Primer: Resilient Buildings Planning Worksheet

Updated May 26, 2023

About this Primer

This primer provides a high-level overview of the Resilient Buildings Planning Worksheet, located here:

https://vancouver.ca/files/cov/resilient-buildings-planning-worksheet.xlsx

This primer summarizes some instructions for the use of the Worksheet – refer to the Worksheet for detailed instructions.

For more information, please visit http://vancouver.ca/zeroemissions.

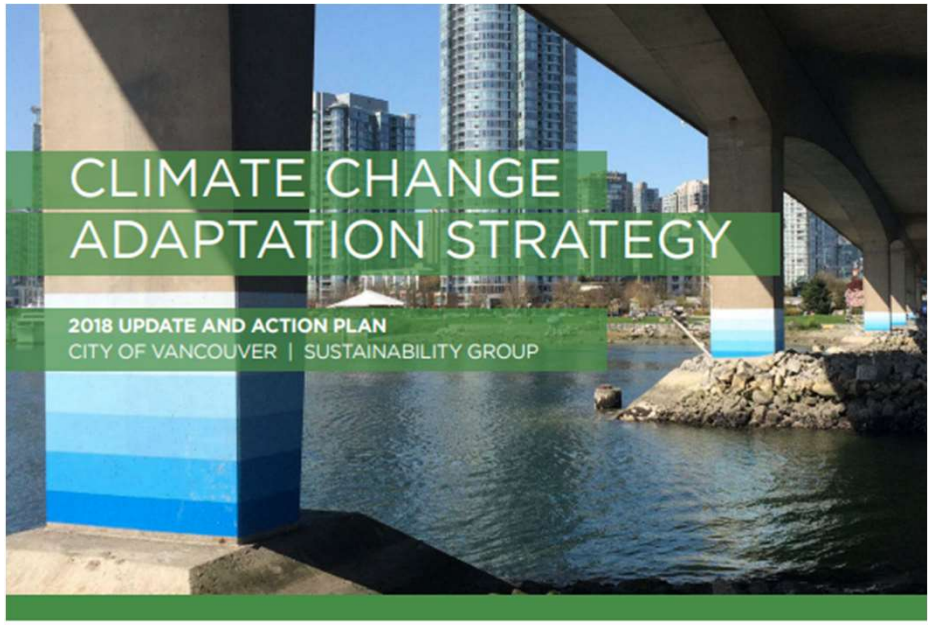
For questions related to this Primer or the Resilient Buildings Planning Worksheet, send questions to green.buildings@vancouver.ca.

Context

Vancouver's Climate Change Adaptation Strategy was updated in 2018.

Action Area - Climate Resilient Buildings

- Objective: Design & construct robust built form that provides co-benefits such as seismic resilience, energy efficiency, accessibility & supporting health & well-being



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Context

Recent changes to improve resilience in large new buildings (Part 3 buildings per VBBL):

Vancouver Building By-law :

- Air filtration with MERV 13 filters (as of July 1 2023) to address poor air quality from traffic pollution & increased wildfire smoke exposure
- Active cooling capable of maintaining indoor air temperature of 26°C with windows closed for multi-family residential in new Part 3 buildings (as of Jan 1 2025) to reduce overheating risk

Rezoning Policies:

- A resilience summary has been required for large sites since 2018 under the Rezoning Policy for Sustainable Large Developments[1], adopted July 25, 2018
- This requirement is replaced by the NEW! Resilient Buildings Planning Worksheet[2] and is expanded to apply to for all rezoning developments with Part 3 buildings under the Green Buildings Policy for Rezonings[3], amended May 17, 2022

[1] https://guidelines.vancouver.ca/policies-rezoning-sustainable-large-developments.pdf
[2] https://vancouver.ca/files/cov/resilient-buildings-planning-worksheet.xlsx
[3] https://guidelines.vancouver.ca/policy-green-buildings-for-rezonings.pdf

Worksheet Applicability

- The Resilient Buildings Planning Worksheet is a requirement of the Green Buildings Policy for Rezonings (amended May 17, 2022) https://guidelines.vancouver.ca/policy-green-buildings-for-rezonings.pdf

