environments under predicted future climate conditions.
- Develop cost-effective low-carbon cooling strategies (including consideration of district cooling) to address thermal comfort needs at UBC.
- Establish mandatory incremental energy use intensity (EUI), thermal energy demand intensity (TEDI), and consider development of thermal demand (W/m²) and GHG Intensity (kgCO2e/m²/yr) targets for tier 1 and tier 3a projects.
- Require whole-building airtightness testing in alignment with BC Energy Step Code.
- Develop and implement a Smart Building Strategy and revise Monitoring Based Commissioning and Commissioning Technical Guidelines with results from the Smart Commissioning pilot projects.
- Develop a strategy and implement policies and procedures during building design to improve operability and maintainability as well as reduce the cost of ownership of energy-related systems in new construction projects.

TARGETS AND INDICATORS

Target: New institutional buildings will meet incrementally reduced energy targets to be Net Positive Ready by 2030.

Target: Reduce average building thermal energy use intensity (TEDI plus DHW) for campus buildings by 50% to 75 kwh/m²/yr by 2050.

Target: Reduce the performance gap between modelled and metered energy use in new institutional buildings by 75% within three years of occupancy by 2020.

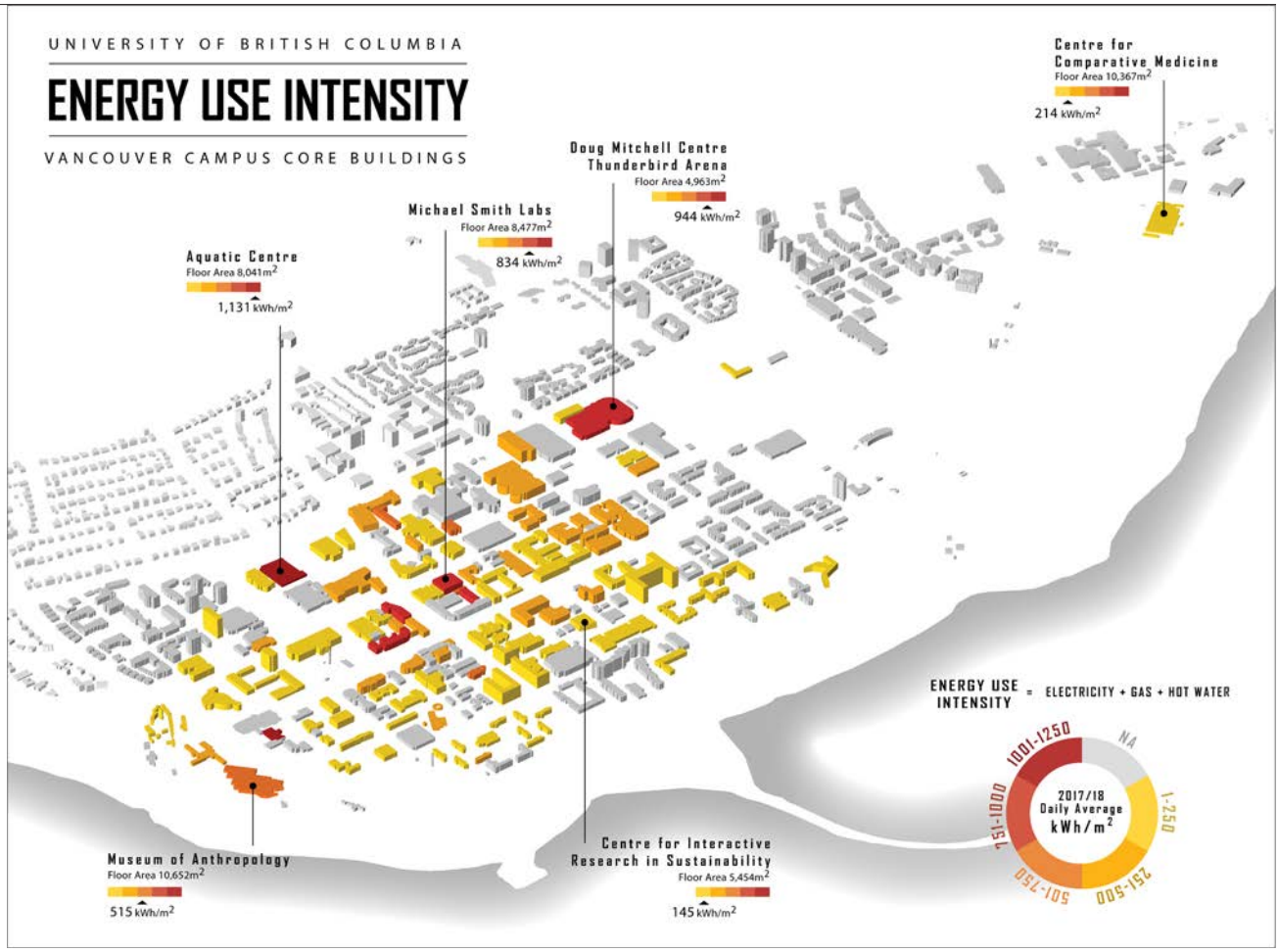


Figure 7. Current campus building energy use intensities (EUI's) illustrating how different uses effect energy use.

The Campus Energy Centre provides energy for the ADES serving 130 buildings **ARCHITECT:** DIALOG **PHOTOGRAPHER:** PHILIP BERTOGG

Water

COMPONENT GOALS

01 UBC will practise responsible water management and use at the building and site scale by advancing water conservation and efficiency, exploring alternative water supply and treatment solutions and building water supply resiliency.

02 UBC will use a low-impact development approach to rainwater management at the site scale to mitigate risk and respect the natural hydrology of the campus.

CONTEXT

In the Lower Mainland of BC there exists a relative abundance of water. However, there are still times when water supplies are low or deficient.

With the impacts of climate change, even more frequent periods of drought in future summer months as well as more frequent intense and severe rainfall in the winter are expected. UBC will be a leader in conserving water and will improve rainwater management by managing this valuable resource and supporting the regional water balance between water use and rainfall.

CIRS – Rainwater is collected from the roofs is measured, and then directed through a bioswale to a deep well without burdening the stormwater infrastructure

PHOTOGRAPHER: DON ERHARDT

Bioswale at the Beaty Biodiversity Centre improves the quality of rainwater runoff

PHOTOGRAPHER: PHILIP BERTOGG

Pathway to Net Positive

Although the University has made great strides in increasing water use efficiency, it is committed to continual improvements in monitoring and research to better understand how water is used, the potential for water reuse strategies, the role UBC should play in the greater region in the event of water emergencies, and how best to adapt to increased droughts brought on by climate change. The GBAP will align with and integrate building and landscape guidance called for in the Water Action Plan.

Rainwater management will be envisioned, designed and built as a holistic system of Low-impact development with green roofs and at-grade solutions combined for new building projects and, where possible, for renewals. Low-impact development (LID) recommendations for UBC include: reduced hard surfaces, thicker top soil, climate-adaptive landscapes, bioswales, French drains and rain gardens. On building sites more than 300 meters from the cliffs, the opportunity to use LID will be optimized; however, a more cautious approach is required closer to the cliffs to mitigate the risk of cliff erosion.

Key Directions

GBAP priority actions focus on the reduction of water use in buildings paired with metering and benchmarking of indoor and outdoor water use. Reductions in cooling tower water use, review of plumbing fixture efficiencies and landscape/irrigation guidelines will be undertaken. Alternate water supply sources best practices will be established.

Rainwater management priority actions include improving LID site rainwater management to help mitigate the risk of floods and cliff erosion on campus as well as developing criteria and guidelines for the use of green and blue roofs.

Rainwater Management Features on University Blvd.
PHOTOGRAPHER: DON ERHARDT
SOURCE: UBC BRAND & MARKETING

FIVE-YEAR IMPLEMENTATION PLAN – SHORT-TERM PRIORITY ACTIONS

- Investigate opportunities to reduce cooling tower water use in existing and new buildings.
- Develop criteria and guidelines for green roof and blue roof projects, based on rainwater management capacity, co-benefits, life cycle costs, and maintenance and operation considerations.
- Implement water metering requirements into (building) policy in alignment with the Water Action Plan.
- Review and update plumbing fixture efficiency requirements for new buildings and retrofits to current leading practice.
- Update landscape design standards and associated irrigation design standards.
- Develop guidelines for alternative water supply sources and systems in buildings (e.g., rainwater harvesting or water reuse systems) and on-site storage in buildings.
- Promote the use of seasonal rainwater features in policy which do not use potable water and consider life cycle costs.
- Require all tier 1, 2 and 3a projects to achieve the equivalent to LEED v4 Rainwater Management credit, Option 2.

TARGETS AND INDICATORS

Target: Reduce the water use intensity on campus by 16% in 2025 and 24% in 2030 (relative to a 2017 baseline), resulting in total water consumption remaining at or below 2017 levels despite growth.

Target: Meter and report on water consumption for individual UBC buildings to enhance our ability to make strategic decisions on water conservation by: 1) ensuring all new buildings include water metering, 2) maintaining or replacing existing meters as required, and 3) adding meters where economically viable, over the next five years.

Target: Maximize rainwater management using low-impact development on building sites that are more than 300 m from cliffs.

Indicator: Increase infiltration, retention and detention of rainwater on campus.

