North Shore Region Mitigation Assessment: Flood Risk Management

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1.0 Introduction

This report examines the plans, objectives, policies, and regulations that pertain to flooding and emergency management in four jurisdictions located in and around the Lower Mainland's North Shore area. The jurisdictions are the District of West Vancouver, the Village of Lions Bay, the Municipality of Bowen Island, and Tsleil-Waututh First Nation. Despite their geographic proximity and shared geographic features, these jurisdictions differ substantially in governance, capacity, and other contextual factors, and in their approaches to planning for natural hazards.

The Province of BC has advised cities to plan for climate-change-caused sea level rise. The current estimated sea level rise to plan for is 0.5 metres by 2050, and one-metre by 2100, but these estimates may change in the future. Floodplain maps are not available for this region; however, sea-level rise scenario maps have been produced by Climate Central, and the one-metre and five-metre impacts are shown in Figure 1 for the four jurisdictions examined in this report. Sea level rise presents a pressing concern for many areas in the region, particularly Lions Bay, Tsleil-Waututh Nation's Burrard Inlet IR#3 reserve, and the southern coastline of West Vancouver.

The impacts of climate-exacerbated flooding are already felt in this region. In late fall 2021, an atmospheric river that affected many jurisdictions in BC impacted Bowen Island, causing rock and debris flows, closing roads and blocking some culverts. The impacts on Bowen were relatively minor compared to other regions of BC, but were still felt due to a lack of equipment and aging infrastructure. In December 2024, a landslide in Lions Bay killed two residents after a slope failed below the Battani Creek reservoir. During an atmospheric river in October 2024, West Vancouver received over 292 mm of precipitation over 48 hours. The stormwater system was overwhelmed, and numerous residents were required to self-evacuate. The worst hit areas were low-lying areas along the coast. In December 2012, a storm surge combined with a 5.5 metre king tide caused significant flooding to all of Metro Vancouver, including parts of West Vancouver, shutting down the Ambleside to Dundarave seawall. King tides are currently tracked in the region and serve as determinants of many severe flood events, typically peaking between December and January. Numerous examples from the region exist, highlighting the regularity of floods due to storm surges, king tides, atmospheric rivers, and, increasingly, a combination of all three.


Cates Bay Beach
Mt Gardner
Killarney Lake
View Point
Millers
Landing
Bowen Island
Snug Cove
Crayola Beach
Bowen Island
Bowen Bay
Tunstall Bay
Seymour
Landing


Cates Bay Beach
Mt Gardner
Killarney Lake
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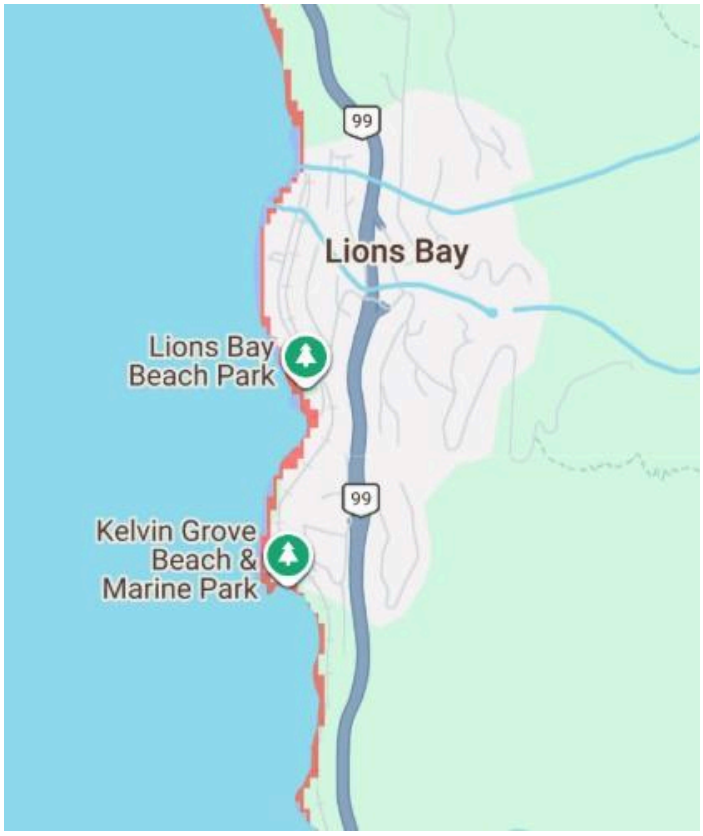
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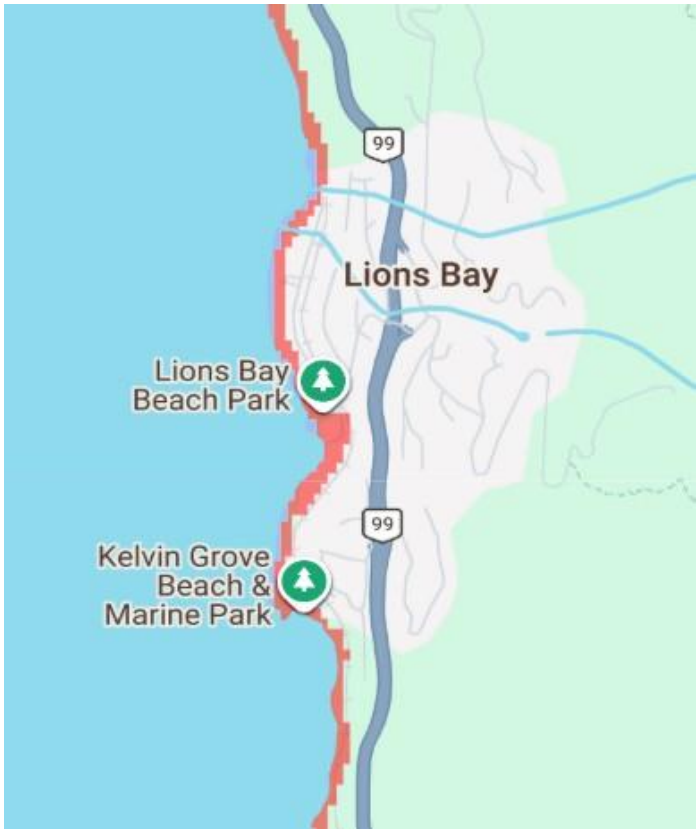
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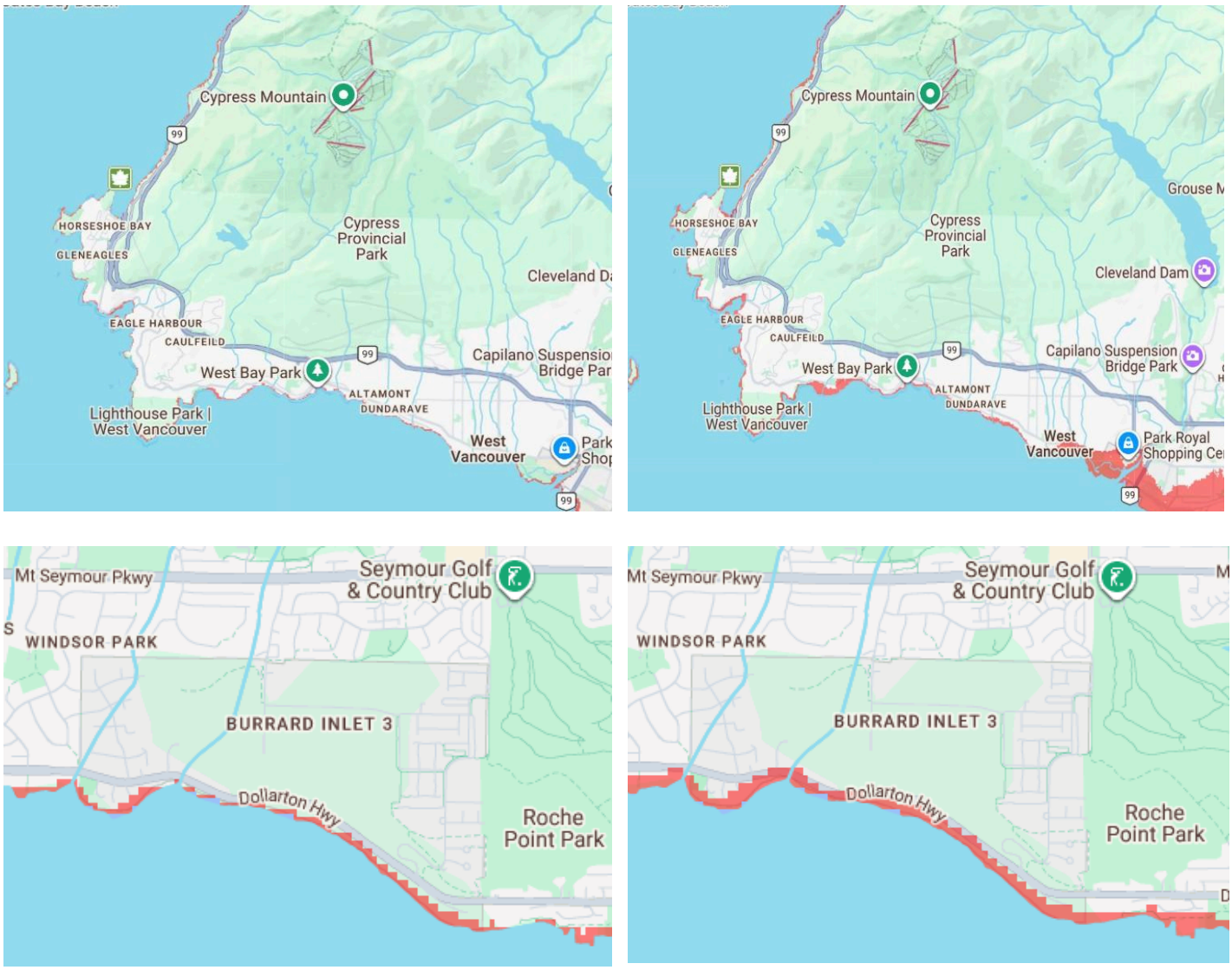

Figure 1: Projected 1 m (left image) and 5 m (right image) sea level rise for Bowen Island (top), Lions Bay (upper middle), West Vancouver (lower middle), and Tsleil-Waututh Burrard Inlet 3 reserve (bottom). Maps from Climate Central web viewer.

1.1 Methodology

1.1.1 Document Review and Sourcing for Each District

To find the flood and flood-related plans and bylaws for the section on the District of West Vancouver, the District website was thoroughly combed, specifically the "Strategies and Plans," "Find a Bylaw" tabs. Plan and bylaw titles and descriptions were analyzed and chosen based on mentions of keywords such as flooding, sea level rise, watercourse management, emergency planning, shoreline protection, or stormwater management. These plans and other planning documents (OCP, DPAs) were subsequently reviewed and summarized for the purpose of this report, emphasizing their purpose, goals, and participating stakeholder groups.

