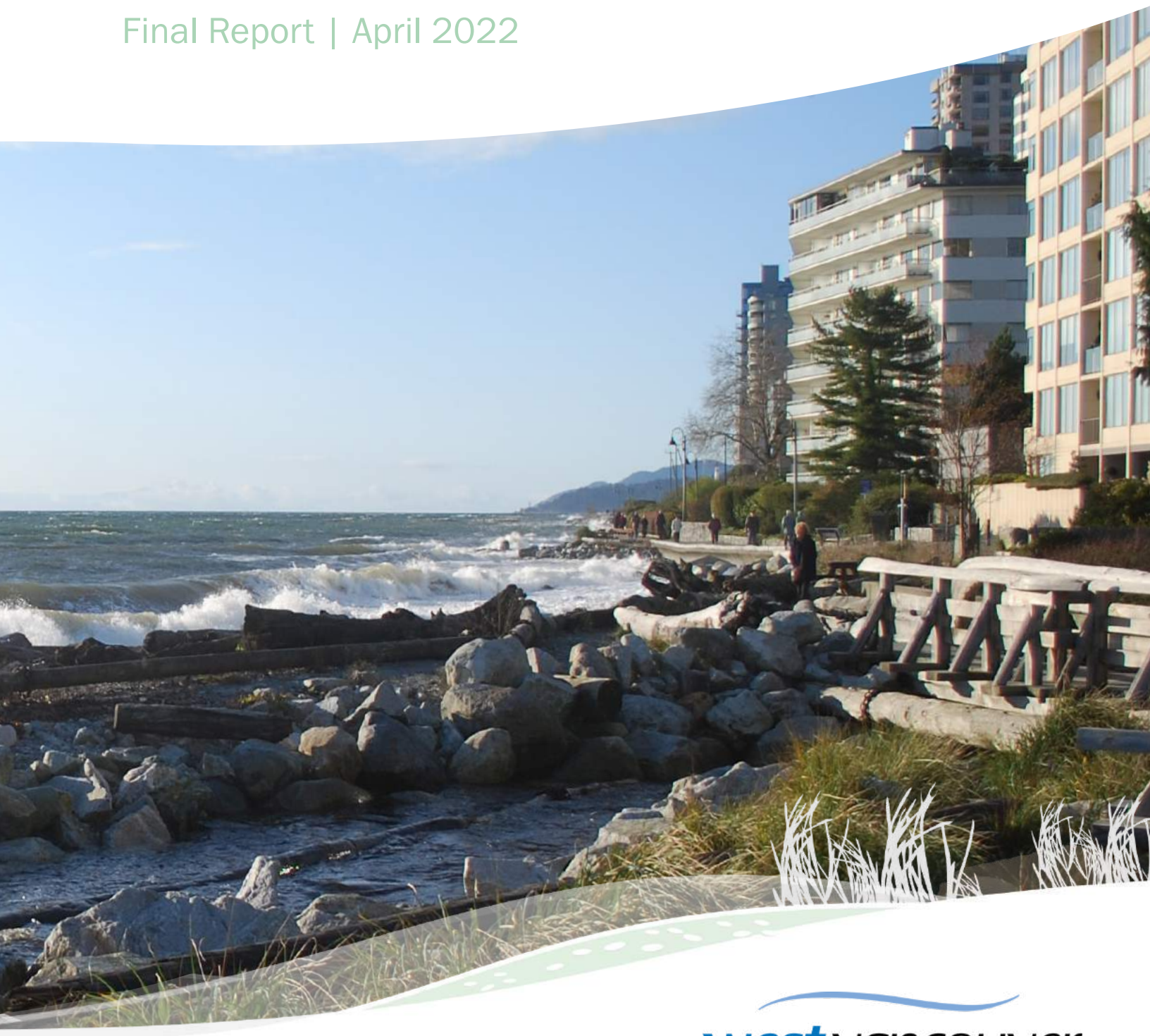
Coastal Marine Management Plan

Final Report | April 2022



west vancouver

EXECUTIVE SUMMARY

The District of West Vancouver is situated along a vibrant and densely developed coastline. A defining feature of the community is access to waterfront parks and shoreline. Public access to a stable, ecologically sound, and uncontaminated coastline is considered a fundamental interest of West Vancouver residents. Scientific modeling indicates that in the future, the coastline and public and private waterfront properties will be exposed to the impacts of climate change in the form of sea level rise, coastal erosion, intertidal area change, coastal flooding and storm surge. Preparing for these impacts will require informed policies and management strategies from all levels of government.

The District has pursued a number of important initiatives to protect the coastline and coastal habitats from development pressures and climate change in order to preserve community and environmental values. Recent initiatives including the West Vancouver Coastal Planning Study (2020) and active participation in the North Shore Sea Level Rise Strategy (2021) have set the stage for focused planning and policy development.

The Coastal Marine Management Plan (the "Plan") was created by the Coastal Marine Management Plan Working Group over three years. The Plan provides a policy framework informed by past and recent initiatives to guide District Council and staff in the management of coastal areas and assets. The following three key policy areas are addressed in this Plan:

Coastal Dynamics and Ecosystems

To provide guidance to the District about the impacts of changing coastal dynamics and recommend adaptive measures for the protection and enhancement of coastal areas, habitats and species, natural capital, and public and private property.

Built Infrastructure and Parks

To manage existing built infrastructure and park facilities and to plan future infrastructure to be resilient to climate change impacts and to ensure the provision of reliable infrastructure services for residents.

Public-Private Interface

To communicate to coastal property owners about their responsibilities for coastal management on private property and facilitate owner-led initiatives on private property to limit impacts on adjacent properties and coastal habitats; and to ensure public access to waterfront parks and shoreline.

Each policy area is supported by more detailed objectives and specific short-, medium-, and long-term recommended actions for the District to adopt over the next 10 to 20 years. The full list of objectives and actions is outlined in Section 4 of the Plan and reflects numerous studies and reports, the input and knowledge of Working Group members, external subject-matter experts, neighbouring municipalities and First Nations, and feedback from West Vancouver residents during public information sessions.

The Plan also includes recommended funding, communication, and progress monitoring approaches that the District may consider to further support implementation of the objectives and actions in this Plan.

Contents

1. INTRODUCTION

West Vancouver sits in a unique marine setting. With stunning views, beaches, and parks, it attracts diverse recreational use and development. Managing the coastline to meet the challenges of sea level rise and a changing climate for current and future generations is essential.

1.1 PURPOSE

The Coastal Marine Management Plan (the Plan) sets a framework to guide the management of coastal areas in the District of West Vancouver (the District), including:

- Preserving ecosystems and managing coastal dynamics such as sea level rise and erosion;
- Protecting built infrastructure, parks, and natural assets in coastal areas; and
- Managing development at public-private interfaces.

The Plan was developed under the guidance and leadership of the Coastal Marine Management Plan Working Group and recommends coastal management objectives and actions for District Council and staff to consider implementing over the next 10 to 20 years.

The Plan is not intended to be a detailed action plan of projects and next steps. Rather, it provides a policy-level resource for District Council and staff to draw on to support decision-making and more detailed initiatives in the future.

1.2 ABOUT THE WORKING GROUP

The Coastal Marine Management Plan Working Group (the "Working Group") is comprised of West Vancouver citizens with an interest and technical expertise in coastal management, and also includes representation from District Council and staff. This group worked together between January 2019 and December 2021 to develop this plan.

Citizen working groups play an important role in the District of West Vancouver's governance and decision-making processes. The first resident-led working group was initiated in 2006 with a goal to provide recommended solutions to address a specific or complex issue through collaborative research.

