



POLICY REPORT

Report Date: November 6, 2018
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Meeting Date: December 5, 2018

TO: Standing Committee on City Finance and Services
FROM: Planning, Urban Design and Sustainability
SUBJECT: 2018 Climate Change Adaptation Strategy Update

RECOMMENDATION

- A. THAT Council approve in principle the 2018-2023 Action Plan incorporated in the Climate Change Adaptation Strategy, generally as shown included as Appendix A and direct staff to begin implementation of the highest priority actions. Staff will seek Council approval of programs and projects that require policy change and/or result in financial implications that cannot be accommodated in existing operating and capital budgets.
- B. THAT staff report back in five years with an update to the Strategy and/or Action Plan that incorporates the latest climate projections in step with new emissions pathways available from the International Panel on Climate Change (IPCC).

REPORT SUMMARY

This report introduces the second iteration of the Climate Change Adaptation Strategy (the Strategy). Adopted in 2012, the Strategy outlines climate change projections for the future, the anticipated impacts, and actions we can take as we continue to prepare.

Over the past six years, the climate change adaptation planning landscape has evolved drastically with far more attention and emphasis at every level of government. Best practices, new science and new focus areas inform this update to the Strategy. This report seeks Council endorsement of the Strategy and the action plan integral to it.

COUNCIL AUTHORITY/PREVIOUS DECISIONS

On July 24, 2012 Council unanimously approved the first Climate Change Adaptation Strategy and a motion that staff report back with an updated Strategy by 2017 to incorporate additional climate science and best practices.

In July, 2014 following an extensive flood modelling exercise, Council approved amendments to the Building By-law and Zoning and Development By-law to raise flood construction levels to respond to increased risk of flood damage due to climate change.

On July, 2018 Council approved motions instructing staff to bring forward further amendments to the Zoning and Development By-law to establish requirements for safe and flood resilient development in flood plains; regulations and policies to guide the design of engineered shoreline flood protection; and funding to support the implementation of a sea level rise design challenge.

CITY MANAGER'S/GENERAL MANAGER'S COMMENTS

The City Manager recommends approval of the foregoing.

REPORT

Background/Context

In March 2007, coincidental with the publication of the Intergovernmental Panel on Climate Change's (IPCC) 4th assessment report, Council directed staff to examine potential impacts of climate change on the City's infrastructure and to identify measures to minimize these impacts. In May 2008, Council received an informational report on climate change adaptation that recommended completion of a vulnerability and risk assessment to prioritize adaptation work.

In 2011, the City joined an ICLEI (Local Governments for Sustainability) pilot project with a cohort of Canadian municipalities to work through a vulnerability and risk assessment and plan adaptation actions and developed the Vancouver's Climate Change Adaptation Strategy – the first of its kind in Canada.

The October, 2018 *Special Report on Global Warming of 1.5°C* authored by the IPCC states that limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society¹. Vancouver's Renewable City Strategy includes strong and ambitious targets to *mitigate* climate change by reducing our carbon pollution. Another key message in the IPCC report is that we are already experiencing the consequences of 1°C of warming through more extreme weather, sea level rise, decreasing arctic sea ice and other changes. Adaptation planning begins to prepare us for local impacts and is an imperative complement to mitigation planning. Proactively planning for shocks and stresses related to a changing climate enables us to take advantage of co-benefits and windows of opportunity versus more costly post-event reactions.

¹ IPCC, 2018. Global Warming of 1.5°C, an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

A decade ago, no environmental risks made the top 10 list in the Global Economic Forum's Risks Report. In 2016, the failure to mitigate and adapt to climate change was ranked at the top of the list. The Insurance Bureau of Canada reports that costs of extreme weather events are being felt by a growing number of Canadian communities; property and casualty insurance losses averaged \$405 million per year between 1983 and 2008, and increased to \$1.8 billion per year between 2009 and 2017.

Since development of the 2012 Adaptation Strategy, Vancouver has experienced new impacts such as king tide flooding and summer air quality alerts. Other impacts continue including increased rainfall-related flooding, sewer back-ups and combined sewer overflows and safety and health risks for frontline communities (systemically vulnerable) related to increasing extreme weather. See appendix C for more examples of local climate change impacts.

The adaptation landscape has also changed with far more action and momentum among other levels of government and partner organizations. All B.C. public sector operations must now develop and implement 10 year adaptation plans and organizations such as the Vancouver School Board are completing adaptation planning. The insurance industry is beginning to offer overland flood insurance to homeowners for the first time in Canada and the Canadian Chartered Professional Accountants (CPA) are supporting municipalities in the new domain of climate-related financial disclosure.

In preparing for a liveable city, implementation of the Strategy will integrate with other City actions where co-benefits are possible. Climate adaptation can also be described as enhancing the City's resilience to climate-related shocks and stresses. In this way, the Strategy is an excellent complement to the broader Resilient Vancouver Strategy (RVS) and many RVS programs and preliminary actions are indicated in the Strategy. Table 2 in Appendix D provides an illustration of the web of integrated programs at the City.

Strategic Analysis

2012 Strategy Implementation

Over 75% of all 2012 Strategy actions have been implemented. 2012 actions that are ongoing or have yet to be initiated have been carried over into the 2018 Strategy. Some of the actions tagged as 'investigate further' have been dropped based on a better understanding of their effectiveness or lack thereof.