- Requirement: submit worksheet at rezoning application for sites containing Part 3 buildings
  - Except applications rezoning to RR-2A/2B/2C, RR-3A/3B and I-1C:
    - For these projects, submit the worksheet at BP submission
    - However, it is recommended to complete this as early as possible in the design stage to identify cost-effective resilience strategies

- Refer to the Green Buildings Policy for Rezonings Bulletin for applicability details https://bylaws.vancouver.ca/Bulletin/bulletin-green-buildings-policy-for-rezoning.pdf

Worksheet Applicability

- Projects conducting risk and resilience assessment to different standards or requirements that are similar or more in-depth than this worksheet (e.g. BC public sector buildings or health facilities, etc.) do not need to complete the worksheet – submit the completed resilience report instead

- Projects with multiple phases: complete this assessment based on information available at the rezoning application stage
  - Focus the assessment on the first building(s) planned in the first phase of the development
  - For subsequent phases, it is strongly recommended to review and update the assessment and at the development permit stage for each phase.

Worksheet Objectives

- Raise awareness and understanding of climate and other hazard related risks and how they may change over the building's life
  - Enable project owners to make climate and risk-informed decisions in building design, construction and operation to improve the building stock's resilience to hazards

- Add structure to discussions on risk and resilience in the design process, using a risk assessment framework based on current industry best practice

- Set minimum expectations for risk assessment process that is suited to the building scale for use at an early design stage

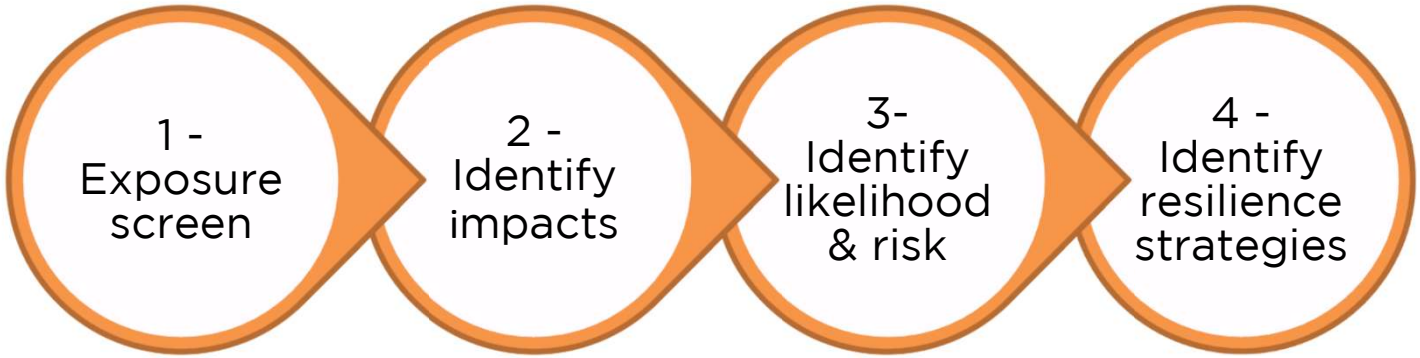
- Evolve best practice for climate adaptation in buildings
  - Identify barriers to adaptation & resilience to shape future code and policy development

Worksheet Outline

- Scope: Building, site and occupants
- Assessment team: design discipline leads, owner, representative of building users & operators, sustainability & resilience leads
- Recommended format: workshop
- Qualitative risk assessment (1-25 scale), adapted from the PIEVC High-Level Screening Guide
- List of resources provided (hazard maps, risk assessment frameworks, resilience strategies)
- Users are encouraged to expand beyond the scope outlined in the Worksheet to accommodate the complexity and/or criticality of the project

Definition of Risk – 4 steps

Exposure x Consequence x Likelihood = Risk



Is the project exposed to the hazard? Yes or No.

What are the impacts to the project's various systems from each hazard?

How does likelihood of hazard change over time? How big is the risk?

What strategies can reduce these risks? What can be applied in early design? Or later? Or why not?