The development permit areas were also found on the District's website, and all 3 were included for their relation to flooding. For plans and DPAs that were not centrally focused on flooding, keyword searches were completed to find mentions of riverine flooding, landslides, coastal flood, and sea-level rise. The District's cross-jurisdiction initiatives, including the North Shore Sea-Level Rise Strategy and North Shore Emergency Response, were found through the District's website's associated webpages for sea-level rise and emergency preparedness, which included information for the public and links to outside sources.

Policies and planning documents from the Village of Lions Bay and the Municipality of Bowen Island were reviewed to identify references to flooding and related water hazards Bylaws, council meeting minutes, and other municipal documents were searched using the keywords flood, flood risk, flood management, drought, and hazard.

Planning and policy documents from the Tsleil-Waututh Nation (TWN) were identified through a review of materials available on the Nation’s website, supplemented by targeted Google searches for documents referenced but not directly accessible online. Where necessary, TWN staff were contacted to request missing materials, including the Community Comprehensive Plan. Given the scope of the project, the analysis focused on documents directly related to Indian Reserve No. 3 (IR#3). Broader regional plans, such as watershed or inlet-level initiatives, were not included in the detailed analysis as they extend beyond the geographic scope of this study. The TWN Land Use Plan and Climate Plans were analyzed using qualitative coding in NVivo 14 to identify themes related to flood risk and environmental management. Documents were coded using thematic categories including flooding hazards, policy objectives, regulatory mechanisms, infrastructure measures, and future planning recommendations. Keyword searches were used to initially screen documents for relevance to flooding and emergency management

1.1.2 Spatial Methodology

Spatial data was obtained from municipal and regional open data portals, including the West Vancouver Open Data Portal, Islands Trust mapping resources, and the Metro Vancouver Regional District Data Hub. When required datasets were not publicly available, municipal mapping teams were contacted directly. Spatial analysis and map production were conducted in ArcGIS Pro. Data layers were clipped to the study area and standardized through consistent symbology and classification. Additional contextual maps were incorporated where relevant.

1.2 Spatial Analysis

The study region includes the District of West Vancouver, Municipality of Bowen Island, Village of Lions Bay, and the Tsleil-Waututh Nation. See Figures 2a/b for a map of the extent of the Tsleil-Waututh Nation consultation territory and Burrard Inlet 3 Reserve, and Figure 3 for a map of the other 3 districts studied in the North Shore region, situated within the Lower Mainland. An elevation map is included in Figure 4 for the region.

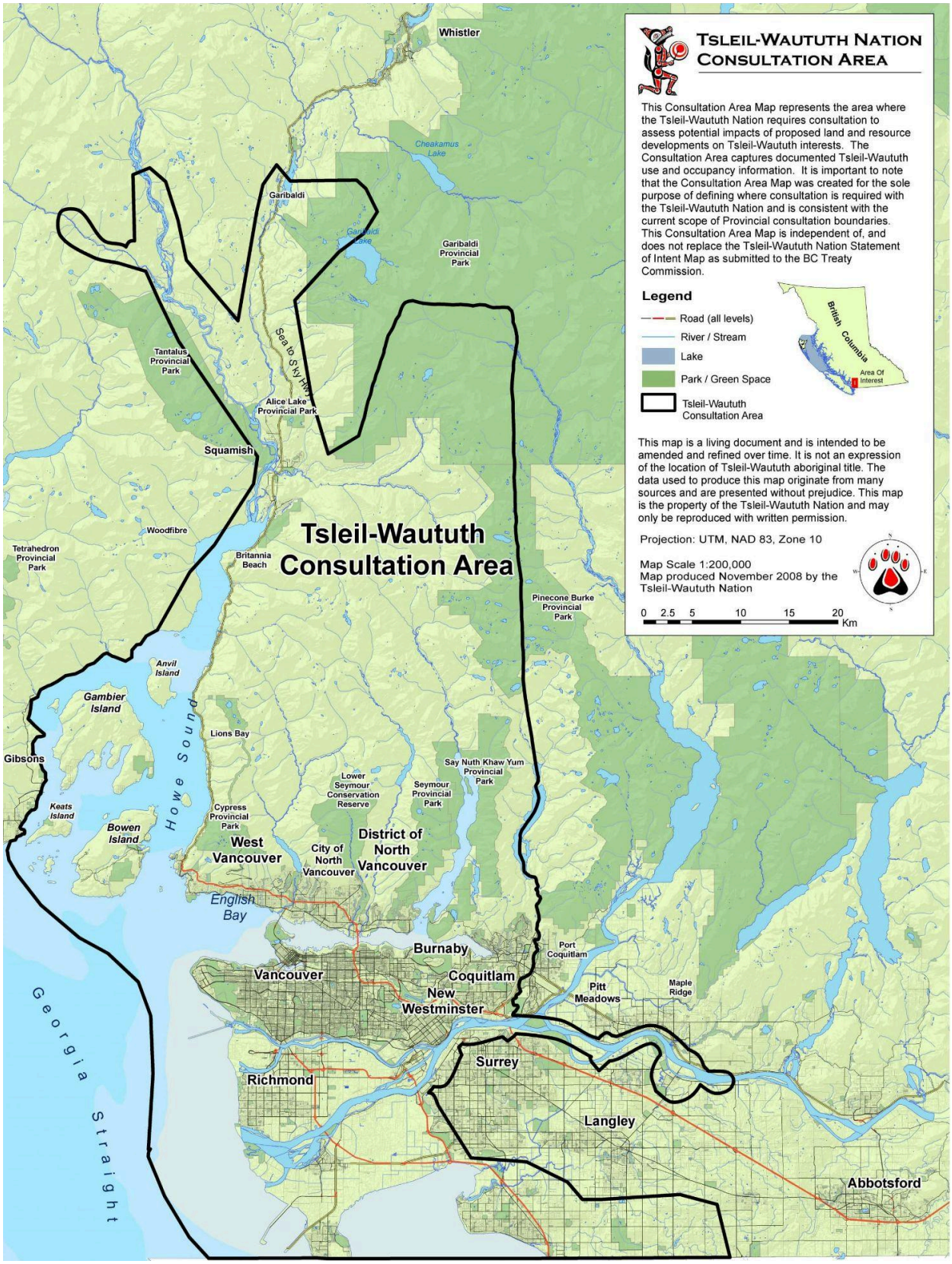

Figure 2a: Tsleil-Waututh Nation consultation boundary, provided by [Tsleil-Waututh Nation](#).

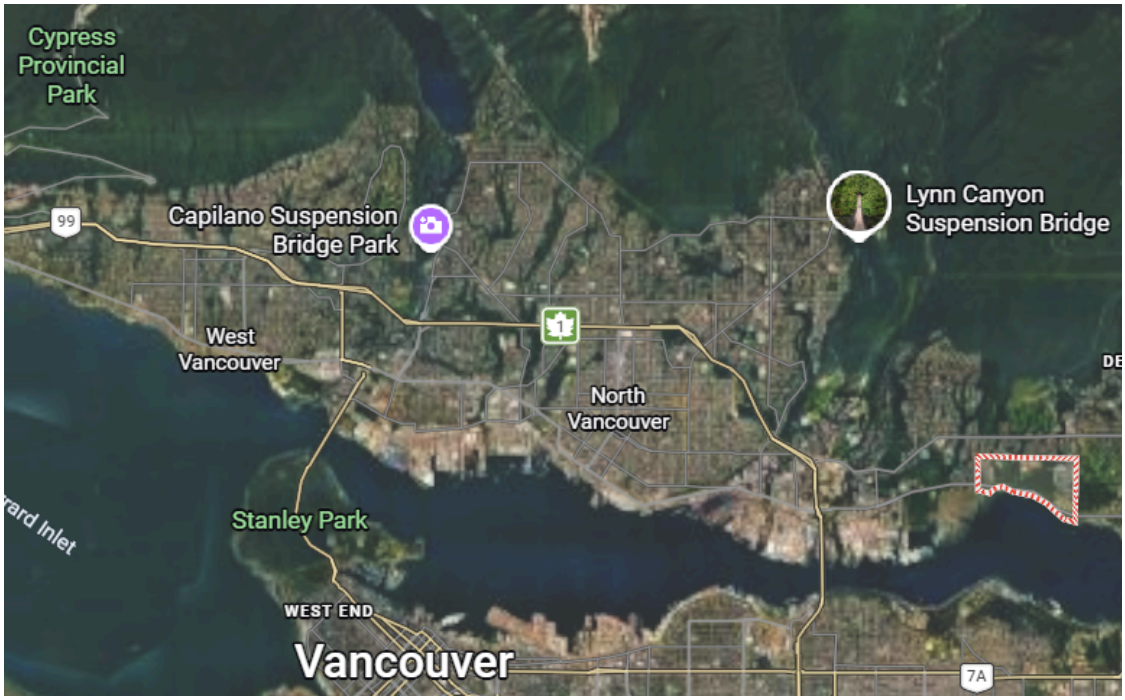

Figure 2b: Location of Burrard Inlet 3 Reserve (red outline), from [Google Maps]

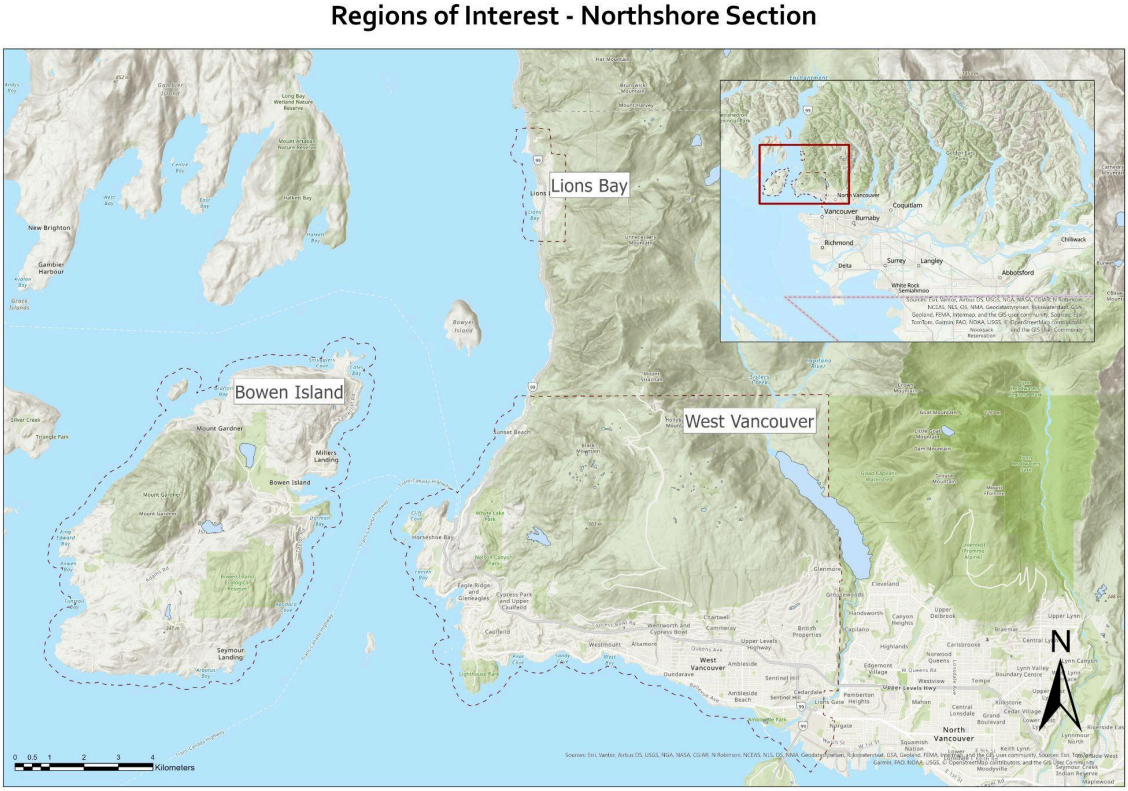

Figure 3: Regions of interest for north shore report. See 'spatial data sources' for data sources.

