Flood Mitigation in the City of Vancouver and Metro Vancouver

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Introduction

Sḵwx̱wú7mesh Úxwumixw (Squamish Nation) is experiencing increasing flood risk driven by climate change, altered flow regimes, aging infrastructure, and population growth. Given this risk, as well as recent flooding affecting the Nation, the Nation is seeking to reduce property-level flood exposure and build long-term flood management strategies by implementing nature-based solutions (NbS). To do so, it will be important for the Nation to understand whether these efforts will be enhanced or diminished by the actions of neighbouring jurisdictions.

This report aims to support the Sḵwx̱wú7mesh Emergency Planning and Response Team by researching the flood risk management practices of two of Squamish Nation's neighbouring jurisdictions: Metro Vancouver and City of Vancouver. Squamish Nation has four reserves that neighbour these jurisdictions: Capilano No. 5 (near Lions Gate Bridge), Mission I.R. No. 1 (Mosquito Creek), Seymour No. 2, and the Sen'áḵw land in Kitsilano. Included in this report is:

1. A **spatial analysis** of the natural and built environment of Metro Vancouver and City of Vancouver as it relates to flood risk and management
2. A review of the **planning regulations** of Metro Vancouver and City of Vancouver as they relates to flood risk and management
3. A review of **strategic land use plans** (Official Community Plan and Regional Growth Strategy) Metro Vancouver and City of Vancouver as they relate to flood risk and management
4. A review of **focused strategies, plans, and programs** Metro Vancouver and City of Vancouver as they relate to flood risk and management

Methodology

Spatial Data Collection

Spatial datasets were collected to analyze the geographic and environmental context influencing flood risk in the study area. Spatial data were obtained from publicly available sources including the Metro Vancouver Open Data Portal, the City of Vancouver Open Data Portal, and the British Columbia Data Catalogue.

Key datasets used in the analysis included digital elevation models (DEM), slope data, land cover classifications, floodplain mapping, reservoir and dam locations, watershed boundaries, and shoreline elevation contours. Aerial imagery and historical photographs documenting coastal flooding events were also collected to provide visual evidence of past flooding conditions.

These datasets were used to examine both the regional hydrological landscape of Metro Vancouver and the local environmental conditions surrounding the Sen̓áḵw land in the City of Vancouver.

Spatial Analysis

Spatial analysis was conducted using ArcGIS Pro software to examine the physical and environmental factors influencing flood risk for Squamish Nation reserves. The analysis was conducted at two spatial scales.

At the regional scale, spatial data were used to examine the relationship between Squamish Nation reserve locations and the broader hydrological system of Metro Vancouver. DEMs and slope maps were analyzed to identify watershed gradients and drainage pathways from the North Shore Mountains toward Burrard Inlet. Reservoirs, dams, and protected watershed areas managed by Metro Vancouver were mapped to understand how regional water infrastructure and watershed management systems interact with downstream reserve locations.

At the local scale, a detailed spatial analysis was conducted for the Sen̓áḵw site. Elevation contours, floodplain boundaries, land cover classifications, and aerial imagery were analyzed to examine the site's coastal setting and surrounding urban infrastructure. Particular attention was given to identifying potential flood drivers, including coastal flooding associated with sea level rise and king tides, stormwater runoff from impervious urban surfaces, and compound flooding resulting from the interaction between rainfall and elevated coastal water levels.

Maps and spatial visualizations were produced to illustrate these spatial relationships and to support the interpretation of flood risk conditions within the study area.

Document Collection

The jurisdictions' high-level strategies and plans include Vancouver Plan, Vancouver Official Development Plan (ODP) Draft, the Metro Vancouver Regional Growth Strategy (RGS), and the Metro Vancouver Electoral Area A Official Community Plan (OCP). We decided to include the ODP in its draft form given that it will be approved by June 2026 at which point it will supersede the current Vancouver Plan.

For City of Vancouver regulations, documents were collected on the City of Vancouver website by searching "flood" and "water" in the "find a bylaw" search function, revealing a list of consolidated bylaws. For Metro Vancouver regulations, documents were collected on the Metro Vancouver's bylaws webpage by searching "flood" and "water".

Other policy, planning, program, and guideline documents were identified through a review of publicly available materials on the City of Vancouver and Metro Vancouver websites. Initial searches focused on major municipal and regional strategies related to climate change and emergency management. This process led to the identification of key documents including Vancouver's Changing Shoreline: Preparing for Sea Level Rise, the Electoral A Emergency Response Plan, and the Climate Change Adaptation Strategy. Following the identification of these key documents, backward citation chaining was conducted to locate relevant supporting plans referenced within these documents.

Documents that did not demonstrate spatial relevance to the study area were excluded from further analysis. The remaining documents were then analyzed to identify the primary focus and objectives of each plan and how flood risks are acknowledged, addressed, and/or managed.

Document Analysis

Documents were downloaded and uploaded to the qualitative analysis software NVivo 14, where a stemmed word query was done using the below query terms. Documents were then coded according to their purpose, relevant flood risk provisions, exemptions, and diagrams/maps, to understand how each jurisdiction regulates flood risk. The query results were then analyzed and relevant results synthesized.

All stemmed word queries in Nvivo used the following key terms: flood OR rain OR pluvial OR sea OR river OR creek OR stream OR coast OR storm OR coastal OR shore OR foreshore OR water OR floodwater OR rainwater OR seawater OR watershed OR blue OR natural hazard OR nature OR hazard OR riparian.

Flood Mitigation in Metro Vancouver

Spatial Analysis

Metro Vancouver is a federation of 21 municipalities, one electoral area, and one treaty First Nation. Electoral Area A is the unincorporated area of the regional district, with land varying from urban, suburban, seasonal use, to rural and remote. Metro Vancouver acts as the local government for Electoral Area A, providing certain key services. Electoral Area A occupies approximately 818 km^2 of land and includes the following communities and inhabited areas:

- Lands along Howe Sound, located between the District of West Vancouver and Squamish-Lillooet Regional District (excluding the Village of Lions Bay). This includes the communities of Ocean Point, Strachan Point and Montizambert Wynd
- Bowyer and Passage Islands (in Howe Sound)
- Northern portion of Indian Arm
- Boulder Island and Carraholly Point (at the southern end of Indian Arm)
- West side of Pitt Lake
- Barnston Island (in the Fraser River, west of Golden Ears Bridge)
- University Endowment Lands (includes most of Pacific Spirit Regional Park)
- University of British Columbia (including University Neighbourhoods)

Regional Context: Squamish Nation Reserves within Metro Vancouver

Squamish Nation reserves are located across several parts of Metro Vancouver, including the Burrard Inlet shoreline and the North Shore of Vancouver. As shown in Figure 1, key reserves in this region are Capilano IR5, Mission IR1, Seymour Creek IR2, and Kitsilano IR6 (Sen̓áḵw).

These reserves are situated within a region characterized by steep coastal mountains, short watersheds, and highly urbanized shorelines. Rivers draining the North Shore Mountains, including the Capilano and Seymour Rivers, flow directly into Burrard Inlet near several Squamish Nation reserve lands. These spatial relationships indicate that the reserves are located at key hydrological transition zones that shape flood risk conditions affecting these communities.

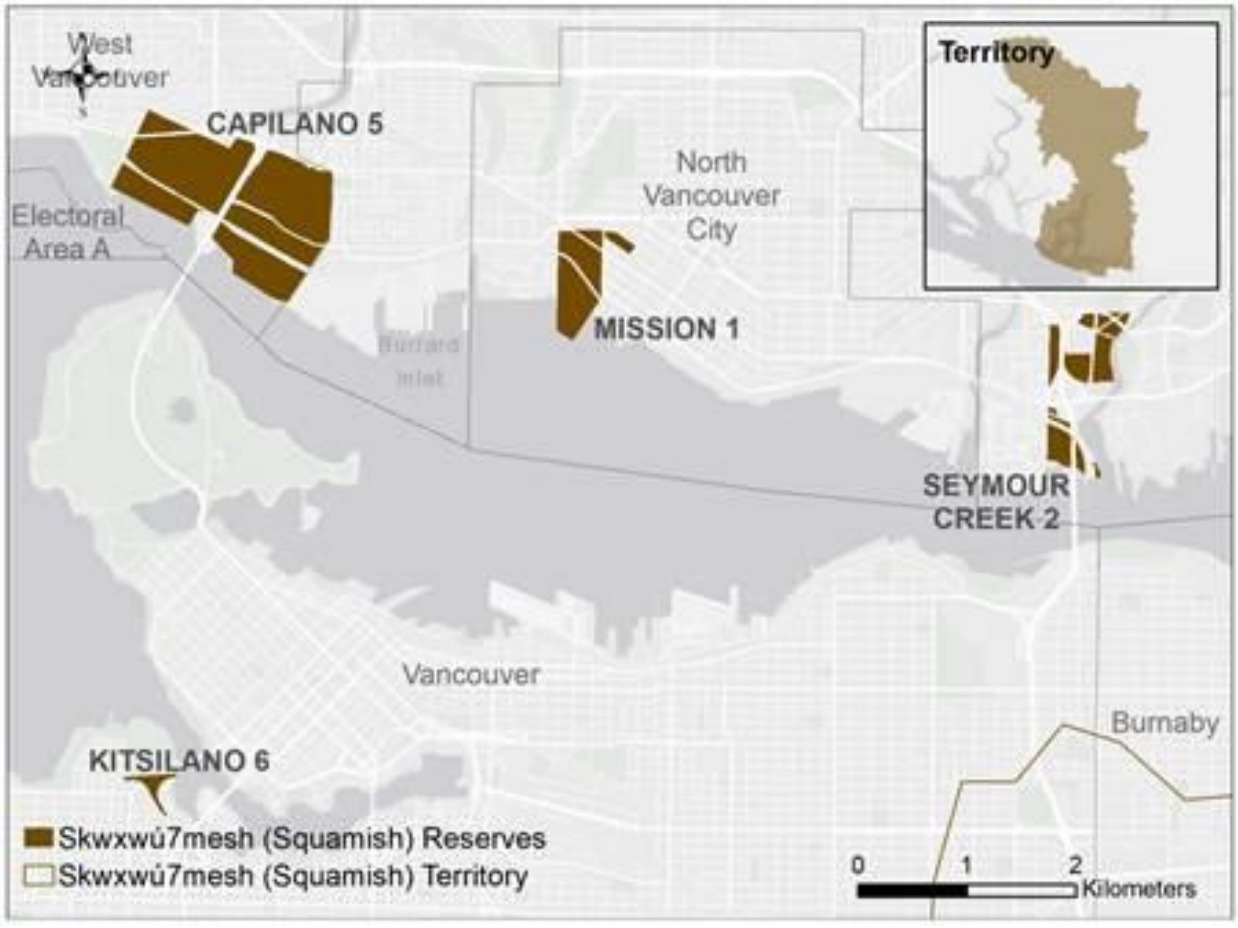


Figure 1: Territory Map of Squamish Nation (2024 First Nations in the Region Facts and Stats, p. 19)

Topography and Runoff Pathways

The DEM presented in Figure 2 illustrates the strong topographic gradient between the North Shore Mountains and the coastal lowlands of Metro Vancouver.

