CLIMATE-READY HOUSING DESIGN GUIDE
Quick User Guide

June 2022

Climate change is having significant impacts on homes and communities across British Columbia – from extreme heatwaves, more frequent flooding, and more severe wind storms. Annual average temperatures across Canada have increased by 1.7°C since pre-industrial times, which is almost twice the rate of temperature rise around the world. These trends are expected to increase as global temperatures continue to rise, particularly if the world does not take radical action to curb greenhouse gas emissions at a local and global scale.

Historic trends are the foundation for the current building codes and standards that we use to design our homes and buildings. This is the key issue. Most of the residential buildings that exist and are being build today are not designed for future extreme conditions and may face increased maintenance needs, system failure in extreme events and fail to protect the health and safety of building occupants.

There is a critical opportunity for housing providers and developers to more proactively incorporate future climate considerations when designing new housing and retrofitting existing buildings. The federal government and Province of B.C. are in the process of developing new standards and tools to support more climate-ready design in the buildings sector.

About this Guide

This Climate-ready Housing Design Guide is intended to serve as a reference tool for housing providers, developers, and other building industry professionals across B.C. on emergent best practices and recommended technical standards for more climate-ready housing design. The Guide provides an editable toolkit of resources that design teams can use to inform more climate resilient design of new or existing housing, including the following key components:

- **Guiding Objectives** – broad statements of best practices for climate resilience to guide design planning and decision-making.
- **Resilient Design Approaches & Technical Standards** – key best practices for more resilient housing planning, design and documentation with details on recommended design thresholds and features.
- **Resilient Design Strategies** – a comprehensive list of climate resilient design strategies that housing providers and designers can pick and choose from to meet their resilience objectives and emerging standards.
- **Low Carbon Resilience Potential** – High-level overview of how each resilience approach and strategy may contribute to reductions in operational and embodied carbon emissions for lower-carbon design.

The Guide is designed to be updated and refined over time to incorporate new technologies, best practices. It will evolve to align with provincial and federal design standards as they are updated to account for climate change.

This version of the Guide has a particular focus on strategies for designing new Part 3 housing (e.g. multi-family residential buildings like apartments and townhomes) to better accommodate overheating, wildfire and poor air quality events. It also includes preliminary guidance on designing for a range of other climate-related impacts affecting buildings such as flooding, seismic, power outage, windstorms, drought, moisture, and ice and snow.

It was designed by BC Housing's Mobilizing Building Adaptation and Resilience (MBAR) initiative with support from Integral Group and a panel of resilient building design experts. It was developed through an iterative workshop series to ensure content represents the most current resilient design best practices, knowledge and technology at the time.

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Using the Guide

The Guide is designed to be a dynamic, editable resource that housing providers and designers can use to tailor to each specific project. Users are encouraged to use the Guide through the following four main steps:

Step 1 – Identify & Characterize Relevant Climate Hazards

Use the "Approaches & Standards" tab in the Guide to identify which climate hazards are relevant for your site and project. Refer to local studies and the best available climate projection information jurisdiction where your project is located. Key sources to draw on include:

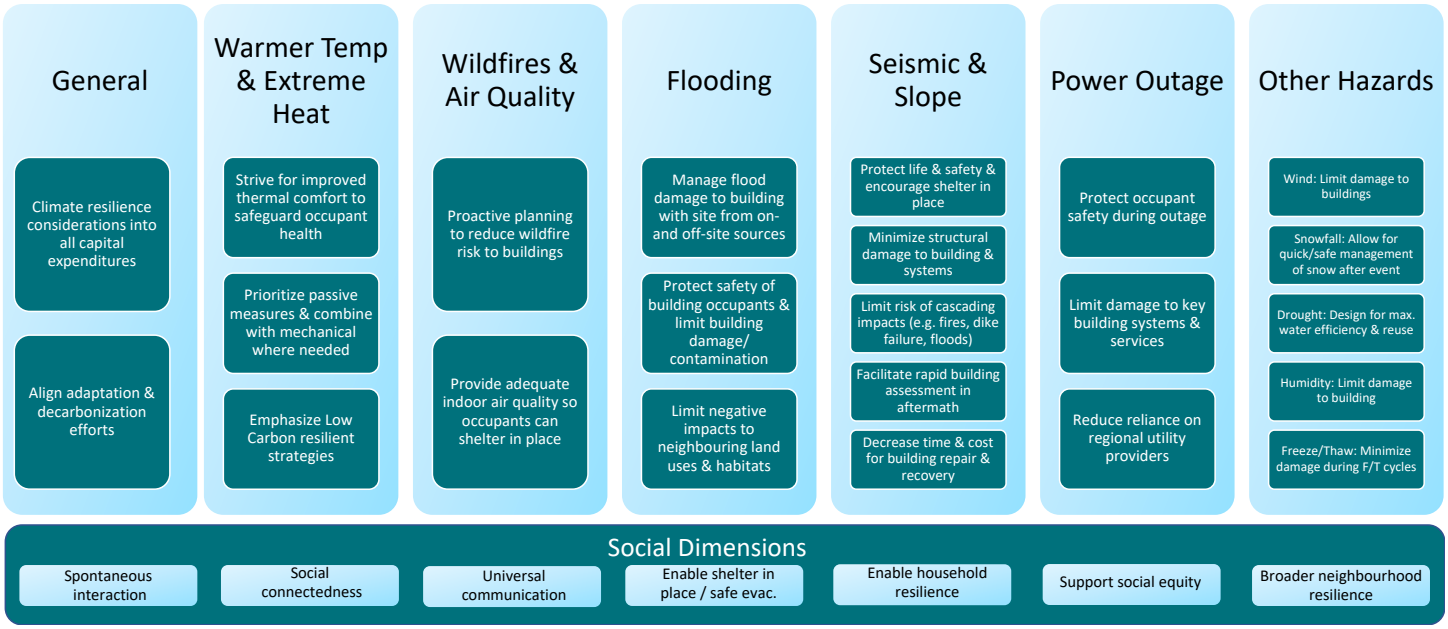
- Climate change adaptation or resilience plans or projection reports published by the municipality or region.
- City or site-specific flood, geotechnical, and/or environmental reports.
- Pacific Climate Impacts Consortium Plan2Adapt, Climate Explorer, and Climate Design Value Explorer tools.
- Intensity-Duration-Frequency (IDF) curve datasets and tools (e.g. Western University's IDF CC tool).
- National online climate projection databases, including the Government of Canada's ClimateData.ca and Prairie Climate Centre's Climate Atlas.

You may also want to consider what measures the local municipality or region may already have in place to mitigate climate hazards. It is generally best practice to consider all potentially relevant hazards to ensure potential impacts or important design strategies aren't missed.

Step 2 – Review Objectives to inform Project Planning

Refer to the "Approaches & Standards" tab and consider the "guiding objectives" associated with each climate hazard relevant to your site. Each guiding objective should be considered carefully to consider how it can be integrated into overall project design objectives, and inform more resilient design and future operations more broadly.

Each hazard is accompanied by between one and five guiding objectives, with additional guidance on how to meaningfully incorporate social dimensions of resilience into housing design. The objectives for each hazard are summarized below:



Step 3 – Consider, Select and Adapt Associated Technical Standards for your Building

Use the "Approaches & Standards" tab in the Guide to identify which "Resilience Design Approaches" and associated "Technical Standards" might be relevant to support planning and design of your project. Refer to the "Key Considerations" and "Low Carbon Resilience (LCR) Potential" columns to inform your selection of approaches. You may want to add your own column to note rationale for why certain approaches were selected or excluded, and for commentary on how to adapt the recommended technical standards for your project. Key considerations that may influence which strategies are right for your project include the type of building (e.g. low-rise, high-rise), type of housing (e.g. market rental vs. strata), and the level of risk a particular hazard poses to a site (e.g. flood or wildfire).