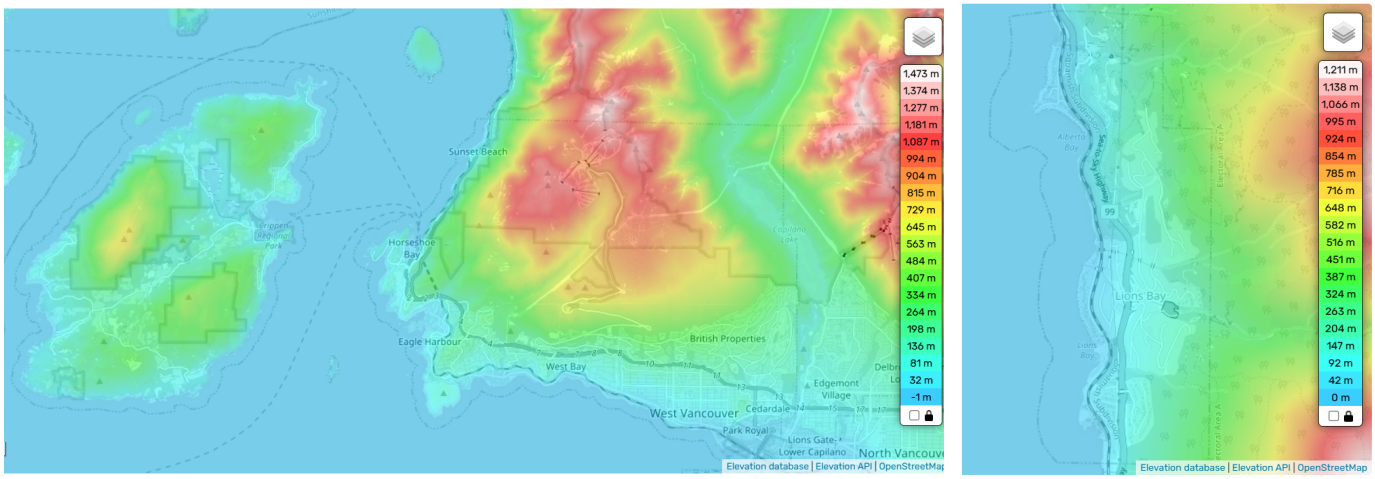

Figure 4: Elevation map for West Vancouver, Bowen Island and Lions Bay.

1.2.2 Spatial Analysis District of West Vancouver

The District of West Vancouver covers roughly 87 km2, and includes development primarily along the shores of the south and west end, as well as extensive parkland to the north. It had a population of 44,122 in the 2021 census, giving it a population density of 506.1 people/ km2. Figure 5 shows building footprints for West Vancouver. This map illustrates that buildings are primarily concentrated in the south along the coastline, where the slope is minimal.

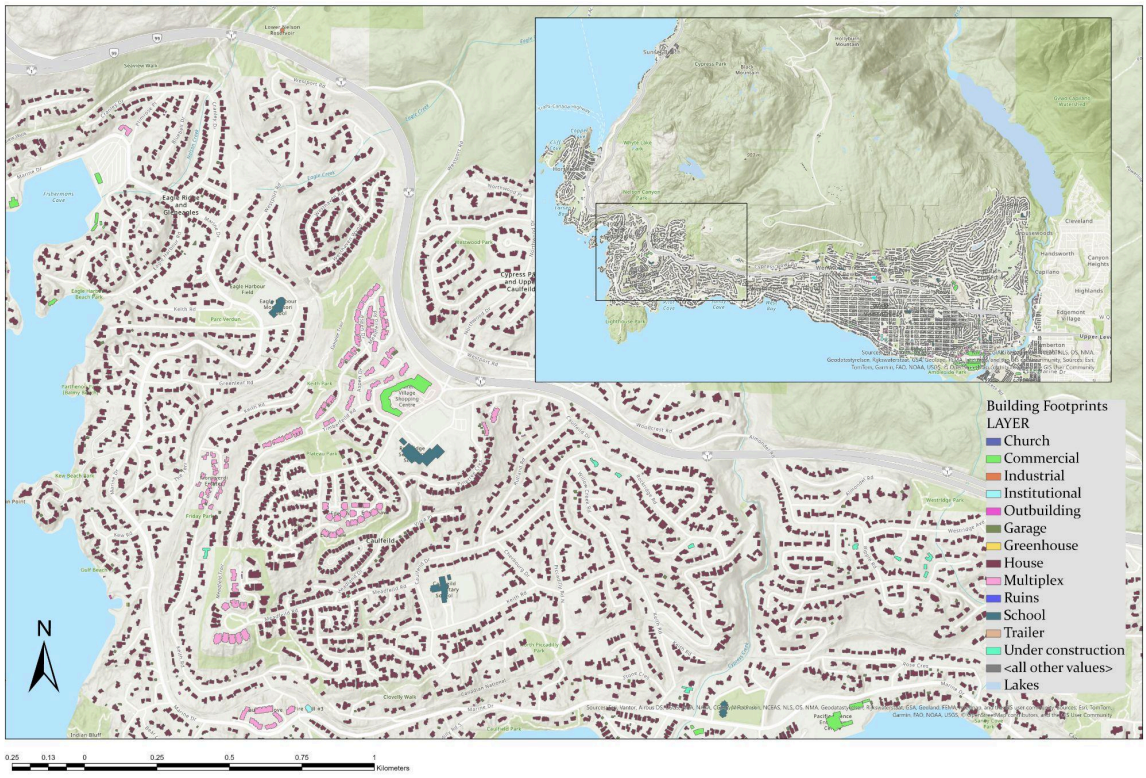

Figure 5: Building footprints for West Vancouver. See 'spatial data sources' for data sources.

Cypress Mountain Park, a popular winter skiing and summer hiking destination, makes up a significant portion of the region. The steep slopes leading northwards towards the peaks in Cypress Park characterize the region's topography. West Vancouver has a minimum elevation of -1 metre along the coast, up to a maximum elevation of 1,468 metres at the peak of Mt Strachan, with an overall average of 384 metres. The north end of the district is characterized by a lot of slope, as can be seen in the elevation map in Figure 4. Popular city parks along the ocean shore at lower elevation include Lighthouse Park, Ambleside Park and Whytecliff Park, which is also the region of the West Vancouver seawall. A zoning map for West Vancouver is shown in Figure 6. This illustrates that over half of the region (by area) is zoned for parks and other public, community use (purple shades). Various residential zonings make up the next largest area (pink shades), followed by a large marine zone ribboning along the coast (blue). Commercial zones are one of the smallest zones (yellows), and all others are tiny in comparison to those zones.

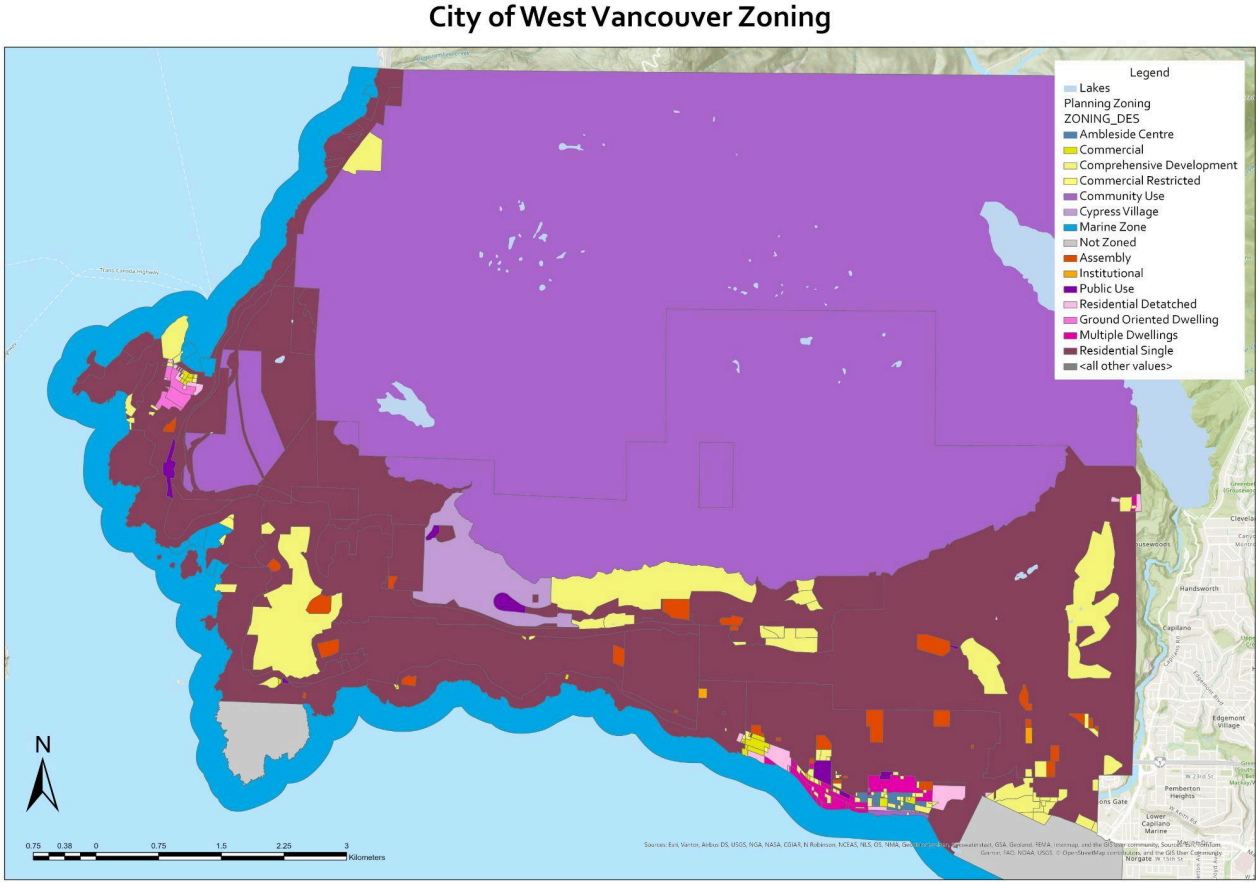

Figure 6: Zoning map for West Vancouver. See 'spatial data sources' below for data sources.