Mandate and Role

As defined in the Working Group Terms of Reference (2018):

> *The mandate of the Coastal Marine Management Plan Working Group is to review information, engage the public and stakeholders, and recommend the adoption of a Coastal Marine Management Plan that provides policy statements on District-specific coastal management issues. The adoption of a Coastal Marine Management Plan will create a comprehensive policy document that will provide guidance to the District on the management of the coastal environment with respect to ecological values, utility and infrastructure protection, shoreline protection for climate change, and balance public and private benefits.*
>
> *For the purpose of this working group, the District Coastal Marine Management Plan will apply to natural, and infrastructure resources of the coastal zone. It will include physical or biological features, processes, places or objects that have ecological, economic, or social or cultural value along the approximately 30 kilometers of shoreline. The area will consist of the natural boundary or high-water mark to 1,000 feet into the Outer Harbour Burrard Inlet/Howe Sound.*

Membership

The Working Group consists of eight volunteer community representatives selected by the Community Engagement Committee, a member of Council, and two District staff liaisons. The Working Group citizen members each bring a strong interest and specialized expertise in coastal management ranging from environmental law, coastal engineering, and marine sciences.

The Working Group consisted of the following members:

Citizen Members

Lori Williams (Chair)
Bill McAllister
Mahsoo Naderi
Alison Nock
Brian Walker
Gary Wharton
Andrew Allen
Lauren Gill (student intern)

Council Members

Councillor Bill Soprovich

Staff Liaisons

Matthew MacKinnon, District Environmental Manager
Corinne Ambor, Parks Stewardship Manager
Andrew Banks, Senior Manager of Parks

1.3 PROCESS FOR PLAN DEVELOPMENT

The Working Group led the development of the Coastal Marine Management Plan between January 2019 and December 2021, with technical input from District staff and external subject matter experts.

Working group members met bi-monthly over this period to review background information, meet with District staff and coastal specialists, and develop recommendations and the core content of the Plan.

The Working Group participated in five phases of work to develop the Plan:

Feb - Dec 2019

BACKGROUND REVIEW

Participated in meetings and site visits to understand the coastal context:

- Reviewed existing District plans, policies, and studies
- Engaged with coastal specialists and other BC communities
- Attended site visits at key waterfront areas including the Ferry Building, John Lawson Park, and Ambleside Park

Jan - Mar 2020

DRAFT RECOMMENDATIONS

Drafted objectives and recommendations for three focus areas:

- Coastal dynamics and ecosystems
- Built infrastructure and parks
- Public-private interface

Jul - Dec 2020

DRAFT PLAN

Drafted content and provided input into the draft plan, including a summary of existing conditions, guiding principles, objectives, recommendations, and implementation approaches.

Jul 2020 - Mar 2021

ENGAGEMENT

Shared core content from the draft plan with the public and neighbouring First Nations through meetings, a survey, and online videos for feedback on objectives and recommendations.

Apr - Dec 2021

FINAL PLAN

Provided input into the final content and design of the Coastal Marine Management Plan, drawing on feedback from District staff, First Nation, and public engagement.


oundarave Sushi

ODLUM BROWN
Investing for Generations
Bakehouse

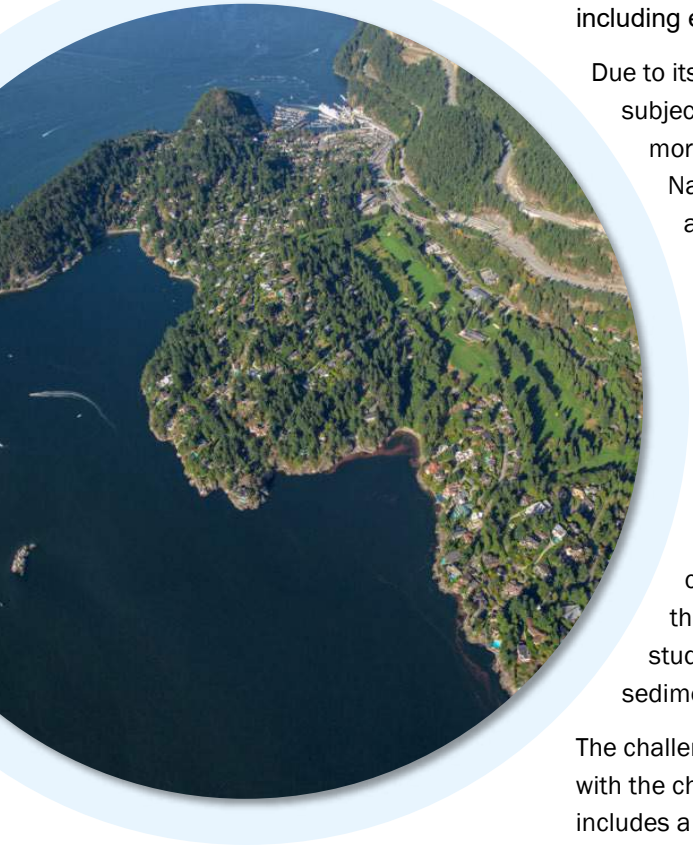
2. BACKGROUND & CONTEXT

West Vancouver is located on the North Shore of metropolitan Vancouver in British Columbia, Canada on the unceded, traditional, and ancestral territories of the Coast Salish Peoples, including the Sḵwx̱wú7mesh (Squamish), səlilwətaɬ (Tsleil-Waututh), and xʷməθkʷəy̓əm (Musqueam) Nations. These Nations have been occupants of these lands and waters since time immemorial and stand as important knowledge holders and partners for coastal management across the North Shore.

This section describes the unique nature and vulnerabilities facing West Vancouver's coastline as a foundation for the objectives and recommended actions outlined in this plan.

2.1 A UNIQUE COASTLINE

The West Vancouver coastline is unique in the Metro Vancouver Howe Sound area. Numerous creeks and tributaries flow into the ocean between the Capilano River and Horseshoe Bay, carrying sediment to beaches along the coast. While these creeks are smaller and have much smaller estuaries than the major rivers that flow into Burrard Inlet's Inner Harbour, they are larger than those found in Howe Sound, which has much steeper hillsides. West Vancouver estuaries and foreshore areas provide important habitat for fish, birds, and other wildlife. They also offer important ecosystem services, including erosion and wave protection and filtration of urban runoff.



Due to its geographic orientation and exposure, West Vancouver's coastline is subject to more severe impacts from wind and storm activity than in the more protected, inland waters of Burrard Inlet to the east of First Narrows. While some areas of the coastline are not likely to need additional protection efforts by the District due to their natural configuration, other areas, such as the Centennial Seawalk, may need extensive work to be protected.

The coastal geomorphology of West Vancouver has been altered by the arrival of settlers, deforestation, urban development, and the construction of the Cleveland Dam in 1954, which has led to the disruption of sediment coming from the Capilano River. Waterfront structures, such as piers, groynes, seawalls, and culverts have further altered natural sediment transport pathways and caused changes to adjacent properties and habitats. Given this complexity, the coastal geomorphology of West Vancouver should continue to be studied to better understand the links between sediment supply, sediment transport, erosion, and habitat.

The challenges of the physical setting of the coastline are further compounded with the challenges of managing the largely privately-owned waterfront, which includes a mix of residential and commercial uses. Coastal protection along privately-owned land can be exceptionally challenging due to management of liability, property owner expectations, and cost. Furthermore, an important CN Rail corridor runs along a significant portion of the West Vancouver waterfront requiring ongoing communication and collaboration.

1 **HORSESHOE BAY** – This busy seaside village hosts a small commercial centre, waterfront park, marina, government wharf, and a major BC Ferries terminal. A concrete seawalk runs along the head of the bay.

2 **WHYTECLIFF PARK** – This park is a regional destination for picnics, swimming, and scuba diving, and includes natural rocky bluffs, an offshore island, and natural gravel beach.