The 2012 Strategy has encouraged the development of many new programs including the Urban Forest Strategy (UFS), the Integrated Rainwater Management Plan (IRMP) and the Coastal Flood Risk Assessment (CFRA). A 2018 action plan for the UFS was supported by Council and includes many important actions to ensure the health of our urban forest in the face of climate change. The IRMP generated the Green Infrastructure team and is changing the way we think about water and utility planning through the Rain City Strategy. The CFRA is recognized internationally among coastline cities and in July, 2018, Council approved the next stage of implementation. Many smaller projects and changes have also been successful, moving the dial toward a more climate-resilient city.

2018 Context

Compared to the state of practice in 2011, climate change adaptation planning is now well established at the local government level. Recent assessments of practitioners and the state of

adaptation include recommendations such as taking an integrated approach and mainstreaming adaptation into existing tools and planning.

The Science:

The updated climate projections (2016) downscaled from global climate models for Vancouver continue along the same trends as the 2011 data with slightly exacerbated anticipated changes. Wetter, warmer winters and hotter, drier summers remain the overarching narrative. By 2050, hot days become 4°C hotter and heat waves happen more frequently. Cooling requirements for buildings in the summer will increase fourfold by 2050 (25% more than current day Portland, Oregon) and a 23% increase in consecutive dry days (drought) is anticipated.

By 2050, extreme rainfall events are expected to become increasingly common and intense with 33% more rain on very wet days and 63% more rain on extremely wet days. The coldest winter nights will become almost 5 degrees warmer. For our region's water supply watersheds the April 1st snowpack is projected to decrease by 58%, meaning less water in our reservoirs. Sea level rise continues with widely varying projections. The Province of BC recommends using 0.5m for planning to 2050, 1m to 2100 and 2m to 2200.

New Strategy Structure and Focus Areas:

Reflecting the evolution of adaptation planning, the 2018 Strategy refocuses actions into two categories: Core Area Actions and Enabling Actions and applies additional lenses to the work.

Enabling Actions focus on integrating or mainstreaming adaptation across City business units and services.

Core Actions will eschew responding directly to the categories of impacts, and instead the plan is reorganized to focus on elements of a liveable city that are common across City programs, including:

- climate robust infrastructure;
- resilient buildings;
- prepared, connected communities;
- healthy and vigorous natural areas; and
- coastline preparedness.

Two additional lenses that will be applied as part of adaptation planning in the City moving forward are: greater ***integration*** with other efforts, including climate change mitigation; and ***equity***.

These new structure and focus areas are described in more detail below.

Core and Enabling Actions

What we have learned in Vancouver over six years of implementing the Strategy mirrors what other practitioners around North America and Europe stress; implementation needs to account for both the planning cycle that results in adaptation actions (core actions) and for increasing adaptive capacity and mainstreaming within the organization and communities (enabling actions). Both are presented in the updated strategy.



Figure 1. Elements of the core adaptation planning cycle (1-6) and enabling factors.

Equity

Climate change shocks and stresses do not affect all groups in the community equally. Frontline communities, those that have been affected by systemic vulnerabilities and inequities, are often at greater risk from the impacts of climate change and often have the fewest resources to respond and adapt. While the 2012 Strategy incorporated actions specific to groups more vulnerable to climate change, this iteration proposes to more explicitly and with focus, address equity. As an example, staff are currently carrying out a project with Evergreen, a local NGO, to interview seniors and non-market housing staff and tenants about how they experience heat stress and how the City can best support these groups during heat waves.

2018 Actions:

In 2011, a thorough review of the anticipated climate changes resulted in a list of over 50 impacts to City projects, programs and services (see examples in Appendix C). The impacts were prioritized through a rigorous risk and vulnerability assessment. In 2018, we revisited the prioritization and added one priority impact: the effect on health and well-being from poor air quality events linked to wildfire smoke.

The Strategy was updated through staff interviews, meetings and a large cross-departmental workshop. The original Adaptation Steering Committee (now the Sea Level Rise Steering Committee) provided input throughout the process. Staff also worked with partners including BC Housing, Vancouver Coastal Health, UBC and UVic. on Strategy development. The City continues to collaborate with the Adaptation to Climate Change Team (ACT) at SFU and the Fraser Basin Council on a number of regional adaptation issues.

As we move forward, there are areas where we've had excellent success and where we intend to build on the ongoing and planned work [Enhance current action]. In addition to building on these successes, we will address several areas where more progress can be made or where

there are current windows of opportunity [New action needed]. Rather than starting only new initiatives, this Strategy also aims to provide an added driver and support to existing initiatives where appropriate.

Table 1 provides an overview of the priority foci for Core Actions. A full list of actions can be found in Appendix A.