How to use the Worksheet

- Detailed instructions are provided with each Step
- The Worksheet is programmed to calculate a risk score for each hazard based on the formula:

Exposure	X Consequence	X Likelihood	= Risk
0 = No	1 = very low	1 = less frequent than current climate	1 to 9 = Low risk
1 = Yes	2 = low	2 =	10 to 16 = Medium risk
	3 = moderate	3 = as frequently as current climate	17 to 25 = High risk
	4 = high	4 =	
	5= very high	5 = more frequently than current climate	

Step 1 – Exposure to Hazards Screen

- Review hazard maps and data
- Is the project exposed to the hazard?
  - Yes or No
  - Provide rationale, cite information source
- All hazards the project is exposed to are further considered in Steps 2-4

Step 1: Exposure to Hazards Screen		
Hazards	**Hazard Exposure**	**Rationale Description**
Earthquake (VBBL shaking levels)	**Yes**	
Extreme heat	**Yes**	
Poor air quality (wildfire related)	**Yes**	
Power outage	**Yes**	
Extreme cold during winter	Yes	
Coastal or riverine flooding (including storm surges)	*No*	
Decreased slope stability or landslide	*No*	
Drought/Water Restrictions	Yes	
Extreme rainfall related flooding	*No*	
Hazardous material incidents	Yes	
Reduced freeze-thaw	*No*	
Pandemic	Yes	
Sea level rise	*No*	
Warmer summer temperatures	Yes	
Warmer winter temperatures	Yes	
Wind	Yes	
Wildfire	*No*	
Poor air quality (traffic related)	*No*	
Other:	*No*	

- Example Step 1 shown for demonstration purposes only. Assessment teams to review applicable hazard information and determine exposure and detailed rationale for each hazard.

Step 2 – Identify Impacts by Category

- A suggested list of systems and components is provided in the "Impact Categories" tab
  - Assessment team to add more as appropriate to project

- Think through the impact of each hazard to each system & component within the project scope

Impact Categories

Directions

1) Consider the following systems and components when thinking through impacts of a hazard in Steps 2, 3 and 4
2) This list is not exhaustive; the assessment team is encouraged to add to the list of systems or components ba
3) Review columns **A** through **H** and add additional components as needed. Add additional systems and compon

Architectural Systems	Civil Engineering Systems	Emergency Preparedness, Planning and Response	Human Systems	L S
Canopies, overhangs, awnings, external shading structures, balconies	Excavations	Building's ability to remain in use post hazard event	Amenity/refuge spaces	I
Entryways and exits including street access	Foundations	Emergency access	Below-grade storage	G i
Façade, cladding, siding, building envelope, weather sealing, air or vapour barrier systems	Membranes / waterproofing	Emergency/evacuation plans, building reaction plans	Building users and residents	L e
Roofing	Site grading	Emergency shelter/refuge areas	Health and well-being (physical & mental)	C c a e
Windows, doors, fenestration	Stormwater cisterns / irrigation, concrete works	Emergency supplies, access to water/sanitation	Maintenance & operations staff, standard operating procedures	P n
	Stormwater conveyance / drainage, green infrastructure elements		Vulnerable building users and residents (seniors, youth, children, those with mobility or health considerations)	S
	Utilities (above or below ground)			T g

Step 2 – Identify Impacts by Category

- Describe the consequences of each hazard to each system
- Assign a value to the consequence of each hazard to each system
  - Qualitative 1-5 scale
    - 1 – very low
    - 2 – low
    - 3 – moderate
    - 4 - high
    - 5- very high

- Do not consider likelihood of the hazard at this step

Step 2: High Level Impact Assessment		
Hazards	Architectural Systems	Consequence Rating
Earthquake (VBBL shaking levels)		3
Extreme heat		2
Poor air quality (wildfire related)		1
Power outage		1
Extreme cold during winter		1
Coastal or riverine flooding (including storm surges)		
Decreased slope stability or landslide		
Drought/Water Restrictions		1
Extreme rainfall related flooding		
Hazardous material incidents		1
Reduced freeze-thaw		
Pandemic		1
Sea level rise		
Warmer summer temperatures		2
Warmer winter temperatures		2
Wind		3
Wildfire		
Poor air quality (traffic related)		
Other:		
Other:		

- Example Step 2 shown for demonstration purposes only. Assessment teams to review applicable hazard information and determine consequences and rationale for each hazard and system.