For flood-related spatial data, West Vancouver has publicly available shapefiles for a 30 metre creek storm buffer around all creeks, a flood construction line, their Foreshore DPA, and some relevant infrastructure (culverts, rain gauges, ditches), as well as basic topographic information (lakes, creeks, parks). A summary of these layers was created in *Figure 7*. Most infrastructure is concentrated in the south end of the district (where most of the buildings are), and most creeks originate up in the mountains to the north and flow south, downslope.

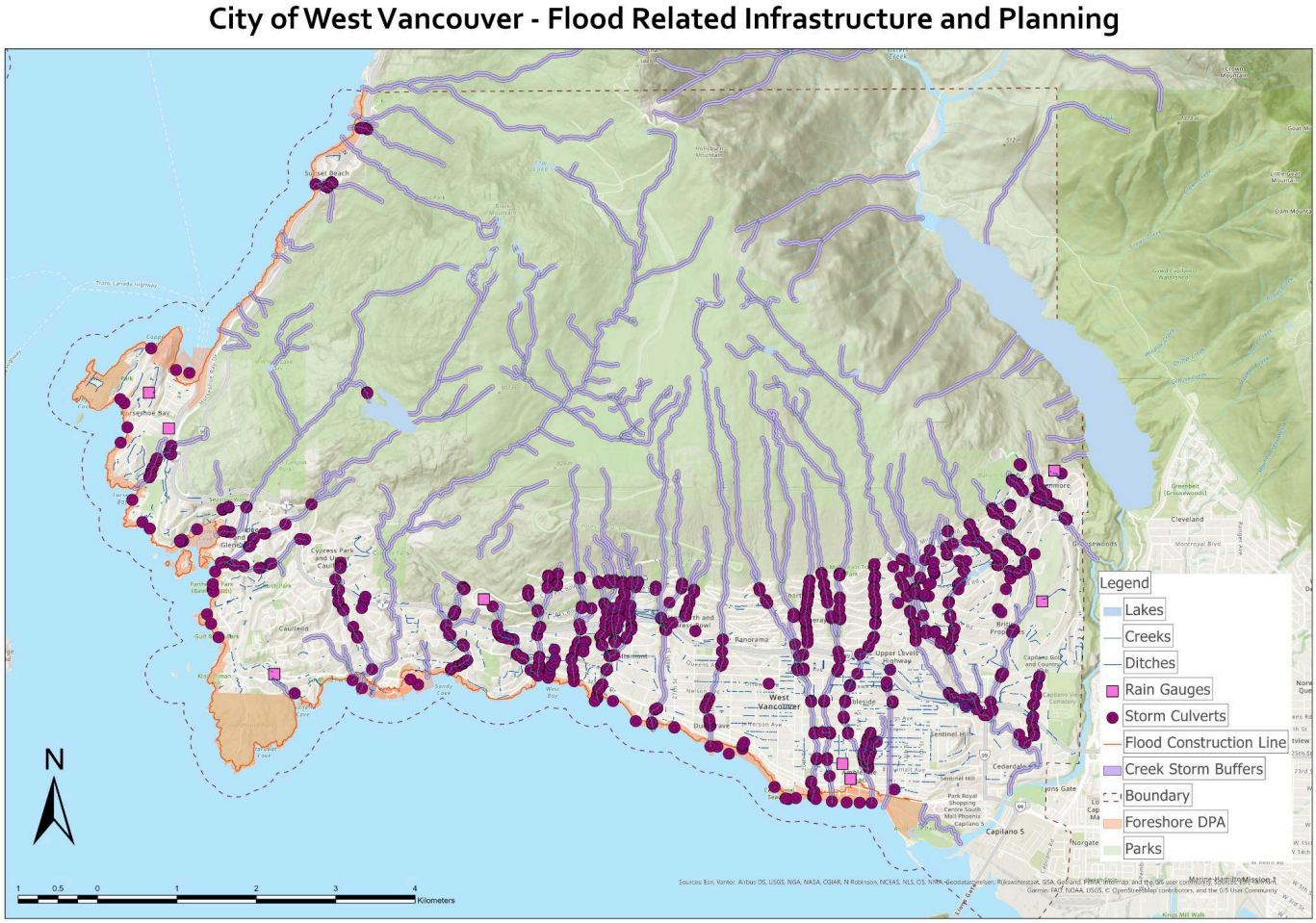

Figure 7: Summary of available flood related infrastructure and planning spatial data for the District of West Vancouver. See 'spatial data sources' below for data sources.

1.2.3 Spatial Analysis Bowen Island

The municipality of Bowen Island covers 50.12 km2 and had a population of 4,256 in the 2021 census, giving it a population density of 84.9 people/ km2. There are 2,036 private dwellings on the island, with only 1,724 of them considered to be permanent residences. This reflects Bowen Island's 'vacation' status, as a popular cottage and camping destination for people that live in the Lower Mainland. A simplified zoning map for Bowen Island was created in Figure 8. This map shows a high proportion of the island classed as parks or other natural areas, mostly surrounding Mount Gardner, the highest peak on the island (at 747 metres). The minimum elevation of Bowen Island is -1 metre, the maximum is 747 metres, and the average is 106 metres. Refer to the elevation map in Figure 4 for a side-by-side of Bowen Island and West Vancouver.

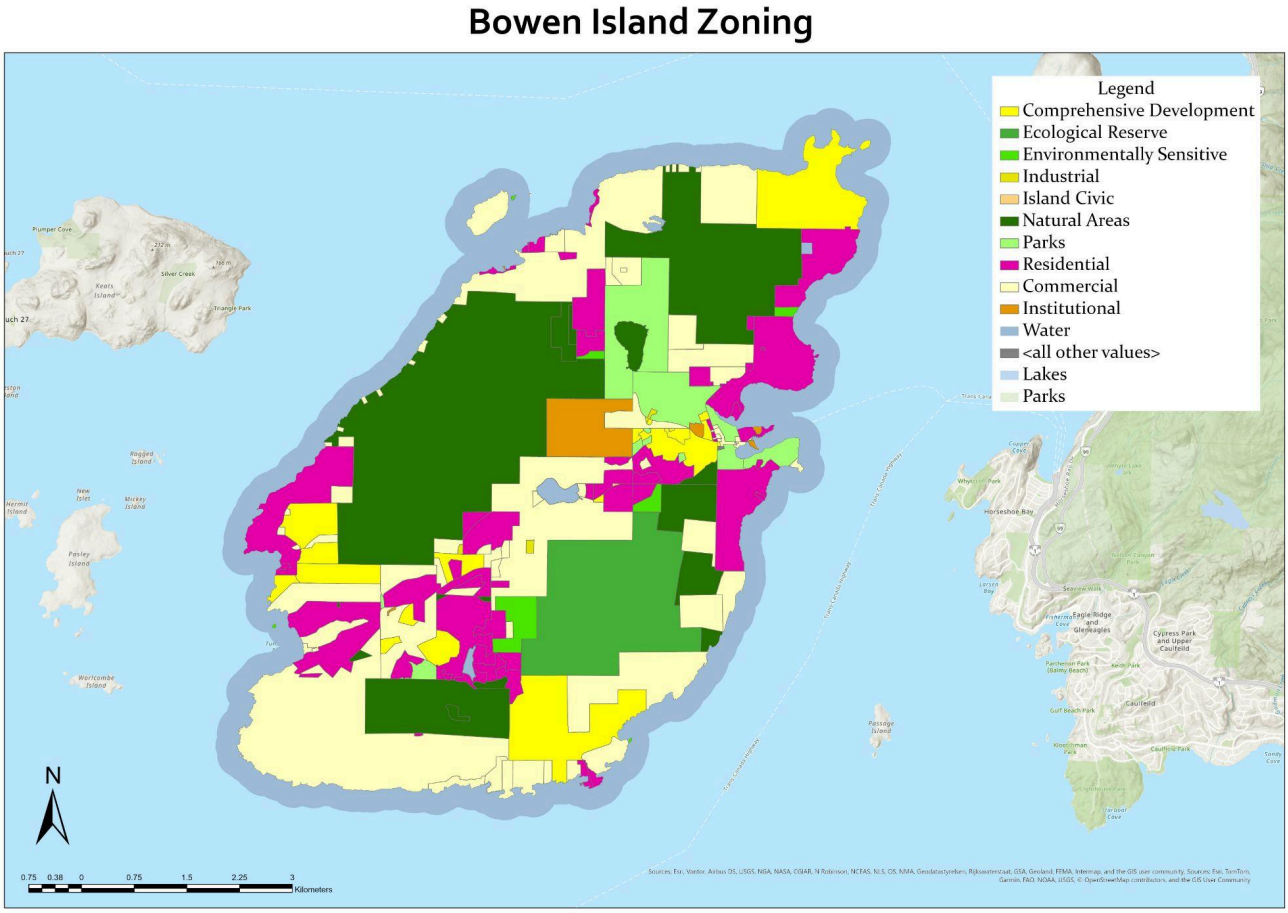

Figure 8: Simplified zoning map for Bowen Island. See 'spatial data sources' below for data sources.

1.2.4 Spatial Analysis Lions Bay

The Village of Lions Bay covers just 2.53 km2 and had a population of 1,390 in the 2021 census, giving it a population density of 549.4 people/ km2. No publicly available spatial layers were found for Lions Bay, but an online mapping platform includes some water-infrastructure-related data, such as the location of culverts and catchbasins. An elevation map is included in Figure 4.

1.2.5 Spatial Analysis Tsleil-Waututh Nation

No spatial data was found for the Tsleil-Waututh Nation (TWN), whose traditional territory covers the majority of the study area. A map of the territory is shown in Figure 2. TWN's primary community, including its administrative centre, is located on the 276-acre Burrard Inlet IR#3 reserve. The reserve parcel is located on the north shore of Burrard Inlet east of the Second Narrows Bridge, surrounded by District of North Vancouver lands and bisected by the Dollarton Highway.

2.0 District of West Vancouver

In 2021, the population of West Vancouver and the Squamish Nation lands in the District was 44,122, expected to grow to 60,000 by 2041, representing a total of 24,500 dwelling units. The District has a unique physical geography. It is characterized by steep slopes with residences stretching up the hillside, and a large proportion of its coastline is privately owned. Several creeks and tributaries flow into the ocean throughout the District, which are prone to flooding in large rainfall events, with recent floods in 2012, 2014, 2016, and 2018. The District's coastline is also subject to severe storm activity. For instance, in 2012, a storm surge plus abnormally high tides caused flooding and damage in John Lawson Park. Similar events occurred in 2014 and 2016, causing damage to commercial and residential properties, even prompting evacuations. The Squamish Nation reserve Xwmélch'sten is nested between West and North Vancouver at the mouth of the Capilano River, representing a unique jurisdictional geography for flood mitigation.