Table 1. Core Actions

Action Area	Action Category	Focus of Attention
Climate Robust Infrastructure	Enhance current action	<ul style="list-style-type: none"> – Improve understanding of water flow in the city and integrate management across green and grey infrastructure, parks and public spaces – Water conservation and “fit for purpose” approach to water use – Groundwater management – Resilient Vancouver Critical Infrastructure project – Prepare City departments for continuity of operations
Climate Resilient Buildings	New action needed	‘future proofing’ the building stock <ul style="list-style-type: none"> - New: Building requirements and design options to improve climate resilience - Existing: Upcoming Deep Retrofit Strategy supports co-benefits to enhance resilience - Thermal comfort and hotter summers
Connected and Prepared Communities	New action needed	<ul style="list-style-type: none"> - Health and safety during heat waves in non-market housing and surrounding neighbourhoods. - Address wildfire smoke events - Support continuation and scaling up of programs such as Resilient Neighbourhoods Pilot Program, Hey Neighbour and a “train the trainer” program for community to advance engagement around seismic and climate resilience.
Coastal Preparedness	Enhance current action	<ul style="list-style-type: none"> - Floodplain development regulations and guidelines - Engagement and design competition - Conceptual design for adaptation approaches for the Fraser River - Study of Climate change impacts to waterfront parks and open spaces.
Healthy and vigorous natural assets	Enhance current action	<ul style="list-style-type: none"> - Support implementation of the Urban Forest Strategy actions for climate change. - Move urban forest maintenance from a reactive to a proactive standard of excellence - Soil preservation - Water quality

Enabling Function Actions

Below is a summary of the focus areas for the enabling actions. All actions can be found in Appendix A.

Mainstreaming climate change into our daily operations is a critical component of this plan and below are some examples of this work:

- The City is working with Certified Public Accounting Canada and the City of Toronto on disclosing climate-related finances. Assessing major capital projects against known climate hazards and risks will be a key next step in this program.
- Engineering Services Project Management Office is spearheading a new asset management framework and climate risks will be inputted as a base consideration.
- Including climate resilience as a foundation in land use planning and development will be pursued through major projects like the proposed City Plan.

To build capacity and knowledge sharing within the City a CityLearn course will be developed to engage staff on the basics of climate risk and vulnerability assessment methods, other tools will be deployed across the organization, and departmental expertise and champions will be developed.

Availability of data for planning and decision-making will also be enhanced and inter-departmental processes will be added to deliver co-benefits and capture windows of opportunity to increase Vancouver's climate resilience.

Monitoring and Renewal:

Successful adaptation to climate change is difficult to measure. Existing indicators from 2012 and a few preliminary new ones have been chosen to build a dashboard to monitor our progress. Resilient Vancouver, Rain City Strategy, Greenest City Action Plan (GCAP) and Healthy City are all plans with indicators that will also reflect movement toward climate resilience. Staff will finalize a set of indicators during this Adaptation Strategy cycle and report out on them during the next update. Progress on Strategy implementation will continue to be reported annually as part of the GCAP annual update.

Adaptation is not a one-off effort but continuous improvement and iteration that incorporates emerging best practices and evolving climate science. The complete Strategy, or solely the Action Plan portion as deemed necessary, will be reviewed and updated in step with the IPCC assessment reports. A five year review cycle continues with the next update due by the end of 2023.

Implications/Related Issues/Risk

Financial

Many of the actions identified in the Strategy are already planned and resourced within existing budgets. Those requiring additional funding will be reported back to Council for consideration as part of the long-term financial and capital planning and annual budget processes. Any incremental actions, including new adaptation measures, will be supported by sound business case analysis, viable partnership and financial strategies, and an implementation plan.

The Task Force for Climate-Related Financial Disclosures (TCFD), chaired by Michael Bloomberg, has developed recommendations for voluntary climate-related financial disclosures to which the City has committed. Staff are working with CPA Canada's pilot program to prepare for reporting in 2019.

Environmental

Vancouver's natural assets are invaluable to biodiversity and community well-being. They also provide important resources to mitigate the impacts of climate change. For example, green space can detain and infiltrate rain water decreasing the risk of flooding and contamination. Trees and vegetation have been proven effective in decreasing the urban heat island effect. A low carbon method of reducing the impacts from climate change often includes reliance on green infrastructure. Our natural assets are also impacted by changes in the climate and must be allowed to adapt naturally or with some intervention.

Vancouver's coastline includes important habitat for fish, birds and other wildlife that is locally and globally significant. Intertidal habitat will be impacted, reduced, and squeezed over time with sea level rise. Thoughtful planning for sea level rise can create opportunities to restore and replicate intertidal habitat by using softer—and greener--flood management approaches that also protect waterfront properties.

CONCLUSION

Adapting to a changing climate is a necessary partner to limiting the extent of climate change through our ongoing greenhouse gas reductions. Impacts of climate change are already being experienced in Vancouver requiring action to reduce and manage risk, especially for those most vulnerable to the impacts. In addition, what we build, plan and develop today should be robust in a different climate future. Reacting after an event to improve climate resilience offers significantly less time to innovate and comes at a higher price tag. We have the opportunity now to incorporate climate change adaptation into how we do business and increase the capacity of the City and community to prepare for, adapt and ideally thrive in the face of our changing environment.

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Climate Change Adaptation Action Compendium

Priority actions are highlighted and appear at the beginning of the tables. Project leads are those departments responsible for the action. All actions will include consultation and collaboration with various City departments.