Elevations in the watershed areas exceed 1000 m, while the reserve lands along Burrard Inlet are located at or near sea level. This steep elevation difference creates short and highly efficient drainage pathways that rapidly transport rainfall and snowmelt from mountainous areas to the coastline.

The circled areas in Figure 2 highlight the locations of Squamish Nation reserves positioned directly at these watershed outlets. During intense precipitation events, runoff generated in the upper watersheds is funneled through narrow river valleys such as the Capilano and Seymour rivers before entering Burrard Inlet. This spatial configuration suggests that these reserve lands may experience increased exposure to river discharge and coastal water level interactions, particularly during extreme rainfall events.

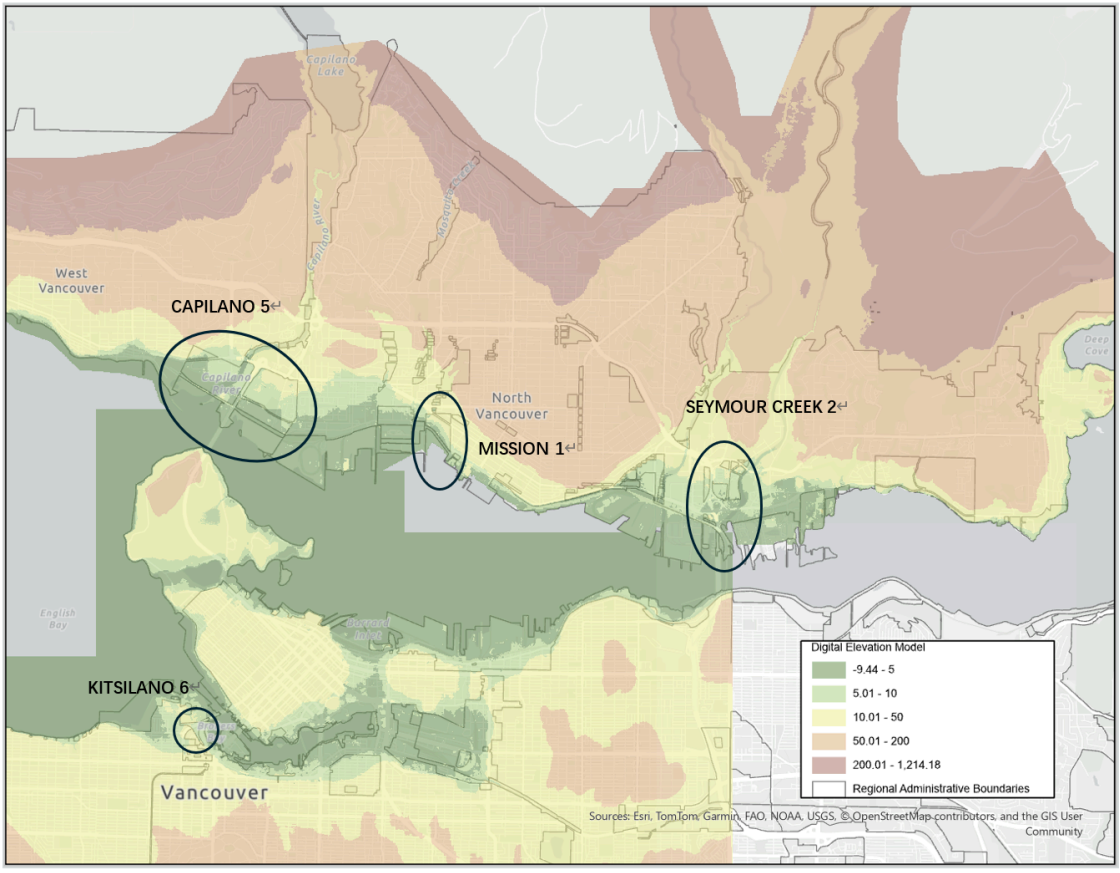


Figure 2: Digital Elevation Model of Metro Vancouver. Data sources: City of Vancouver Open Data Portal (Lidar 2022), Metro Vancouver Open Data Portal (Regional Land Use Designation), Government of British Columbia Data Catalogue (Lidar BC). Map created by the authors.

Regional Parks and Water Infrastructure

The North Shore Mountains contain several large watersheds that supply drinking water to the Metro Vancouver region. These include the Capilano and Seymour watersheds, both of which are managed by Metro Vancouver as protected water supply areas. As shown in Figure 3 and 4, these watersheds include large reservoirs and dam infrastructure, such as the Capilano reservoir, the Seymour reservoir, and the Cleveland Dam on the Capilano River. These watershed areas serve multiple functions simultaneously. They provide drinking water storage, regulate river flows through reservoir infrastructure, and are managed as protected conservation landscapes with limited public access. As a result, large portions of the North Shore Mountains remain forested and undeveloped.

This watershed management system plays an important role in shaping downstream flow conditions. Forested mountain landscapes absorb more rainfall and slow runoff compared to urban areas. However, the steep terrain of the North Shore Mountains creates highly efficient drainage pathways that funnel water rapidly toward the coastline.

During intense precipitation events, rainfall and snowmelt from large mountain catchments are concentrated into a limited number of river channels, including the Capilano and Seymour Rivers. These rivers discharge directly into Burrard Inlet near several Squamish Nation reserve lands.

Reservoirs within these watersheds store significant volumes of water and regulate river flows through dam infrastructure. Under normal conditions, reservoirs can moderate downstream flows by storing runoff during wet periods. However, during extreme rainfall events—such as atmospheric river storms—reservoir inflows can increase rapidly. In such situations, reservoir releases or spillway discharge may contribute to elevated downstream river flows.

Because Squamish Nation reserves such as Capilano IR5 and Seymour Creek IR2 are located near the lower reaches of these rivers, they occupy locations where mountain watershed runoff, regulated reservoir flows, and coastal water levels intersect. This spatial relationship suggests that regional watershed processes—including precipitation patterns, reservoir operations, and river discharge—may influence flood risk conditions affecting Squamish Nation reserves along the Burrard Inlet shoreline.

Figure 3: Map of Metro Vancouver Water Supply Areas and Dams (Metro Vancouver, Watersheds and Reservoirs | Metro Vancouver, 2026)

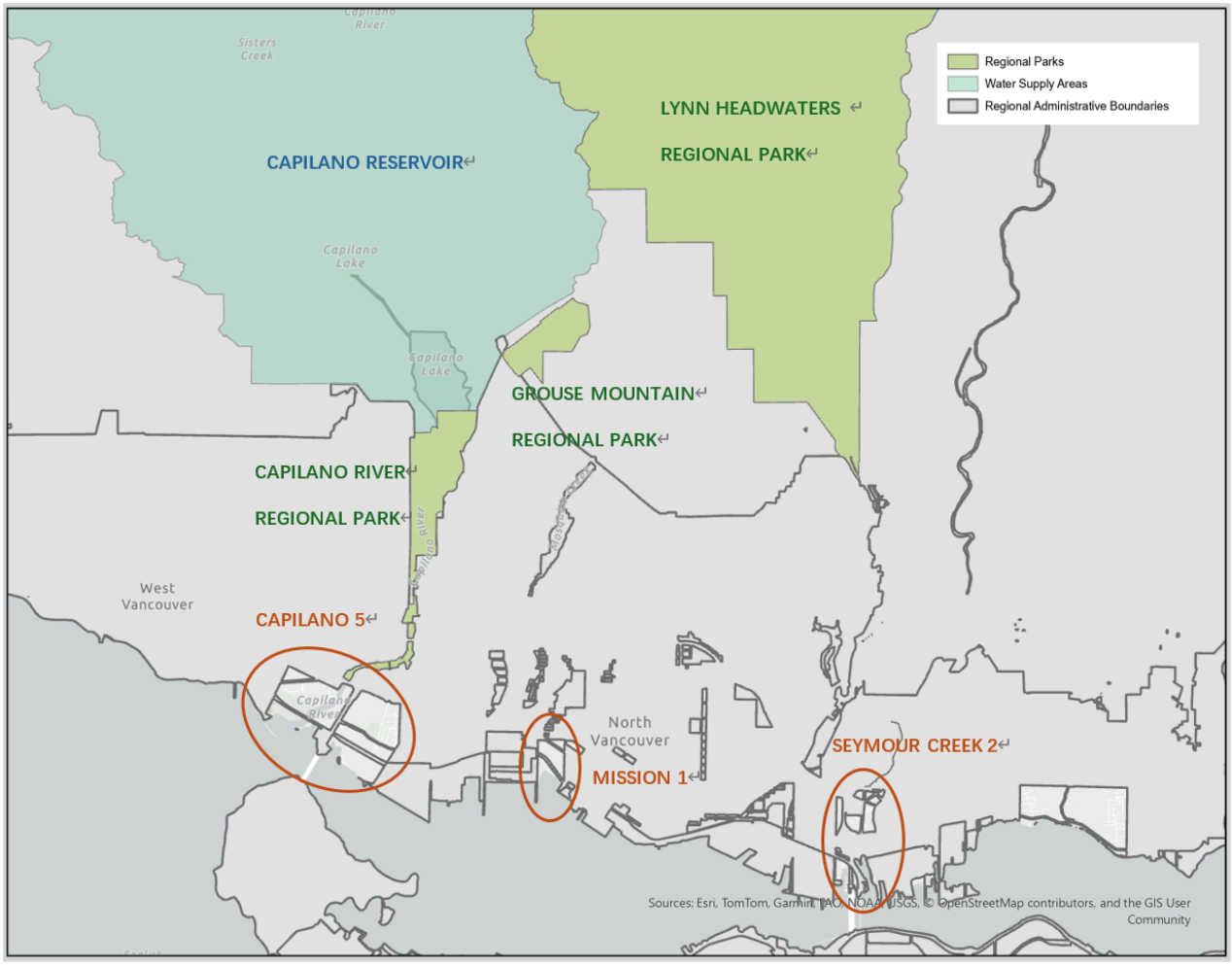


Figure 4: Map of Metro Vancouver Water Supply Area and Parks. Data sources: Metro Vancouver Open Data Portal (Regional Land Use Designation, Water Supply Areas, Regional Parks Boundaries). Map created by the authors.

Taken together, the spatial relationships shown in Figures 1–3 suggest that Squamish Nation reserves along Burrard Inlet occupy locations where mountain watershed runoff, regulated reservoir flows, and coastal water levels intersect. This convergence of hydrological processes may increase flood exposure during extreme rainfall events.

Strategic Land Use Plans and Strategies

Metro Vancouver - Regional Growth Strategy

The RGS outlines the land use policies that will guide growth and development across the region and within member communities. Both the plan's foundational context statement and regional challenges section recognize the region's vulnerability to climate change and natural hazards, including coastal and pluvial flooding (p.5).

Broadly, the RGS prioritizes resilience to climate change and natural hazards in its vision (p.11) and strategies, with a particular focus on ensuring resilience to hazards is considered in planning and designing new developments, as well as transit and service infrastructure (e.g., p.15,17,28,31-34, and 81-82).