3 **EAGLE HARBOUR & FISHERMAN'S COVE** – These small harbours house two marinas, two yacht clubs, and the estuaries of Eagle Creek and Nelson Creek.

4 **LIGHTHOUSE PARK** – One of West Vancouver's most ecological significant natural areas, this destination park is a remaining example of old growth coastal forest in Metro Vancouver and includes steep coastal bluffs and small pocket beaches along its shoreline. It also houses the Point Atkinson Lighthouse.

5 **CAULFEILD PARK** – This rocky natural shoreline park is important foraging area for marine birds while also providing scenic views toward Vancouver's skyline and across to English Bay, Kitsilano, and Point Grey for visitors.

6 **STEARMAN BEACH** – A popular site for viewing tidepools and marine life at low tide, the beach and adjacent neighbourhood sits on the sediment fan of Cypress Creek. The beach disappears almost entirely at high tide. The surrounding neighbourhood is low lying and therefore vulnerable to sea level rise.

7 **DUNDARAVE PARK & PIER** – Located at the foot of 25th Street, the area includes a park, beach, restaurant, and the pier, with a small float for boaters. Storms have periodically damaged the pier and adjacent seawalk. The pier sustained significant damage during a storm surge event in January 2022.

8 **CENTENNIAL SEAWALK** – A popular site for evening strolls, this 1.7-km seaside walkway runs from the bottom of 18th Street to Dundarave Park. The current seawall is protected from waves by rock riprap along its face but can still be overtopped by water and debris during storms that coincide with high tides.

9 **JOHN LAWSON PARK & PIER** – This low-lying waterfront park is a favourite for kids and families due to the large playground, picnic area, and bathroom facilities. Lawson Creek, a salmon-bearing stream, flows into Burrard Inlet, just west of the pier.

10 **MILLENNIUM PARK & ARGYLE AVENUE WATERFRONT** – This waterfront land along Argyle Avenue is progressively being redeveloped from single family homes to a community park as the remaining homes are vacated. The park and adjacent Marine Drive corridor are low-lying and vulnerable to sea level rise.

11 **FERRY BUILDING GALLERY & AMBLESIDE PIER** – Located at the foot of 14th Street, this park area include a small art gallery within a heritage building and a fishing pier. The pier sustained significant damage during a storm surge event in January 2022.

12 **BOAT LAUNCH & HOLLYBURN SAILING CLUB** – This private sailing club and has been open since 1963. The clubhouse and boat launch have sustained damage in storm events dated as far back as the mid-1970s and were most recently damaged during a storm surge event in January 2022.

13 **AMBLESIDE BEACH & PARK** – The park and beach area including a playground, playing fields, a skate park, basketball court, and a concession stand. The whole Ambleside area is low lying and vulnerable to sea level rise.

14 **CAPILANO PACIFIC TRAIL** – Runs along the shoreline from the Capilano River to the east end of Argyle Avenue. Ambleside Dog Beach and the Ambleside Par 3 Golf Course are located at the west end of trail. A large duck pond, once a blind channel of the Capilano River estuary and an important First Nations fishing site, is also located in this area.

15 **SPIRIT TRAIL** – Runs through Ambleside Park along south side of railway tracks. The trail sits within a low-lying area that is vulnerable to sea level rise.

2.2 POTENTIAL IMPACTS FROM CLIMATE CHANGE

Like other coastal communities, the West Vancouver coastline is vulnerable to impacts from climate change, particularly impacts from sea level rise including coastal flooding and erosion, and changes to intertidal areas and ocean conditions.

The District has a history of coastal and creek flooding, with recent floods in 2012, 2014, 2016, and 2018. In 2012, a storm surge in combination with an especially high tide overtopped the shore in John Lawson Park causing damage and depositing debris. In 2014, Lawson Creek overtopped its banks during a heavy rainfall event, flooding commercial properties along Marine Drive causing damage to electrical systems and property. More recently, in 2016, a heavy rainfall event led to Willow Creek overtopping its banks causing flooding and evacuation of residents.

Flooding of low-lying coastal areas is expected to become more frequent and severe as sea levels continue to rise and rainfall becomes more intense. A summary of potential impacts from climate change on the West Vancouver coastline is provided below.

Sea Level Rise and Storm Surge

Globally, sea levels rose on average 0.20 m relative to the land between 1901 and 2018. According to new data presented in the IPCC Physical Science Basis Report (2021), the average global rate of rise has more than doubled in the last decade to 3.7 mm per year[1]. Observed local rates of sea level rise relative to the land are determined by both global sea levels and whether the land is subsiding (which increases sea level) or uplifting (which reduces sea level) locally. The West Vancouver coastline is varied and experiences both processes, however projections suggest that sea level rise rates will continue to accelerate beyond the rate of uplift[2]. The Province of BC recommends that coastal communities plan for a predicted rise of 1 m by year 2100 and 2 m by 2200, over the historic year 2000 baseline, with local adjustments for site-specific land subsidence or uplift[3]. However, depending on different climate scenarios, it's possible that sea level rise could progress at a slower or, more likely, a faster rate. The District may need to adjust the projections it uses in the future to reflect changes in climate science and sea level rise estimates for BC.

Without adaptation measures, sea level rise will gradually lead to permanent inundation of some low-lying areas and increase the risk of flooding during storm surge events. A storm surge refers to a temporary rise in water level that occurs when high winds and atmospheric pressure from an intense storm push water toward the coast. They are most impactful when they coincide with high tides and waves. Storm surges reaching higher than one metre have already been measured in English Bay.

The risk of flooding is highest when a storm surge coincides with the annual high tides that occur between November to January and July to August. These extreme high tide events provide an example of what normal water levels will look like in the future due to sea level rise. Figure 1 shows the different ocean conditions that contribute to flooding. Comparing the graphics shows how water levels and the risk of flooding are expected to be higher in the future with sea level rise. Sea level rise and storm surge could result in more frequent (but shallow) flooding of parks, roads, businesses, and private property, if no changes are made. The District is in the process of mapping and preparing for coastal flooding from storm surge and sea level rise.

[1] IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S. L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M. I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T. K. Maycock, T. Waterfield, O. Yelekçi, R. Yu and B. Zhou (eds.)]. Cambridge University Press. In Press. https://www.ipcc.ch/report/ar6/wg1/#TS

[2] Lambert, A., S. Mazzotti, N. Courtier, L. Nykolaishen, 2007. Crustal uplift and sea level rise in northern Cascadia from GPS, absolute gravity, and tide gauge data. *Geophysical Research Letters*. 34(15).

[3] Ausenco Sandwell, 2011. Climate Change Adaption Guidelines for Sea Dikes and Coastal Flood Hazard Land Use. Guidelines for Management of Coastal Flood Hazard Land Use. Prepared for BC Ministry of Environment