CORE ACTIONS

Robust Infrastructure

Action #	Action Description	Project Lead	Timeline
I.1	Complete integrated modeling of water in the city (pipe system, surface water and groundwater). Prioritize watersheds to be modeled to support city objectives such as Combined Sewer Overflow elimination, Rain City Strategy, growth planning and preliminary watershed assessments. Leverage modeling to complete overland flood route mapping and take an integrated approach to drainage systems including public realm, grey and green rainwater infrastructure systems, coastal flood protection, and parks.	Eng. ISUP*	ongoing
I.2	Complete comprehensive information gathering to support system modeling, catchment prioritization, and early implementation of the most effective, resilient water management actions. Early investment will ensure an option analysis of new approaches to servicing is timely.	Eng. ISUP	2020
I.3	Utilize the piped system, green infrastructure and other rainfall storage strategies to attenuate water from catchments that drain into floodplain areas prone to coastal flooding. The aim is to reduce stormwater draining to low lying areas to mitigate peak flows and total flow volume at the runoff source. This will result in the appropriate timing and investment of stormwater pumping facilities.	Eng. ISUP	ongoing
I.4	Continue water conservation and efficiency actions; develop regulations to support the usage of alternative water sources including groundwater, graywater and blackwater for non-potable demand. The 'fit for purpose' approach to water end use will reduce pressure on the regional supply and delivery of treated drinking water.	Eng. Water CBO	2023
I.5	Undertake a drainage study for low-lying Southlands area to include an assessment of the existing dike network and pump station and recommend improvements for the drainage system as needed.	Eng. Sewers	2020
I.6	Support integration and evaluation of climate adaptation into overall infrastructure resilience initiatives being scoped through the Resilient Vancouver Strategy Process	CRO and RM	2020
I.7	Continue increasing City departments' capability to manage a business disruption. Complete list of department critical services and develop tools, templates for departments to own and prepare their critical services for continuity of operations	RM	2023

I.8	Develop a groundwater management strategy and/or protection plan	Eng. ISUP	2023
I.9	Update the private side standards for stormwater retention, detention and reuse to reflect 2100 precipitation projections (IDF curve), and 2050 growth and climate scenarios	Eng. ISUP	2020
I.10	Develop a Combined Sewer Overflow Elimination Strategy alongside the current sewer separation program	Eng.	2021 ongoing
I.11	Investigate and implement pervious pavement where appropriate.	Eng. Streets	ongoing
I.12	Develop regulation for non-potable reuse in the Vancouver Plumbing Code	DBL, CBO,	2020
I.13	Complete landslide risk identification and mitigation (from 2012 plan)	SUS	2020
I.14	Add climate change and resiliency considerations to utility design standards and specifications. Continue to build and specify guidelines as standards are updated	Eng.	2018 ongoing
I.15	When completed investigate and adopt appropriate elements of NRC's updated design climate data for reference by codes and standards	Eng.	2020
I.16	Support application of the Envision climate risk section to the two pilot projects and propose any improvements to the scope/deployment of Envision.	Eng.	2020
I.17	When completed investigate and adopt appropriate elements of NRC's guidelines for the adaptation of existing roads to climate change	Eng.	2020
I.18	Complete the Coastal Sanitary Pump Station Resiliency Upgrade Project to replace, refurbish and add resiliency upgrades to 6 sanitary pump stations and 2 forcemains surrounding Vancouver's coastline.	Eng.	2023

*Eng. ISUP – Integrated Strategy and Utility Planning (new division within Engineering)
 CRO - Resilient Vancouver Strategy group
 RM - Risk Management

Resilient Buildings

B.1	Within the upcoming deep retrofit strategy (Renewable Buildings 2050) adjust requirements and process for existing buildings to support enhancement of resiliency to climate and other hazards.	SUS	2020
B.2	Evaluate and integrate where possible the new CSA standards and NRC guidelines for buildings related to climate change hazards in the VBBL where possible, including new climate loads.	SUS	2023
B.3	Continue to incorporate new summer normals related to active cooling and thermal comfort in building policy and bylaws: encourage heat pumps, reduce cooling demand in new blg., detailed thermal comfort guidance, exploration of future weather data for building design and modelling, etc.	SUS	2023
B.4	Build on phase 1 of the MBAR project with a study and report on potential building requirements and	SUS	2023

	design options to “future-proof” buildings. Review outputs and develop recommendations for potential updates to building policy or by-law.		
B.5	Streamline heat pump permitting process and provide clarity on requirements.	SUS	2020
B.6	Consider updating the VBBL to cap the amount of summer solar heat gain in residential units.	SUS	2023
B.7	Research opportunities within existing buildings to require consideration of solar heat gain.	PDS	2023
B.8	Work with partners to research opportunities to include thermal comfort as part of certified rental building program and also work to increase the capacity of landlords to address thermal comfort in their buildings.	SUS Eng. Water	2023
B.9	Track cooling energy demand intensity in new construction applications, and explore including limits in building policy and by-law	SUS	2021
B.10	Explore opportunities to refine and enhance limits on overheating, and to develop guidance for industry.	SUS	2019
B.11	Review future climate data and develop recommendations for use in building policy or by-law.	SUS	2019
B.12	Explore opportunities to use measured building data to inform updates to building policy or by-law.	SUS	ongoing
B.13	Review results of BC Housing MBAR project and develop recommendations for use in building policy or by-law.	SUS	2021
B.14	Introduce requirements for, or facilitate an increase in application of green roofs.	CBO	2020
B.15	Provide guidance and clarify permit requirements for the installation of electrochromic glass. Work with planning and building staff to ensure a shared understanding and support.	SUS	2021
B.16	Include resilience checklist in large site rezoning. Evaluate and move toward more guidelines and standards.	SUS	2018
B.17	When available, incorporate the new Canadian Standards Association standard for residential basement flooding into building inspections and new building checklists for planning and development	SUS	2020
B.18	Explore opportunities to encourage or require active cooling, to ensure comfort and safety, in building policy or by-law	SUS	2021