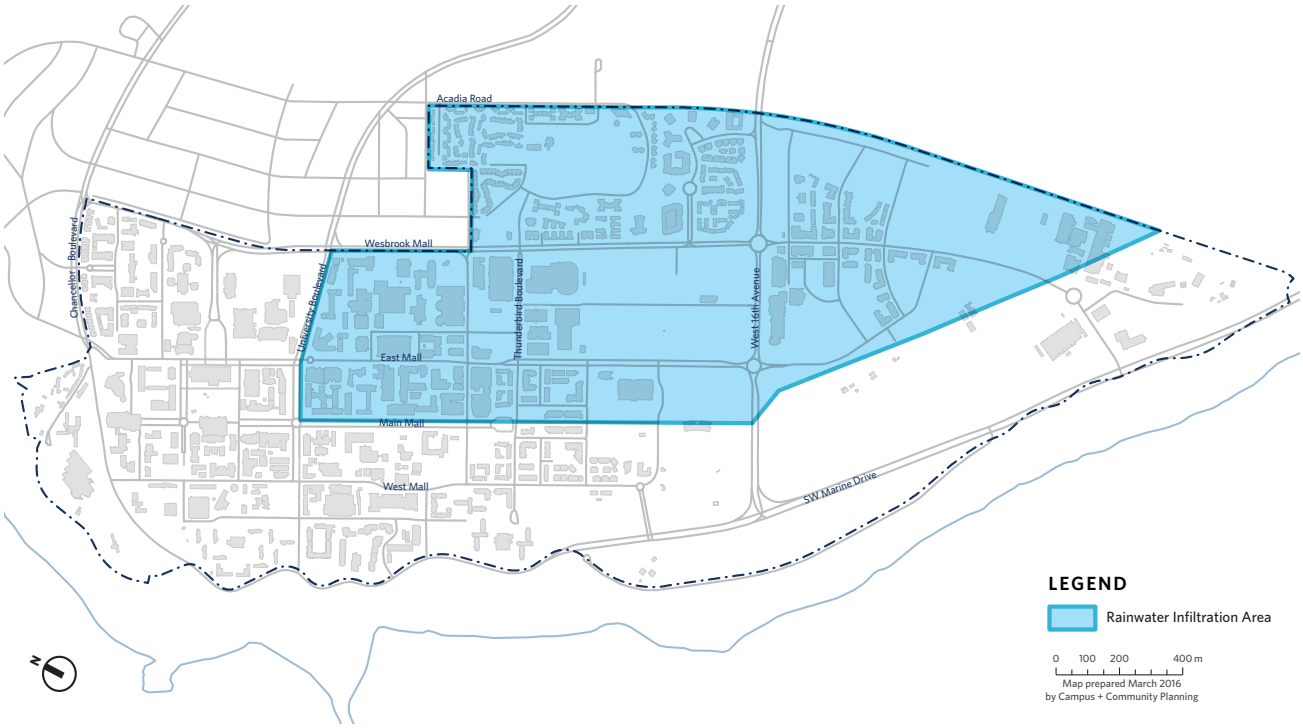


Figure 8. A plan of rainwater infiltration area across campus.
Source: UBC LEED Implementation Guide for Building Design and Construction v4 (2016).

Materials & Resources

COMPONENT GOALS

01 UBC will prioritize the use of building materials that have net positive environmental impacts.

02 UBC will support marketplace transformation by designing buildings with materials that are not harmful to human and ecological health.

03 UBC will support the development of the circular economy by promoting the adaptation, reuse and recycling of materials and products during a building's lifetime.

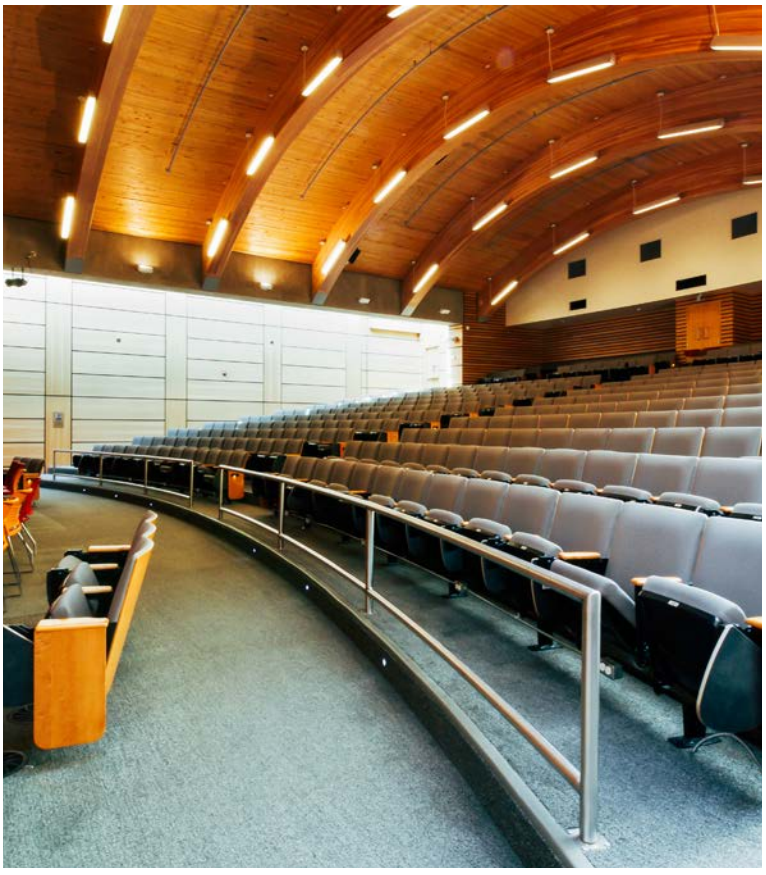
CONTEXT

UBC has policy in place to reduce the environmental footprint in its material choices, the handling of these materials and the waste products generated during construction and occupancy (UBC LEED Implementation Guide and UBC Technical Guidelines).

To work towards the materials and resources component area goals, policy will need to be implemented incrementally over the GBAP time frame to update to current practice and to reflect continuous improvement.

Pathway to Net Positive

Between 2004 and 2014, UBC had an average yearly expenditure of approximately $64 million worth of construction materials. By shifting material choices based on environmental and health impacts, UBC can continue to reduce the negative environmental and health impacts of the University's buildings and play a significant role in moving the marketplace towards net positive impacts.



Local wood products and low emitting seats are featured at the CIRS auditorium.

ARCHITECT: PERKINS+WILL
PHOTOGRAPHER: PHILIP BERTOGG

Key Directions

In the Materials and Resources component area UBC will incrementally reduce the environmental footprint of buildings through building material choices, construction techniques and diversion of waste from landfill during construction and occupancy. The GBAP will require material transparency through environmental product declarations as they become more available and will track and prioritize materials with low levels of embodied carbon. An approach to identifying and eliminating building materials considered harmful to health will be developed based on reviews of best practices and a market supply analysis. In the long term, an integrated approach to policy that balances environment impact and includes embodied carbon and healthy building material requirements based on a life cycle assessment approach will be developed.

At Ponderosa Commons the overhang protects students from the rain and has a warm wood soffit, the wall above is a durable precast concrete sandwich panel.

ARCHITECT: KPMG ARCHITECTS AND HCMA ARCHITECTURE + DESIGN

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Review current operational waste recycling infrastructure guidelines to maximize adaptability over time and improve diversion rates (e.g., location, access, frequency, size, etc.).
- Review current metrics and benchmarks for construction waste in order to reduce total amount of waste produced. Consider project size, structure, and typology.
- Undertake staff and faculty engagement to develop a targeted and realistic approach to the use of life cycle assessments for new construction projects (based on experience gained with Brock Commons Tallwood House's full life cycle assessment and life cycle cost pilot).
- Develop guidelines for making building material choices through research (level 2) that are informed by health impacts based on a review of best practices, market supply, and stakeholder engagement (i.e., list commonly used building materials considered harmful to health in the sourcing, manufacturing, installation, occupancy or end-of-life phase).
- Develop guidelines for building design adaptability and deconstructability.
- Develop a process for piloting and monitoring innovative building products in design and construction practices that reduce life cycle impacts.
- Mandate the incremental reduction of environmental impact in building materials through pilots and best practice review.
- Implement policies for reduced embodied carbon in buildings, starting with a requirement to report embodied carbon, followed by incremental reductions.

TARGETS AND INDICATORS

Target: Eliminate 100% of UBC-identified building materials in new construction that are known to be detrimental to human and ecological health by 2035.

Target: Require all new buildings to be Zero Waste Ready[13] by 2020.

Target: Divert 100% of construction and demolition waste from landfill by 2035.

[13] *Buildings fully meet the most recent version of the Recycling Infrastructure Guidelines for UBC Buildings and the UBC Technical Guidelines related to waste and recycling requirements.*

Biodiversity

COMPONENT GOALS

01 UBC will develop highly functioning landscapes at the building and site scale to contribute to biodiversity and natural ecosystem processes.

02 UBC will engage campus teaching and research opportunities to enhance biodiversity management capacity.

Above-Left: Biosciences Building
PHOTOGRAPHER:
PHILIP BERTOGG

Above-Right: Nest Garden
PHOTOGRAPHER:
PHILIP BERTOGG

CONTEXT

Biodiversity is the richness of plant and animal species, their ecosystems, and the ecological processes that sustain them.

Enhancing biodiversity by nurturing natural systems provides for a range of ecological services: local and global climate regulation, water supply retention, erosion and sediment control, hazard mitigation, pollination, habitat functions, waste decomposition and treatment, human health and wellbeing, food and renewable non-food products, and cultural benefits. The natural systems of UBC are a critical component of the University's identity and support community health and wellbeing. Ecological processes cross scales, beyond the boundary of a building site.

Pathway to Net Positive

A net positive approach involves nurturing UBC's natural systems that provide for a range of important ecological services, which are typically undervalued. Biodiversity is an emergent component of the GBAP. Through the Campus Biodiversity Initiative: Research and Demonstration (CBIRD), UBC will conduct research and develop partnerships with regional organizations and will take essential steps to understanding biodiversity on a regional scale and UBC's potential role in the region.

Natural systems are a critical component of the University's identity and support the place and experience component area. The biodiversity that these systems support is part of community health and wellbeing and helps to sustain mental and physical health. The ability of natural systems to help UBC adapt to climate change is an additional co-benefit.

Key Directions

Priority actions for biodiversity focus on developing principals and providing guidance for landscapes and green roofs that consider the ability for the planted installations to support regional biodiversity priorities and provide other co-benefits. Building and landscape projects will need to address ecological assets identified in campus-scale site assessments, bird-friendly design guidelines will require improvement, and linkages to research initiatives will need to be strengthened.

FIVE-YEAR IMPLEMENTATION PLAN – SHORT-TERM PRIORITY ACTIONS

- Review and research national and international best practices, incorporate findings into guidance for current development projects, and use findings to provide background for policy development that guides metrics at a building and landscape scale. (Include a review of Canada's goals based on the Convention on Biological Diversity, Sustainable Sites Initiative (SSI) and Strategic Directions for Biodiversity Conservation in the Metro Vancouver Region[14]).
- Engage a consultant(s) to conduct site assessments to identify and assess the ecological assets, endangered and vulnerable species, and environmentally sensitive areas on a campus or neighbourhood scale. Site assessment reports will be used to inform individual project designs.
- Establish partnerships between research and operations through participation in CBIRD and related Level 1 and 2 SEEDS projects.
- Identify and monitor key biodiversity metrics at the site and building scale to determine baseline conditions and rates of change based on research studies and crowd-sourcing (e.g., YardMap, eBird, BirdVis, iTree, etc.).
- Develop a set of principles for landscapes and green roofs that consider the following: 1) ability to adapt to climate change, 2) ability to attract pollinators, 3) reduction of invasive species, 4) microclimate suitability (sun, shade, etc.), 5) ability to support passive solar strategies (e.g., provide shade, reduce wind), 6) campus character zones and irrigation zones (green or brown areas), and 7) regional biodiversity priorities.
- Determine site-specific biodiversity requirements for each development project based on the neighbourhood-wide site assessments and principles identified above.
- Reflect the CBIRD vision and values in policy development.
- Based on review of the Library Gardens SSI pilot project, investigate the adoption of the Sustainable Sites Initiative as the required rating system for significant landscape projects.