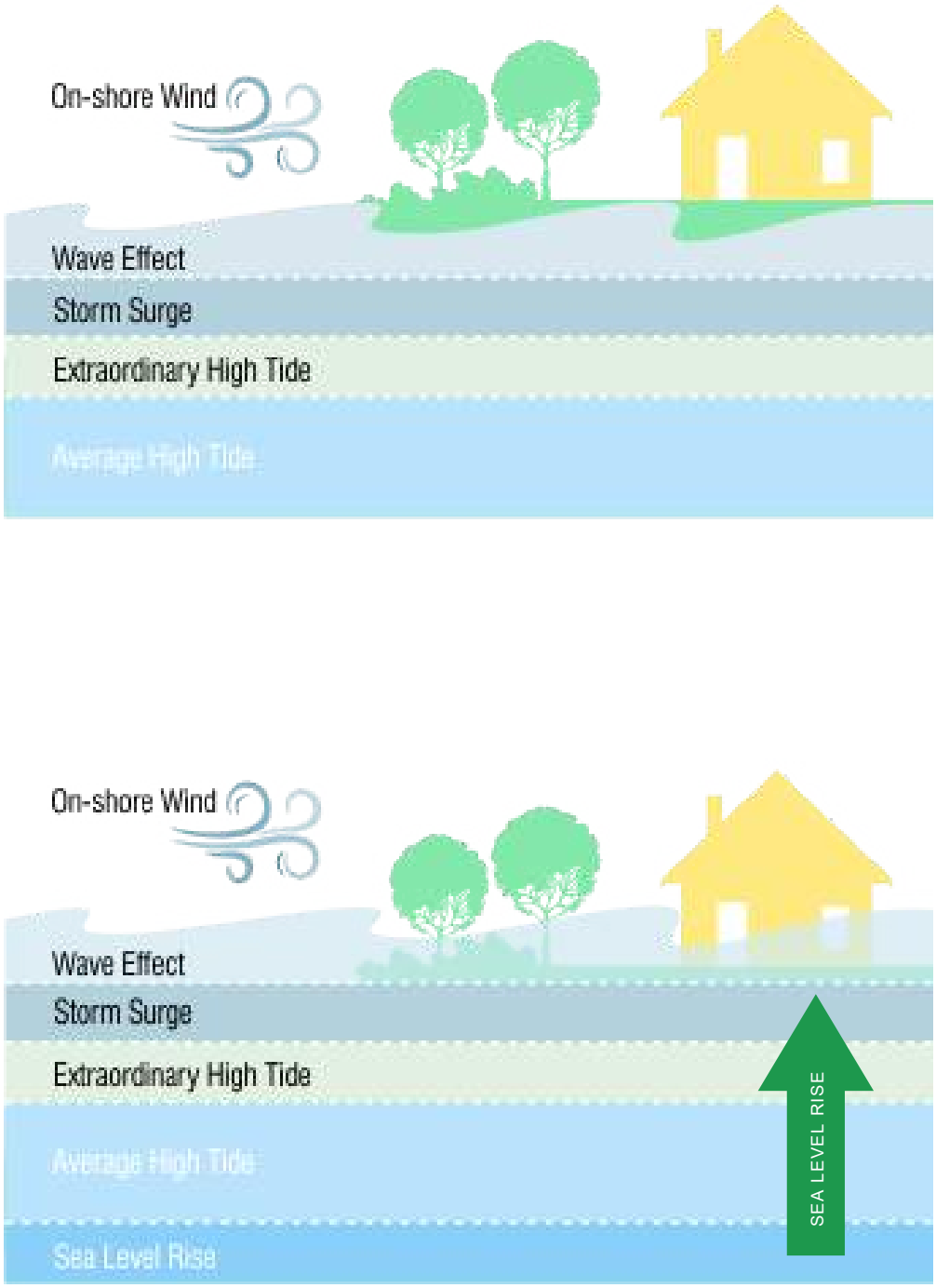


Figure 1: Ocean Conditions that Contribute to Flooding

Intertidal Habitat Loss

Sea level rise is also expected to reduce the area of intertidal habitat in West Vancouver. The intertidal zone, also known as the "foreshore", refers to the section of shoreline that is exposed during low tide and inundated during high tide. This area provides important and productive habitat for a wide variety of coastal species including birds, marine mammals, fish, shellfish, aquatic plants, and macroalgae.

As shown in Figure 2, the loss of intertidal habitat happens when rising sea levels run up against barriers, such as hard coastal protection (e.g., seawalls) or steep rock shorelines. As the sea level rises, the intertidal area shifts upwards and moves inland. Where the coastline is protected, hardened, or naturally steep, the intertidal area cannot migrate and is lost. The phenomenon is often known as "coastal squeeze".

In the District, if no adaptation actions are undertaken, sea level rise is expected to reduce the size of many recreational beaches and the overall amount of intertidal habitat available for marine life and wildlife that live on or use intertidal habitat for feeding (e.g., shorebirds). West Vancouver creek mouths also have steeper and much narrower estuaries than those in the Inner Harbour, making them more vulnerable to the loss of intertidal habitat due to sea level rise.

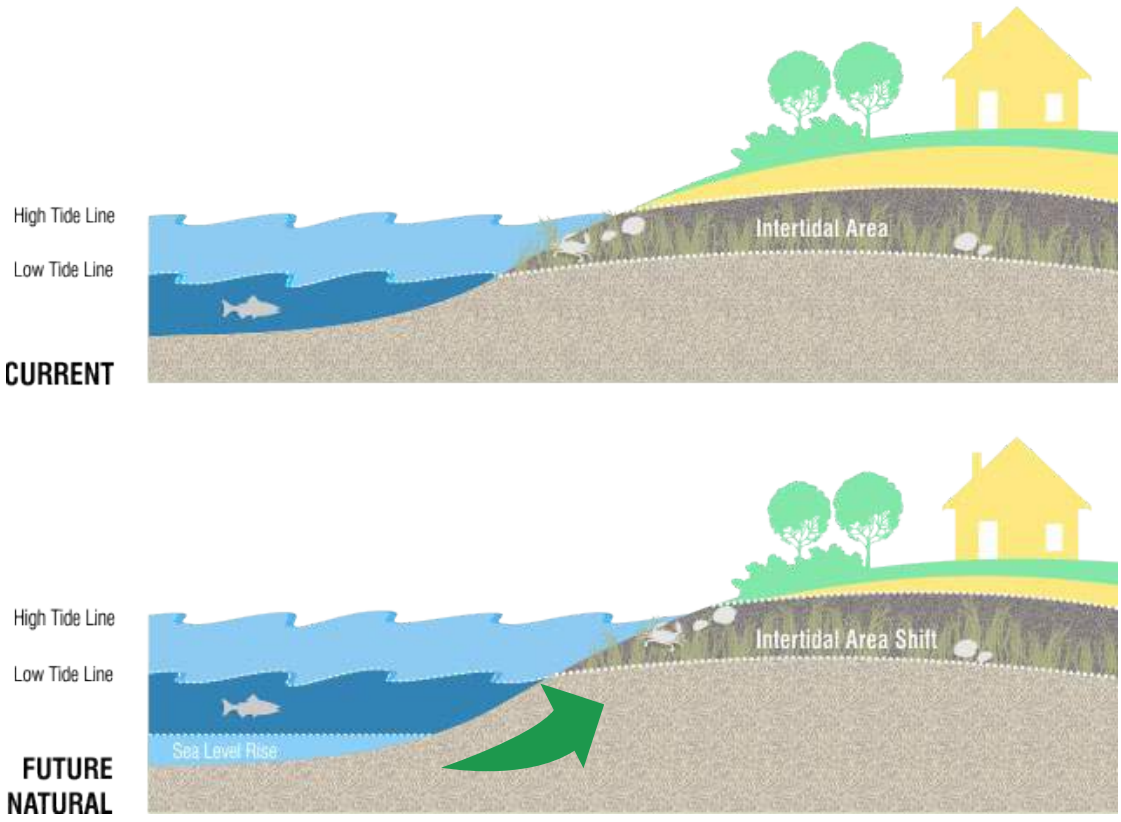


Figure 2: Effect of Flooding to Intertidal Habitats

Wave Effects and Coastal Erosion

Wind and ship movements produce waves that run up the shore and can erode away softer sand or gravel over time. The runup height of a wave crashing on shore is influenced by the shape of the shoreline. For example, a natural beach with a gently sloping shoreline will result in a smaller wave run up upon impact than a vertical bulkhead or retaining wall. Wave effects can slowly erode the shoreline resulting in loss of land or beach sediments to the sea. In the District, this may mean loss of privately owned land or impacts to public infrastructure such as roads and waterfront parks.