2.1 Planning Regulations

2.1.1 Bylaws

Flood-Related Bylaws	**Purpose**
Creeks Bylaw No. 3013	Prevents the obstruction of creeks to maintain their ability to hold water in floods. It also prevents building along creek banks or beds without permission, or relocating creek sediment.
Zoning Bylaw No. 4662 (Sec 130.13)	Mandates a minimum 9.1-metre waterfront yard in any residential zones that are waterfront abutting.
Zoning Bylaw No. 4662 (Sec 120.22)	Mandates retaining wall grade line and buildup of grade in all zones. It also limits retaining wall heights.
Building Bylaw No. 5340	Section 9.3(j) outlines the requirements for an owner to work with a professional if their land is vulnerable to flooding, debris flows, or similar hazards. Section 11.2(f)(xxi) requires site plans to show floor system geodetic elevations to ensure compliance with provincial flood mapping. Sections 11.2(f)(v) and 11.2(f)(xvii) detail setback requirements from bodies of water.
Watercourse Protection Bylaw No. 4364	Protects District watercourses and prohibits the obstruction of streams, ditches or drains. It also requires that construction projects follow a sediment and erosion control process.

2.1.2 Development Permit Areas

2.1.2 a. Foreshore Development Permits

The District of West Vancouver has adopted three Development Permit Areas (DPAs) and development guidelines for each. The Foreshore DPA was adopted in response to the risks of coastal hazards and flooding and seeks to protect people and properties. It also provides information for owners on how to safely redevelop their properties while respecting the environment. If one sought to build a new home in the Foreshore DPA, they must follow the District's NE2 Foreshore Protection Area (FPA) Guidelines, s. I, II, and III. This includes building habitable space to the Flood Construction Level (FCL). In addition, if one sought to develop within the FPA (within 15m of the natural boundary, or the high tide line), they must comply with the FPA guidelines in the OCP (Schedule II). Exemptions of a Foreshore Development Permit exist for interior or minimally invasive exterior renovations, fences that allow the passage of water, and emergency works. In addition, recreation facilities, washrooms, renovations, accessory buildings, small-scale additions, and commercial spaces are exempt from requirements to meet the FCL.

2.1.2 b. Environmental Development Permits

The District's Environmental Development Permits (EDP) were adopted in response to the Riparian Area Protection Regulation in Part 14 of the BC Local Government Act. The EDP areas were not established for the primary purpose of flood protection, but instead to protect riparian habitats from development. Nonetheless, an EDP is required for proposed developments within 15m from the top bank of a watercourse, so flood protection is a secondary benefit. Development includes any major impacts to vegetation or soils, construction, and even flood protection works.

2.1.2 c. Wildfire Development Permits

The Wildfire Hazard Development Permit Area includes all properties within 100 metres of a forested area. Although its primary focus is on reducing the risk of wildfire, it does highlight the dual benefits of the DPA for post-fire hazards, including landslides, debris flows, and erosion.

2.2 Strategic land use plans

2.2.1 Official Community Plan

The District of West Vancouver's Official Community Plan's (OCP) main flood focus is on municipal stormwater management and on physical and non-physical flood protection from watercourses and sea-level rise. In contrast site-level resilience and adaptation are broad or nonexistent for housing, businesses and transportation. The following policies are notable:

- 2.1 "Housing, Existing Neighbourhoods," policy 2.1.24 calls for review of regulations for climate adaptation in new housing and site design.
- 2.2 "Housing, Future Neighbourhoods, Managing the Upper Lands" policy 2.2.4 calls for area development plans to feature an environmental plan, including stormwater management and environmental risk management.
- 2.5 "Municipal Operations and Infrastructure" policies 2.5.14 - 2.5.17, which apply best practices to sewage and drainage systems, seek the consideration of 200-year storm events in the design of drainage facilities and flood control works, low-impact storm water management, such as infiltration through absorbent landscapes, replacing old piping for reducing inflow, and employing green infrastructure where possible for flood risk.

- 2.6 "Natural Environment" policies 2.6.11 and 2.6.12 call for updating shoreline protection strategies and flood construction levels for protection from sea level rise, and establishing a foreshore development permit area. Policy 2.6.18 calls for reviewing development requirements for risks of hazards such as floods, landslides and debris flow. Lastly, policies 2.6.20 to 2.6.22 call for non-specific land use regulations, non-structural enhancements and structural flood protection measures for sea flooding, watercourse enhancements for flood and slope hazards, and expanding green infrastructure in public and private development.

2.2.2 Regional Growth Strategy

The District of West Vancouver endorsed Metro Vancouver 2040—Shaping our Future (Regional Growth Strategy Bylaw 1136, 2010) in March 2011, which was soon adopted by the Metro Vancouver Regional Board in July 2011. The District later updated their Regional Context Statement in March 2015 to reflect its Official Community Plan's alignment with Metro Vancouver's Regional Growth Strategy. The Metro 2040 strategy sought to achieve the following goals: create a compact urban area, support a sustainable economy, protect the environment and respond to climate change impacts, develop complete communities, and support sustainable transportation choices. The most pertinent topics of alignment between the District's OCP and Metro 2040 related to flooding are the following:

*District of West Vancouver Regional Context Statement **alignment** with Metro 2040.*

Metro 2040	**OCP: Regional Context Statement**	**Focus/Alignment**
3.27: Consider watershed and ecosystem planning and/or Integrated Stormwater Management Plans in the development of municipal plans.	Section 2 D: 2.6.9	Recommendations for integrated stormwater management plans for District watersheds.
3.3.4 d: Identify policies and strategies to support integrated storm water management and water conservation.	Section 2 D: 2.6.9	Recommendations for integrated stormwater management plans for District watersheds.
3.4.4: Minimize risk associated with climate change and natural hazards.	Section 2 D: 2.6.19 to 2.6.23 Section 2 D: 2.6.18 Section 2 E: 2.9.13	Public safety and protecting property from different forms of floods, slope hazards, and extreme weather events; Development requirements for natural hazards; Community resiliency during emergencies, disasters and extreme weather events.
3.4.5: Consider incorporating climate change and natural hazard risk assessments into the planning and location of municipal utilities, assets, and operations.	Section 2 A: 2.1.24 Section 2 C: 2.5.4, 2.5.5, 2.5.17, & 2.5.19 Section 2 D: 2.6.11, 2.6.17, 2.6.18, 2.6.20, 2.6.21, & 2.6.22	Regulatory reviews of housing and site design for climate adaptation; Planning and managing municipal infrastructure for climate change adaptation; Adapting to climate change and natural hazards in planning and development.
4.2.4 f: Assess health implications of plans and infrastructure.	Section 2 C: 2.4.25 & 2.5.5	Climate/natural hazard risk for planning transportation and municipal infrastructure.

2.3 Additional plans

2.3.1 North Shore Sea Level Rise Risk Assessment and Adaptive Management Strategy

The 2021 North Shore Sea Level Rise Strategy serves as the only coastal risk collaborative plan between North Shore partner governments and organizations, including Squamish Nation. The cross-jurisdictional aspect of the plan is notable, recognizing that sea level rise does not respect borders between the participating communities. They also note the importance of collaboration, which strengthens planning efforts and is crucial in reducing risk and enhancing resilience to coastal intrusion. The plan is centred on six key sectors that are facing increased risk concerning coastal flooding and intertidal areas due to sea level rise: social services, development and infrastructure, transportation, economy, environment, and culture and heritage. Specific attention is placed on adaptation for buildings and businesses, transportation and wastewater infrastructure, and intertidal habitats. The strategy includes implementation actions to guide sea level rise adaptation planning over 10 years, until the year 2030. These include high-level actions, emphasizing principles of resist, accommodate, avoid, retreat, and advance. Second, a toolkit is included with 26 tools for sea level rise adaptation, policy guidance is also included on managing floodplain development, and adaptation concepts where future collaborative planning is recommended are detailed for nine comprehensive adaptation planning zones.

2.3.2 West Vancouver Coastal Marine Management Plan

In 2022, the District adopted the Coastal Marine Management Plan. The plan provides a policy framework to guide the District Council and staff in the management of coastal areas. It centres on three key policy areas. First, to offer guidance to the District on the impacts of shifting coastal dynamics and provide adaptive measures for the protection of coastal habitats and public and private property. Second, to manage existing built infrastructure and park facilities regarding climate resiliency. Third, communicate with coastal property owners about their responsibilities for coastal management on private property. Each of these policy areas is enhanced by specific short, medium and long-term objectives and recommended actions for the District over the next 10 to 20 years. Notably, section 3.3 - Coastal Management Planning notes the District's historical bias towards "hard" approaches to coastal erosion protection. In addition, the driver for this plan is stated to be the desire for consistent approaches to flood and erosion management. The shift towards "soft" approaches with the desire for consistency is therefore appreciated.

2.3.3 Integrated Stormwater Management Plans

The Vinson, Brothers and Hadden Creeks Integrated Stormwater Management Plan (2017) examines management and planning issues for the study watersheds, with a focus on creek health, balanced with the need for flood conveyance and public safety. The specific flood-related recommendations from this plan are to plan for upgrades to under-capacity in-stream culverts and to determine whether mitigation is required for flood risk due to inadequate capacity of creek cross-sections. The Five Creeks Integrated Stormwater Management Plan (2013) reports similar objectives, but for different watersheds (Pipe, Westmount, Cave, Turner, and Godman Creeks). Under a 200-year return period flood event, the drainage system at the time of the plan's creation was analyzed, and 18 culverts and 24 channel sections were deemed inadequate for peak flows.

2.3.4 Emergency Plans

2.3.4 a) West Vancouver Emergency Plan

The District's emergency plan has several practical mentions of flooding. First, the duties of specific municipal departments are outlined in a major flooding event (e.g. engineering holds responsibility for local flood protection operations such as sandbagging and pumping). Second, it notes that based on a North Shore hazard vulnerability analysis, flooding, debris flow, and severe weather hold three out of seven spots on the priority events list. The plan also details the level of response expected from a flood, including relevant agencies, such as possible evacuations and emergency service responses. Lastly, the plan states that evacuations may only be ordered by a Local Authority or the Province, only after declaring a State of Local or Provincial Emergency.

2.3.4 b) North Shore Emergency Management

North Shore Emergency Management is a partnership agency between North Shore municipalities to plan and coordinate emergency disaster response. For flooding, they provide recommendations for the public on how to prepare and what to do during and after a flood. They also provide emergency notifications, and on their website, they offer links to helpful sources.

2.4 Conclusion

The District of West Vancouver has, in recent years, renewed its focus on flooding, especially concerning sea-level rise. The District's DPAs, especially its Foreshore DPA, represent a well-appreciated effort to plan for future coastal flooding risks. The District has a historical bias towards "hard" approaches to coastal flooding, but its OCP and related plans represent an appreciated shift towards "softer" solutions. West Vancouver's riverine flooding, in contrast, requires more work. Firstly, there is little focus on the Capilano River in the aforementioned plans, which was surprising. Second, the attention paid to creek flooding risk is adequate, but it was difficult to determine what goals in these plans have been addressed since their adoption.

3.0 Bowen Island

The municipality of Bowen Island considers flooding briefly throughout some of its plans and regulations, but it is clearly not a planning priority. This section will summarize the regulations that do exist for Bowen Island, as well as some that have been proposed.