TARGETS AND INDICATORS

Target: Require 100% compliance to UBC Bird Friendly Design Guidelines for Buildings for new institutional buildings by 2020.

Indicator: Increase opportunities to provide habitat for birds, pollinators and other species.

Note that, based on foundational studies and data gathering identified in the GBAP actions, further targets and indicators will be integrated into future updates of the GBAP.

[14] *Working Together for the Georgia Basin. Strategic Directions for Biodiversity Conservation in the Metro Vancouver Region (2008).*

Health & Wellbeing

COMPONENT GOALS

01 UBC will enhance the mental, physical social dimensions of wellbeing by making them integral to building and landscape design decisions.

02 UBC researchers, community stakeholders and building occupants will be engaged in a meaningful and ongoing way to inform building and landscape design decisions around health and wellbeing.

03 UBC will become a leader in enhancing wellbeing through the built environment within the context of higher education in Canada.

CONTEXT

UBC's campus environments, both built and natural, play a vital role in the physical, mental and social wellbeing of all students, staff and faculty.

Well-designed spaces can: work to promote physical activity; enable social connections; improve productivity, learning, and overall health; foster equity and inclusion; and promote accessibility and ease of use. Since the Okanagan Charter[15] was adopted, UBC has committed to incorporating health and wellbeing into all aspects of campus culture and operations.

Pathway to Net Positive

Prioritizing health and wellbeing is foundational to the success of individuals and the overall community at UBC, and it is closely linked to biodiversity and place and experience component areas. A system-wide holistic and proactive approach that champions wellbeing is currently in development through UBC Wellbeing, a collaborative effort that aims to make the University a better place to live, work and learn.

Key Directions

The GBAP will provide guidance for how building and landscape design can nurture the mental, physical and social dimensions of well-being. Wellbeing principles, objectives and metrics that will inform site-specific building and landscape requirements will be integrated into the GBAP in full coordination with the development of the UBC Wellbeing Strategy.

Foundational work in this emerging component area will include review of best practices, particularly the WELL Building Standard (through a pilot study to identify specific WELL Building Standard guidance that is aligned with UBC priorities).

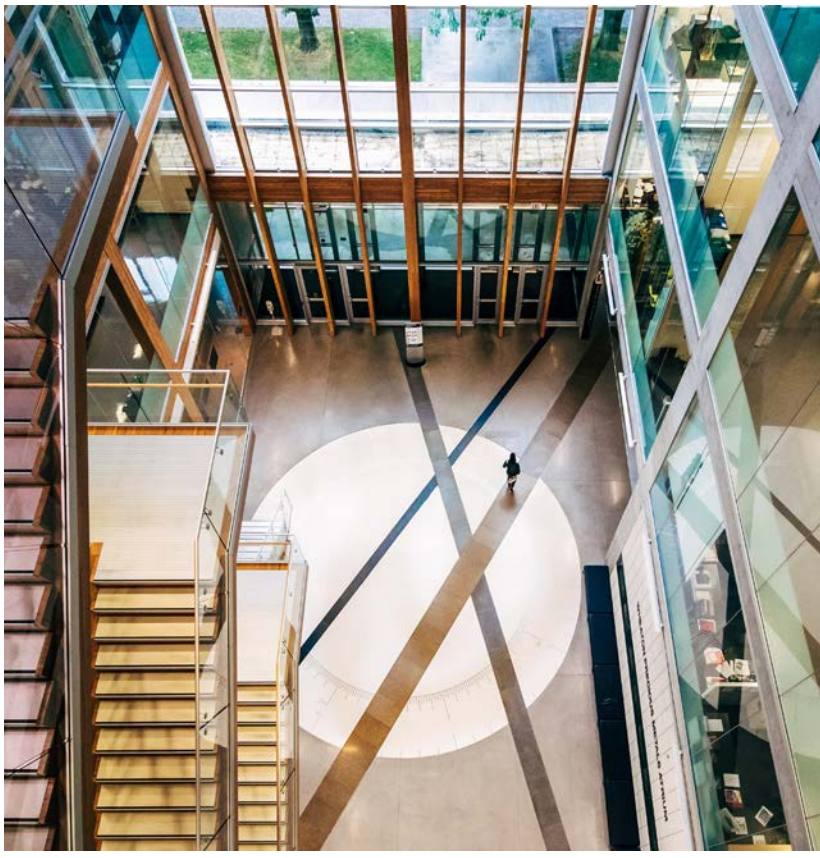
[15] *Okanagan Charter: An International Charter for Health Promoting Universities and Colleges (2015).*

FIVE-YEAR IMPLEMENTATION PLAN – SHORT-TERM PRIORITY ACTIONS

- Review research and best practices for physical, mental and social health and wellbeing in buildings.
- Develop health and wellbeing guiding principles for building design that promote physical, mental and social wellbeing (e.g., incorporating social or contemplative space, designing spaces that allow inclusion, incorporating universal design principles, promoting ease of use, incorporating ergonomic principles, developing daylighting requirements, considering acoustic requirements, etc.).
- Identify metrics for health and wellbeing (e.g., temperature, indoor air quality, daylight levels, acoustic levels, views to exterior, number of indoor plants, healthy working postures, etc.) and develop targets and performance measures.
- Develop a strategy for all projects to include considerations of ergonomics, universal access requirements, and how users of different sizes and abilities will interact with the environment (e.g., conduct table-top drawing simulations or mock-ups, analyze risks, and engage building occupants for feedback).
- Test the WELL Building Standard against existing buildings (e.g., Earth Sciences Building) in a pilot study and identify WELL Building Standard credits and best practices that are aligned with UBC priorities.
- Coordinate with UBC's Wellbeing Strategy in collaboration with UBC Wellbeing to guide how building and landscape design can nurture physical, mental and social dimensions of health and wellbeing.
- Incorporate health and wellbeing strategies into policies and design briefs for building and landscape projects.
- Establish relationships with off-campus partners to advance the connection between research and practice for health and wellbeing in buildings.

TARGETS AND INDICATORS

Targets and indicators will be developed based on foundational studies and data gathering identified in the GBAP.



Above: Move Stairs in CIRS encourage us inhabitants to take the stairs

PHOTOGRAPHER: PHILIP BERTOGG

Right: Cantilevered wood stairs at the Earth Sciences Building make taking the stairs pleasurable

PHOTOGRAPHER: PHILIP BERTOGG

Quality

COMPONENT GOALS

01 UBC buildings and landscapes will be durable, reliable and resilient.

CONTEXT

Quality is defined as that which makes a building reliable, durable, resilient, comfortable, dependable, and a contributor to the UBC brand.

UBC requirements for building quality are communicated through the UBC Technical Guidelines. UBC prioritizes durability for buildings and products that maximize life cycle and the total cost of ownership while meeting the functional requirements of building users.

Durable materials are preferred that minimize the need for new resources and their cost of operation and maintenance in the building's lifetime. Components, finishes, equipment and systems that require minimal maintenance and exhibit a high level of maintainability and long-term reliability are preferred.

Key Directions

To improve quality, UBC will analyze and strengthen existing processes. Increased compliance with project goals, UBC Technical Guidelines and UBC Sustainability Submission Requirements will be pursued.

To improve clarity particularly for renovations and retrofits, the green building requirements have been identified for each tier and are as follows:

TIER	DESCRIPTION	AREA/BUDGET	GREEN BUILDING REQUIREMENTS
TIER 1	New Buildings – Large	>1,000 m^2, >$5M	▪ Green building certification ▪ Energy target ▪ UBC Technical Guidelines ▪ Life Cycle costing focus ▪ Sustainability Process
TIER 2	New Buildings – Small	<1,000 m^2, >$5M	▪ Energy target ▪ UBC Technical Guidelines ▪ Life cycle costing focus ▪ Sustainability Process
TIER 3	Major Project Renovations a. Renewal (includes envelope and mechanical system upgrade)	>$5M	▪ Green Building Certification ▪ Energy target ▪ UBC Technical Guidelines ▪ Life cycle costing focus ▪ Sustainability Process
	b. Other (extensive interior upgrades)		▪ UBC Technical Guidelines ▪ Life cycle costing focus ▪ Meeting with Sustainability & Engineering
TIER 4	Partial Fit-outs	$1M – $5M	▪ UBC Technical Guidelines ▪ Life cycle costing focus ▪ Meeting with Sustainability & Engineering
TIER 5	System Upgrades (e.g., chiller replacement, controls)	n/a	▪ UBC Technical Guidelines ▪ Life cycle costing focus

Table 5. Tier system with green building requirements for institutional building projects.

In collaboration with UBC Project Services, Properties Trust, and Infrastructure Development, the GBAP clarifies performance targets and expectations for the renovation and retrofits of existing buildings. UBC prioritizes full renewal of aging buildings (tier 3a) rather than demolition and replacement, which can result in significant savings in construction costs, new materials, and environmental impact, and reduces UBC's deferred maintenance debt. Renewal can also preserve significant buildings while creating state-of-the-art facilities, helping to foster a sense of place and UBC's identity. Other major renovations (tier 3b) may involve only partial building renovation and upgrade, or renovations in support of significant changes to academic activities. Smaller renovations (tier 4) that support asset management or academic need have reduced requirements. System upgrades (tier 5) occur as needed during the service life or to specifically improve building performance and are typically geared to reduce UBC's deferred maintenance debt.

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Review and investigate opportunities to apply international climate resilience standards, such as the RELi resilience standard, to projects.
- Undertake a Greenest City Scholars study of the RELi resilience standard to identify the credits and best practices that align with UBC priorities.
- Develop review process for Owners Project Requirements.
- Require LEED documentation to be submitted to UBC at design, construction, and final review stages.
- Develop a strategy to conduct a full review of the UBC Technical Guidelines to ensure clarity and eliminate redundancies.

TARGETS AND INDICATORS

Target: Major projects track and achieve their design brief sustainability goals by 2020 (subject to approved changes during design process).

Target: Achieve 100% compliance with UBC Technical Guidelines by 2025 (compliance allows for approved variances).

Target: Achieve 100% compliance with UBC sustainability submission requirements by 2025 (compliance allows for approved variances).