As sea levels rise, waves will reach higher elevations and may gradually or abruptly alter the shape of the shore as patterns and rates of erosion change. Natural shorelines may shift and adapt to these changes potentially without a need for large intervention, but in doing so can significantly affect waterfront properties and cultural sites. For this reason, the District and property owners may need to consider erosion control measures. The potential consequences that erosion control measures can have on ecologically valuable habitats and Indigenous archaeological, cultural, and spiritual sites will need to be considered in consultation with local First Nations.

The West Vancouver shoreline will react differently to coastal erosion and sea level rise depending on its composition. Rocky headlands will be resistant to erosion and can be left alone to adapt over time. However, some areas such as Centennial Seawalk may require extensive engineering if they are to be protected.

2.3 THE SHORELINE MATTERS!

The coastline is one of the District's greatest natural assets. West Vancouver's coast provides a broad range of critical community, infrastructure, and ecosystem services including:

- Habitat – The West Vancouver coastline provides habitat for fish, birds, marine mammals, and other wildlife. Key habitat such as beaches and kelp forests are important for salmon rearing and forage fish spawning. Intertidal areas provide important foraging areas for marine birds and fish. Marine mammals rely on food species supported by these habitats.
- Ecosystem Services – Some of the many ecosystem services provided by the West Vancouver coastline include erosion and wave protection, filtration of runoff by riparian vegetation, and shade provided by trees along the waterfront.
- Cultural and Heritage Sites – West Vancouver is a part of the traditional territories of the Sḵwx̱wú7mesh (Squamish), səlilwətaɬ (Tsleil-Waututh), and xʷməθkʷəy̓əm (Musqueam) Nations and the coastline holds significant cultural values for the Nations, including important. archaeological, cultural, and spiritual sites. The District's waterfront also hosts post-contact heritage sites, such as the Caulfeild heritage area.
- Businesses and Residential Areas – Waterfront businesses (e.g., Ambleside) and residential areas (e.g., Erwin Drive) are a common feature along the West Vancouver coast.
- Infrastructure/Utilities –The District has numerous infrastructure assets and utilities along the coastline including watermains, sanitary sewer infrastructure, storm drain outfalls, public washrooms, playgrounds, piers, and hydro and telephone lines.
- Tourism and Recreation Opportunities – West Vancouver parks, beaches, and trails along the coast from Horseshoe Bay to Ambleside are an important draw for local tourism that brings visitors from across the region and international guests.

2.4 COASTAL ADAPTATION APPROACHES

The District of West Vancouver already has a number of policies, plans, and initiatives in place to manage flooding and erosion along the coast. As sea levels rise, additional approaches will be needed to adapt to changing conditions and build coastal resilience over time.

The District was a key contributor to development of the North Shore Sea Level Rise Strategy (2021), which outlines coastal adaptation approaches under four high-level categories that can be used in combination to manage sea level rise hazards:

Resist

Measures that aim to prevent flooding from occurring. They typically focus on structural measures such as building dikes to reduce the likelihood of flooding.

These measures can also include nature-based approaches such as planting vegetation along the shoreline to reinforce banks.

Accommodate

Measures that allow flooding to happen but reduce its impact on infrastructure or property. They typically focus on non-structural adaptation measures, including consciously acknowledging flood risk, defining how much risk we are willing to tolerate, and raising livable spaces in areas vulnerable to flooding.

Avoid

Measures that aim to manage or reduce the amount of existing or new development in high risk areas. They typically focus on land use planning to avoid building or adding more in areas that are vulnerable to flooding, or by gradually relocating buildings and infrastructure away from areas at risk of flooding.

Flood construction levels (FCLs) and building setbacks are some of the planning tools used to manage new development in coastal areas.

Advance

Measures that aim to reclaim land to make space for structures such as dikes, which can reduce the likelihood of flooding in coastal areas. Reclaimed land could be used for wildlife habitat, recreation, or other purposes.

Advance measures include establishing constructed wetlands or salt marshes to manage wave effects and erosion and provide habitat.

These four adaptation approaches have been adapted from the Province of BC Sea Level Rise Adaptation Primer (2013) and tailored to the North Shore context.

3. REGULATORY AND LEGAL CONTEXT

3.1 COASTAL MANAGEMENT JURISDICTION

Land use management authority along the West Vancouver coastline is complex and involves a range of actors and interlinking legal, regulatory, and policy frameworks:

- District of West Vancouver holds jurisdiction and authority to manage land uses on both waterfront lands and the provincial aquatic Crown land located below the high water mark within Burrard Inlet. Authority over the Crown foreshore is provided under the District's *Head Lease Agreement* (2013) with the Province of BC.
- First Nations have rights within their traditional territories that are protected by the *Canadian Constitution* and have been affirmed by Canadian courts. Both the federal and provincial governments have a duty to consult with Indigenous peoples when these rights may be negatively impacted by decisions under their jurisdiction. In addition, First Nations are leading efforts to improve the health of the Burrard Inlet ecosystem and have specific objectives for ecosystem recovery and restoration, including expanding wild food harvesting and restoring populations of important species that have been lost because of changes to the coastline, overfishing, and pollution.
- Metro Vancouver (Greater Vancouver Regional District) manages infrastructure and associated rights-of-way for water and wastewater services along the West Vancouver coastline, including the sewer interceptor system which conveys wastewater from West Vancouver properties to the Lions Gate Wastewater Treatment Plant.
- Utilities, such as BC Hydro, Fortis BC, and CN Rail own and manage infrastructure and rights-of-ways in waterfront areas. In particular, CN Rail owns and manages an important railway corridor that runs along a portion of the West Vancouver coast.

- Private property owners in West Vancouver include large commercial and multi-family residential developers and single-family residential property owners. These owners are responsible for managing hazards on their lands (e.g., erosion) in a way that meets applicable bylaws and regulations. Legal and regulatory tools applied by the District of West Vancouver such as restrictive covenants (Section 219 of the *Land Title Act*) and provincial water leases may exist on and overlap with private property. Property owners need to understand the conditions for use of land that these tools may impose, such as setbacks to structures from the natural boundary and restrictions on uses.
- The Provincial Government manages the diversion and use of freshwater resources (including both surface water and groundwater), regulates works in and around creeks and streams, and would be responsible for regulating any future potential flood protection works such as dikes and seawalls if they were to be built in the future. They also manage regional highway rights-of-ways in some waterfront areas.
- The Federal Government is responsible for the management of fisheries, the protection of fish and fish habitat (including shellfish), protection of migratory birds, and the protection and recovery of species at risk. They are also responsible for issuing permits for changes to structures or shorelines that might impact navigation.

There are many other groups who hold an interest in the West Vancouver coastline, and will continue to play a role in future coastal management initiatives. These groups include:

- Neighbouring local governments, including Squamish Nation, Tsleil-Waututh Nation, and the District of North Vancouver, have expressed an interest in collaborating on regional coastal protection and restoration initiatives, including flood protection in the face of sea level rise. The Squamish Nation, with its reserve lands adjacent to the eastern border of West Vancouver, is a key partner with the District.
- Non-profits and volunteer groups have played a pivotal role in supporting coastal management and restoration initiatives to date, including the District of West Vancouver's Shoreline Preservation Society (SPS) and West Vancouver Streamkeeper Society.
- Small watercraft and recreational waterfront users who visit West Vancouver beaches, Seawalk, parks, and marinas have a responsibility to use waterfront areas in a way that doesn't harm the environment and that respects local laws and regulations.