The RGS also recognizes the importance of natural assets and ecosystems in bolstering local resilience and adapting to climate change across three of its five goals. In Goal 1: Create a Compact Urban Area (p.38), Strategy 1.3 focuses on achieving resilient and healthy communities. It directs Metro Vancouver to increase resilience to climate change impacts and natural hazards and to collaborate with Nations to advance land use policies that reduce community exposure to climate change impacts. In addition, Strategy 1.4 focuses on protecting rural lands from development and directs Member Jurisdictions to support the protection and restoration of ecosystems to enable adaptation to climate impacts.

In Goal 2: Support a Sustainable Economy (p.46), Strategy 2.1 directs Metro Vancouver to advocate that the Port of Vancouver develop strategies for climate and hazard adaptation. Strategy 2.3 recognizes the importance of agricultural land for economic and climate adaptation purposes and outlines policies directing Member Jurisdictions to support climate adaptation actions including "monitoring of stormwater, flooding, and sea level rise impacts on Agricultural land, implementing flood construction requirements for residential uses, and maintaining and improving drainage and irrigation infrastructure that support Agricultural production" (p.51).

Most relevant to flood protection are the strategies in Goal 3: Protect the Environment, Address Climate Change, and Respond to Natural Hazards (p.52) which recognizes the role of natural assets, ecosystems, and habitats in providing diverse ecosystem services, including flood control. Strategy 3.1 outlines tools to protect the ecological integrity of the region, including the Conservation and Recreation land use designation which is used to protect areas and ecosystems that, in addition to recreation or natural resource uses, may buffer communities from the impacts of climate change hazards.

Strategy 3.2 includes directives for Metro Vancouver to identify and build on existing green infrastructure networks and develop an Implementation Guide to support the further integration of green infrastructure across the region (3.2.3), and to work with Nations to support the use of NbS (3.2.4). It also directs Member Jurisdictions to develop and implement Integrated Stormwater Management Plans (3.2.7.v).

Strategy 3.3. specifically focuses on increased resilience to hazards and directs Metro Vancouver to support regional flood management, possibly through the implementation of the Lower Mainland Flood Management Strategy, to continue working with the Integrated Partnership for Regional Emergency Management and relevant stakeholders (3.4.1), and to advocate the Federal and Provincial governments advance guidelines, programs, and funding and encourage policy adoption for flood management at the local level and incorporate resilience considerations into building codes and standards. It also directs Member Jurisdictions to adopt statements that include flood-proofing policies (3.4.5), integrate natural hazard and climate change risks into land use, utility, and asset planning (3.4.6) and adopt flood hazard management guidelines (3.4.8).

Electoral Area A : Official Community Plan

This OCP is a regulatory bylaw that directs the land use and development across Electoral Area A in the Metro Vancouver region. Electoral Area A includes several communities and geographically dispersed locations across the Metro Vancouver region, as shown in Figure 5.

Relevant policies include key policies to protect natural assets and resources (p.15), with land use designitions (including Watershed, Park, Natural Resource, and Water) noted as key tools for protecting their land (p.12).

In addition, this OCP includes a policy on ensuring safety for residents and property which includes the proposed action to manage lands exposed to coastal flood hazards and recognizing the potential impacts of sea level rise on these areas (p.24).

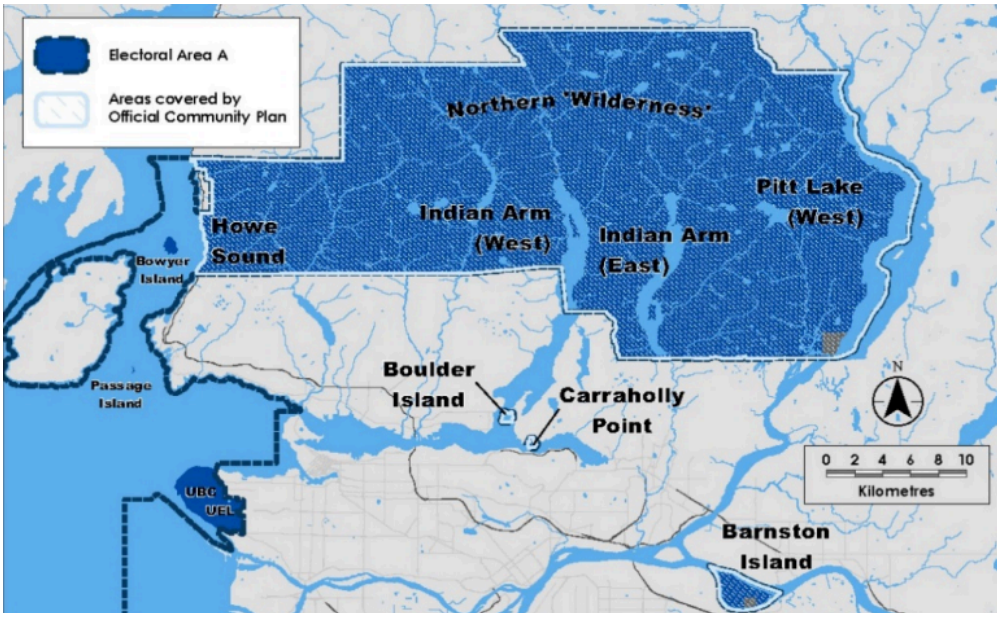


Figure 5: Electoral Area A, showing the area covered by this OCP. (Metro Vancouver Regional District, 2017, p.1)

Regulations

In Metro Vancouver, bylaws are enacted by three of Metro Vancouver's legal entities:

- Metro Vancouver Regional District (MVRD), formerly called the Greater Vancouver Regional District (GVRD);
- Greater Vancouver Water District (GVWD); and
- Greater Vancouver Sewerage and Drainage District (GVS&DD).

GVRD Electoral Area A Zoning Bylaw No. 1144, 2012 (consolidated)

This bylaw has zoning regulations in place for all Electoral Area A communities except Passage and Bowyer Islands under Islands Trust jurisdiction, First Nation Reserves under federal jurisdiction, University Endowment Lands administered by the province, University of British Columbia, including the University Neighborhoods Association. It manages flood risk by providing setbacks from the natural boundary of the sea, non-tidal waters, and riparian areas (pp.21-23).

Adjacent bylaws which do not directly affect flood risk management include:

- GVRD Electoral Area A Building Administration Bylaw No. 1043, 2006 requires building permits for the construction or alteration of buildings, structures, and plumbing systems in all Electoral Area A communities except for the University of British Columbia and the University Endowment Lands, Building demolition and moving permits are also required. Metro Vancouver is responsible for ensuring that construction meets the minimum safety requirements of the British Columbia Building Code.

- GVS&DD Sewer Use Bylaw No. 299, 2007 (unofficial consolidation) protects the Sewers and Sewage Facilities from damage and promotes efficient and cost-effective operation of the Sewers and Sewage Facilities, promotes Biosolids quality, protects human health and safety, assists efforts to remain in compliance with laws and regulatory instruments, protects the environment, and imposes fees payable by persons who discharge liquid waste into a Sewage Facility or whose liquid waste is treated by a Sewage Facility.

- GVS&DD Sewerage and Drainage Areas Boundaries Bylaw No. 310, 2018 legally define the boundaries of the specific sewerage and drainage areas (such as the Fraser Sewerage Area) that are eligible to receive regional wastewater services.

- GVWD Water Supply Areas Protection Bylaw No. 268, 2026 restricts access and regulates the use of the water supply areas to protect the environment for the purposes of minimizing risks of contamination to the water supply, and conserves the water supply areas lands.

Focused Plans, Strategies, and Programs

Climate 2050 Progress Report

The report provides an update on regional climate trends and outlines policies, programs, and infrastructure investments undertaken in 2024–2025 to reduce greenhouse gas emissions and strengthen climate resilience (p.5). It highlights increasing flood risks linked to record rainfall and atmospheric river events that caused flooding and landslides in the region (pp.5-22). It also notes river and floodplain flooding along the Fraser and Coquitlam Rivers and ongoing upgrades to dikes and flood protection infrastructure to address these risks (p.23).

Flood risk management strategies include:

- Infrastructure-based measures such as upgrading dikes and flood protection networks along the Fraser and Coquitlam Rivers and improving climate-resilient water and wastewater systems to handle extreme rainfall (pp.22-23).
- NbS including wetland and bog restoration (e.g., Burns Bog) to improve water retention and land acquisition to protect floodplains and enhance natural flood resilience (p.19).

The report also notes future flood protection work, with designs underway and construction planned for 2027–2029 under the Joint Flood Mitigation Program (p.23).

Interim Draft Liquid Waste Management Plan

The purpose of the Liquid Waste Management Plan is to protect public health and the environment by managing wastewater and addressing regional pressures such as climate change, population growth, and urban development in Metro Vancouver. The plan addresses urban flooding risks caused by heavy rainfall and excess stormwater entering sewer systems, which can lead to sanitary and combined sewer overflows (p.1,25).

Key actions to reduce flooding and sewer overflows include:

- Reduce inflow and infiltration by inspecting, repairing, and replacing sewer pipes and private laterals to prevent rainwater and groundwater from entering sanitary sewer systems (pp.27–28).
- Separate combined sewer systems so stormwater and wastewater flow in different pipes, reducing overflows during heavy rainfall events (pp.33–34).
- Construct sewer overflow storage tanks to temporarily store excess wastewater during major storms and prevent environmental discharge (pp.26,31).

- Improve rainwater and watershed management through urban planning and stormwater system design that protects watershed health and reduces runoff impacts (p.39).
- Upgrade and maintain wastewater infrastructure, including sewers and treatment plants, to improve resilience to heavy rainfall and climate change (pp.17–20).

The plan aligns with regulations such as the Environmental Management Act, Municipal Wastewater Regulation, and Wastewater Systems Effluent Regulations under the Fisheries Act, which guide wastewater discharge standards and environmental protection (pp.8,11). It also outlines future actions including upgrading treatment plants, reducing sewer overflows, improving rainwater management, and strengthening climate-resilient wastewater infrastructure (pp.14–16).

Electoral Area A Emergency Management Plan

The purpose of this plan is to provide guidance for coordinating emergency response, communication, and roles during disasters affecting Electoral Area A in Metro Vancouver (p.12). Flooding is identified as one of the key hazards considered in emergency planning for Electoral Area A, although the document does not specify the exact flood type (e.g., river, coastal, or pluvial) and refers to flooding in general terms (p.15).

The plan operates under Metro Vancouver Bylaw No. 1238 (2016) and follows provincial legislation such as the Emergency Program Act and the Local Government Act, which guide emergency management and response (p.12). It also incorporates findings from Hazard, Risk and Vulnerability Assessments (HRVA) conducted for Electoral Area A in 2005 and a regional HRVA by the Integrated Partnership for Regional Emergency Management (2013), which identify flooding, wildfires, and landslides as major hazards in the region (p.15).

The plan outlines preparedness and mitigation actions such as reviewing hazard and risk assessments, monitoring hazards, coordinating with partner agencies, and practicing response procedures to strengthen emergency readiness (p.15). It also mentions developing building bylaws and regulations in high-hazard areas to help reduce risks from hazards including flooding, wildfires, and landslides (p.15).