The snapshot from the Guide (below) shows one example of a Resilience Design Approach and associated Technical Standard for one climate hazard.

#	RESILIENCE DESIGN APPROACH	TECHNICAL STANDARDS
2 WARMER TEMPERATURES & EXTREME HEAT		
Guiding Objectives:		◊ Strive to improve thermal comfort and safeguard the health of occupants into the future. ◊ Prioritize passive design strategies to reduce energy and emissions and improve passive survivability. Where necessary for thermal comfort and occupant health and safety, incorporate active cooling measures. ◊ Emphasize low carbon resilience (LCR) through strategies that simultaneously reduce emissions and enhance …
2.4.	Provide means of passive cooling or passive heat gain reduction strategies to reduce demand on cooling equipment. Passive cooling and heat gain reduction strategies are to be prioritized over mechanical cooling. Mechanical cooling should be installed as supplementary in all buildings, if passive strategies are insufficient to maintain year-round thermal safety.	Passive strategies to be considered include (but are not limited to) the following: • Optimizing building location, orientation, shape, and geometry for reduced year-round energy requirements, • Designing buildings with central courtyards and single loaded corridors to enable suite cross-ventilation, • Exterior shading (passive, active and compatible with operable windows), capable of reducing solar gains to 20 watts/m^2 through windows on south and west facades between the months of April and October, • Operable windows carefully oriented to promote cross-ventilation, • Reduced window-to-wall ratios, • Enhanced, continuous insulation, • High performance glazing that minimizes incident solar radiation (e.g. low Solar Heat Gain Coefficient coatings), and • Optimized selection of exterior building colours and surface finishes to account for heat gain. • Where windows are single-sided, target cross-ventilation where possible and provide window openings of 4% of floor area to meet CIBSE TM 59 with passive cooling only. For each suite and/or home, include at least two operable windows or door openings to obtain direct outdoor air and provide a source of backup ventilation. For CEDI targets, refer to standard 2.1 in this document. Document recommendations within the Energy Modelling and Thermal Safety Report.

Step 4 – Incorporate Appropriate Climate Resilient Design Strategies into your Project

Use the "Resilient Design Strategies" tab to identify specific resilient design strategies to include as part of project planning, design and costing. Each s trategy is associated with a particular climate hazard but may, in reality, address multiple climate hazards at once. It is recommended that design teams start with a long list of potential strategies as options to consider, and then narrow down to a short list of preferred strategies based on cost and feasibility analysis during design. Once the short list of strategies is selected, refer back to the Resilience Approaches and Technical Standards on the "Approaches & Standards" tab to inform detailed design of selected strategies.

The snapshot from the Guide (below) shows examples of Resilient Design Strategies that may support passive design approaches & standards shown in the snapshot in Step 3.

RECOMMENDED RESILIENT DESIGN STRATEGIES				
RESILIENT DESIGN STRATEGY	PRIMARY HAZARD	REQUIREMENT CATEGORY	SCALE	LEAD TEAM
Include passive design measures that encourage natural ventilation (e.g. use both high and low windows). Locate operable windows in strategic locations for back-up cooling and night purge, noting that night purge will become less effective over time as overnight temperatures increase.	Warming Temperatures & Extreme Heat	Architectural	Building	Architect
Provide exterior shading (both passive and active), especially for glazing on south and west facades.	Warming Temperatures & Extreme Heat	Architectural	Building	Architect
Where appropriate considering future climate conditions, employ thermal mass strategies for passive cooling.	Warming Temperatures & Extreme Heat	Architectural	Building	Architect
Orient buildings and open spaces to maximize passive cooling (e.g. layout and form that encourages natural airflow).	Warming Temperatures & Extreme Heat	Architectural	Building	Architect