3.2 LOCAL REGULATIONS & POLICY DIRECTION

Existing District policies and plans set a direction to build coastal resilience in a way that preserves and enhances coastal ecosystem services and amenities. These foundational plans and policies include:

- Official Community Plan (Bylaw 4985) – This document provides objectives and policies to guide high-level decision-making for future planning and land-use changes in the District. The OCP speaks to the need for mitigating effects of climate change and building resilience through nature-based approaches (i.e., green infrastructure, watercourse enhancement opportunities, and use of renewable energy); a key pillar of the Coastal Marine Management Plan.
- Development Permit Areas and Bylaw – The District has several development permit areas (DPAs) that outline additional standards and guidelines for development in certain areas. In particular, the DPA for Watercourse Protection and Enhancement Areas (NE 13) requires environmental permits and special considerations for work within 15 m of the top of any watercourse, including coastal areas. The District's Planning staff are currently creating new policies related to coastal flood construction levels and a draft Foreshore DPA for future private waterfront development.

- Parks Master Plan (July 2012) – This plan provides a balanced approach to park planning that incorporates the protection and restoration of ecosystems, encourages active living, fosters stewardship, and outlines innovative approaches to manage resources.
- Natural Capital Assets Strategy – The District of West Vancouver has led a number of initiatives and studies to inventory, value, and enhance natural assets in the District. This includes the Municipal Natural Assets Initiative (July 2018) and West Vancouver's Natural Capital Assets: A Preliminary Inventory (June 2019). The former details a pilot project for the enhancement of natural assets and the latter provide a high-level assessment of the value of natural assets in the District based on the

ecosystem services they provide. These reports serve as a foundation for policies and approaches in this Coastal Marine Management Plan.

- Invasive Plant Strategy (June 2014) – Shoreline-associated areas are considered to be a priority area for invasive plant management as they support sensitive and important ecosystems. The District's Invasive Plant Strategy outlines an approach to mitigate the spread of invasive plants on private and public lands. Management of invasive plants along the shoreline is important in maintaining the value of the foreshore as a natural asset in the face of sea level rise.
- Plan for Trails on Public Land (April 2018) - This plan provides high-level policy direction for planning, management, and use of trails in the District. This plan guides the management of trails along the changing shoreline in tandem with the Coastal Marine Management Plan.

3.3 COASTAL MANAGEMENT PLANNING

Historically, the District has implemented "hard" approaches for coastal erosion protection, such as the concrete or rip rap seawalls that are currently common in many low-lying coastal areas across West Vancouver. Unlike many other coastal communities in Metro Vancouver, the District does not have provincially regulated flood protection infrastructure (i.e., dikes) along the coast.

Between 2005 and 2015, the District collaborated with volunteer groups to implement erosion protection projects in several locations to enhance ecological conditions or improve human use within the foreshore and in creek estuaries. While many of the projects have been implemented, the monitoring of project outcomes and effects on surrounding ecosystems has been limited or inconsistent.

A key driver for the development of the Coastal Marine Management Plan is the desire to establish standard objectives to guide consistent and compatible flood and erosion management approaches on both public and private properties.

There are many initiatives working to address marine management issues across the region. For example, the District is a participant in the Átl'ka7tsem/Howe Sound Biosphere Region Initiative. Átl'ka7tsem/Howe Sound received formal UNESCO Biosphere Region designation on September 15, 2021. The proponents of this initiative have worked collaboratively with stakeholders such as local governments and non-governmental organizations to encourage sustainable development, biodiversity, conservation, reconciliation, diversity and inclusion for the Squamish Nation and other communities in Howe Sound. The Initiative has also sponsored the creation of the Howe Sound/Átl'ḵa7tsem Marine Reference

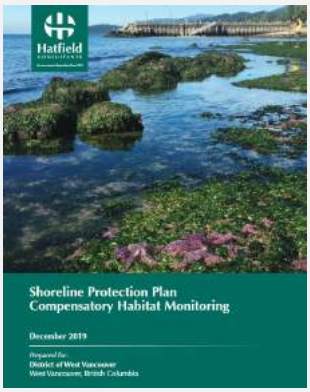
Guide which will be a valuable tool for the District and will support informed decision-making for coastal marine management and community education.

Over the past two decades, the District has led a number of planning initiatives to support more nature-based or "soft" approaches for coastal management that protect built assets and property while preserving environmental habitats and services.

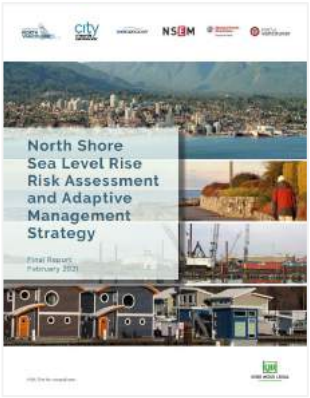
Past and ongoing coastal management planning initiatives include:

Ambleside – Dundarave Long Term Shoreline Planning Framework (March 2005) - This report summarizes key issues and recommended actions for coastal management between the Ambleside beaches and Dundarave Pier. The report was created by the citizen-led Engineering Advisory Committee and defines nine priority and core recommendations and over 32 specific projects with cost estimates. Area-specific issues, including a description of jurisdictional context, played a role in guiding the development of objectives and recommendations in the Coastal Marine Management Plan.

Shoreline Protection Plan (2006 – 2015) - This plan set a proactive approach to provide natural, cost-effective shoreline protection measures. It was initiated in 2006 with a goal to *"re-create and foster natural processes to sustain a naturally resilient and healthy shoreline, to address the impacts of development, climate change and sea level rise"*. The plan identified a set of "ready-to-go" shoreline protection pilot projects to be implemented between 2008 and 2011, with a new list of projects defined as part of the 2012 update to the Plan. Many of these pilot projects have since been implemented and have paved the way for privately funded shoreline protection projects to further strengthen the networks of shoreline protection work across the District. The Shoreline Protection Plan set the foundation for developing the Coastal Marine Management Plan to establish a vision and framework to guide future shoreline management projects.



Shoreline Protection Plan Compensatory Habitat Monitoring (2019) – This study summarizes findings from site investigation and monitoring to understand potential impacts from Shoreline Protection Plan project implementation on coastal habitat. The Study considered impacts to fish habitat, riparian planting health, and the environmental stability of four study locations: Marr Creek Channel, 18th Street Rock Mounds, Lawson Pier Drift Sill, and Ambleside Drift Sill. The study made recommendations for how the District could further incorporate habitat enhancement features into future shoreline protection works to support the District's ongoing initiatives for prioritizing nature-based approaches in coastal areas.