Step 3 – Identify Likelihood & Assess Risk

- Evaluate the likelihood of the hazard changing over life of the building
  - 1 – less frequently than current climate
  - 2 –
  - 3 – as frequently as current climate
  - 4 -
  - 5 - more frequently than current climate

- For climate related hazards, use internationally recognized climate projections and conservative scenarios (e.g. RCP 8.5)

Step 3: Likelihood and Risk Assessment	Hazard Likelihood
Refer to 'Step 3 - Instructions' for detailed guidance on this step.	Direction: Choose
Earthquake (VBBL shaking levels)	3
Extreme heat	4
Poor air quality	4
Power outage	4
Extreme cold during winter	2
Coastal or riverine flooding (including storm surges)	*n/a*
Decreased slope stability or landslide	*n/a*
Drought/Water Restrictions	*n/a*
Extreme rainfall related flooding	4
Hazardous material incidents	3
Reduced freeze-thaw	*n/a*
Pandemic	4
Sea level rise	*n/a*
Warmer summer temperatures	4
Warmer winter temperatures	3
Wind	*n/a*
Wildfire & Wildfire Smoke	5
Other:	

- Example Step 3 shown for demonstration purposes only. Assessment teams are to review applicable information and assign likelihood scores.

Step 3 – Identify Likelihood & Assess Risk

Step 3: Likelihood and Risk Assessment	Hazard Likelihood	Architectural Systems	Civil Engineering Systems	Emergency Preparedness, Planning and Response	Human Systems
Refer to 'Step 3 - Instructions' for detailed guidance on this step.	Direction: Choose	Risk Rating	Risk Rating	Risk Rating	Risk Rating
Earthquake (VBBL shaking levels)	3	12	9	12	12
Extreme heat	4	8	8	16	16
Poor air quality	4	4	4	12	16
Power outage	4	4	4	16	16
Extreme cold during winter	2	2	2	8	10
Coastal or riverine flooding (including storm surges)	*n/a*	0	0	0	0
Decreased slope stability or landslide	*n/a*	0	0	0	0
Drought/Water Restrictions	*n/a*	0	0	0	0
Extreme rainfall related flooding	4	16	16	16	0
Hazardous material incidents	3	6	3	12	0
Reduced freeze-thaw	*n/a*	0	0	0	0
Pandemic	4	4	4	16	20
Sea level rise	*n/a*	0	0	0	0
Warmer summer temperatures	4	8	8	16	16
Warmer winter temperatures	3	6	6	6	3
Wind	*n/a*	0	0	0	0
Wildfire & Wildfire Smoke	5	20	10	25	20

- The Worksheet calculates risk scores based on Steps 2 and 3
  - Medium risks will turn yellow
  - High risks will turn red
- This step identifies the most vulnerable systems and helps prioritize risks to the project

Step 4 – Identify Resilience Strategies

- For all medium & high risks (risk score >10), identify possible strategies to reduce the risks, and discuss whether the strategy will be applied to the project

- Provide details on:
  - Strategies that will be included in design
    - Who will be responsible for implementing the strategy?

  - Strategies that will be considered further in the project's life cycle
    - How/when will the risk and resilience information be passed along?
    - Who may be responsible for the strategy?

  - Strategies that are not being implemented now or considered for the future
    - Why not? What barriers exist?