The new building tier structure will provide guidance for renovation projects such as the Biosciences Building

ARCHITECT (RENOVATION): DIAMOND SCHMIDT
PHOTOGRAPHER: PHILIP BERTOGG

Climate Adaptation

COMPONENT GOALS

01 UBC buildings and landscapes will have the resilience to respond to both anticipated and unpredictable changes in climate.

02 UBC will engage with researchers in a meaningful and ongoing way to inform building policy and guidelines around climate adaptability.

CONTEXT

Through historical evidence and future modelling we know that temperatures will continue to rise as a result of climate change.

For the Lower Mainland, modelling predictions indicate that there will be long-term warming, more extreme weather events, changing precipitation patterns and rising sea levels.[16] These changes mean an increased risk of flooding, damage from storms, and overheating during summer highs. Changes to the design, construction and renovation of buildings and landscapes will be required to adapt to these future impacts. Without action, UBC's livability and economic prosperity goals are at risk.

Climate adaptation could be achieved through a change in approach to different aspects of building design, including: building form and orientation, building envelope, roof design, shading and glazing design, internal layout, interior environment, service infrastructure, exterior spaces, and the relationship between indoor and outdoor space. A key change at UBC is it that buildings will need to be designed for human comfort in the higher temperatures expected in our region over the building's lifetime.

Pathway to Net Positive

The broader UBC Resiliency Initiative will develop principles, objectives and metrics to guide adaptation in buildings and landscapes and address policies and guidelines that respond to risk across different scales – building, neighbourhood, campus and region. UBC will partner with regional partners including Metro Vancouver and the City of Vancouver to coordinate strategies.

Climate adaptation actions can provide multiple or synergistic benefits. For example, improved building envelopes can have multiple benefits, including reduced thermal heat transfer, reduced energy costs, reduced GHG emissions and improved thermal comfort. However, this must be balanced with the potential for increased cooling needs in future warmer temperatures resulting from these tight building envelopes.

Adaptation actions intersect with other components, including water and energy. For example, water conservation is a climate adaptation strategy that helps to reduce impacts from hotter, drier weather in future summers. For buildings, design measures such as shading, orientation, glazing and ventilation help to reduce energy demands and provide thermal comfort in hotter, drier summers.

As we make investments in our buildings, it is imperative that our designs, retrofits, operations and maintenance respond to adaptation needs. The cost of no action, both from a future retrofit and public safety perspective, could be much higher than proactively planning infrastructure to be resilient to future climate change impacts.

[16] *Metro Vancouver. Climate Projections for Metro Vancouver (2016).*

Earth Sciences Building shades and overhang provide shading from the morning sun

ARCHITECT: PERKINS+WILL
PHOTOGRAPHER: PHILIP BERTOGG

Key Directions

UBC will ensure buildings and landscapes adapt to a changing climate by using the most up-to-date climate data to guide building design and retrofits. Priority actions focus on a review of best practice for adaptation and identifying and conducting vulnerability assessments of infrastructure, including buildings, landscapes and stormwater infrastructure. GBAP actions will be integrated with an emerging campus Resiliency Initiative, when available, which will develop principles, objectives and metrics to guide adaptation in buildings and landscapes. Additional guidance in the water and energy components sections address specific approaches to climate adaptation.

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Review current research and best practices for climate adaptation strategies in buildings.
- Identify climate adaptation research opportunities for buildings and landscapes on a local, regional and global scale.
- Conduct vulnerability assessments of campus buildings, landscapes and infrastructure at periodic intervals.
- Integrate early guidance on climate adaptation measures into project design briefs.
- Coordinate with the campus-wide Resiliency Initiative and climate adaptation strategies, as they evolve based on vulnerability assessments, evaluations and best practice review, by implementing policies on a building and landscape scale that respond to key climate change impact areas (e.g., increased temperature, variable weather patterns, increased flood events, increased smoke, increased peak events, etc.).
- Incorporate aspects into building and landscape designs to serve campus-wide emergency response preparedness in coordination with key departments, including Infrastructure Development and Risk Management Services.
- Update GBAP once the Resiliency Initiative is adopted.

TARGETS AND INDICATORS

Targets and indicators will be developed based on foundational studies and data gathering identified in the GBAP.

Place & Experience

COMPONENT GOALS

01 UBC buildings and landscapes will provide opportunities for collaboration, innovation and community development to reflect the social and environmental sustainability aspirations of the University.

CONTEXT

The Campus Plan and the Public Realm Plan have played major roles in creating a sense of place on campus since their implementation.

Through these plans UBC already has ambitious and successful place-making policy and is looking for improvements and synergies with other green building component areas to carry through to new developments.

Buchanan Courtyard provides an outdoor gathering space for arts students with places for sitting , studying and eating.

PHOTOGRAPHER: PHILIP BERTOGG

Pathway to Net Positive

Place and experience is a component of the GBAP that specifically promotes architectural and landscape designs that outwardly express social and environmental sustainability aspirations of UBC.

This component is emerging in nature, examples might include:

- Celebrating natural systems (e.g., University Boulevard stormwater feature)
- Using locally appropriate materials (e.g., First Nation House of Learning use of locally selected timbers)
- Fostering social connection and cohesion through design of exterior and interior spaces (e.g., the exterior/interior knoll at the Nest)
- Building elements that tell a story and learning landscapes (e.g., rainwater leaders that show water collection at CIRS)
- Exposing building systems creatively (e.g., Campus Energy Centre boilers)

Indian Residential School History and Dialogue Centre provides a place for contemplation both inside and in the library gardens

PHOTOGRAPHER: PAUL JOSEPH / UBC COMMUNICATIONS & MARKETING

Key Directions

Design has a role to play in telling the sustainability story of the building and landscape and communicating their unique identities. Design can also express human and ecological wellbeing by teaching about the processes or systems within the building and by expressing their presence. Expression can also be more abstract and creative, which communicates sustainability in a less literal manner (e.g., through art installations or playful demonstrations). It is important that buildings and landscapes serve the larger aspiration of producing positive, memorable and personally relevant experience, especially given the potentially limited time students are in attendance.

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Identify short-and long-term student-led initiatives that contribute meaning and memory associated with buildings and landscapes.
- Review the Public Realm Plan goals and guidelines for better coordination and compliance of building landscapes.
- Establish additional GBAP place and experience component goals, in coordination with Campus and Community Planning, to help express a project's social, environmental and economic sustainability goals.
- Integrate heritage considerations early in the design through mandatory "Statements of Significance" for existing buildings.
- Analyze and improve existing design and development processes for strengths and weaknesses in integrating the GBAP place and experience component goals in project design objectives.

TARGETS AND INDICATORS

Targets and indicators will be developed based on foundational studies and data gathering identified in the GBAP.

The Residential **Green Building Action Plan**

The following pages provide an in depth description of the context and direction of all eight component areas as well as the process improvements required. In each component area, goals, selected priority actions, targets and indicators are shown with an explanation of the context and key directions.

A complete list of UBC's short, medium, and long term actions for the residential action plan is shown in Appendix B.

In the residential neighbourhoods, REAP (the Residential Environmental Assessment Program) is the key policy driver. REAP is a UBC-specific green building rating system that applies to multi-use residential and mixed-use (residential with commercial at grade) buildings. The fundamental idea behind REAP building requirements is to support the reduction of environmental impact at the building site and neighbourhood scale incrementally over time. All new residential projects, including private developments and Faculty and Staff Housing, are required to achieve a minimum REAP Gold certification.

Wesbrook Neighbourhood
PHOTOGRAPHER: PHILIP BERTOGG

Process

COMPONENT GOALS

01 UBC policies and processes will support the achievement of the GBAP component goals and targets.

02 GBAP component goals and targets will be communicated and easily accessible to internal and external stakeholders.

03 UBC will integrate lessons learned from each project to improve building designs.

04 UBC buildings will be evaluated as opportunities for research, innovation and continuous improvement.

05 UBC will commit to monitoring and benchmarking building performance to encourage continuous improvement on campus and in relation to industry standards.

Residential Ideas Workshop

CONTEXT

Effective and efficient process is a foundational aspect of planning at UBC.

Wesbrook Neighbourhood
PHOTOGRAPHER: PHILIP BERTOGG

Key Directions

It is important to leverage and build upon existing processes to ensure that sustainability objectives inform development from project inception to post-occupancy performance tracking.

The University needs to start measuring the performance of projects in the neighbourhoods, learn from data collected, and integrate new knowledge into existing policies in all component areas of the GBAP.

Tying operations into teaching, learning and research through short- and long-term strategic research opportunity plans will help connect the necessity of physical facilities to the enhancement of UBC's academic mission.

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Develop a sustainability process for new residential construction.
- Develop a process to introduce GBAP requirements for retrofit and renovation projects in neighbourhoods.
- Create REAP credits for mandatory benchmarking, performance reviews and post-occupancy surveys.
- Create a GBAP requirements web page that links to all relevant policies and tools for easy accessibility by stakeholders.
- Update to REAP 3.1 for BC Energy Step Code alignment.
- Update to REAP 4.0 based on component area priorities in time for the development of the Stadium Road neighbourhood with stakeholder review.
- Update the UBC Advisory Urban Design Panel requirements to include sustainability outcome requirements.

Energy

COMPONENT GOALS

01 UBC buildings and landscapes will advance the campus towards net positive energy and greenhouse gas neutrality by reducing energy demand and focusing on site-specific passive design approaches.