Healthy and Vigorous Natural Areas and Green Space

NA.1	Support implementation and integration across departments of the UFS Action Plan, especially those actions for climate resilience: Recommendations 8,14,16,32,34.	PB	2023
NA.2	Support implementation and integration across departments of the Biodiversity Strategy	PB, SUS	2023
NA.3	Develop policy and practices that facilitate soil preservation or is preferential to the reuse of naturally produced topsoils from offsite locations.	PB	2023

NA.4	Complete the Planning Department's in progress Living Systems Strategy which will include measures for integrating climate change actions into city planning and development.	PDS	2020
NA.5	Develop a policy to guide climate risk and opportunities-based approach to waterfront planning & design. The policy will be reviewed regularly and address up to date climate & water level projections, adaptable design, green infrastructure based protective measures and a variety of climate change-related risks, directing planning, design and management of greenspace, open space and developed waterfront landscapes.	PB, PDS, Eng. ISUP	2023
NA.6	Continuous improvement on Stanley Park Fire Preparedness and Fire Fuel Management programs	PB	ongoing
NA.7	Move Urban Forest maintenance from a reactive to a proactive standard for excellence	PB	2020
NA.8	Collaborate with and support DTES BIAs and community stewardship of street trees in line with the Urban Forest Action Plan action of doubling the street canopy in this area.	PB,PDS, Eng.	ongoing
NA.9	False Creek Water Quality Working Group lead Master Planning for False Creek, including water quality objectives.	Env. Serv.	2023
NA.10	Build on the False Creek management focused working group to advance knowledge and monitoring of marine waters related to pollution, hydraulics and ocean acidification	SUS	2023
NA.11	Develop a factsheet on UHIE for staff and developers. Develop communication that focuses on the economic and co-benefits of trees.	Comms., PDS	2020
NA.12	Monitor and report out on environmental aspects of new Large Sustainable Sites Policy	SUS	2023
NA.13	Expand forest naturalization projects in areas such as Everett Crowley Park and other parks and open spaces as recommended in the BDS and UFS.	PB	ongoing

Prepared, Connected Communities

C.1	Work with partners VCH, Evergreen, social housing providers and others to develop short term and longer term strategies for health and safety during heat waves in non-market housing and the surrounding neighbourhoods.	SUS, ACCS	2020
C.2	Address mitigation of UHIE across disciplines prioritizing neighbourhoods with high temperature and frontline communities.	PDS	ongoing
C.3	Refresh personal preparedness communication and programming away from a focus just on earthquakes to a message of what you can do to be more self-sufficient, prepared and resilient across a range of shocks	OEM	2020
C.4	Support climate resilience lens and climate adaptation activities in Resilient Neighbourhood Pilot Program. Support continuation, fund sourcing and scaling-up of this program and programs like it that focus on neighbourhood resilience through social connections (i.e. Hey Neighbour).	CRO, SUS	2020
C.5	Address wildfire smoke events through proactive planning for communications, filtered air assessment and pilot clean air shelters, and worker safety	ACCS, REFM,	ongoing

		SUS	
C.6	Integrate with the Resilient Vancouver work on facilities to begin a cross-disciplinary conversation about using our facilities and community centres to collectively support people in increasing and different ways – extreme weather, heat, poor air quality etc. Continue to engage regional partners to this end as well.	OEM, CRO SUS, PB, ACCS	2020
C.7	Work with the Province, Metro Vancouver and other partners to complete work necessary to integrate effective food system climate change adaptation strategies within City policies and strategies	SUS, ACCS	2023
C.8	Re-establish the Extreme Heat Planning Committee. First order of business: reassess triggers and thresholds for Extreme Heat Initial Response Guideline (IRG) to add more levels of triggers and actions and include poor air quality events to address potential public alert fatigue	OEM, SUS	ongoing
C.9	Improve information available for homeowners in terms of preparing for various types of flooding	Comms, Eng.	2020
C.10	Continue to explore planning, response, and recovery tools and resources for Disaster Support Hubs and increase public awareness of these sites.	CRO, OEM	2020
C.11	Complete an assessment of non-market housing buildings with the goal of identifying short and long term cooling options. Address air filtration where possible.	ACCS, REFM	2020
C.12	Develop public facing material push ahead of wildfires addressing both fire risk in Stanley Park and air quality risks and related mitigation efforts.	Comms, SUS	2019
C.13	Choose several pilot cooling facilities to be designated clean air shelters for use during poor air quality events during the summer. Evaluate how they are used and program needs moving forward	SUS, REFM	2019
C.14	Continue to add public access to water fountains and where appropriate other water related cooling such as misting stations and VFRS ad hoc cooling.	Eng.	ongoing
C.15	Design public spaces and bike routes with natural or built shade.	PB, Eng.	ongoing
C.16	Continue with adopt a catch basin program – increasing participation each year	Eng.	ongoing
C.17	Support the development of a train the trainer program for community to advance engagement around climate and seismic resilience within neighbourhoods and with harder-to-reach groups. Link to OEM's public education work.	CRO, SUS, OEM	2020
C.18	Ensure heat mapping data from the 2015 SFU project and floodplain mapping data is included in the Risk Profiler tool being developed for Resilient Vancouver by Natural Resources Canada.	SUS	2020