Step 4 – Identify Resilience Strategies

Risk, Hazard, and Resilience Strategy Reporting Table						
Risk	Select Hazard:	Select Impact Category:	Select the assessed risk level:	Describe potential resilience strategy or strategies to reduce this risk:	Select status of resilience strategy:	Describe rationale for status:
1	Earthquake (VBBL shaking levels)	Emergency Preparedness, Planning and Response	Medium Risk	Designate space for outdoor assembly during emergency and seismic events. Train building staff to conduct Rapid Damage Assessments. Create a plan to describe post-earthquake assessments, communications and inspections.	Will incorporate into project	Space has been designated in courtyard - signage to be prepared as part of Construction drawings. Post-earthquake building plan to be led by seismic & emergency preparedness consultant and shared to residents as part of welcome package. Funding will be set aside for training building staff.
2	Earthquake (VBBL shaking levels)	Structural Systems	Medium Risk	Further study to investigate stability of building site and surrounding soils and underlying geology.	Will be explored in future project stages - provide details	Owner and structural engineer and Geotech to confirm budget available to conduct further studies by designed detail stage.
3	Extreme heat	Emergency Preparedness, Planning and Response	Medium Risk	Ensure building personnel aware of residents needing extra assistance. Set up buddy system for neighbours to check on each other. Provide building personnel and residents with basic emergency response training.	Will incorporate into project	Owner will draft building emergency preparedness plan and pass to building operators and residents at occupancy. Funding is set aside for emergency preparedness training.
4	Extreme heat	Human Systems	Medium Risk	Educate occupants on how to keep cool, including closing windows after noon and opening them at night. Provide occupants knowledge of how they can install portable air conditioners in their space. Provide cooling to amenity room for use by residents.	Will incorporate into project	Owner and building operator to set create extreme heat management plan and share with residents. Cooling is designed for amenity space which is noted as a cooling room and is easily accessible - design team to coordinate at detaile design.
5	Extreme heat	Landscape & Ecological Systems	Medium Risk	Focus onsite plantings on drought and heat resistant species.	Will incorporate into project	Landscape architect to lead.
6	Poor air quality (wildfire related)	Emergency Preparedness, Planning and Response	Medium Risk	Same as #3.	Will incorporate into project	Same as #3.
7	Poor air quality (wildfire related)	Human Systems	Medium Risk	Provide higher than code air filtration capability in all living spaces	Will be explored in future project stages - provide details	Owner and mechanical to confirm options for higher level filtration for amenity space or for insuite ventilation systems and confirm by detailed design.

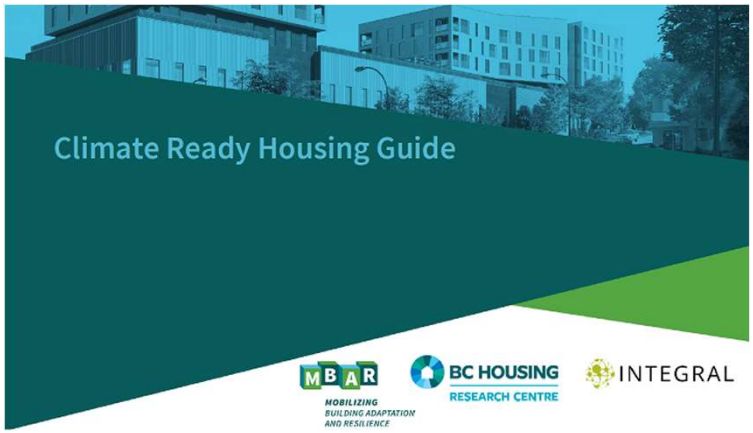
- Example Step 4 shown for demonstration purposes only. Assessment teams are to review potential resilience strategies and determine whether they can be applied to the project.

Resources

PACIFIC CLIMATE IMPACTS CONSORTIUM Design Value Explorer

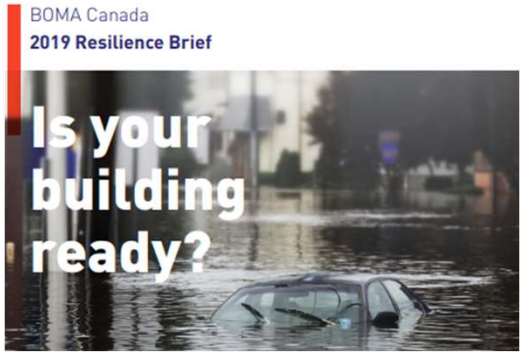
Climate Atlas of Canada

PCIC Climate Explorer



BOMA

ClimateData.ca



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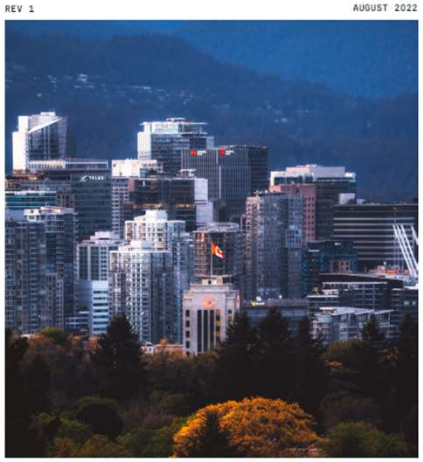
PRACTICE ADVISORY

CLIMATE CHANGE CONSIDERATIONS FOR BUILDING ENCLOSURE ENGINEERS



- Additional resources listed in the Worksheet