02 UBC buildings will have indoor thermal environments that are comfortable and enhance health and wellbeing.

03 UBC will integrate lessons learned to improve building energy performance.

CONTEXT

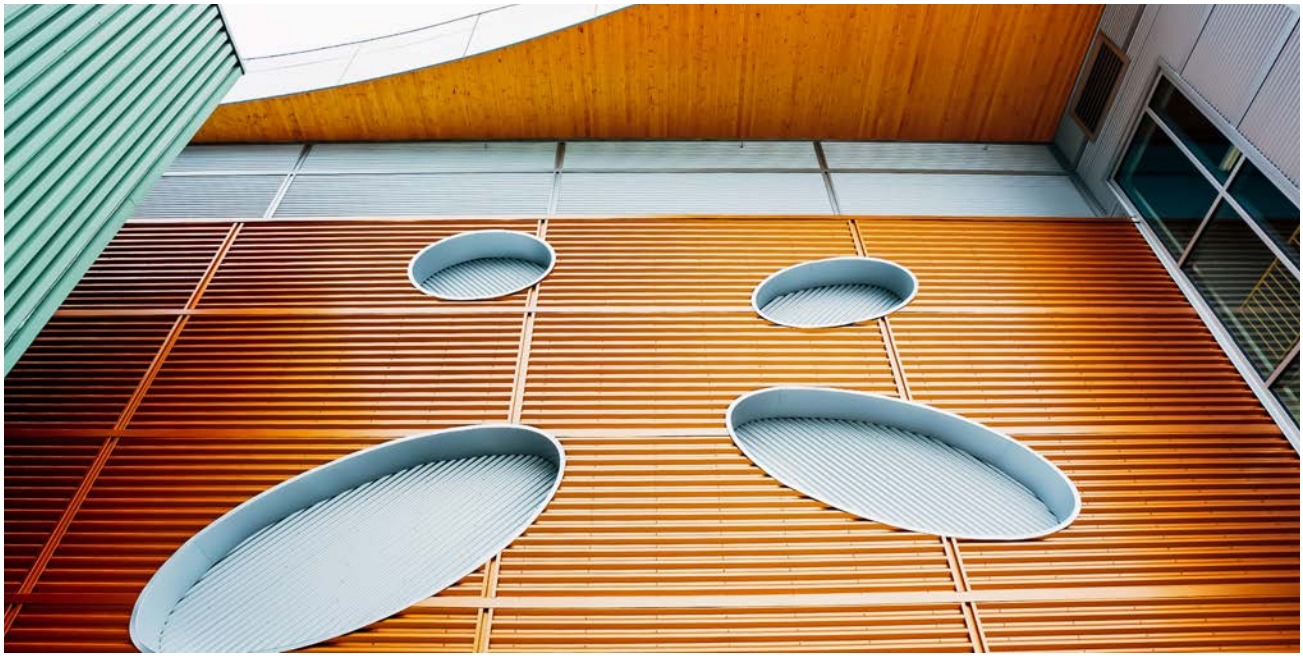
Buildings provide nearly 30% of regional GHG emissions[17] and nearly half of emissions from the UBC residential neighbourhoods.[18]

To achieve improved energy performance and emission reductions along with other sustainability objectives, UBC established the Residential Environmental Assessment Program (REAP) in 2007 as a Land Use Rule.

To identify an energy and GHG reduction pathway in residential neighbourhoods, UBC developed a Community Energy and Emissions Plan (CEEP) in 2013 to set ambitious goals for energy and emission reductions. The CEEP identifies an energy and emissions reduction strategy that will result in a 90% reduction in building GHG emissions by 2050. To achieve this target, the CEEP recommends the establishment of a low-carbon Neighbourhood District Energy System (NDES), improved energy performance measures through REAP, and the implementation of a building retrofit program.

The objective of the NDES is to provide heat and hot water with reduced GHG emissions by providing low-carbon thermal energy for UBC residential neighbourhoods, including Wesbrook Place, East Campus, Acadia Park and Stadium Road. District energy is currently in phase 1 of its development, serving Wesbrook Place using temporary natural gas boilers. Phase 2 implementation will use an alternate energy source, currently contemplated as waste heat recovery from TRIUMF or interconnection with the ADES, which is expected to occur in 2024.

[17] *Metro Vancouver. Greenhouse Gas Factsheet (2013).*
[18] *UTOWN@UBC. Community Energy and Emissions Plan (2013).*



TRIUMF – Advanced Rare Isotope Laboratory. The cooling towers at Triumf presently transfer all of the waste heat into the atmosphere. This waste heat could be used to provide thermal energy via hot water to the NDES.

ARCHITECT: CHERNOFF THOMPSON ARCHITECTS

UBC is currently working on the balance between building performance and the business case for the development of the low-carbon NDES.

More recently, the Province of BC has instituted the BC Energy Step Code to define a pathway to net zero–ready buildings by 2032. The federal Pan Canadian Framework defines a similar pathway.

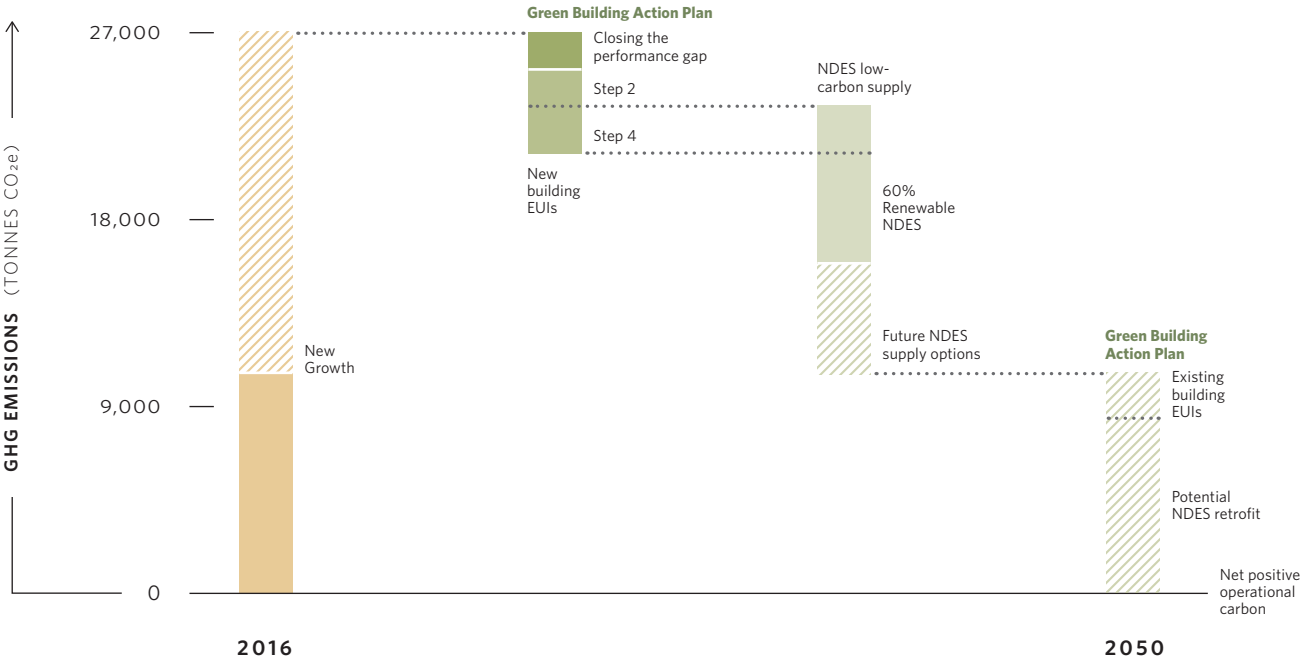


Figure 9. An illustrative graph of UBC's greenhouse gas (GHG) emissions in residential developments and the role of the GBAP in reaching net positive operational carbon by 2050.

Pathway to Net Positive

The CEEP identifies an energy and emissions reduction strategy that will result in near zero building GHG emissions by 2050. To achieve this target, the CEEP recommends the establishment of a low-carbon Neighbourhood District Energy System (NDES), improved energy performance measures through REAP, and the implementation of a building retrofit program. In 2015, the BC Utilities Commission approved the establishment of phase 1 of a low-carbon energy utility—the UBC NDES. Phase 2 planning is in progress and will include a fuel switch from temporary natural gas energy centres to a renewable 60% energy centre in 2024. The CEEP targets a 100% renewable energy centre by 2040.

To achieve improved performance and consistency with other BC jurisdictions, REAP 3.1 energy targets will be aligned with Step 2 of the BC Energy Step Code targets. Step 2 calls for an EUI of 130 kwh/m²/yr and a TEDI of 45 kwh/m²/yr.

Costing studies commissioned by UBC and the Province of BC demonstrate that BC Energy Step Code targets are cost effective for developers to Step 3 of the code *(Table 6)*. The implications of the Step 2 target for REAP considers impacts on future demand and a utility rate for the NDES. The studies identified positive paybacks up to Step 3 of the code, on a life cycle costing basis (net-present value, including energy cost savings).

		UBC STUDY		BC HOUSING STUDY
TYPOLOGY	STEP CODE LEVEL	LOW	HIGH	AVERAGE
LOW RISE	STEP 1	0.0%	0.0%	0.0%
	STEP 2	0.0%	0.1%	0.5%
	STEP 3	0.5%	1.1%	0.6%
	STEP 4	2.3%	4.1%	2.6%
HIGH RISE	STEP 1	0.0%	0.0%	0.0%
	STEP 2	0.4%	0.9%	0.4%
	STEP 3	0.5%	1.4%	0.8%
	STEP 4	2.3%	4.1%	2.4%

Table 6. Incremental capital costs based on costing studies by UBC and the Province of BC.

Key Directions

To ensure residential development is on a pathway to achieving net positive energy and GHG emissions, the GBAP's priority actions focus on the alignment of REAP with the BC Energy Step Code. This includes the implementation of an energy benchmarking monitoring program intended to provide feedback on the realized performance of REAP energy targets and the NDES. Improving the understanding of design measures to maintain thermal comfort under future climate conditions is an emerging priority. A key objective is to achieve GHG reductions across the energy demand and supply spectrum at the lowest total cost of ownership.

FIVE-YEAR IMPLEMENTATION PLAN – SHORT-TERM PRIORITY ACTIONS

- Undertake a study to identify envelope and mechanical design options that achieve comfortable indoor environment under predicted future climate conditions, with priority emphasis on passive approaches where feasible.
- Review feasibility of developing and implementing REAP requirements for existing buildings.
- Implement an energy benchmarking system as part of an ongoing monitoring program.
- Develop GHG intensity targets to ensure cost-effective pathways to zero GHG emissions for buildings connected or not connected to the NDES.
- Develop energy efficiency education programs, including a quick-start for strata councils, to support building owners and residents in partnership with the UNA.
- Mandate incremental energy use intensity (EUI) and thermal energy demand intensity (TEDI) building targets that align with BC Energy Step Code requirements and support the development of the NDES renewable energy centre by 2024.
- Mandate whole building airtightness testing and energy modelling in alignment with BC Energy Step Code by 2018 and set airtightness targets by 2020.
- Develop a program to inform building owners of energy performance through benchmarking reporting by 2020.

TARGETS AND INDICATORS

Target: New residential buildings will meet energy targets to be Net Zero Ready by 2032 in alignment with the BC Energy Step Code.

Indicator: Increase energy efficiency of existing residential buildings through standards and programs.

Central achieved REAP gold Plus and uses passive design features such as increased insulation to reduce energy demand.

ARCHITECT: RAMSEY WORDEN ARCHITECTS

Water

COMPONENT GOALS

01 UBC will practise responsible water management and use at the building and site scale by advancing water conservation and efficiency, exploring alternative water supply and treatment solutions and building water supply resiliency.

02 UBC will use a low-impact development approach to rainwater management at the site scale to mitigate risk and respect the natural hydrology of the campus.