JWUP For the Capilano and Seymour Watersheds

The Joint Water Use Plan (JWUP) Consultative Committee Summary Report documents the consultation process used to develop the Capilano-Seymour JWUP for Metro Vancouver. The report summarizes stakeholder interests, performance measures, and recommended operating strategies that Metro Vancouver will use to develop the final Joint Water Use Plan.

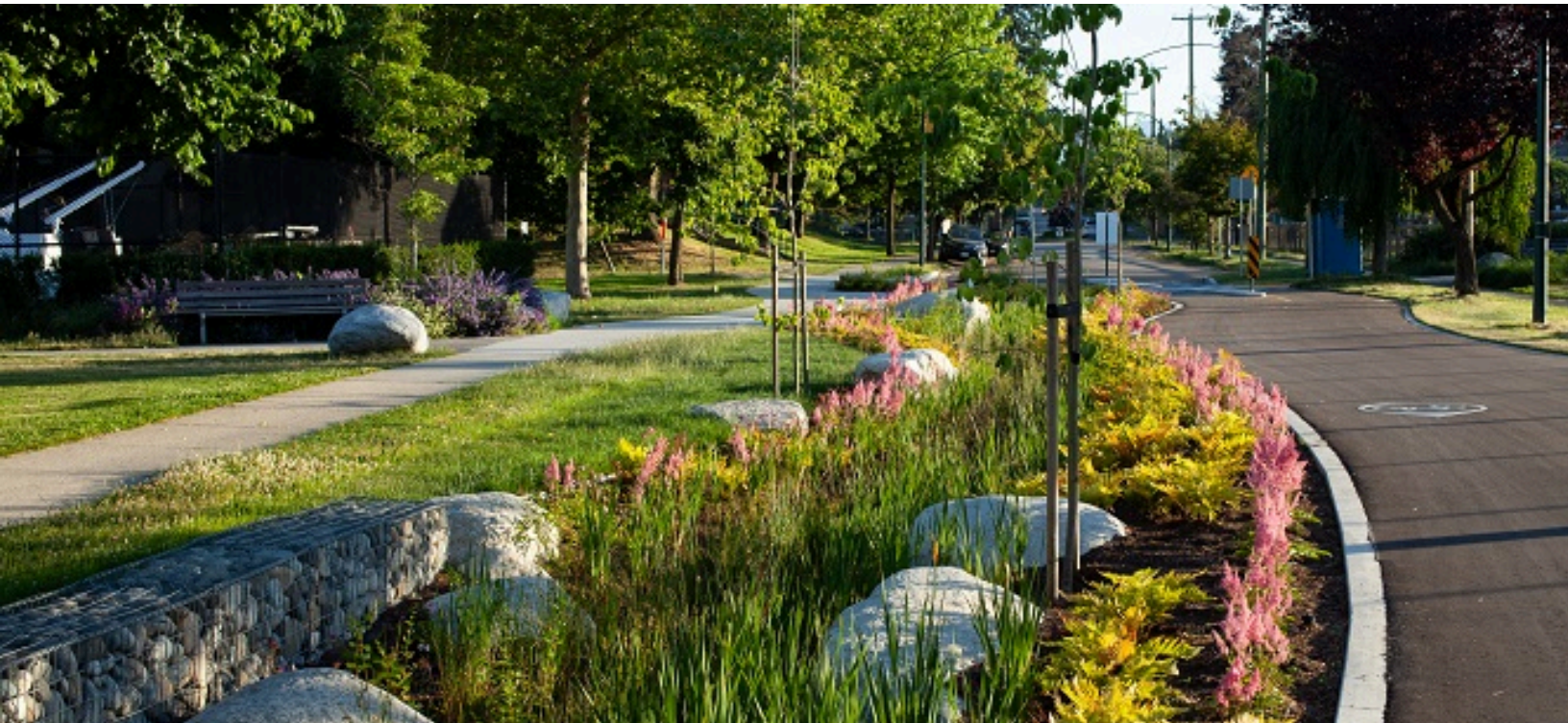
The document primarily addresses reservoir operations, water supply management, ecological impacts, and hydropower considerations. Downstream flooding is not identified as a key issue or focus of the report, and the document does not outline specific flood mitigation strategies related to downstream flood impacts.

Stormwater Source Control Design Guidelines

These guidelines aim to support Metro Vancouver municipalities in reducing runoff by managing water balance at the site level through on-site rainfall volume reduction, runoff water quality improvement, and runoff rate control for small, everyday rainfall events that occur frequently in the winter or rainy season in the Metro Vancouver region. It emphasizes managing rainwater at the source (at the site and street scale), mostly through green infrastructure such as absorbent landscapes (section 2-1), infiltration swales (section 3-1), rain gardens (section 4-1), pervious paving (section 5-1), green and blue-green roofs (section 6-1), infiltration trenches and soakaway manholes (section 7-1), and soil cell and tree trenches (section 8-1), among others, to reduce runoff volume and peak flow.

Sustainable Infrastructure and Buildings Design Guide

This design guide helps Metro Vancouver project leads understand and achieve the goals of the Sustainable Infrastructure and Buildings Policy, which identifies LEED Gold or Envision Gold as the level of performance to be achieved. Specifically, the guide focuses on the achievement of Metro Vancouver's Priority Performance Objectives for infrastructure and buildings. It recommends minimizing stormwater runoff quantity, rate, and quality impacts (pp.74-78,141-144) by incorporating on-site management features that reduce flood peaks and mimic natural hydrology. It also emphasizes site selection that protects sensitive ecosystems, preserves soils, and enhances habitat (pp.79-82,145-148), which have the potential to buffer flood effects through vegetation and infiltration.



Flood Mitigation in City of Vancouver

Spatial Analysis

Sen̓áḵw within City of Vancouver

Sen̓áḵw (Kitsilano Indian Reserve No. 6) is located at the southern end of Burrard Bridge at the entrance to False Creek in Vancouver (Figure 6). The site occupies a narrow coastal area along Burrard Inlet and lies within a highly urbanized environment, surrounded by major transportation infrastructure and urban land uses.

Historically, the site was expropriated from the Squamish Nation in the early twentieth century and used for infrastructure and transportation purposes. Immediately to the west of the site lies Vanier Park, a large waterfront park built on reclaimed shoreline. To the east and north, the site is connected to the regional road network through Burrard Bridge and adjacent arterial streets. The land was formally returned to the Squamish Nation in 2003 following a settlement with the federal government.

This location places Sen̓áḵw at the intersection of several urban and coastal systems, including marine tidal processes, urban stormwater drainage, and transportation infrastructure runoff. Today, the site represents one of the most prominent urban reserve lands in Metro Vancouver.

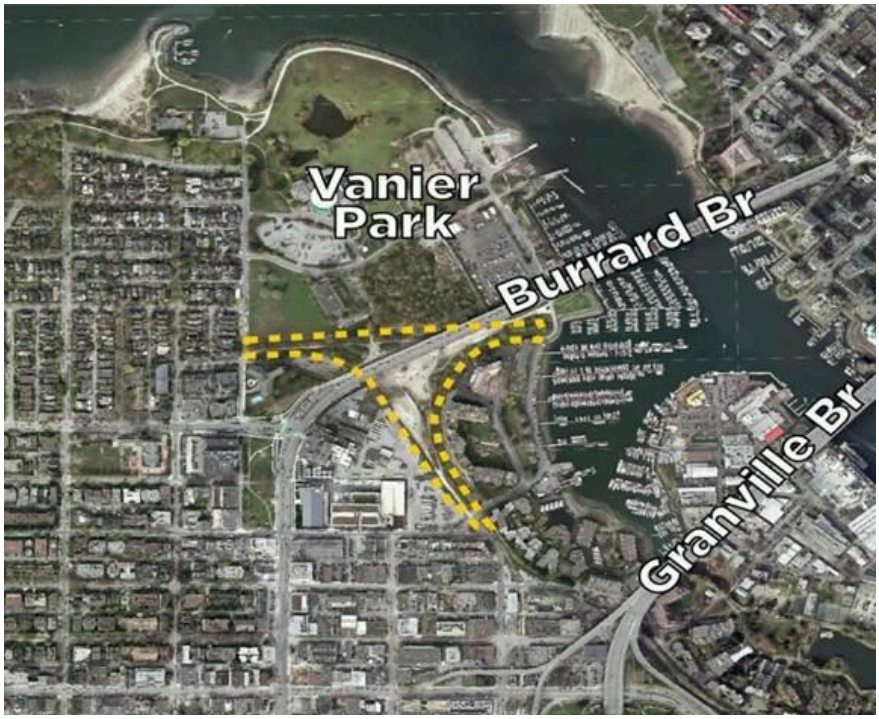


Figure 6: Location of Sen̓áḵw in aerial photo (Kits Point Residents Association, 2022)

Topography and Coastal Flood Exposure

Figure 7 illustrates that the Sen̓áḵw site lies within a low-lying coastal zone along Burrard Inlet. Much of the surrounding shoreline is located within the City of Vancouver's designated floodplain. The 2m contour lines in the figure show that large portions of the area surrounding False Creek and Vanier Park are only slightly above sea level. This low elevation increases the site's exposure to coastal flooding, particularly during extreme high-water events.

Because Sen̓áḵw sits at the mouth of False Creek, the site is influenced by both marine tidal conditions and local stormwater drainage systems. When coastal water levels rise during storms or king tides, the capacity of nearby stormwater outfalls to discharge runoff into False Creek may be reduced.