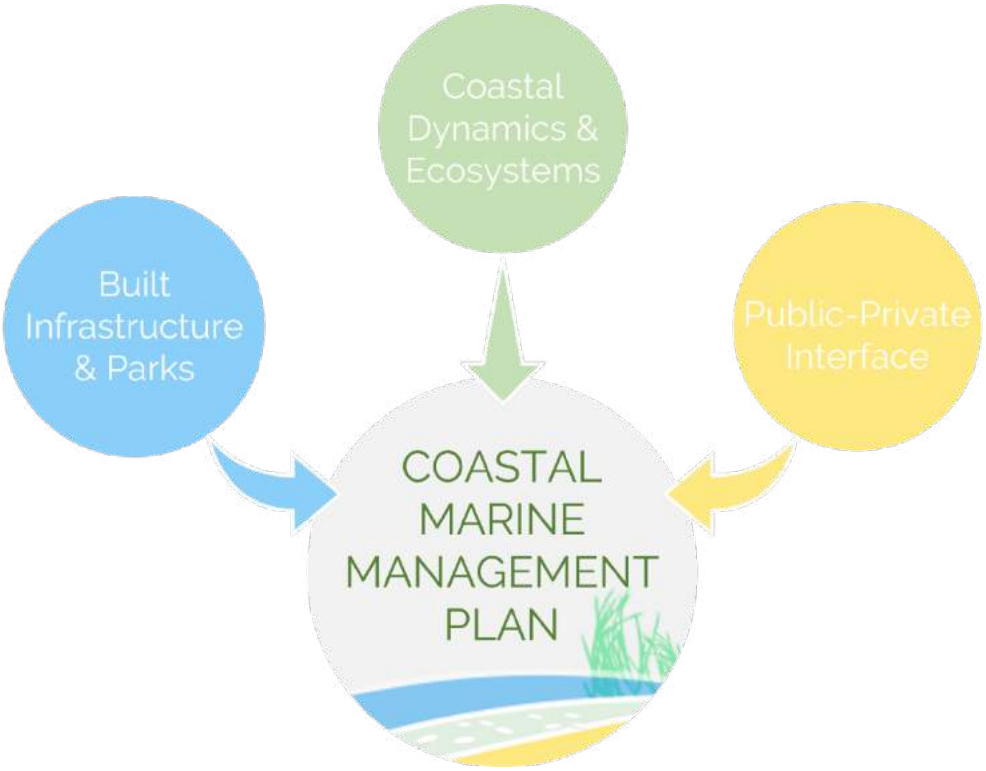
North Shore Sea Level Rise Strategy (2021) - The District was an active partner in developing a strategy to address sea level rise across the North Shore. Other partners in the project include the District of North Vancouver, City of North Vancouver, Squamish Nation, Vancouver Fraser Port Authority, and North Shore Emergency Management. Strategy development involved sea level rise flood mapping, a consequence and risk assessment to define priorities for adaptation and defining key resources and guidance for adaptation planning. It sets a vision, guiding principles, and framework for North Shore partners to continue working together to adapt to sea level rise in a way that is coordinated and compatible across jurisdictional boundaries. This Coastal Marine Management Plan builds on the findings and recommendations in the Strategy to support ongoing alignment and collaboration between North Shore jurisdictions.

Coastal Planning and Preparation of a Foreshore Development Permit Area Study (2020)

The District's Planning and Development Services Department carried out a coastal planning study and coastal flood mapping to inform planning and adaptation action along West Vancouver's coastline. The study recommended updates to the District's flood construction levels, the creation of a Foreshore Development Permit Area, and other site-specific measures to build coastal resilience to sea level rise and coastal flooding.

4. THE PLAN

This Coastal Marine Management Plan outlines a framework and direction recommended by the Working Group to guide coastal management in the following three, interrelated policy areas:



Each policy area is described in the sections below with information on the context, key issues and objectives, and a list of recommended actions for the District to draw from to guide coastal management over the next 10 to 20 years.

A COASTAL DYNAMICS AND ECOSYSTEMS

The Coastal Dynamics and Ecosystems policy area outlines objectives and recommended actions to manage hydrodynamic, geomorphic, and ecological processes (e.g., erosion, coastal flooding, sediment transport, intertidal area change) and to restore natural habitats for fish and wildlife, including rocky, cobble and sandy beaches, creek estuaries and riparian areas near the coast.

Natural processes and ecological protection and restoration are interlinked and must be managed in a coordinated way to draw on multidisciplinary expertise in coastal engineering, geomorphology, and marine and coastal biology.

Key Issues

The Working Group has identified the following key issues as a foundation for setting objectives and recommendations in the Plan:

- There is limited information on the status of much of the District coastline including bathymetric, ecosystem and archeological data, and the areas most vulnerable to sea level rise and storm surge hazards.
- Development pressure including shoreline hardening and modification, infrastructure protection and development, pollution from urban runoff, and increased recreational use in foreshore areas increase the demand for coastal management initiatives.
- Changes to sediment inputs from creeks and upland drainage as well as transport along the coast may affect natural coastal processes, beaches, and habitats.
- Climate change, including sea level rise and severe storm surges, will have a range of impacts on the coastal environment. These impacts may include increased coastal flooding, erosion, and intertidal habitat loss.
- Marine habitat quality and quantity is important to support natural ecosystems and biodiversity and can be reduced through a combination of the issues and dynamics described above.
- The District has limited in-house resources in the areas of coastal engineering and geomorphology, coastal marine management, and marine biology.
- Logs and other storm debris are a significant and repeated cause of damage to the District's coastline, natural assets, and waterfront infrastructure and piers. Log debris, however, may also provide a form of natural erosion protection on some beaches.

Objectives

The following objectives have been defined by the Working Group to guide the management of coastal dynamics and habitat preservation along the West Vancouver coastline.

Key Objective: Provide guidance to the District about the impacts of changing coastal dynamics and recommend adaptive measures to protect and enhance coastal areas, habitats, natural capital, and public and private property.

Supporting objectives include:

A.1.1. Appreciate and manage the natural attributes of the District's coastline to protect the recreational and ecological value for future generations.

A.1.2. Work with property owners and neighbouring jurisdictions to manage coastal erosion to preserve and enhance coastal ecosystems from species loss and degradation including the issue of intertidal habitat loss due to rising sea levels.

A.1.3. Provide a framework for the District to guide the implementation of the next stage of the Shoreline Preservation Plan projects.

A.1.4. Prioritize "soft", nature-based adaptation approaches such as those from the Green Shores Reference Guide for coastal management, where feasible.

A.1.5. Plan for the Province of BC's sea level rise projections of 0.5 meter by year 2050, 1.0 meter by 2100 and 2.0 meters by 2200. Recognize that sea level rise will occur over a long period of time, allowing some adaptation approaches to be implemented through multiple phases.

A.1.6. Maintain or restore sediment transport pathways to effect sediment accretion along the shoreline and to create new habitat and coastline protection.

A.1.7. Work with neighbouring jurisdictions to enhance coastal habitats over time through restoration actions that will achieve a net environmental gain and contribute to overall ecosystem recovery.

A.1.8. Undertake monitoring programs for past and future coastal projects and consider opportunities for partnerships with neighbouring jurisdictions.

A.1.9. Value coastal areas as important natural assets that provide ecosystem services and benefits as part of the capital assets of the District.

Recommended Actions

The Working Group recommends the following actions that the District may choose to take to support and implement the Coastal Dynamics and Ecosystems objectives set out above. These actions have been grouped by the recommended implementation timeline.

Short Term

A.2.1 Retain the services of an experienced coastal engineer and marine biologist to:

1) review information in the recent coastal assessments completed for the North Shore Sea Level Rise Strategy (2021) and West Vancouver Coastal Planning Study (2020);
2) complete a vulnerability assessment of the District coastline to identify the current location and condition of important intertidal and subtidal habitats such as eelgrass, kelp forests, and forage fish spawning beaches to determine those in need of adaptation due to climate change impacts;
3) evaluate the effectiveness of the work undertaken by the District since 2008 (Shoreline Preservation Plans 2005–2011 and 2012–2015) in providing coastal protection and habitat enhancement;
4) evaluate the "Future Projects" in Section 2 of the "Shoreline Protection Plan 2012–2015" to determine which projects to be undertaken by the District; and
5) based on the assessment in (4) above, determine the priority of implementation for the projects in Section 2 of the "Shoreline Protection Plan 2012–2015" to be undertaken as well as any other recommended coastal management approaches for implementation in the near and longer term.

A.2.2 For each project undertaken, specific plans for implementation should include:

1) an assessment of the materials and costs required for implementation;
2) opportunities to collaborate with other stakeholders, communities, jurisdictions, and volunteer groups for shared costs, donated materials, and expertise; and
3) identification of possible funding sources.

A.2.3 Adopt a process to obtain necessary archaeological information:

1) Consult District and BC Archaeology Branch resources to collate existing archaeological information about the District coastline and update the information on an ongoing basis; and
2) Retain the services of an archaeological professional to conduct archaeological due diligence. Each archaeological due diligence assessment should be completed in collaboration with local First Nations. Incorporate the information from the due diligence assessment into the planning process for each project.

A.2.4 Due to the high value of the coastline to West Vancouver, the District is encouraged to build staff expertise and resources in coastal marine management and marine biology (e.g., staff, training).