Kitchen in Faculty and Staff housing featuring low flow plumbing fixtures and Energy Star appliances to reduce water use

CONTEXT

In the Lower Mainland of BC there exists a relative abundance of water. However, there are still times when water supplies are low or deficient.

With the impacts of climate change, even more frequent periods of drought in future summer months as well as more frequent intense and severe rainfall in the winter are expected. UBC will be a leader in conserving water and will improve rainwater management by managing this valuable resource and supporting the regional water balance between water use and rainfall.

Wesbrook Neighbourhood
PHOTOGRAPHER:
PHILIP BERTOGG

Pathway to Net Positive

Although the University has made great strides in increasing water use efficiency, it is committed to continual improvements in monitoring and research to better understand how water is used, the potential for water reuse strategies, the role UBC should play in the greater region in the event of water emergencies, and how best to adapt to increased droughts brought on by climate change. The GBAP will align with and integrate building and landscape guidance called for in the (concurrent) Water Action Plan.

Rainwater management will be envisioned, designed and built as a holistic system of low-impact development with green roofs and at-grade solutions combined for new building projects and, where possible, for renewals. Low-impact development (LID) recommendations for UBC include: reduced hard surfaces, thicker top soil, climate-adaptive landscapes, bioswales, French drains and rain gardens. On building sites more than 300 meters from the cliffs, the opportunity to use LID will be optimized; a more cautious approach is required closer to the cliffs to mitigate the risk of cliff erosion.

Key Directions

GBAP priority actions focus on a water metering and benchmarking strategy and the development of landscape and irrigation design standards. Landscape and irrigation design standards will be updated to incorporate drought-resistant plantings and more suitable trees. Irrigation will be tailored to specific plant requirements across the campus to ensure responsible water use.

Rainwater management priority actions include improving LID site rainwater management to help mitigate the risk of floods and cliff erosion on campus as well as developing criteria and guidelines for the use of green and blue roofs.

FIVE-YEAR IMPLEMENTATION PLAN – SHORT-TERM PRIORITY ACTIONS

- New residential projects to achieve the same rainwater management requirements as institutional projects by 2020.
- Institute a residential building benchmarking program for water consumption.
- Develop a water metering strategy (building and suite level) for residential buildings; consider a visualization concept that concurrently educates users.
- Develop building landscape and associated irrigation design standards for upcoming neighbourhoods based on low impact development.
- Develop a strategy that coordinates building landscape rainwater management with rainwater management in the public realm.
- Develop criteria and guidelines for green roof and blue roof projects, based on rainwater management capacity, co-benefits, maintenance and operation considerations for residential building typologies.
- Promote the use of seasonal rainwater features in policy which do not use potable water and consider the life cycle costs for strata owners.

TARGETS AND INDICATORS

Target: Maximize rainwater management using low-impact development on building sites that are more than 300 m from cliffs.

Indicator: Increase infiltration, retention and detention of rainwater in the neighbourhoods.

Materials & Resources

COMPONENT GOALS

01 UBC will prioritize the use of building materials that have net positive environmental impacts.

02 UBC will support marketplace transformation by designing buildings with materials that are not harmful to human and ecological health.

03 UBC will support the development of the circular economy by promoting the adaptation, reuse and recycling of materials and products during a building's lifetime.

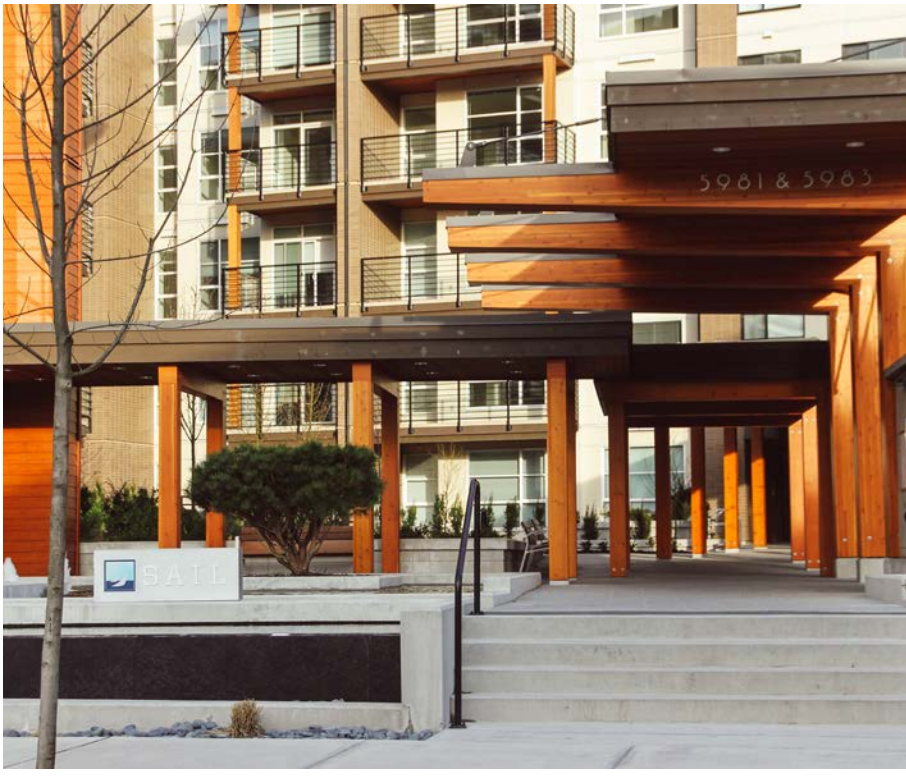
CONTEXT

UBC has policy in place to reduce the environmental footprint in its material choices, the handling of these materials and the waste products generated during construction and occupancy (REAP).

To work towards the materials and resources component area goals, policy will need to be implemented incrementally over the GBAP time frame to update materials credits to current practice and improve over time.

Pathway to Net Positive

By shifting material choices based on environmental and health impacts, UBC can continue to reduce the negative environmental and health impacts of the University's buildings and play a significant role in moving the marketplace towards net positive impacts.



The entrance sequence features a glulam structure, the beams an columns are locally manufactured.
PHOTOGRAPHER: PHILIP BERTOGG

The Yu Building is clad in brick which is a highly durable material

ARCHITECT: PERKINS+WILL

Key Directions

The GBAP will require material transparency through environmental product declarations and will prioritize materials with reduced environmental impact and low levels of embodied carbon. The GBAP will develop an approach to identifying and eliminating building materials considered harmful to health based on reviews of best practices and a market supply analysis.

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Develop guidelines for building materials considered harmful to health in their use or manufacture, based on best practice review, stakeholder engagement and consideration of market supply.
- Require incremental reductions in environmental impact of building materials, based on pilots, best practice review and market readiness study.
- Implement design service life requirements for new construction projects.
- Create an integrated policy for building materials that considers reduced environmental impact, healthy material requirements and life cycle analysis.

TARGETS AND INDICATORS

Target: Eliminate 100% of UBC-identified building materials in new construction that are known to be detrimental to human and ecological health by 2035.

Target: Require all new buildings to be Zero Waste Ready[19] by 2020.

Target: Divert 100% of construction and demolition waste from landfill by 2035.

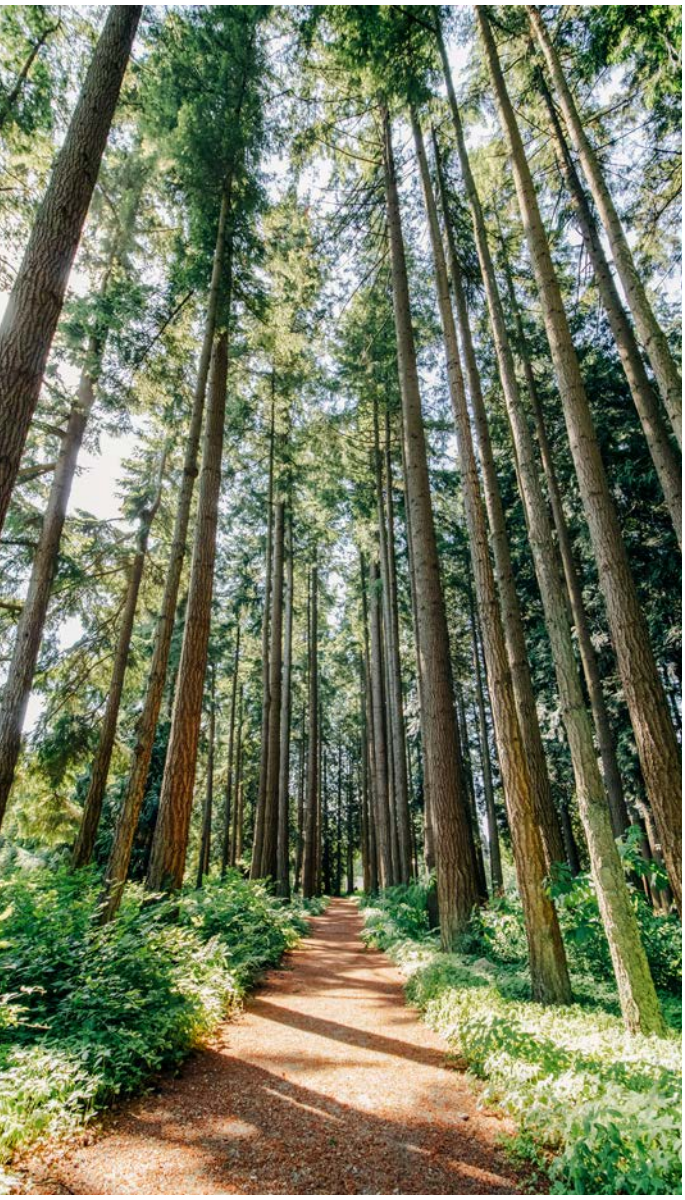
[19] *Buildings fully meet the most recent version of the Recycling Infrastructure Guidelines for UBC Buildings and the UBC Technical Guidelines related to waste and recycling requirements.*

Biodiversity

COMPONENT GOALS

01 UBC will develop highly functioning landscapes at the building and site scales to contribute to biodiversity and natural ecosystem processes.

02 UBC will engage campus teaching and research opportunities to enhance biodiversity management capacity.



CONTEXT

Biodiversity is the richness of plant and animal species, their ecosystems, and the ecological processes that sustain them.

Ecological processes cross scales beyond the boundary of a building site. Enhancing biodiversity by nurturing natural systems provides for a range of ecological services: local and global climate regulation, water supply retention, erosion and sediment control, hazard mitigation, pollination, habitat functions, waste decomposition and treatment, human health and wellbeing, food and renewable non-food products, and cultural benefits. The natural systems of UBC are a critical component of the University's identity and support community health and well-being.