3.1 Planning Regulations

3.1.1 Bylaws

The Bowen Island Municipality Traffic and Use of Streets Bylaw No. 133 states that property owners and any development workers must maintain culverts, and never stop the flow of them during construction. One of the goals of this bylaw is to help keep roadways safe during high rain events, which relates to flood risk mitigation, though this is not explicitly stated in the bylaw.

3.1.2 Development Permit Areas

Bowen Island has proposed the integration of a Hazardous Areas Development Permit Area, which would regulate developments that are proposed in areas deemed hazardous, including "lakes and wetlands, coastal erosion and flooding areas, steep slopes hazard areas, and stream erosion and flooding areas". This would be the first regulated consideration of flood risk in DPAs on Bowen Island. This would require an amendment to Bowen Island Municipality Land Use Bylaw No. 57, 2002. It was proposed in 2022 but does not seem to have been passed or implemented as of the writing of this report. The map included in the proposed DPA includes a year 2100 sea level rise projection, shown in Figure 9, which is a potentially useful tool in siting new buildings on Bowen Island.

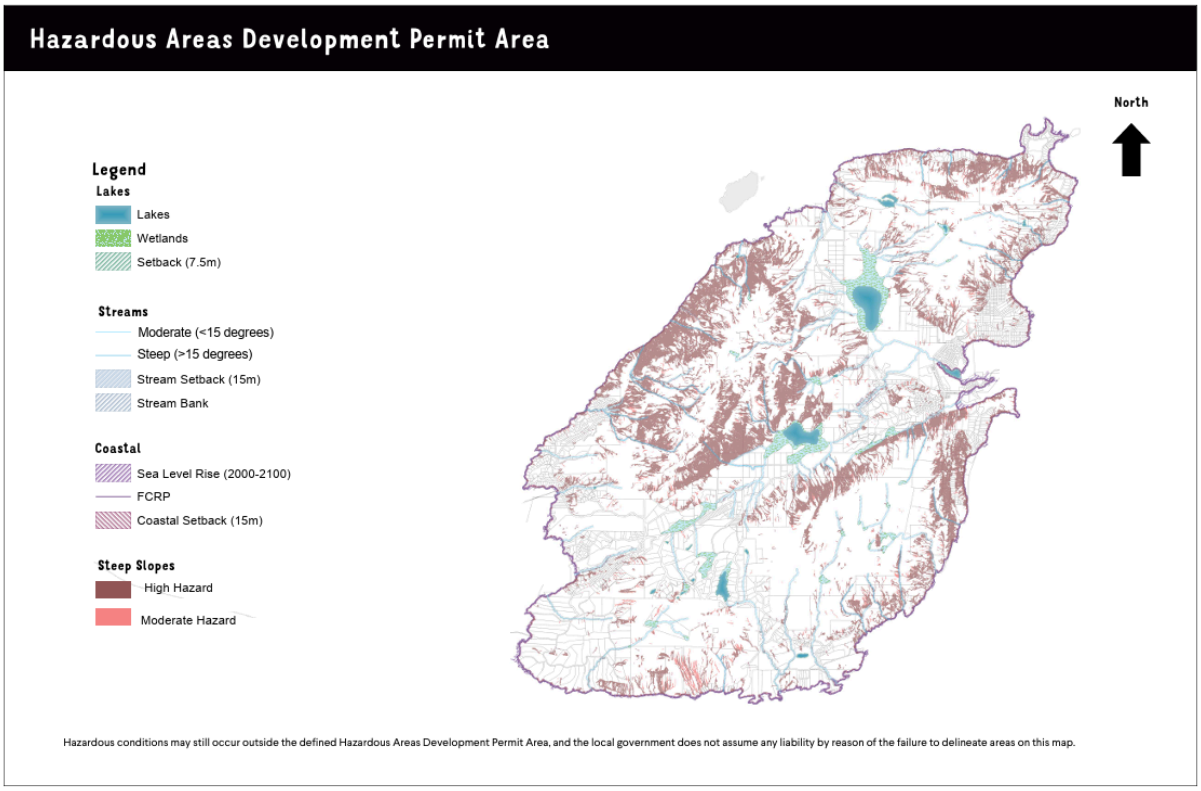

Figure 9: Proposed Hazardous Development Permit Area on Bowen Island.

3.2 Strategic land use plans

3.2.1 Official Community Plan

Bowen Island's Official Community Plan considers flooding a few times, namely in anticipating the impacts of climate-change driven frequent flooding, drought, landslides, and storm surges. Specific relevant objectives are listed below.

- Objective 32: "To recognize the importance of permanent and seasonal creeks and other wetlands and their buffer areas for surface and ground-water supply, pollution and sediment control, flood control, erosion control, fisheries, wildlife, other flora and fauna, recreation and aesthetic values."

- Policy 45: “The Municipality will request Metro Vancouver Parks to ensure that the delicate vegetation, the important mixed habitat areas and the vertebrates and invertebrates of the Killarney Meadow Flood Plain and Killarney Lake areas are protected while encouraging respectful use and enjoyment.”
- Policy 65: “The Municipality will: ensure the design, layout and construction of all roadways, large paved areas and driveways within areas designated as Development Permit Areas for protection of the natural environment and longer roadways with deep road cuts in all other areas take into account the potential interception of precipitation, surface and subsurface run off; mitigate the adverse effects of any such interception; take into account the protection of ground-water recharge areas; and minimize flooding and erosion.”
- Objective 131: “To ensure that property is not flooded or damaged by any stormwater management efforts.

3.2.2 Regional Growth Strategy

Bowen Island’s Strategic Plan does not mention flooding directly. The only relevant statement to flooding is that they plan to “Apply to the Pacific Institute of Climate Solutions to fund additional staff to update the climate action plan.” This future plan update may include flooding impacts.

3.3 Additional plans

3.3.1 Emergency Plans

Bowen Island’s Emergency Management Plan states that “People in British Columbia forced from their homes by fire, floods, or other emergencies may receive emergency support services.” That is the only serious mention of flooding. It is on the emergency radar, but is not given as much consideration as other types of emergencies, such as fires. Notably, many of the aspects of the Plan can be applied to flood-related emergencies, such as the ‘Bowen Island Public Notification System (BowENS)’, which can be used to quickly notify residents of an ongoing emergency.

Bowen Island’s Evacuation Plan mentions that “Hazardous events that present an immediate threat, such as hazardous material accidents/incidents, fires, and flooding, may require a tactical evacuation.” Therefore, the steps for evacuation outlined in this document may be applied to flood-related evacuations.

Though not an official plan, the Bowen Emergency Guide provides information for residents of Bowen Island to prepare for and calmly handle emergencies. It includes fires, earthquakes and extended power outages, but flooding is not mentioned as a potential risk. This speaks to the lack of concern Bowen Island seems to have regarding serious flood events.

3.3.2 Other Plans and Strategies

Bowen Island's Hazard, Risk and Vulnerability Assessment identifies flooding as likely to occur every 2-5 years, with a low hazard severity total, especially when compared with other hazards like fire, earthquake, and rockfall.

Bowen Island's Climate Action Strategy 2025 update includes flooding in the short term goal of "Seeking funding from senior levels of government for flood planning, mitigation efforts, and support for private property owners". It is also a long-term goal in "Assess floodway capacity in consideration of increased winter precipitation and establish new Flood Construction Levels (FCL) where appropriate", "Upgrade high-risk culverts identified in climate modelling assessments to reduce flooding impacts, protect road access, and safeguard infrastructure", "Develop and implement regulatory tools for areas with climate vulnerabilities such as fire zones, flood prone areas, and shorelines". Therefore, though flooding is not currently a large consideration in regulations, it is on the municipality's radar and may be included in future updates.

3.4 Conclusion

While flooding is acknowledged within several Bowen Island municipal plans, it is not currently a major focus of regulatory planning. Existing bylaws address stormwater and culvert maintenance in ways that indirectly support flood risk mitigation, while the Official Community Plan references flooding primarily in relation to environmental protection and stormwater management objectives. Emergency planning documents recognize flooding as a potential hazard but provide limited flood-specific guidance compared to other hazards. More recent planning initiatives, including the proposed Hazardous Areas Development Permit Area and the Climate Action Strategy update, suggest that the municipality is beginning to consider flood risk more explicitly and may introduce stronger regulatory and planning tools in the future.

4.0 Village of Lions Bay

The Village of Lions Bay is a small coastal municipality located along Howe Sound on the Sea-to-Sky corridor. The village sits at the base of the North Shore Mountains, where steep forested watersheds drain directly toward the coast. Several creeks run through Lions Bay, carrying runoff from the surrounding mountainous catchments. Due to its coastal setting and mountainous watershed, Lions Bay is exposed to several natural hazards, including flooding, debris flows, and extreme rainfall events. As climate change increases the frequency and intensity of extreme weather events, municipalities such as Lions Bay are beginning to consider how local planning frameworks can better address hydrological hazards and watershed dynamics.

4.1 Planning Regulations

4.1.1 Bylaws

In the Zoning and Development Bylaw No. 520, two bylaws mention flooding. The Temporary Use Permits Bylaw 4.6.4 states that the CAO may specify conditions in a temporary use permit for a short term rental if a building inspector deems that a parcel on short term rental use will be located in or is subject to flooding, mud flows, debris flows, debris torrents, erosion, land slip, rockfalls, subsidence or avalanche or other considerations applicable under the BC Building Code for this type of occupancy. The Food Protection bylaw 4.19 states that no building or structure shall be constructed, erected or placed:

1. "within 15 metres of the natural boundary of a watercourse;
2. on ground surface less than:
    a) 0.7 metres above the 200 year flood level, which level has been established by the Ministry of Environment;
    b) 3.1 metres above the natural boundary of a watercourse where the 200 year flood level has not been established; and
    c) 1.6 metres above the natural boundary of the sea"

4.1.2 Development Permit Areas

Four Village of Lions Bay Development Permit Areas consider flooding. Within DPA 1 – Coastal Zone Hazards – guidelines include a coastal flood hazard assessment prepared by a qualified registered professional to define the year 2100 shoreline position and derive the flood construction level, appropriate setback and any necessary mitigation work. Within DPA 2 – Creek Hazards – guidelines include:

- DPA 2a: Appropriate flood proofing against potential overland flows by establishing an FCL a minimum of 1 m above finished grade and construction using concrete reinforced foundation to the FCL.
- DPA 2b: Debris flood and debris flow assessment by a qualified registered professional, and house foundations must be designed with concrete steel reinforced foundations.
- DPA 2c: A minimum 15m setback from the ravine crest or 30m setback for ravines deeper than 30m, seismic slope stability assessment, and landslide assessment when ravine sidewalls are present.

4.2 Strategic land use plans

4.2.1 Official Community Plan

In the Village of Lions Bay Official Community Plan Policy J states to "Liaise with the Ministry of Transportation to ensure proper maintenance and functioning of flood and debris control channels."

4.2.2 Regional Growth Strategy

The Village of Lions Bay Regional Context Statement considers flooding a few times, namely in acknowledging the future impacts of climate hazards and future updates to policy to include flooding and sea-level rise. Specific relevant objectives are listed below.