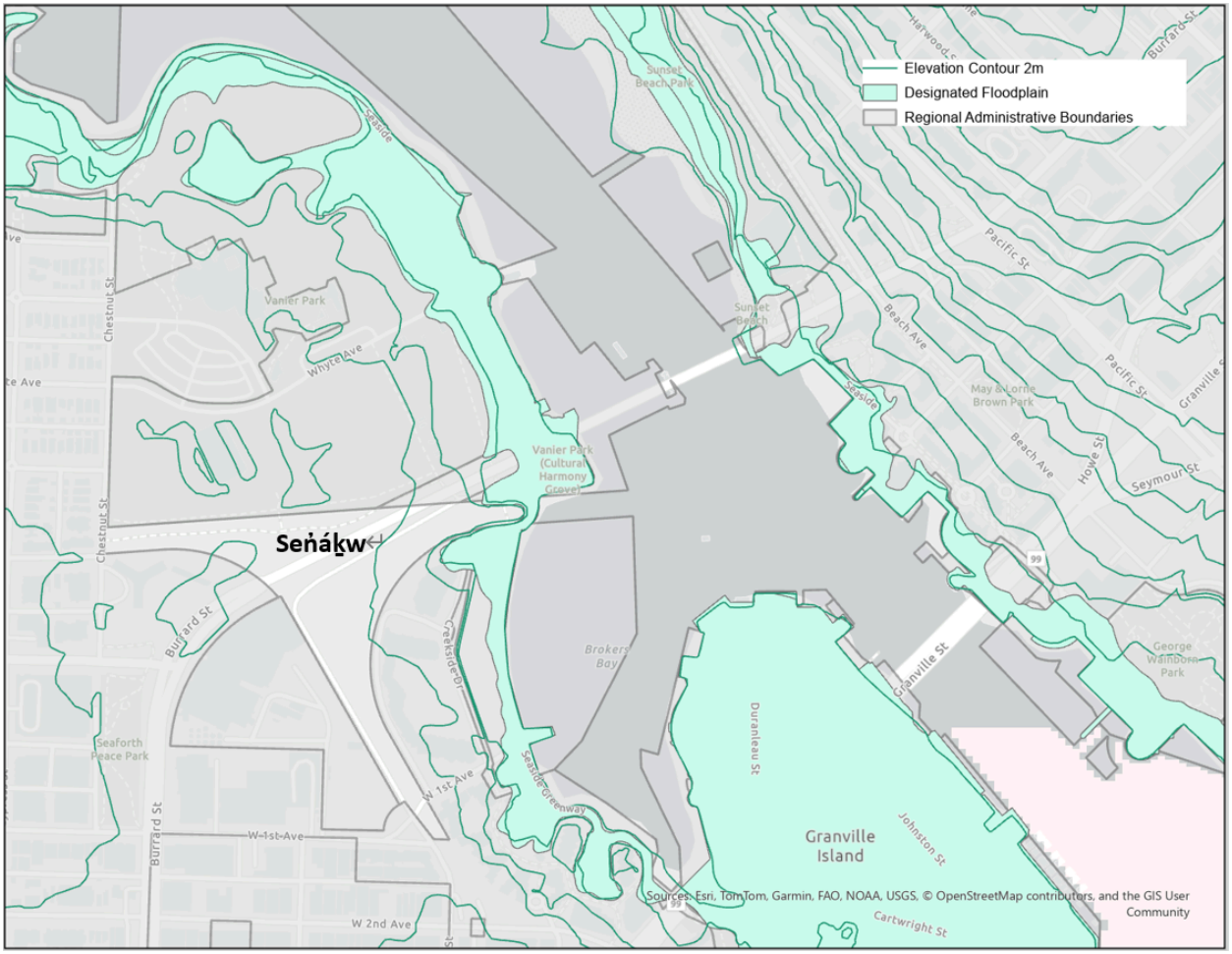


Figure 7: Map of Vancouver elevation contours (2m) and designated floodplain near Sen̓áḵw. Data sources: City of Vancouver Open Data Portal (Designated Floodplain, Elevation contour lines - 2-metre contours), Metro Vancouver Open Data Portal (Regional Land Use Designation). Map created by the authors.

Coastal Flooding and Sea Level Rise

King tide events have periodically caused flooding along parts of Vancouver's shoreline. Photographic documentation (Figure 8) shows shoreline flooding in areas near False Creek during these events. To date, observed sea level change in Vancouver over the past century (1910 – 2017) has been 3.7 m. Projections indicate that sea levels along the British Columbia coast may rise by approximately 1 m by 2100 (Figure 9). Combined with climate change (rising sea levels and more frequent extreme rainfall events), damage from ocean debris and flooding during king tides are becoming more common, with significant increases in the frequency and severity of coastal flooding.

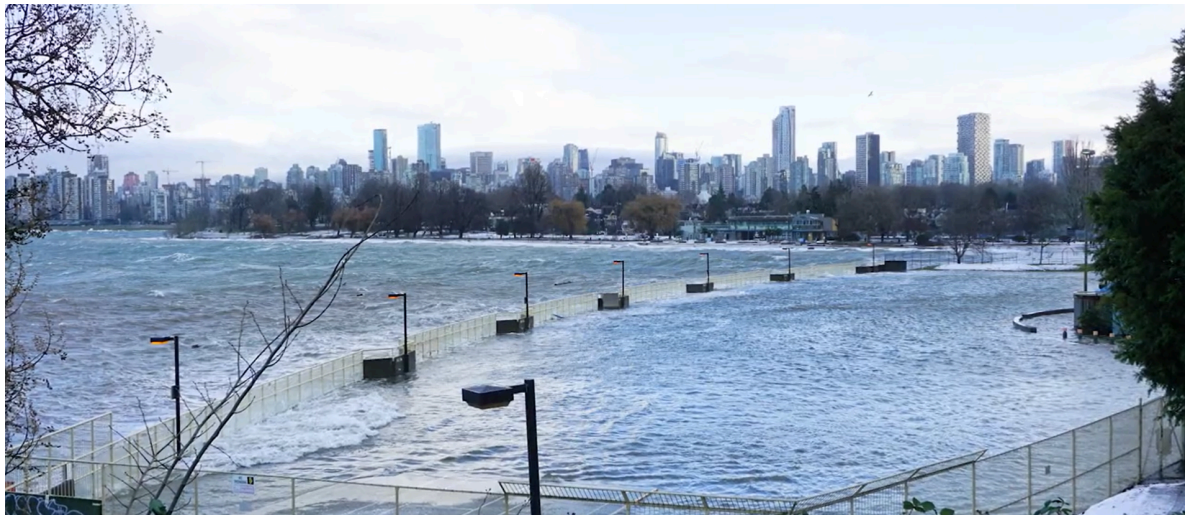


Figure 8. King tides in winter storms have caused significant structural damage to Kitsilano Outdoor Pool (Catherine Urquhart, 2022)

Figure 9: The foot of Cambie Bridge with possible future sea levels painted as a public art project (Ted McGrath, 2021)

Influence of Urban Infrastructure

The land cover classification map shown in Figure 10 highlights the highly urbanized character of the area surrounding Sen̓áḵw. Large portions of the surrounding landscape consist of buildings, paved surfaces, and transportation infrastructure, indicating a high overall density of impervious surfaces in this area. Impervious surfaces prevent rainwater from infiltrating into the soil and instead generate surface runoff that must be managed through engineered drainage systems. As a result, rainfall events in dense urban environments can produce large volumes of stormwater runoff in short periods of time.

The location of Sen̓áḵw directly adjacent to the bridge structure also means that runoff generated from bridge infrastructure may contribute to localized drainage pressures near the shoreline. Burrard Bridge carries large volumes of traffic and includes extensive impervious surfaces. Rainfall falling on bridge decks and surrounding roads is rapidly conveyed into the city's stormwater drainage network. Stormwater from these surfaces is transported through underground pipes and discharged into False Creek through coastal outfalls. During high tides, however, elevated water levels may reduce the efficiency of these drainage systems.

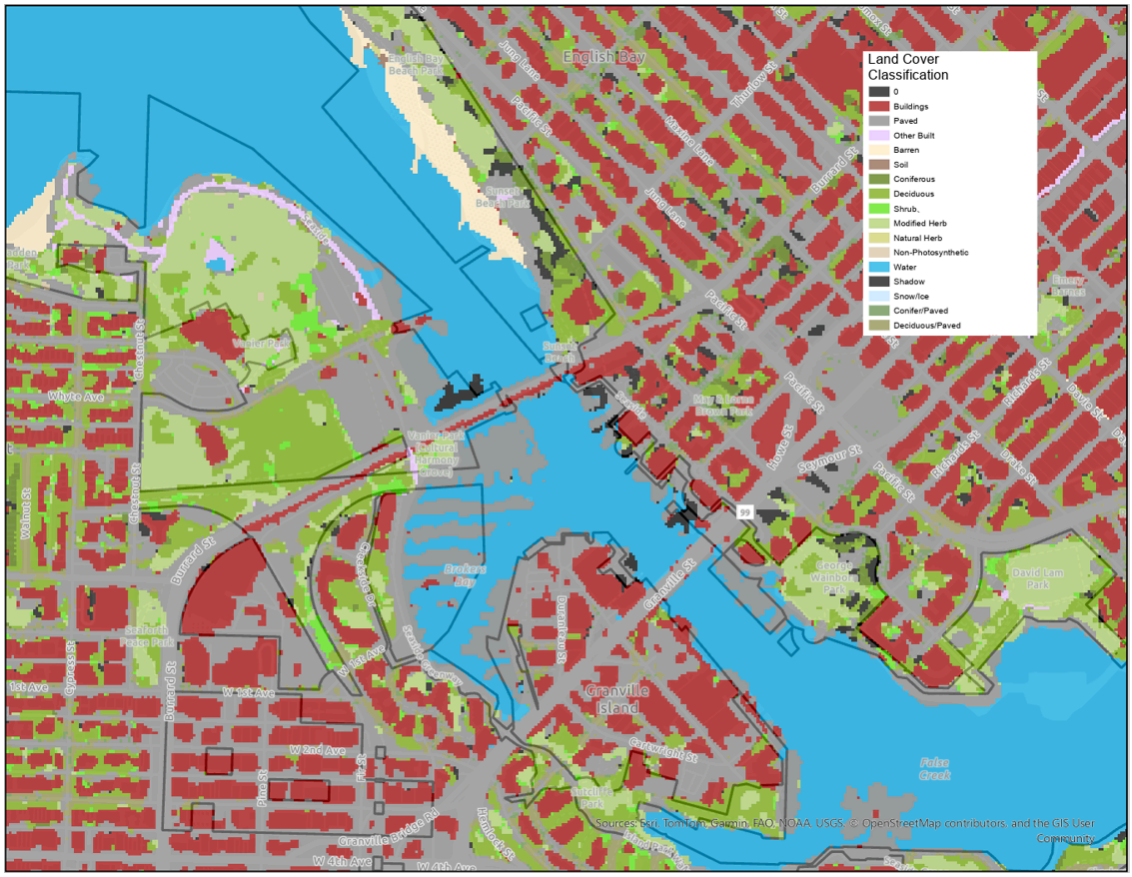


Figure 10: Land cover classification of City of Vancouver near Sen̓áḵw. Data sources: Metro Vancouver Open Data Portal (Regional Land Use Designation, Land Cover Classification 2020). Map created by the authors.

Strategic Land Use Plans and Strategies

City of Vancouver - Vancouver Plan

The Vancouver Plan is City of Vancouver's long-term (30 year) planning and visioning document and was approved in 2022. It serves as an equivalent to other municipalities' OCPs. It sets out high-level strategy themes, with directions and more granular policies to achieve those strategic directions.

The Vancouver Plan centers the climate emergency as one of the key challenges facing the city, with specific mentions of sea level rise, more severe rainstorms, and increased flooding as relevant hazards (p.9). The City states that infrastructure upgrades to prevent flooding are a key goal of future plans (p.36).

Part 4 of the Vancouver Plan focuses on their Land Use Strategy. Here, the City includes specific policies to:

- Ensure that public spaces are resilient to sea level rise (L1.3.6)
- Leverage urban forestry and green space to improve drainage (L.1.3.7)
- Ensure new developments plan for and reduce the risks of flooding and other hazards, with particular focus on high-risk areas (L.1.9.3), while incorporating green building design guidelines to capture, retain, and infiltrate rainwater (L2.3.8)

Part 5 focuses on eleven key policy areas that the City would like to support. For the first policy area, Housing, the plan highlights the importance of reducing hard surfaces and increasing on-site rainwater management for future multi-plex proposals (p.90-91).

Part 5-2. Economy (p.95) contains a brief mention of the need for proposed industrial developments or intensifications within or near ecologically sensitive areas to support the City's overall ecological and coastal adaptation vision.