The neighbourhood areas of campus are comprised of both private and public landscape areas. Thoughtful master planning of these landscape areas offers the greatest potential to maintain or re-establish the natural systems that are essential to the health of environments. As owner of the public realm, and planner and regulator of campus neighbourhoods, the University can achieve a systems-based approach to incremental landscape development within the framework of private sector development.

Through REAP and the neighbourhood plans, UBC has set out requirements related to biodiversity. Requirements for drought-tolerant and -adapted landscapes are mandated in REAP. Elements like greenways (connection to larger habitat areas), green edges, tree retention and parks, and bird-friendly design guidelines for buildings are integrated into existing neighbourhood plans.

The forests around UBC are valuable ecological assets
PHOTOGRAPHER: PHILIP BERTOGG

PHOTOGRAPHER: PHILIP BERTOGG

Pathway to Net Positive

A net positive approach involves nurturing UBC's natural systems that provide for a range of important ecological services, which are typically undervalued. The Green Building Action Plan supports and is expected to integrate with an emergent Biodiversity Strategy for the campus as a whole. This strategy will identify principles, objectives and metrics that will inform site-specific building and landscape requirements for integration in updates to the GBAP. The strategy will leverage partnerships with Metro Vancouver and City of Vancouver to ensure alignment with their biodiversity strategies.

Natural systems are a critical component of the University's identity and support the place and experience component. The biodiversity that these systems support is part of community health and wellbeing and helps to sustain mental and physical health. The ability of natural systems to help UBC adapt to climate change is an additional co-benefit.

Key Directions

Priority actions for biodiversity focus on ensuring that major residential project address ecological assets identified in neighbourhood site assessments, developing principles for landscapes and green roofs, and improving bird-friendly design guidelines.

Updated credits in REAP Version 4 and future neighbourhood plans will be based on review of best practices and guidelines, such as the Sustainable Sites Initiative. Specifically, the GBAP will provide guidance for landscapes and green roofs that consider the ability for the planted installations to support regional biodiversity priorities and provide other co-benefits.

FIVE-YEAR IMPLEMENTATION PLAN – SHORT-TERM PRIORITY ACTIONS

- Require all major projects to address a neighbourhood-wide site assessment that identifies important ecological assets, endangered and vulnerable species and environmentally sensitive areas.
- Establish partnerships between research and operations through participation in CBIRD (Campus Biodiversity Initiative: Research and Demonstration) and related Level 1 and 2 SEEDS projects.
- Develop a set of principles for neighbourhood landscapes and green roofs that consider the following: ability to adapt to climate change, ability to attract pollinators, microclimate suitability (sun, shade, etc.), ability to support passive solar strategies (e.g., provide shade, reduce wind), irrigation zones (green/brown areas), and regional biodiversity priorities.
- Further develop UBC Bird Friendly Design Guidelines for Buildings and create a mandatory policy in order to reduce the number of bird collisions with buildings.

TARGETS AND INDICATORS

Target: Require 100% compliance to UBC Bird Friendly Design Guidelines for Buildings for new residential buildings by 2025.

Indicator: Increase opportunities to provide habitat for birds, pollinators and other species.

Note that, based on foundational studies and data gathering identified in the GBAP actions, further targets and indicators will be integrated into future updates of the GBAP.

Health & Wellbeing

COMPONENT GOALS

01 UBC will enhance the mental, physical and social dimensions of wellbeing by making them integral to building and landscape design decisions.

02 UBC researchers, community stakeholders and building occupants will be engaged in a meaningful and ongoing way to inform building design decisions around health and wellbeing.

03 UBC will become a leader in enhancing wellbeing through the built environment within the context of higher education in Canada.

CONTEXT

UBC's neighbourhood environments, both built and natural, play a vital role in the physical, mental and social wellbeing of all students, staff and faculty.

Well-designed spaces can work to promote physical activity, enable social connections, improve productivity, learning, and overall health, and foster equity.

Bicycle parking outside the Westbrook Community Centre accommodates a healthy mode of transportation

PHOTOGRAPHER: PHILIP BERTOGG

Pathway to Net Positive

A system-wide holistic and proactive approach that champions wellbeing is currently in development through UBC Wellbeing. UBC Wellbeing is a collaborative effort that aims to make the University a better place to live, work and learn.

Prioritizing health and wellbeing is foundational to the success of individuals and the overall community at UBC and provides co-benefits to the biodiversity and place and experience components.

Key Directions

The GBAP will coordinate guidance for how building and landscape design can nurture the social dimensions of wellbeing. Wellbeing principles, objectives and metrics, rooted in this strategy, that will inform site-specific building and landscape requirements will be integrated into the GBAP.

FIVE-YEAR IMPLEMENTATION PLAN – SHORT-TERM PRIORITY ACTIONS

- Identify metrics for health and wellbeing in residential buildings (e.g., temperature, indoor air quality, daylight levels, acoustic levels, views to exterior, number of indoor plants, etc.).
- Update bicycle storage requirements in policy through stakeholder engagement and recommendations made in the study Making Spaces: Bicycle Storage in Multi-Unit Residential Buildings on the University of British Columbia Campus.[20]
- Update REAP to include health and wellbeing credits.
- Develop amenity spaces that respond to community needs and are flexible and adaptable over time.

TARGETS AND INDICATORS

Note that, based on foundational studies and data gathering identified in the GBAP actions, further targets and indicators will be integrated into future updates of the GBAP.

Red Barn Community Centre Playground provides a play area essential to family health and wellbeing

PHOTOGRAPHER: PHILIP BERTOGG

[20] *Smith, C. Making spaces : Bicycle storage in multi-unit residential buildings on the University of British Columbia Campus. (2017).*

Quality

COMPONENT GOALS

01 UBC buildings and landscapes will be durable, reliable and resilient.

CONTEXT

Quality is defined as that which makes a building reliable, durable, resilient, comfortable, dependable, and a contributor to the UBC brand.

UBC intends to continue to build innovative neighbourhoods that support a strong sense of community and, through their development, contribute financially in a significant way to the University endowment.

Quality construction for neighbourhood buildings is required through REAP and the neighbourhood plans. REAP mandates sustainability requirements that improve the quality of life for residents, such as the requirement for low-emitting materials on the interior of buildings. The neighbourhood plans have requirements for the exterior appearance and cladding materials of buildings that are aesthetically appropriate and have attributes of increased durability compared to typical multi-unit residential buildings.

Key Directions

UBC will work to ensure new buildings are built to a level of quality that reflects an optimum total cost of ownership for UBC as well as owners and renters of units. UBC intends to improve the branding of REAP and its link to quality building.

REAP will provide verified energy performance by instituting Energy Step Code requirements, including mandatory energy modeling and air tightness testing, along with energy commissioning. This will provide residents with comfortable buildings and owners with reduced energy costs and assurance that energy systems are functioning properly.

UBC supports quality construction in the neighbourhoods to provide superior housing for faculty, staff, students and residents, and this reflects well on the University's reputation.

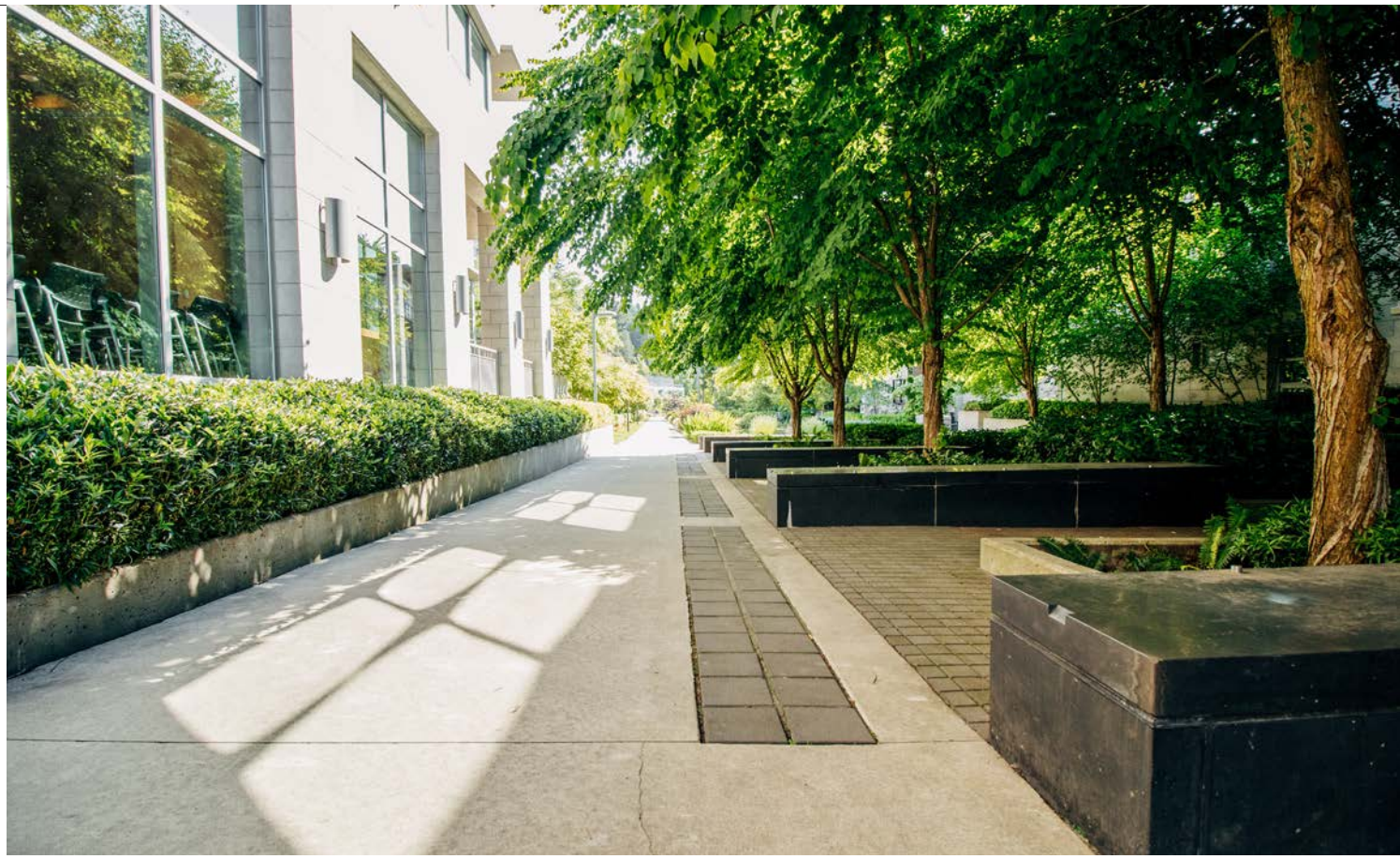
FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