*ACCS – Arts, Culture and Community Services

Coastline Preparedness

S.1	Amend the Zoning and Development By-law to ensure that flood plain development is done in a manner that protects people, property, and the natural environment from the consequences of flood	SUS, PDS -	2020
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	hazards and enables future flood management infrastructure.	plan	
S.2	Host a city-wide sea level rise engagement and design competition to raise awareness and support for the design and implementation of holistic flood management infrastructure.	SUS	2021
S.3	Complete conceptual design of preferred adaptation approaches for the Fraser River shoreline.	PDS, SUS, Eng.	2021
S.4	Complete a study of climate change impacts, including coastal processes related to sediment transport, water chemistry and erosion, and sea level rise, for Vancouver waterfront parks and open spaces.	PB	2023
	Citywide Actions	PB	ongoing
S.5	As part of the City Wide Plan, support the development of flood management and adaptation policy and planning to improve coastal preparedness at a City scale.	SUS, PDS	2020
S.6	Continue to collaborate with Musqueam, Squamish and Tsleil-Waututh on governance, studies, communications & engagement related to adaptation and coastal preparedness.	SUS, Eng., PB	ongoing
S.7	Develop bylaws, regulations and policies to guide the design of engineered shoreline flood protection such that it is adaptable and built to a consistent performance standard	Eng.	2020
S.8	Develop a long-term funding strategy to support implementation of coastal flood protection.	SUS, Finance	2020
	Zone Specific Actions:		
S.9	Using the tools from CFRA III initiate public engagement on sea level rise and adaptation approaches for the Kitsilano flood hazard zone.	SUS	2023
S.11	Support adaptation approaches for the Waterfront Road flood hazard zone in coordination with broader planning of the Central Waterfront area..	Eng.	ongoing
S.12	Support adaptation and resilience design as part of planning for the St Paul's hospital precinct.	SUS, PDS, Eng.	ongoing
S.13	Jericho Beach pier design and renewal to improve access to disabled sailors and accommodate sea level rise.	PB	Design: 2019
S.14	Support the design and development of the North East False Creek shoreline from Science World, including the decking south of Science World, to the western Concord site to incorporate flexible flood management design.	PDS, PB, Eng, SUS	2023
S.15	Work with Provincial and Regional partners to plan and implement Phase 2 of Vancouver's sea level monitoring program.	SUS	2020
S.16	Develop a flood hazard response plan for the Fraser River	OEM, SUS	2023
S.17	Cambie Sheet Pile wall design and replacement as part of the development of South East False	Eng.	2023

	Creek.		
C.18	Stanley Park Seawall adaptation pilot projects as funding is made available	PB, Eng, SUS	2023

ENABLING ACTIONS

Mainstreaming

	Finance		
E.1	Begin incorporating climate-related financial disclosure in City financial planning in 2019. Work with partners like the City of Toronto and CPA Canada in their TCFD Guidance for Cities project.	Finance	2020
E.2	After several years of climate-related financial disclosure explore adding a specific climate assessment to large capital plan projects.	Finance	2021
E.3	Incorporate a scan of major projects against hazard and risk mapping to identify where staff risk experts should be involved early in the project	Finance, SUS, CRO	2023
	Project Management		
E.4	Add climate change considerations to the sustainability addendum of the engineering project management framework	Eng. PMO	2020
E.5	Support application of the Envision climate risk section to the two pilot projects and propose any improvements to the scope/deployment of envision	Eng. PMO, SUS	2020
	Asset Management		
E.6	Add climate projections and information to multi-hazards risk assessment in the new engineering asset management framework	Eng. PMO,	2020
	Planning		
E.7	Continue to develop the Resilient Neighbourhood Design Framework	PDS (UD), CRO	2020
E.8	Incorporate climate change adaptation as a foundational element in the upcoming City Plan	PDS	2023
E.9	Work with planners to increase understanding of new floodproofing guidelines and related zoning regulation changes.	PDS, SUS	2020
E.10	Integrate spatial hazard and utility planning as a foundational element of land use planning by including it as a core element in job descriptions	PDS, Eng.,	2023

Capacity building and knowledge sharing

E.11	Develop City Learn course to share climate risk and vulnerability assessment methods	SUS	2020
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Data and Information