Part 5-3. Climate Change (p.103) recognizes that destructive flooding is already occurring and that adaptation actions must be implemented to protect the community from hazards including flooding and sea level rise, with sea-levels expected to rise by 0.5 metres by 2050.

Part 5-4. Ecology (p.105) recognizes natural streams, creeks, and watersheds as key components of the City's ecological vision. Relevant policies in this area include a shift to watershed scale planning (4.1.1), increased collaboration with First Nations to support the stewardship of water systems (4.1.2), exploration of the establishment of water rights and/or conservation zones for important water bodies (4.3.2), support of the hydrological cycle

through the protection of urban soil (4.3.4), and collaboration with First Nations on management plans and conservation guidelines for all types of natural areas (4.3.5).

Parts 5-5. Transportation (p.116) and 5-6. Public Space (p.136) both include policies to increase the integration of natural assets and green infrastructure into roadways and the public space network to better support rainwater management and disaster response planning.

Part 5-10. Watersheds and Water Resources outlines a vision for "resilient water, sewer, and drainage systems that restore natural watershed functions, adapt to climate change, and serve communities equitably" (p.138). This chapter includes policies to expand the use of green rainwater infrastructure on roadways (10.2.1), develop a blue-green network to systematically reduce flood risk, manage rainwater and support climate adaptation (10.2.2), and leverage the use of natural waterways as drainage assets through ecological restoration and maintenance (10.2.3). In addition, this chapter advocates for site-level rainwater management through the development of land acquisition plans and design guidelines for water-adaptive public spaces (10.3.1) and the acceleration of building-scale rainwater management (10.3.2).

City of Vancouver - Official Development Plan (Draft)

The ODP was developed in response to new Provincial legislation, Bill 18, and will be the City's first statutory land use plan. It is currently in its draft form and a final version must be adopted by June 2026. The ODP builds upon the Vancouver Plan from 2022 while including provincially mandated additions, as well as changes to reflect new Council directions or improve clarity. Listed here are the relevant additions or changes in the current draft:

- Part 5-3. Climate (p.120) includes a subsection on climate adaptation builds on the Vancouver plan by calling for the implementation of recommended actions from the Climate Change Adaptation Strategy to increase resilience to hazards like extreme rainfall and sea level rise (3.2.1), as well as collaborate with local Nations, including Squamish Nation, to explore innovative approaches to adaptation (3.2.3).
- Part 5-10. Utilities (p.166), features a map of existing and historic streams and shorelines (Map 18, p.167). It also establishes policies to use a watershed-based planning approach, as guided by the Healthy Waters Plan, to mitigate flooding under current and future climate conditions (10.1.1), and continued coordination with Metro Vancouver on future infrastructure developments and approaches to reduce combined sewer overflows (10.1.4). It also included a map of drainage infrastructure (Map 20, p.171).
- Part 5-12. Hazardous Lands and Risk Reduction (p.178) outlines policies to understand, mitigate, and adapt to the various hazards and risks facing the city. This chapter includes a dedicated section to flood hazards, with a map of surface flood hazard areas

(Map 23, p.181). This map illustrates Sen̓áq̓w's increased exposure to coastal and overland flood risk by the year 2100.

- The City's policies in this chapter focus on deepening their knowledge and understanding of hazard risks through mapping and data collection (12.1.1), collaborative and equity-focused research (12.1.3 and 12.1.4), and communication and knowledge mobilization (12.1.5). Additionally, the City aims to use land use planning and policy development to reduce risks. These policies include continued research on hazard areas (12.2.2), the consideration of limiting development in hazard areas (12.2.3), and partnership building with provincial and federal governments to support risk reduction initiatives (12.2.4).

Regulations

The primary regulations that provide flood risk management support in the City of Vancouver are the Flood Plain Standards and Requirements, Building Bylaw, Zoning and Development Bylaw, and Subdivision Bylaw. Adjacent bylaws, such as the Waterworks Bylaw, Fire Bylaw, and Sewer and Watercourse Bylaw provide very limited flood risk management support. Because it is governed by its own Charter, City of Vancouver does not have Development Permit Areas (DPAs).

Building Bylaw No. 14343 (Book I, Vol. 1) (consolidated)

Vancouver regulates the design and construction of buildings via its Building Bylaw (previously called the Building Code), as enabled under the Vancouver Charter. Since 2014, the bylaw designates floodplains in False Creek, Fraser River, Burrard Inlet, and English Bay (see Figures 11 and 12). To manage flood risk on designated floodplains, it enforces Flood Construction Levels (FCLs) of 4.6 m (pp.21,200) as well as design, construction, and setback requirements on floodplains (pp.244-246) to prevent damage to buildings, prohibit hazardous materials below FCLs and ensure safe egress during floods. It does not apply to flood control and hydro electric dams and structures (p.9).

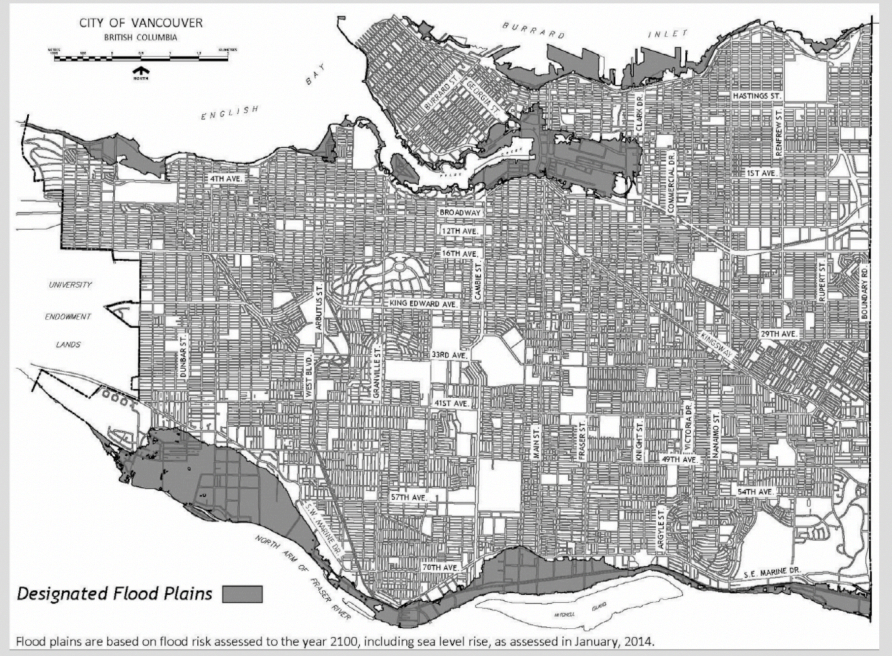


Figure 11: Designated Floodplains in the City of Vancouver (Vancouver Building Bylaw 2025, p.45)

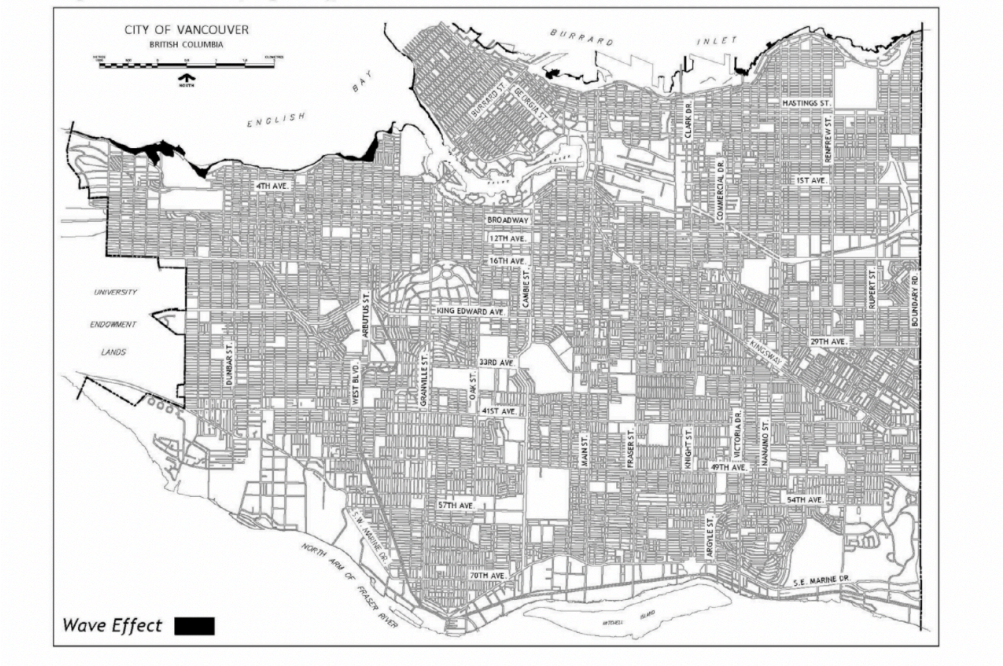


Figure 12: Wave effect zone in designated floodplains in the City of Vancouver (Vancouver Building Bylaw 2025, p.46)

Flood Plain Standards and Requirements (effective 2015; amended 2019)

These standards and requirements provide guidance on meeting the City's designated flood plain standards as described in the Vancouver Building Bylaw and how designated floodplains (Burrard Inlet, English Bay, False Creek, and Fraser River) must meet FCLs through measures such as fill placement, structural elevation, setbacks, adequate drainage systems, and implementation of flood resilient construction and/or protective measures to reduce the damage and recovery time from flood events (pp.3-6). FCLs enhance resilience by aiming to reduce or prevent injury, trauma and loss of life, minimize property damage, and reduce the amount of time it takes to return to operational functionality (p.1). The standards and requirements defend against flood risk from coasts (sea level rise, storm surge), rivers (Fraser River), and intense rainfall/stormwater. This means that Vancouver actively develops in flood-risk areas but pairs development with flood protection infrastructure and building elevation requirements.

Zoning and Development Bylaw No. 3575 (consolidated)

This bylaw regulates the use of land, and the density, floor area, form, placement and design of buildings in the City of Vancouver. It restricts or conditions development approvals in floodplains by controlling land use and permitting processes to align with the Flood Plain Standards and Requirements (pp.2-5). It also allows floor area exclusions in R districts to achieve FCLs (p.10), and requires upgrades to sewer, drainage, and flood management infrastructure for development approvals of amenities, facilities and utilities (Schedule I, p.1).

Subdivision Bylaw No. 5208 (consolidated)

This bylaw regulates the division of land into two or more parcels, consolidation of lots, property line adjustments, and the creation of air space parcels. It prevents subdivision approval in wet or flood-prone lands until the City Engineer confirms adequate drainage or flood mitigation measures are in place, and ensures new parcels are designed with proper stormwater and sewer infrastructure to limit creation of flood-vulnerable properties (p.9).