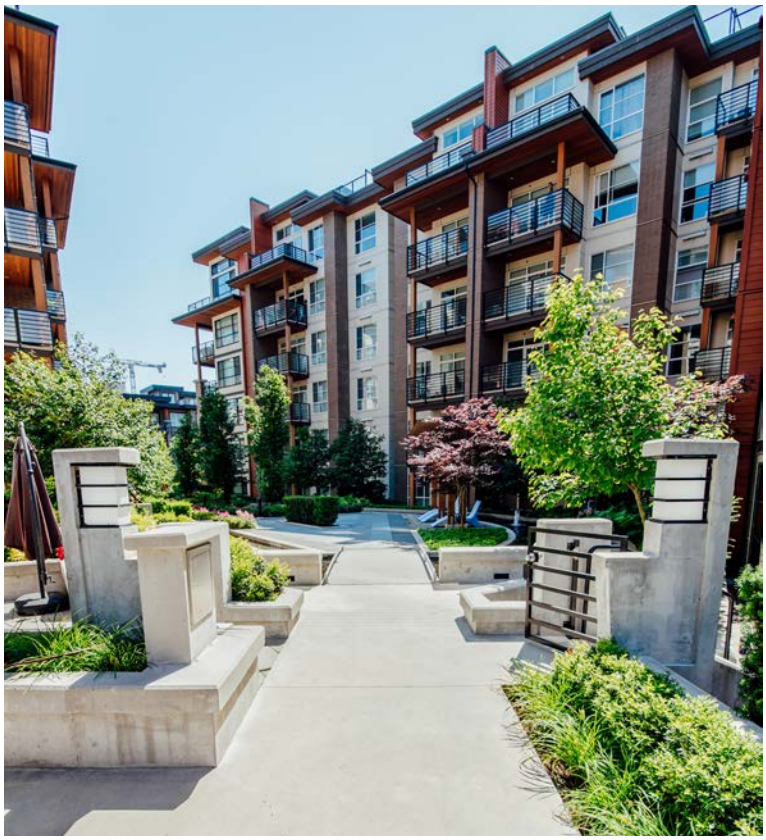
- Create a branding strategy for REAP to increase awareness of UBC's sustainable buildings.
- Work with real estate agents to ensure all buyers are aware of sustainability benefits associated with buildings.

TARGETS AND INDICATORS

Target: Achieve 100% compliance with REAP Gold requirements by 2020.

Note that additional quality targets and indicators will be integrated into future updates of the GBAP.





Above + Left: Wesbrook neighbourhood's REAP certified buildings help provide quality to residents through sustainable design.

PHOTOGRAPHER: PHILIP BERTOGG

Climate Adaptation

COMPONENT GOALS

01 UBC buildings and landscapes will have the resilience to respond to both anticipated and unpredictable changes in climate.

02 UBC will engage with researchers in a meaningful and ongoing way to inform building policy and guidelines around climate adaptability.

CONTEXT

Through historic evidence and future modelling we know that temperatures will continue to rise as a result of climate change.

For the Lower Mainland, modelling predictions indicate that there will be long-term warming, more extreme weather events, changing precipitation patterns and rising sea levels.[21] These changes mean an increased risk of flooding, damage from storms and overheating during summer highs. Changes to the design, construction and renovation of buildings and landscapes will be required to adapt to these future impacts. Without action, UBC's livability and economic prosperity goals are at risk.

Climate adaptation could be achieved through a change in approach to different aspects of building design, including: building form and orientation, building envelope, roof design, glazing design, internal layout, interior environment, service infrastructure, exterior spaces and the relationship between indoor and outdoor space. A change at UBC is that building will need to be designed for human comfort in the higher temperatures expected in our region over the building's lifetime.

Pathway to Net Positive

The broader UBC Resiliency Initiative will develop principles, objectives and metrics to guide adaptation in buildings and landscapes and address policies and guidelines that respond to risk across scales—building, neighbourhood, campus and region. UBC will partner with regional partners, including Metro Vancouver and the City of Vancouver, to coordinate strategies.

Climate adaptation actions can provide multiple or synergistic benefits. For example, improved building envelopes can have multiple benefits, including reduced thermal heat transfer, reduced energy costs, reduced GHG emissions and improved thermal comfort. However, this must be balanced with the potential for increased cooling needs in future warmer temperatures resulting from these tight building envelopes.

Adaptation actions intersect with other components, including water and energy. For example, water conservation is a climate adaptation strategy that helps to reduce impacts from hotter, drier weather in future summers. For buildings, design measures such as shading, orientation, glazing and ventilation help to reduce energy demands and provide thermal comfort in hotter, drier summers.

As investments are made in UBC's buildings, it is imperative that designs, retrofits, operations and maintenance respond to adaptation needs. The cost of no action, both from future retrofit and public safety perspectives, could be much higher than proactively planning infrastructure to be resilient to future climate.

[21] *Metro Vancouver. Climate Projections for Metro Vancouver (2016).*

Yu Building courtyard allows cross ventilation for all suites which helps to keep units cool in summer
ARCHITECT: PERKINS+WILL

Key Directions

UBC requirements for residential development in REAP will ensure buildings and landscapes adapt to a changing climate by using the most up-to-date climate data to guide building design and retrofits. Priority actions focus on review of best practice for adaptation and identifying and conducting vulnerability assessments of residential infrastructure, including buildings, landscaping and stormwater infrastructure. GBAP actions will be integrated with an emerging campus Resiliency Initiative, when available, which will develop principles, objectives and metrics to guide adaptation in buildings and landscapes. Additional guidance in the water and energy component areas address specific approaches to climate adaptation.

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Review current research and best practices for climate adaptation strategies in residential buildings.
- Identify climate adaptation research opportunities for buildings and landscapes on local, regional and global scales.
- Conduct vulnerability assessments for neighbourhood buildings and infrastructure.
- Coordinate with the campus-wide Resiliency Initiative for climate adaptation strategies, as they evolve, by implementing policies on a building and landscape scale that respond to key climate change impact areas.
- Implement policies (REAP updates, neighbourhood plans) for climate adaptability in the neighbourhood built environment.

TARGETS AND INDICATORS

Based on foundational studies and data gathering identified in the GBAP actions, further targets and indicators will be integrated into future updates of the GBAP.

Place & Experience

COMPONENT GOALS

01 UBC buildings and landscapes will provide opportunities for collaboration, innovation and community development to reflect the social and environmental sustainability aspirations of the University.

CONTEXT

UBC already has ambitious and successful place-making policy and is looking for improvements and synergies with other themes to carry through to new neighbourhoods.

UBC Campus and Community Planning is responsible for long-range and current planning, which includes regulating development that supports the University's strategic directions through planning initiatives and day-to-day activities.

Wesbrook Community Centre provides and gathering and recreational space for residents

PHOTOGRAPHER: PHILIP BERTOGG

Pathway to Net Positive

Place and experience is a component of the GBAP that specifically promotes architectural and landscape designs that outwardly express social and environmental sustainability aspirations of UBC. This component area is emerging in nature. Examples of strategies might include:

- Celebrating natural systems (e.g., greenway water feature on the east side of Wesbrook Place).
- Using locally appropriate materials (e.g., use of wood at Sail).
- Fostering social connection and cohesion through the design of exterior or interior spaces (e.g., exterior courtyards at Dahlia and Magnolia).
- Building elements that tell a story and learning landscapes.
- Exposing building systems creatively.

Outside amenity space encourages social interaction at Nobel House Staff & Faculty housing

PHOTOGRAPHER: COURTESY VILLAGE GATE HOMES

Key Directions

Design has a role to play in telling the sustainability story of the building and landscape and communicating their unique identities. Design can also express human and ecological wellbeing by teaching about the processes or systems within the building or by expressing their presence. Expression can also be more abstract and creative, which communicates sustainability in a less literal manner (e.g., through art installations or playful demonstrations). It is important that buildings and landscapes serve the larger aspiration of producing positive, memorable and personally relevant experiences, especially given the potentially limited time students are in attendance.

FIVE-YEAR IMPLEMENTATION PLAN — SHORT-TERM PRIORITY ACTIONS

- Establish GBAP place and experience component goals for buildings and landscapes in coordination with Campus and Community Planning during neighbourhood development (e.g., component goal: the design of the building and landscape expresses elements of UBC's social and/or environmental sustainable design initiatives).

TARGETS AND INDICATORS

Note that targets and indicators may be integrated into future updates of the GBAP.

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Glossary

- **Circular Economy:** An industrial system that is restorative and regenerative by design as opposed to the traditional linear economic model (to make, use, and dispose). A circular economy model aims to extend the lifespan of products, components and materials through innovative design, reuse, refurbishment, adaptation and recycling to ultimately minimize disposal.
- **Community Energy and Emissions Plan (CEEP):** A document prepared by a local government and/or community that outlines: (a) the jurisdiction's historical energy sources, energy demand and resulting emissions (often referred to as an energy profile); (b) the jurisdiction's future energy and emissions targets; (c) the jurisdiction's strategy for meeting energy and emissions targets. In the UBC context, the CEEP applies to the areas within the University Neighbourhoods Association (UNA) community.
- **District Energy:** District energy systems produce steam, hot water or chilled water at a central plant and distribute it to buildings to provide space and water heating and/or cooling.
- **Greenhouse Gas (GHG) Emissions:** Gases emitted from fuel combustion and other sources that contribute to the greenhouse effect and global warming. These include carbon dioxide, methane, nitrous oxide, ozone and chlorofluorocarbons.
- **Low-Impact Development (LID):** Systems and practices that use or mimic natural processes that result in the infiltration, evapotranspiration or use of stormwater in order to protect water quality and associated aquatic habitat.
- **Net Positive:** A mode of development that gives more back to human and ecological systems than it takes. This approach focuses on generating mutual benefits to humans and the environment as opposed to only attaining net zero negative impacts. See also regenerative sustainability.
- **Net Zero:** A state in which balance is achieved between carbon-emitting activities and actions that reduce or offset emissions from those activities, so that net annual emissions are equal to zero.
- **Regenerative Sustainability:** Refers to a systems-based approach and practice that produces net positive contributions to human and natural systems. The principles of regenerative sustainability guide the vision of the Green Building Action Plan and the development of buildings at UBC. See also net positive.
- **Resilience:** The ability for systems, buildings, landscapes and people to anticipate, adapt and recover from the effects of climate change.
- **Water Use Intensity:** The amount of water used per unit of population, currently indicated by full-time equivalent

Djavid Mowafaghian Centre for Brain Health
PHOTOGRAPHER: DON ERHARDT
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