E.12	Hazard mapping available for staff and for public. Message out more broadly about existing staff map layers.	SUS, GIS	2020
E.13	Collaborate with Resilient Vancouver team, Office of Emergency Management and Natural Resources Canada in the development of innovative tools, such as the Risk Profiler, and tactics to communicate information about climate risk to the public, support decision making for planners and staff, and motivate and empower action from residents and stakeholders.	CRO, SUS, OEM	2020
E.14	Make climate projections widely available across the city. Increase knowledge of the projections and engage staff with respect to other climate projections and tools that would be useful.	Comms., SUS	2023
E.15	Develop and maintain a database of climate change adaptation funding available from different levels of governments and funders. Include major local adaptation research projects (MEOPAR, MBAR)	SUS	2020

Governance, Leadership, Partnerships

E.16	Collaborate with Resilient Vancouver Strategy team to support an exploration of distributed leadership models to improve governance of resilience, natural hazard management and climate change adaptation.	SUS, CRO	2023
E.17	Continue to work with partners and expand networks. Collaborate with VCH on a forum for regional adaptation practitioners and with the Resilient Vancouver Strategy team on a regional hub for practitioners.	SUS, CRO	2023

Executive Summary, 2018 Climate Change Adaptation Strategy

This is the second iteration of the nationally leading Climate Change Adaptation Strategy that aims to prepare Vancouver for a new normal in terms of climate. Proactively planning for change allows for a greater variety of implementation options, harnessing windows of opportunity and lower costs.

The October, 2018 Intergovernmental Panel on Climate Change (IPCC) special report² stated that “Limiting global warming to 1.5°C would require rapid, far-reaching and unprecedented changes in all aspects of society...”. Mitigation efforts (such as those in the Renewable City Action Plan) are more important than ever to limit the extent of climate change we experience. At the same time, the imperative to prepare for current and anticipated changes and to expect the unexpected continues to increase.

The impacts of a changing climate are being observed globally and locally. Since development of the first Adaptation Strategy in 2011, Vancouverites have experienced extreme rainfall causing street flooding, king tide storm surge flooding causing coastline areas like Kitsilano Pool to flood, longer dry spells in the summer, hotter summer weather, tree die-offs, and increasing incidence of air quality issues due to wildfires outside the region.

Projections from global climate models for the 2050s in Vancouver (relative to the baseline time period 1971-2000) signal a worsening of what has been observed: hotter, drier summers; warmer, wetter winters and sea level rise. Extreme events such as extreme rain and heatwaves are anticipated to increase in frequency and intensity, the growing season will become extended and streamflow will change in peak flow timing and volume.

These projections translate to a range of impacts such as: increased risk of health and safety impacts for frontline communities including those in lower quality housing, isolated seniors and the homeless population; new and existing buildings being maladapted in terms of thermal comfort, water ingress, durability etc.; increased loss of trees and vegetation; and increased street, property and shoreline flooding. Limited benefits are expected such as longer growing seasons and lower winter heating bills.

Strong initial steps have been taken in Vancouver to prepare for the impacts of climate change but continued momentum is needed. The 2012 Climate Change Adaptation Strategy is responsible for driving the implementation of over 50 actions across the city, increasing our preparedness for climate change. Beyond specific Strategy actions, consideration of adaptation to climate change has been incorporated in diverse projects ranging from the technical detail of new wharf designs to climate resilience principles in community plans.

Achievements from the 2012 Strategy include the internationally recognized Coastal Flood Risk Assessment, changes in the way we design and approach drainage, and an Urban Forest

² IPCC, 2018: Global Warming of 1.5°C, an IPCC special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.

Action Plan that targets high temperature and high heat vulnerability neighbourhoods for tree planning.

The 2018 Adaptation Strategy update is based on the same guiding principles and goals as the previous strategy. Guiding principles are:

- Use the best, most up-to date science available (evidence-based)
- Promote flexible and adaptive management approaches that leave a range of future options available. (adaptable)
- Give priority to adaptation strategies that build on existing programs or policies and provide co-benefits with other community priorities. (integrated)
- Collaborate with community partners (relevant and transparent)
- Mainstream adaptation into day-to-day City business (comprehensive)
- Prioritize equitable outcomes – (equitable or fair)

The 2018 Strategy includes a new set of priority and supporting actions and several new focus areas. As the field of adaptation matures, practitioners are recognizing that successful implementation requires enabling factors that reach beyond an action plan. Adaptation is not a one-off effort but requires building the capacity within a given organization and community to continue learning, collaborating and innovating over years. Actions are now split into Core Actions and Enabling Actions. Other focus areas are: better integration with other city work via co-benefits and earlier identification of overlap, and focusing more explicitly on equity.

The Strategy relies on a diversity of existing City and community strategies and plans that aim to improve the overall resilience of the city to shocks and stresses, and to address inequities and systemic vulnerabilities that challenge resilience. Of particular note in this regard is the Resilient Vancouver Strategy under development in 2018. The impacts caused by climate change (dealt with in this Strategy) are one of many types of shocks and stresses Vancouver will face in coming decades. The Resilience Strategy deals with broader resilience-building within the city and works in unison with this Strategy to improve Vancouver's ability to prepare for, respond and recover from shocks and stresses. This Strategy refers often to work underway on the broader Resilient Vancouver front.

The Strategy is composed of 5 core action areas and 17 enabling actions that address adaptation efforts until the next update in 2023. Core actions build on the work started in 2012 and are divided into five action areas: climate resilient buildings, climate robust infrastructure, vigorous and healthy natural areas, connected and prepared communities and coastline preparedness. In many instances good adaptation work is already planned or underway instigated by a different driver such as sustainability, resilience or risk management.