Adjacent bylaws which do not have provisions that directly affect flood risk management include:

- Waterworks Bylaw No. 4848 (consolidated) has provisions for fixing of rates, charges and conditions for the supply of water by the City of Vancouver's Water Works system. It indirectly supports flood resilience through cross-connection control and service shutoffs to prevent contamination during flood events. It clarifies customer responsibilities and enforcement to maintain a safe and functional drinking water system in emergencies.
- Fire Bylaw No. 14419 (consolidated) regulates fire safety in homes and communities. It requires emergency procedures for all hazards, including floods, to be integrated into building fire safety plans and promotes coordinated preparedness and response strategies for flood emergencies in multi-occupant or high-rise buildings.
- Sewer and Watercourse Bylaw No. 8093 (consolidated) regulates the quantity and quality of discharged wastes and the degree of pretreatment required, provides for the approval of plans for waste treatment, and provides for the collection of certain sewer rates to be applied towards a separately administered "Sewer Utility" account.

Focused plans, strategies, and programs

Climate Change Adaptation Strategy

This strategy provides a framework for identifying and prioritizing climate vulnerabilities and risks and for guiding policies, programs, and infrastructure investments that build resilience into City operations (pp.2–3). The Strategy identifies key flood-related impacts including overland flooding from heavy rainfall and coastal/Fraser River flooding due to sea level rise and storm surges, along with risks such as surface water ponding, sewer back-ups, and reduced drainage capacity near outfalls (pp.14–15).

Flood risk management is integrated through a structured risk and vulnerability assessment process to prioritize actions (pp.7–9). Key flood-related actions include:

- Completing a Comprehensive Integrated Stormwater Management Plan and continuing sewer separation to increase drainage capacity and reduce flooding and sewer back-ups (p.19).
- Conducting a Coastal Flood Risk Assessment to inform long-term protection planning (pp.20–21).
- Strengthening flood-proofing policies and integrating adaptation into the Vancouver Building Bylaw (p.1).
- Applying coastal response strategies such as Protect (dikes/seawalls), Accommodate (raising FCLs), Planned Retreat, and Avoid (land-use controls) to manage sea level rise risks (p.18).
- Using NbS such as parks, greenspace, and urban vegetation to enhance stormwater detention, infiltration, and groundwater recharge (p.17).

Summary of Updated Hazard, Risk and Vulnerability Analysis

The purpose of the report is to provide Council with a summary of the 2024 Hazard, Risk and Vulnerability Analysis (HRVA) and seek endorsement of key hazards to guide future emergency management planning (p.1). Flooding is identified as a key hazard under coastal flooding and extreme rainfall, assessed within the overall risk matrix and recognized for its high potential to damage infrastructure (pp.4–5).

The report emphasizes flood risk management through mitigation, preparedness, and risk-informed planning based on HRVA findings (pp.4–5). Key approaches include:

- Infrastructure-based measures such as upgrading aging civic facilities and strengthening critical infrastructure including roads, bridges, sewers, and water systems to withstand future hazards (pp.6–7).

- NbS such as urban forestry, green infrastructure, and wetlands that absorb rainfall and provide protection against coastal flooding (p.7).

The report references the Emergency and Disaster Management Act (EDMA), which requires updated risk assessments, Indigenous consultation, and the development of an Emergency Management Plan (p.1–2). It recommends preparing an updated HRVA and developing a new Emergency Management Plan in line with upcoming provincial regulatory timelines (p.1).

Vancouver Shoreline Flood Preference Design Reference

The purpose of the report is to define design criteria and considerations for shoreline flood protection works preferred by the City of Vancouver, ensuring they fit Vancouver's physical, land-use, and policy context (p.1-1). The report addresses flood hazards affecting Vancouver's shorelines, including coastal flooding from tides, storm surge, and waves, as well as Fraser River freshet flooding where high river flows combined with tidal influence raise water levels (pp.2-1,2-2). The document presents an integrated shoreline flood risk management approach that combines structural (infrastructure) and non-structural measures when structural protection is required (p.1-1).

Key strategies include:

- Infrastructure-based measures such as earthfill dikes, dikes with retaining walls, and limited standalone flood walls, supported by engineering measures like bank protection (riprap), seepage control, wave runup analysis, and internal drainage design (pp.4-2, 6-9, 6-12).

- NbS that reduce wave energy and flood risk using features such as mudflats, salt marshes, beaches, and kelp beds, and nature-based bank protection along the Fraser River (p.8-3).

- Integrating habitat enhancement and "design with nature" approaches, including wetland restoration, transition zones, swales, rain gardens, permeable surfaces, and floodable parks outside protection lines (pp.6-26, 7-7, 8-1).

The report follows the Province of BC Sea Level Rise Policy, recommending planning for 1 m sea level rise by 2100 and 2 m by 2200 (pp.2-3), and aligns with the City of Vancouver Flood Management Program and related guidelines (pp.2-5 to 2-7). It emphasizes long-term adaptive planning, defined design horizons, and integrated planning processes to address sea level rise and climate change impacts (pp.2-2 to 2-3; 6-1; 1-1 to 1-2).

Vancouver's Changing Shoreline: Preparing For Sea Level Rise

The purpose of the document is to explain how sea level rise and coastal flooding may affect Vancouver and to outline the City's approach to planning, adaptation, and resilience along its shoreline (p.18). It addresses coastal flooding caused by sea level rise and major storm events (1:500 year storm), as illustrated in the coastal floodplain map shown in Figure 13. It also highlights flooding from storm surges and king tides, where winter storms can raise water levels 50–100 cm above normal high tide (p.8).

The report presents four main coastal flood risk management approaches (p.16):

- Resist: build protective structures such as shoreline or inland dikes and offshore barriers to prevent floodwater from entering.
- Accommodate: raise or flood-proof buildings and infrastructure so they can function during flooding.
- Move: relocate people, buildings, or facilities away from high-risk flood areas and restore land to more natural conditions.
- Combination: use a mix of protection, accommodation, and retreat to balance safety, habitat, recreation, and community needs.

Protective actions include shoreline and inland dikes, raising buildings and infrastructure, regulating development through higher FCLs, and using NbS such as Greenshores dikes and habitat restoration (pp.16–18).

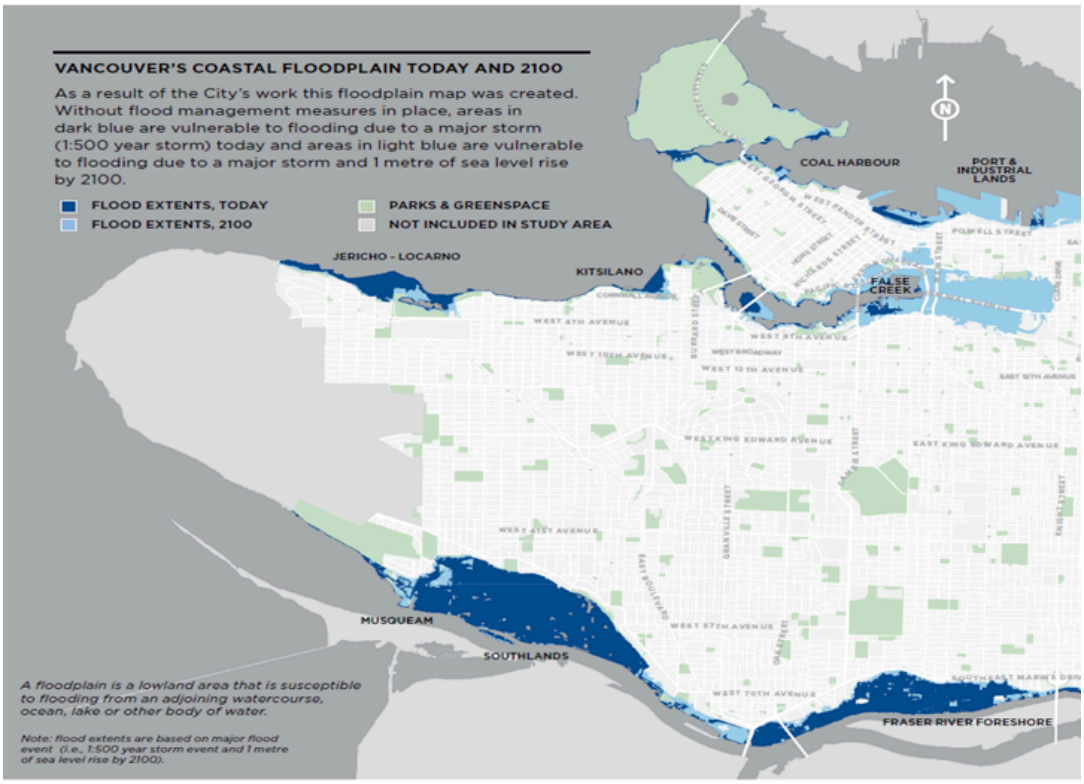


Figure 13: Vancouver Coastal Floodplain - Current and Future Risk (City of Vancouver(2018), Vancouver's Changing Shoreline: Preparing for Sea Level Rise, p.6)

Citywide Integrated Rainwater Management Plan – Vision, Principles And Actions

This plan sets targets, programs, and actions to guide how Vancouver manages rainwater and protects receiving waters (p.i,1). It addresses rainfall-driven urban flooding risks, particularly when heavy rainfall and stormwater runoff overwhelm combined sewer systems and cause combined sewer overflows into coastal waters (p.6). The plan promotes integrated rainwater management that reduces stormwater entering pipes, restores natural pathways through infiltration and evapotranspiration, and maintains reserve capacity in drainage systems to improve resilience to changing precipitation patterns (pp.33–34).

Key actions include:

- Reducing combined sewer overflows through continued sewer separation and drainage system upgrades (p.6).
- Implementing green infrastructure and NbS such as rain gardens, swales, and absorbent landscapes to manage stormwater runoff (pp.30,33–35).
- Using both grey infrastructure and green infrastructure to manage rainfall and improve stormwater filtration and infiltration within urban environments (pp.30–31).

The plan aligns with water-quality and habitat protection requirements from Environment Canada, Fisheries and Oceans Canada, and the Province of British Columbia, and supports implementation through the Metro Vancouver Integrated Liquid Waste and Resource Management Plan (p.7). Future work is guided through phased implementation programs, including ongoing, short-term, sustained, and long-term actions to expand rainwater management practices across the city (pp.45–58).

Rain City Strategy

The purpose of the Rain City Strategy is to transform how the City of Vancouver manages rainwater by treating it as a valuable resource rather than waste, while addressing increasing pressures from climate change, urban densification, aging infrastructure, and water quality concerns in surrounding waterways (pp.4,19). The strategy focuses on reducing stormwater runoff, urban flooding risk, and combined sewer overflows (CSOs) by implementing green rainwater infrastructure (GRI) across the city (pp.4,8). The strategy emphasizes managing rainwater close to where it falls to reduce pressure on sewer systems and improve the health of receiving waters such as Burrard Inlet and False Creek (pp.22, 30, 63).

Key actions include:

- Implement GRI such as rain gardens, bioswales, permeable pavement, rainwater tree trenches, and green roofs to capture, infiltrate, and treat rainwater before it enters the drainage system (pp.7,23).
- Establish a rainwater management design standard requiring new public infrastructure projects and private developments to capture and treat 48 mm of rainfall per day through infiltration, evapotranspiration, or reuse (pp.5,12).
- Requiring rainwater management on development sites and integrating GRI into capital infrastructure projects, streets, parks, and public spaces (pp.5,15).
- Expand rainwater harvesting and non-potable water systems to reuse captured rainwater (pp.23,32,49,86).
- Retrofit existing streets, public spaces, and parks to absorb and manage stormwater runoff (pp.15-17, 113-115, 121).