- Goal 3: “Climate change impacts are hard to quantify, but Lions Bay is aware of the risks of sea-level rise, more intense flooding, erosion, subsidence, mudslides, and fire.”
- Policy 4.2d: “Through policy changes in the OCP update, Lions Bay will encourage modest intensification of its existing residential areas and avoid development of areas associated with landslide and wildfire risk. Update(s) will also address flood control and oceanside setback requirements to address risks of sea-level rise.”

4.3 Additional plans

4.3.1 Emergency Plans

The Village of Lions Bay Emergency Plan lists flooding as a potential impact to Lions Bay as part of the landslides/debris torrent hazard category. The only other mention of flooding is that “People in British Columbia forced from their homes by fire, floods, or other emergencies may receive emergency support services.” The Village of Lions Bay Evacuation Brochure does not mention flooding, and no other evacuation plans have been publicly released.

4.4 Conclusion

The Village of Lions Bay currently addresses flood-related hazards only in a limited and indirect manner within its policies and regulations. While references to flooding and associated risks appear in some documents, flood management does not appear to be a central or consistently integrated component of the municipality’s planning framework. This suggests an opportunity for the Village to more explicitly incorporate flood risk considerations into future policies, planning documents, and hazard management strategies to strengthen long-term community resilience.

5.0 Tsleil-Waututh Nation

The Tsleil-Waututh Nation (TWN) is an Indigenous Nation whose primary contemporary community is located on the north shore of Burrard Inlet. Tsleil-Waututh people have occupied and lived with lands along and surrounding the inlet (traditionally known as səlilwət) since time immemorial. TWN directly controls three parcels of reserve land: Inlailawatash IR #4 and #4A, which are located at the north end of Indian Arm and are currently uninhabited, and Burrard Inlet IR #3, which is the site of TWN’s primary village, including its administrative centre. In 2007, TWN signed a Framework Agreement with Canada under the First Nation Land Management Act, taking over management of reserve lands from governance by the *Indian Act*, and adopted the Tseil-Waututh Nation Land Code. The new Land Code precipitated the adoption of the Tsleil-Waututh Nation Land Use Plan 2018-2118 in 2019. In addition to plans pertaining to IR #3, TWN has also undertaken a number of larger environmental and climate resilience planning initiatives in their traditional territory, including the Burrard Inlet Action Plan and the xʔəl̓ílwətaʔɬ/Indian River Watershed, Integrated Stewardship Plan 2022.

TWN's IR #3 has three creeks that run through it to the inlet, and due to its location on the shoreline, is at risk from both riverine and coastal flooding. Parts of the shoreline of IR#3 have experienced up to 13 metres of erosion. TWN is currently undertaking a community-engaged and nature-based flood and erosion resilience project on the shoreline of the reserve lands the TWN Reserve Shoreline Adaptation & Restoration Project).

5.1 Planning Regulations

5.1.1 Laws and Bylaws

TWN's laws and bylaws do not specifically address any flood risk or natural hazard mitigation matters. The TWN Zoning Bylaw 1992, which governs the "special development zone" where the majority of the Nation's on-reserve economic development initiatives are located (a golf driving range and private housing), contains the following provision:

5.i.i. Each development shall protect the natural integrity of the Special Development Zone, shall be environmentally sound, and shall not impose any threat of irreparable damage to the Special Development Zone or any occupants of the Zone.[1]

4.1.2 Development Permit Areas

TWN does not use any formal development permit areas, and therefore does not have DPAs related to flooding or riparian zones.

5.2 Strategic land use plans

5.2.1 Comprehensive Community Plan

The Tsleil-Waututh Nation is currently in the process of reassessing its comprehensive community plan. The updated plan is not yet available, but its development is discussed in a short film released by the nation. The Nation's 2015 comprehensive community plan is no longer publicly available, but was shared by the nation on request. The 2015 plan was intended to offer a 20-year vision integrating culture, economy, health and environment across nine domains, set long-term goals, outline policies and establish an amendment process to keep the plan aligned with evolving community priorities. Flooding is discussed twice explicitly in the document. First in *Governance and Management Objective 8: Ensure that all staff and Leadership understand and prepare for the impacts of climate change on the community* [2] and in *Infrastructure Objective 6: Ensure that TWN infrastructure is resilient* [3]. There is an emphasis on community education and awareness about anticipated climate impacts, including the creation of flood plans, while evaluating how climate change may affect programs and services. The CCP suggests the creation of a flood plan as an indicator of success. Regarding infrastructure, they intended ongoing monitoring of housing and infrastructure, incorporating climate considerations into building standards, and adopting best practices for infrastructure preparedness. It remains to be seen whether similar statements will appear in the forthcoming renewed CCP.

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[1] Page 3
[2] Page 41, relevant pages of the CCP can be sent at request
[3] Page 54

5.2.2 Paddling Together: 2022-2025 Strategic Plan

Paddling Together, TWN's most recent Strategic Plan, was in place from 2022 to 2025. The Nation's stated mission, ʔəxʔixəltəl (paddling together), is to uphold the snəwẇeyəɬ (teachings and ways of being) and the ʔəyẏ sqʷeləwən (good feelings) of Sleil-Wautt people. The Nation's core values and seven strategic pillars were established to guide Chief and Council decisions, shape departmental work plans, budgets and resource allocation, and set goals for the next three years. One of the seven pillars of the plan was Climate Action, which contains a goal of ensuring infrastructure, ecosystems, and communities are resilient to the impacts of climate change[4]. The plan does not explicitly mention flooding or any other natural hazard, but climate change goals did serve as a policy statement and guide for later plans created by the nation. A new strategic plan has not yet been produced for 2026 onwards.

5.2.3Tsleil-Waututh Nation Land Use Plan 2018-2118

TWN's master land use plan is a policy document expressing high-level objectives and more specific policies for the management of TWN's lands and waters on a 100-year timescale, as well as designating land uses for IR#3, and noting areas for further future policy work. The plan considers both the risk of riverine (in this case, creek), overland, and coastal flooding to IR#3.
In its introduction, the plan notes the risk to IR#3 lands from overland flooding, citing a 2011 drainage study that found that existing drainage systems on the reserve are inadequate during peak stormwater events. It notes that flow levels in the creeks through the reserve have increased due to runoff from surrounding District of North Vancouver neighbourhoods, and that "with climate change underway, further study is needed to ensure that these creeks do not pose long-term risks to TWN lands". This is not reiterated as a specific policy, as other areas of future work identified in the plan are.

The plan creates a Protected Area Land Use designation[5], which is applied to lands alongside creeks and the foreshore throughout IR#3 (see Figure 10). The Protected Area Land Use designation is described as primarily serving to protect ecologically and culturally sensitive areas with high community value from development, but also recognizes the safety risks to developing in these areas, due to their vulnerability from "storms and other natural events." The plan does not provide regulatory specifications regarding any type of land use.

TWN policies[6] with regard to the Protected Area Land Use Designation include to:

> 8. Identify setbacks from creeks on Sleil-Waututh (IR#3) and limit opportunities for development within protected setback areas;
> 9. Limit opportunities for new development in areas at risk of flooding or erosion in the next 100 years due to increased stream flows and sea level rise
> 10. Identify risks associated with existing culvert crossings on Dollarton Highway and ensure that future culverts address climate change data related to flooding and coastal inundation modelling while respecting ecological values

[4] Page 20
[5] Page 64
[6] In the Land Use Plan, "Policies" are numbered, but "Objectives" are not.

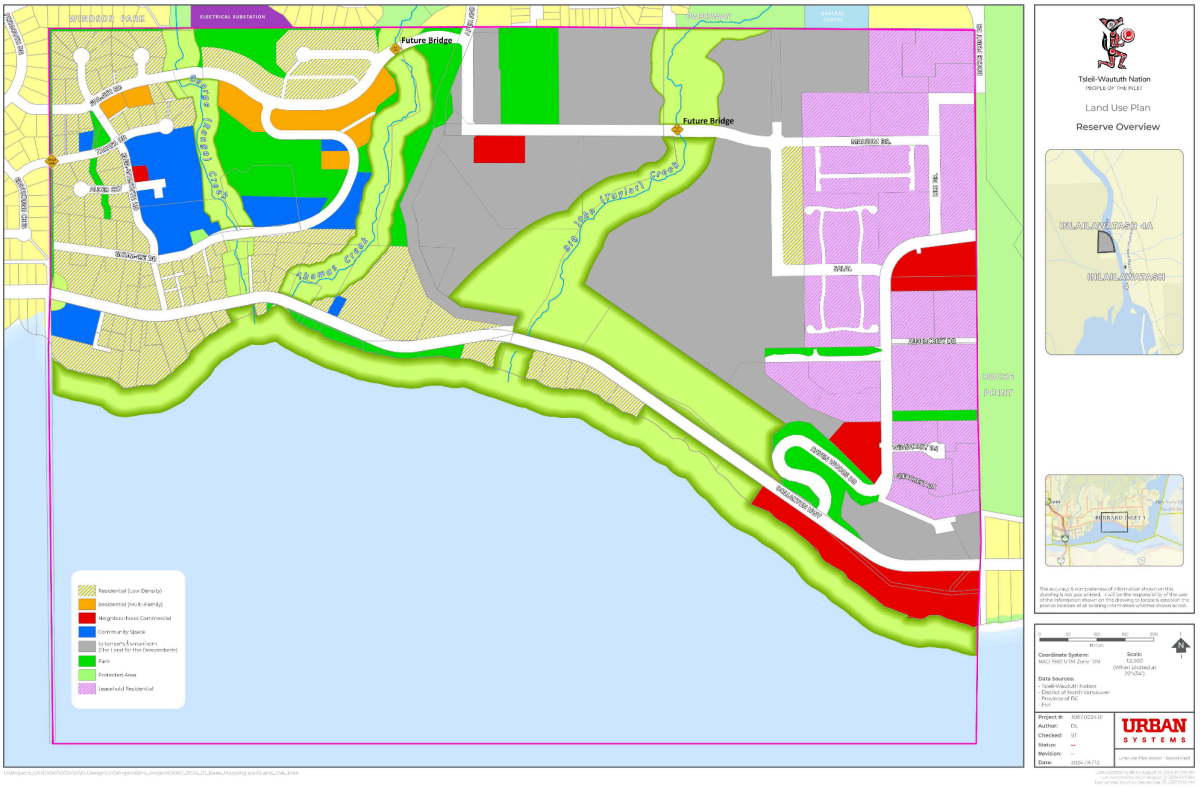

Figure 10: TWN Land Use Plan Map (amended 2024 from 2018 plan). Areas in lime green are designated as Protected Area Land Use.

Coastal erosion and the risk of coastal flooding are discussed throughout the plan, reflecting the traditional, cultural, and geographic importance of Burrard Inlet and its foreshore to TWN. Coastal erosion is already having an impact on IR#3, likely due to climate change and the presence of larger boats on the inlet. The Land Use Plan is written to be in alignment with TWN's 2015 Burrard Inlet Action Plan. Objectives and policies related to improving the health and security of the foreshore in IR#3 appear primarily under the "Foreshore" section of the plan[7], and include:

Objectives:

- Preserve and enhance the foreshore to increase resilience against climate change and sea level rise;
- Assert jurisdiction over Tsleil-Waututh waters;
- Encourage marine species diversity through restorative and enhancement projects of the foreshore;
- Regulate activities to ensure public health and safety.