The table below outlines the Core action areas and where the foci are. Those categorized as 'enhance planned action' have had good success over the last 6 years and have many actions planned that support adaptation. New action needed denotes that these action areas include a fair number of new actions.

Core Actions

Action Area	Action Category	Focus of Attention
Climate Robust Infrastructure	Enhance planned action	<ul style="list-style-type: none"> - Improve understanding of water flow in the city and integrate management (Rain City Strategy and Integrated Utility Management Planning). - Increase use of green infrastructure where appropriate - 'Fit for purpose' approach to water end use - Resilient Vancouver Critical Infrastructure project
Climate Resilient Buildings	New action needed	<p>'future proofing' the building stock</p> <ul style="list-style-type: none"> - New: Building requirements and design options to improve climate resilience - Existing: Upcoming Deep Retrofit Strategy supports co-benefits to enhance resilience - Thermal comfort and hotter summers
Connected and Prepared Communities	New action needed	<ul style="list-style-type: none"> - Health and safety during heat waves in non-market housing and surrounding neighbourhoods. - Address wildfire smoke events - Support continuation and scaling up of community resilience-building programs such as Resilient Neighbourhoods Pilot Program
Coastal Preparedness	Enhance planned action	<ul style="list-style-type: none"> - Floodplain development regulations and guidelines - Engagement and design competition - Conceptual design for adaptation approaches for the Fraser River - Study of Climate change impacts to waterfront parks and open spaces.
Healthy and vigorous natural assets	Enhance planned action	<ul style="list-style-type: none"> - Support implementation of the UFS actions for climate change. - Move UF maintenance from a reactive to a proactive standard of excellence - Soil preservation - Water quality

Examples of local impacts related to climate change projections			
	Hotter, Drier Summers (including higher frequency and intensity of heat waves)	Warmer, Wetter Winters (including higher frequency and intensity of rain and storms)	Sea Level Rise
Human systems (community)	<ul style="list-style-type: none"> - Increased health and safety risks, especially to frontline communities during extreme heat events - Water supply shortages felt in late summer due to a decreased spring snow pack and higher summer temps could result in increased costs for water and imperative conservation measures - Decreased thermal comfort in buildings in the summer due to lack of air conditioning or increasing electricity costs with air conditioning 	<ul style="list-style-type: none"> - Increased health and safety risks for frontline communities including those in lower quality housing, homeless population and seniors - Increases in private property sewer back-ups in combined sewer areas due to high rainfall volume - Increased costs for response actions and clean-up after heavy rain events - Reduced energy cost to heat buildings 	<ul style="list-style-type: none"> - Increased flooding along the coast and Fraser River as sea level rises and the storm surge and waves breach height of land - Gradual inundation of low lying land along the coast and the Fraser River. - Increasing costs of flood insurance where available for floodplain areas.
Natural Systems	<ul style="list-style-type: none"> - Increased tree loss, especially newly planted trees due to drought. - Changing invasive plants and pests affecting existing ecosystems and the services they provide. - Water quality affected by temperature and increased combined sewer overflow from heavy rain events. 	<ul style="list-style-type: none"> - Increase in impacts to urban forests, green spaces and trees from temperature extremes and wind storms resulting in increased maintenance and replacement costs and changes to aesthetics and use 	<ul style="list-style-type: none"> - Increase in shoreline erosion affecting natural environment and public amenities such as parks, trails and access to the water - Shoreline habitat squeeze resulting from rising water and hard infrastructure solutions (dikes)
Built Environment (Buildings and Infrastructure)	<ul style="list-style-type: none"> - New and existing buildings may be maladapted as the climate changes in terms of thermal comfort, water ingress, wind durability, rain on snow loads, etc. - Increasing stress on green infrastructure in the summer time - - 	<ul style="list-style-type: none"> - increased duration and occurrence of power outages causing cascading impacts - Increased surface water flooding from ponding of rainfall in low lying areas or heavy rainfall overcoming the capacity of drainage system - Increase in landslide risk affecting public infrastructure and private property - Increased volume of third party liability claims against the city from major rain events 	<ul style="list-style-type: none"> - Increased damage to structures (seawalls) and shoreline resulting in greater discontinuity of use - Reduced gravity drainage of the existing drainage system, resulting in more frequent - Saltwater intrusion in built up areas affecting the longevity of underground infrastructure and pump stations

Intersection of Climate Change Adaptation and other City Efforts

Table 2. Interconnectedness of Adaptation at the City.

Action Areas in the Adaptation Strategy	Resilient Vancouver Strategy	Rain City Strategy	Healthy City Strategy	Renewable City	VanPlay*	GCAP, esp. Green Buildings	Earthquake Preparedness and E.M.	Urban Forest Strategy	Biodiversity Strategy
Connected communities	X		X		X			X	
Prepared communities	X						X		
Coastal Preparedness					X		X		X
Resilient Buildings	X			X		X		X	
Robust Infrastructure	X	X		X			X	X	X
Healthy Natural Env.		X	X		X	X		X	X
Adaptive Organization	X								
Community Capacity	X	X	X	X	X	X	X	X	X

*VanPlay: Parks and Recreation Services Master Plan