The strategy establishes long-term targets to capture and treat 90% of Vancouver's average annual rainfall and manage runoff from 40% of the city's impervious surfaces by 2050, primarily through new development requirements, infrastructure upgrades, and strategic retrofits (pp.3,117). Implementation occurs through three coordinated action plans focused on Streets and Public Spaces, Buildings and Sites, and Parks and Beaches (pp.124-135). The Rain City Strategy aligns with federal and provincial, regional, and other City of Vancouver regulations (p.23).

Key Directions for the Healthy Waters Plan

The purpose of Key Directions for the Healthy Waters Plan is to outline policy and infrastructure directions for Vancouver's long-term sewage and rainwater management strategy. The document builds on earlier planning phases to improve water quality, reduce CSOs, and address pressures from climate change, aging infrastructure, and urban growth. The plan highlights that heavy rainfall, urban runoff, and combined sewer systems can lead to sewer overflows, pollution entering receiving waters, and increased risks of flooding and sewer back-ups (pp.7,14). This plan notes that pollution and sewage spills affect the ecological health of waterways and the cultural and harvesting practices of the Musqueam, Squamish, and Tsleil-Waututh Nations.

Key actions include:

- Adopt an enhanced approach to sewer separation to accelerate efforts to reduce pollution and divert rainwater, groundwater and buried creeks away from City and regional sanitary sewer infrastructure (p.36)
- Expand the use of GRI on streets and public properties to manage and clean rainwater runoff and reduce the volume of rainwater entering the sewer system (p.33).
- Optimize the rainwater management policy use for redevelopment, to minimize costs of growth-driven system capacity upgrades as well as flooding and CSO risks (p.34)
- Define flood-proofing policy for development (p.35)

The plan also incorporates extreme rainfall and overland flooding risk assessments to evaluate infrastructure performance and guide investment priorities (p.23). It aligns with broader regulatory and policy frameworks including regional liquid waste management requirements and municipal climate adaptation strategies, and outlines a future Healthy Waters Implementation Plan that will establish funding strategies, monitoring programs, and adaptive management approaches to address flooding, sewer back-ups, and climate-related water risks over the long term (pp.10–11)

Coastal Flood Risk Assessment Phase I

The purpose of the City of Vancouver Coastal Flood Risk Assessment (CFRA) - Phase 1 Final Report is to assess the potential impacts of coastal and river flooding in Vancouver under future sea level rise scenarios and to provide a foundation for future flood management policies, land-use planning, and infrastructure decisions. The report evaluates multiple scenarios combining projected sea level rise and major storm events to identify areas of vulnerability along Vancouver's coastline and riverfront. It highlights that rising sea levels, storm surge, and extreme rainfall events could increase flood risk, disrupt drainage systems, and affect critical infrastructure, transportation corridors, and neighbourhoods located in low-lying coastal areas.

The report recommends that the City adopt an adaptive approach to coastal flood management due to uncertainty in future sea level rise projections (pp.109-111). Recommendations focus on improving flood modelling, infrastructure planning, and emergency preparedness (pp.109-111). These include better documentation of future flood events to improve model calibration, updating flood models when new LiDAR data or major infrastructure changes occur, and assessing risks to below-ground infrastructure such as tunnels or underground facilities (pp.109-111). The report also recommends reviewing emergency evacuation plans and gathering areas in vulnerable waterfront areas such as False Creek (pp.109-111). Additionally, rising sea levels are expected to reduce the capacity of the stormwater drainage system, and the report suggests increasing pumping capacity to mitigate backwater flooding impacts (pp.109-111).

Coastal Flood Risk Assessment Phase II

Phase II of the Coastal Flood Risk Assessment Phase identifies False Creek and the False Creek Flats area as a zone of increasing long-term coastal flood risk due to sea level rise and extreme storm events. Projections suggest that while flooding risk is currently low, lower-lying areas could experience more frequent flooding by mid-century, with the False Creek Flats becoming vulnerable during rare flood events by around 2070 without protective measures.

The report evaluates several potential flood mitigation strategies that could inform adaptation approaches in nearby areas, such as raising the False Creek seawall, constructing a sea barrier near Burrard Bridge, implementing dike infrastructure, and gradually adapting buildings and infrastructure to become more flood-resilient over time (p.38). While large structural protections could provide full flood protection, they require significant investment and have environmental and aesthetic trade-offs, whereas incremental adaptation allows risk to be managed over time (pp.44-45). The report recommends maintaining/acquiring the right-of-way for a partial dike as well as a raised sea wall, maintaining a potential footprint of the barrier, and implementing a barrier or sea wall by 2100 (pp.102-104).

Broadway Plan

The Broadway Plan addresses flooding primarily in the context of climate change adaptation, stormwater management, and infrastructure planning. The plan recognizes that rising sea levels and more extreme rainfall events will increase the risk of coastal and overland flooding, as well as CSO events in the Broadway area (pp.512,547). It highlights the role of GRI and NbS in reducing flood risk by increasing rainwater infiltration through permeable surfaces and natural areas in parks, public spaces, and private developments (pp.462-463, 519). The plan also references broader city initiatives such as the Rain City Strategy, Healthy Waters Plan, and the Greenest City Action Plan, which aim to reduce urban runoff, improve sewer capacity, and manage rainwater to address climate change impacts and population growth (p.523).

The Broadway One Water Plan proposes pipe upgrades, strategic sewer separation, and expanded green rainwater infrastructure to manage runoff, and reduce CSOs (pp.525, 548). Additional measures include constructing new stormwater outfalls designed to adapt to sea level rise, expanding on-site rainwater and groundwater management requirements, and integrating blue-green infrastructure networks that manage water while enhancing public space and biodiversity (p.525). The plan also notes that development applications may be required to upgrade water, sewer, and drainage infrastructure as a condition of development to ensure adequate system capacity and reduce flood risk as the area grows (p.548).

False Creek Flats Area Plan

The False Creek Flats Plan establishes a long-term vision for the redevelopment of the False Creek Flats. Flooding is only briefly addressed in the plan. The Flats are identified as a low-lying area that may face flood risk from future sea level rise and large storm events by the end of the century. The plan suggests improving resilience through raising new development, exploring adaptive building design, and incorporating flood-resilient construction methods. However, flooding is not a central focus of the document, and the plan does not outline detailed flood mitigation policies or regulatory tools beyond general climate resilience measures (p.62).

Engineering Design Manual

This design manual consolidates the City of Vancouver's design preferences and criteria into one comprehensive and cohesive document. The manual is framed by a resilience approach and flooding is one of the hazards addressed by the guidelines. The manual includes both grey and green infrastructure solutions to reduce flood risk. For example, it includes technical criteria for storm drainage design such as storm sewer sizing, allowable flow rates, and on-site detention or infiltration during rainfall events, and guidelines on flood control systems, such as tide gates and dikes (pp.139-148). In terms of green infrastructure, it provides guidelines for engineered soils, bioretention, and other on-site controls to reduce volume of water entering the pipe system (pp.152-153). The manual refers to other documents from the City of Vancouver and Metro Vancouver for further guidelines throughout.

Key Takeaways

Strategic Land Use Plans and Strategies

Both Metro Vancouver and the City of Vancouver's strategic land use plans and strategies center climate change and natural hazards as critical challenges facing their jurisdictions. They both prioritize resilience to climate impacts across multiple sections of their plans including their economic, land-use, community well-being, and environmental health strategies. Within these plans, both include specific mentions of coastal and pluvial flooding as threats to public safety, buildings, and infrastructure. High-level strategies to mitigate flood impacts focus on considering hazards when siting and designing future developments; protecting, conserving, and restoring existing natural assets and ecosystems; and integrating green infrastructure into site-level and community-level planning.

Regulations

Both jurisdictions' regulatory approach is to actively develop in flood-risk areas but with flood protection infrastructure and building elevation requirements.

Metro Vancouver's regulations appear to only impact flood risk reduction at the site scale, rather than the landscape scale. This is because Metro Vancouver's regulations are limited to the Electoral Area A, such as the Zoning Bylaw which limits development using setbacks from the sea, non-tidal waters, and riparian areas. The Building Administration Bylaw ensures BC Building Code compliance for flood-proofing during permitting, while sewer and water bylaws indirectly support flood risk management by protecting infrastructure without direct flood measures.

City of Vancouver regulations also focus on reducing flood risk at the site scale through the Building Bylaw, Zoning and Development Bylaw, Subdivision Bylaw, and Flood Plain Standards and Regulations, which govern where and how development occurs. The Building Bylaw designates floodplains (Burrard Inlet, English Bay, False Creek, and the Fraser River) and requires building setbacks and FCLs for new development, and the Flood Plain Standards and Requirements operationalize the Building Bylaw. FCLs are framed as a resilience tool to reduce loss of life, property damage, and recovery time from coastal, riverine, and intense rainfall events. The Zoning and Development Bylaw manages development approvals compliance with FCLs and flood standards and requires upgrades to sewer, drainage, and flood-management infrastructure as part of rezonings or amenity projects in at-risk locations. Through the Subdivision Bylaw, the City controls the creation of new parcels in flood-prone or wet areas and ensure that they incorporate appropriate stormwater and sewer infrastructure to reduce flood risk. Waterworks, Fire, and Sewer and Watercourse bylaws support these measures by protecting drinking water systems, embedding flood procedures in fire safety plans, and managing sewer discharges and utility finances.

Focused plans, strategies, and programs

Metro Vancouver addresses flood risk through a mix of infrastructure upgrades, wastewater management, NbS, and emergency preparedness across its regional plans. Key actions include dike improvements, sewer separation, wetland restoration, and strengthened emergency response planning to manage increasing flood risks linked to extreme rainfall and climate change. However, flooding is often discussed within the context of climate change without clearly identifying specific flood types or spatial risk areas, and many measures focus on infrastructure and preparedness rather than broader landscape-scale flood mitigation strategies.

Building on this regional context, the City of Vancouver addresses flood risk through a more detailed municipal framework that combines infrastructure upgrades, rainwater management, coastal protection, and climate adaptation planning. Key strategies include stormwater management, sewer separation, shoreline protection works, higher FCLs, and NbS such as wetlands, green infrastructure, and coastal habitats to address risks from extreme rainfall, sea level rise, and storm surge. Municipal strategies support the expansion of green rainwater infrastructure, including rain gardens, permeable surfaces, bioswales, and green roofs to capture and infiltrate rainfall close to where it falls to reduce pressure on sewer systems and improve water quality in receiving waterways. While the City adopts an integrated approach combining grey and NbS supported by regulatory tools and long-term adaptation planning, many measures still focus on protecting infrastructure and specific shoreline areas, and broader citywide landscape-scale mitigation and long-term relocation strategies remain limited.

Both jurisdictions have design guidelines that address flood risk management at the site scale but also the street and city scale and include both grey and green infrastructure approaches.

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