Policies:

2) Work to protect foreshore for climate change resilience, such as sea level rise;
8) Align foreshore use with the Objectives set in the Burrard Inlet Action Plan;
9) Explore natural erosion protection measures to replace shoreline hardening;
10) Ensure Members' access to the foreshore is preserved and maintained.

[7] Page 38

5.3 Additional plans

5.3.1 Emergency Planning

TWN does not have a currently publicly available Emergency Management Plan. A plan was developed in 2009, and is expected to be updated.[8] TWN has a mutual Emergency Support Services Agreement with North Shore Emergency Management (NSEM), and has undertaken joint emergency planning with its neighbours, the District of North Vancouver, City of Vancouver, District of West Vancouver, and the Squamish Nation.

The Tsleil-Waututh Nation Land Use Plan 2018-2118 states some general objectives pertaining to emergency management, including:

- Improve TWN and individual community members' capacity to respond to on-reserve emergencies and natural disasters;
- Build awareness and facilitate community conversations to enhance community resiliency.
- Mitigate potential for disasters with sustainable land management and infrastructure solutions.

5.3.2 TWN Reserve Shoreline Adaptation & Restoration Project

TWN is currently in the midst of a multi-year nature-based shoreline restoration project to strengthen, protect, and improve community member access to the Burrard Inlet shoreline of IR#3. The work is intended to protect community lands, infrastructure, and archaeological values from the threat of coastal flooding and worsening erosion and coastal squeeze. This work aligns with multiple objectives outlined in the Tsleil-Waututh Nation Land Use Plan 2018-2118, and also builds on and supports the Comprehensive Community Plan and Burrard Inlet Action Plan. The work is being supported by a $10.1 million investment from TWN and senior levels of government ($7.6M through Green Infrastructure Stream of the Investing in Canada Infrastructure Program and $2.5M from TWN with support from the Province of BC).

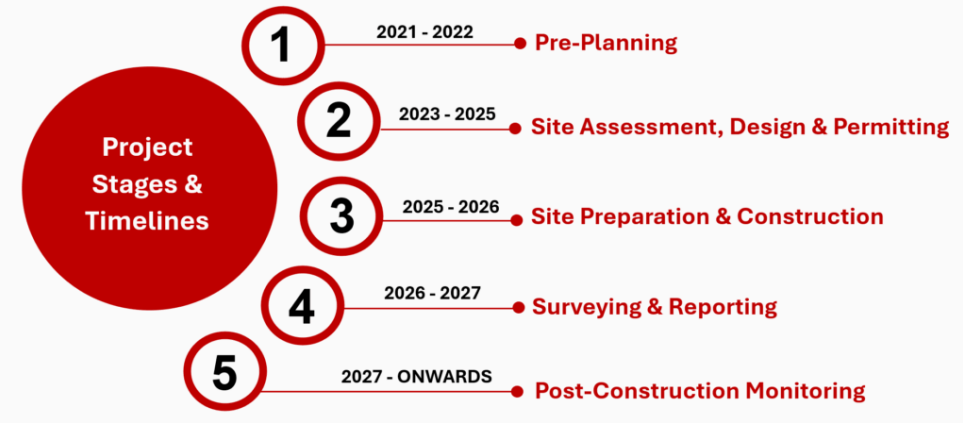

Figure 11: Projected timeline of TWN Shoreline Adaptation & Restoration Project

[8] The Nation posted a Request for Proposals that closed in September 2025 for a consultant to complete an Evacuation Plan.

Figure 12: Map of planned area of TWN Shoreline Adaptation & Restoration Project

5.3.4 Climate change and community health action plan 2022

The Climate Change and Community Health Action Plan identifies strategies to strengthen community health and resilience to climate change impacts affecting TWN. The plan is focused on the interactions of climate hazards with social, environmental, and cultural determinants of health and outlines actions possible through existing programs and planning initiatives. The report highlights how climate change already impacts the community, which includes flooding, although it is not centred. The plan emphasizes strengthening community resilience through planning, education, and preparedness initiatives.

The plan uses hazards identified in the first climate change resilience plan document, including:

- Coastal flooding associated with sea level rise
- Creek flooding caused by intense rainfall events
- Urban flooding resulting from heavy precipitation overwhelming the drainage systems
- Shoreline erosion and loss of intertidal areas

These hazards may cause damage to people, homes, infrastructure, and cultural sites while also affecting access to traditional lands and resources.

The plan outlines actions to be implemented to support climate resilience and improve coordination across departments. The plan is proposed to be integrated into existing staff work plans and program budgets where possible. Implementation of the plan is supported through interdepartmental collaboration coordinated by the Coordinated Climate Action Team (CCAT). A priority-matrix framework is used to identify the timing of actions, responsible departments, and budget considerations and sets indicators for monitoring success. has limited detail on specific flood management infrastructure, very few measurable implementation targets, and focuses on planning and awareness rather than regulatory flood management measures.

5.3.5 Understanding our communities' climate change vulnerabilities 2020

TWN Climate change vulnerabilities assessment: Understanding our communities' climate change vulnerabilities was developed as phase 1 of the community climate change resilience planning (CCCRP) initiative. The projected phases of CCCRP are shown in figure 13 The purpose was to evaluate the potential impacts of climate hazard on TWN's community and identify adaptation measures for long term resilience planning. The assessment focuses primarily on Burrard Inlet IR #3, the nation's current village site. It evaluates baseline environmental conditions, infrastructure exposure, and community assets that may be affected by climate change hazards, including 3 types of flooding.

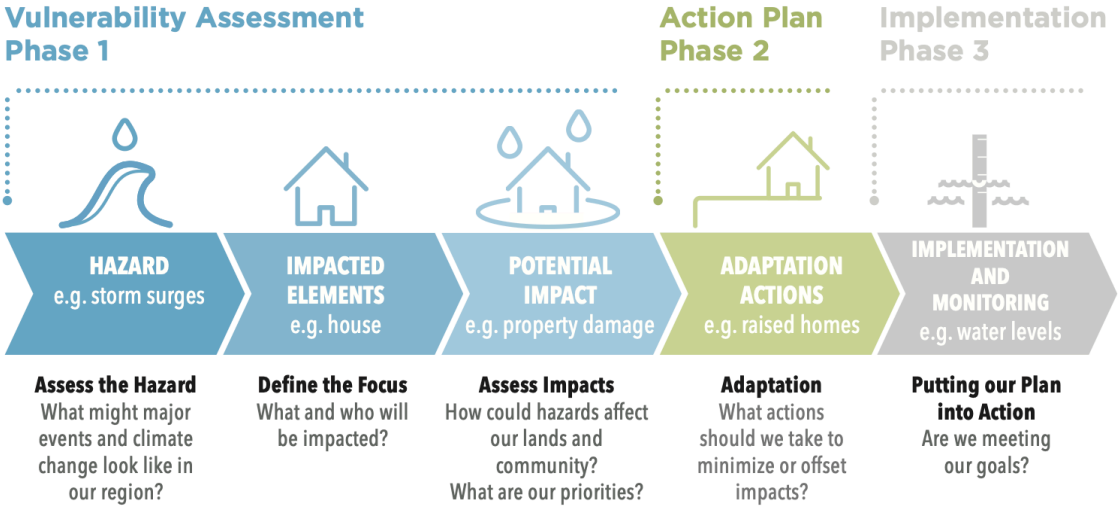

Figure 13. Current and future phases of the TWN community climate change resilience planning (CCCRP) initiative

Coastal flooding: May occur when high tides, wind, and waves combine to raise water levels along the shoreline. Their hazard modelling indicates that many waterfront properties could experience flooding under extreme scenarios involving approximately two metres of sea level rise. Infrastructure located near the mouths of creeks, including cultural sites and a sewer main, may be particularly vulnerable.

Creek Flooding: can occur during intense rainfall events or when culverts become blocked. Floodwaters may damage nearby properties or cause road washouts at creek crossings. The plan identifies three main creeks which flow through the community: George Creek, Thomas Creek, and Big John Creek, with heightened flood risk at road crossings and in low-lying areas.

Urban Flooding: occurs when heavy rainfall overwhelms the stormwater system, and runoff flows overland. Community members identified several locations where repeated overland flooding has occurred on residential properties, including: Sleil-Waututh Road, Ghum Lye Drive, Alder Court, and Sections of Takaya Drive.

The plan includes a *Preliminary Climate Change Adaptation Toolkit* that may be implemented in future planning. Several of the suggested actions could be used to address flooding.

Policy and Planning	**Structural Works**	**Resilient infrastructure + Nature-based solutions**	**Community preparedness**
Integrated stormwater management plan for on-reserve creeks	Shoreline rock armouring	Stormwater low-impact development, green infrastructure	Emergency response and evacuation planning for floods and wildfires
Rainfall design criteria for culverts	Retaining walls	Long term relocation of critical infrastructure	Empower and incentivize household-level emergency response plans
Establish shoreline and creek hazard area flood construction levels (elevated construction)	Upgrade Dollarton Highway culverts	Intertidal vegetation restoration	Integrate seasonal storm surge water level forecast into operations
Shoreline and creek setbacks for structures		Beach sediment nourishment	
		Clam garden breakwaters	
		Urban tree planting	

The adaptation measures discussed in this plan were preliminary and not yet implemented as regulations; many of the recommended actions require further planning and funding. The plan also recognizes that the hazards require additional monitoring and long-term analysis. At the same time the document is clearly foundational in the creation of further plans, including the Shoreline Restoration Project, the Climate Change and Community Health Action Plan, the xʔəl̓ílwətaʔɬ/Indian River Watershed Integrated Stewardship Plan 2022, and the Burrard Inlet Action plan.

5.4 TWN Conclusion

TWN has been undertaking a program of ambitious and multifaceted planning for the community's future under climate change. The scope of this planning work goes beyond just the community's primary reserve lands, looking outward at, for example, watershed health in TWN's traditional territory, and the health of Burrard Inlet. The Nation's core values are expressed strongly and consistently throughout different plans. This approach has resulted in a number of higher-level strategic plans with significant thematic overlap. While these plans do sometimes supportively refer to each other, their order of precedence and implementation progress can be challenging to parse from an outsider perspective. Some plans, namely the Land Use Plan and Climate Resilience Plan, are described as being first phases of multi-phase plans, but it's not clear from publicly available information when future phases are expected.

6.0 Conclusion

The four jurisdictions described in this report share many attributes of geographical risk (namely, shoreline locations, sloping terrain, and urban creeks characteristic of the North Shore) for flooding, coastal erosion, and other associated hazards. While they differ significantly in other regards, examining their respective flood plans and policies provides an interesting comparative study of different approaches to similar hazards.

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7.5 Tsleil-Waututh Nation

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