A.2.5 Work with other coastal communities to formulate a resolution for the Union of British Columbia Municipalities (UBCM) to manage logs and forestry debris entering the Strait of Georgia, including identifying possible funding sources such as the forest industry, Ministry of Forests, etc.

A.2.6 Consider obtaining up-to-date, high-resolution topographic (above sea level) and bathymetric (below sea level) data of the coastline over time through LIDAR, side scan sonar, or other methods.

Medium Term

A.2.7 Communicate District support in writing to the Provincial Government for the development of a province-wide Coastal Marine Strategy, or similar legislation, to provide a consistent approach to coastal management across B.C.

A.2.8 Incorporate an assessment of surface soils and estimates of sediment loads discharged onto the foreshore by creeks and storm drains in existing and new District Integrated Stormwater Management Plans (ISMPs) to maintain or restore sediment transport pathways and allow for sediment disposition and accretion on the shoreline.

A.2.9 During re-development or enhancement or diversion projects at creek mouths, require that suspended sediment is captured and redirected to the foreshore for accretion, where feasible and appropriate.

A.2.10 Define and implement best management practices for coastal erosion mitigation and to enhance ecosystems using evolving scientific and engineering information.

A.2.11 Offset intertidal habitat loss due to coastal squeeze through habitat creation and enhancement, where feasible.

A.2.12 Prioritize the use of climate-resilient plant species and “soft” approaches for bank protection and habitat enhancement in the management of waterfront parks and public lands in alignment with the Green Shores Reference Guide.

A.2.13 Establish regular monitoring programs to assess the effectiveness of coastal management projects including biophysical and topographic surveys to accurately track changes to the foreshore and to monitor the impacts.

Long Term

A.2.14 Incorporate Coastal Marine Management Plan Working Group recommendations into implementation of the Ambleside Waterfront Plan, the Ambleside Park Master Plan, and future development permit area regulations affecting the coastline.

A.2.15 Research and apply for funding for coastal projects from governmental and non-governmental sources where possible and investigate long-term financing strategies to implement the measures needed to protect and enhance the District coastline.

B BUILT INFRASTRUCTURE AND PARKS

The Built Infrastructure and Parks policy area outlines objectives and recommended actions to manage and protect existing built infrastructure, park assets, and natural assets against impacts from climate change and changing coastal dynamics.

The District is responsible for managing a broad array of utilities, public facilities, parks, and natural assets, many of which are located in or are connected to waterfront areas and provide critical services across the District. Over the coming decades, much of this waterfront infrastructure will be threatened by sea level rise and impacts from increased storm activity.

Waterfront infrastructure assets managed by the District include watermains, sanitary sewers, and storm drains. Non-District owned infrastructure is also located along the coast. In Horseshoe Bay, along the Centennial Seawalk, and in Ambleside Park, lies Metro Vancouver's sewer interceptor system leading to the Lions Gate Wastewater Treatment Plant. The CN Rail line runs from the Capilano River to Dundarave. All of these assets will be affected by sea level rise and storm surges.

There are numerous well-used parks and natural assets on the foreshore from Horseshoe Bay to Ambleside. Natural assets refer to natural features along the coast, such as beaches, marine habitats, and wetlands, that provide important ecosystem services. Waterfront park facilities include public washrooms, playgrounds, piers, and other structures owned and managed by the District. The District also manages a network of waterfront seawalls, pathways, and beach access points, which may be at risk of damage from changing coastal dynamics.

Many of these assets were constructed years ago without the benefit of a coastal engineer or a coastal management master plan. The result has been that some of the works, particularly those directly on the foreshore, have caused erosion of protective beaches or adversely affected shoreline values and functions. Many of this older infrastructure has not been formally surveyed or assessed to determine their current condition.

The way the District manages and builds infrastructure and park facilities can cause harm to marine ecosystems and habitats, which are also facing pressures from a changing climate, and ongoing growth and development in the region. Coastal hazards that need to be taken into account include storm surge and sea level rise that will cause coastal erosion and threaten existing infrastructure and park facilities. The District is working to integrate the anticipated effects of climate change as it manages its waterfront infrastructure so that it may enhance and benefit from, rather than harm, marine ecosystems.

Key Issues

The Working Group has identified the following key issues as a foundation for setting objectives and recommendations in the Plan:

- There is limited information on existing infrastructure in coastal areas, including asset condition, vulnerability to coastal and climate change hazards, and how critical each asset is for delivering essential community services.
- Extreme flows in creeks could increase flood and erosion risk in coastal areas, particularly at creek estuaries. This damage could be significant if high creek flows occur concurrently with high coastal water levels (e.g., annual highest tides).
- Potential future damage to infrastructure (e.g., sanitary sewers, pump stations, and storm drains) from coastal hazards (e.g., storm surge, waves, and sea level rise) could disrupt the delivery of community services. This is particularly true for buried infrastructure near foreshore areas (e.g., sewers between 27th and 28th streets).
- Some of the District land and infrastructure in waterfront areas is owned or controlled by others, which may pose challenges for management and upgrades.

Objectives

The following objectives have been defined by the Working Group to guide the management of infrastructure, parks, and natural assets along the West Vancouver coastline.

Key Objective: Manage built infrastructure and park facilities to be resilient to coastal hazards, to be well-maintained and to provide reliable services.

Supporting objectives include:

B.1. 1 Consider a risk-based approach to prioritize the planning and design of future infrastructure and parks projects in coastal areas.

B.1.2 Refer to the most up-to-date information on the condition of waterfront infrastructure to enable informed management and decision-making.

B.1.3 Establish measures to protect existing infrastructure and utilities and consider the possible relocation of infrastructure assets in flood and erosion-sensitive areas.

B.1.4. Draw on the best available coastal science, engineering and management practices when planning for the maintenance, improvement, or replacement of waterfront infrastructure.

B.1.5. Protect and enhance public access to waterfront parks, trails, beaches, and beach access paths.

Recommended Actions

The Working Group recommends the following actions that the District may choose to take to support and implement the Built Infrastructure and Parks objectives set out above. These actions have been grouped by the recommended implementation timeline.

Short Term

B.2.1 Draw on information about sea level rise and coastal flood levels from the North Shore Sea Level Rise Strategy (2021) and West Vancouver Coastal Planning Study (2020) to identify high-risk areas and prioritize infrastructure upgrade projects.

B.2.2. Where record drawings exist, survey buried linear infrastructure (e.g., sanitary sewers, watermains, storm drains) located near the foreshore to determine potential beach erosion or accretion since construction, and to establish a baseline for future surveys. Surveys should include the measurement of beach elevation over the pipe and depth-of-cover over top-of-pipe.

B.2.3. Survey the elevation of wastewater pump stations and sewer manholes located on or near the foreshore to determine if sea level rise and storm surge could flood and/or damage the stations and manholes. Also evaluate pump station backup power supply including its protection from sea level rise and storm surge.

B.2.4. Where formal design or record drawings are absent, conduct a survey of existing District-owned seawalls and groynes to determine top elevation, beach elevation, and location relative to property lines.

B.2.5. Update existing asset inventory information for all infrastructure in waterfront areas, particularly those in the highest risk areas.

Medium Term

B.2.6. Establish an ongoing erosion monitoring program to determine erosion rates near infrastructure assets (e.g., sanitary sewers along the waterfront).

B.2.7. Identify adaptation options available to prepare for and mitigate the impacts of sea level rise and storm surge on waterfront infrastructure assets and facilities.

B.2.8. Protect waterfront parks, trails, beaches, and beach access paths by designing and constructing future flood and erosion mitigation works that preserve and promote public access with due consideration to environmental issues.

B.2.9. In locations of shared jurisdiction (e.g., Ambleside Park and Centennial Seawalk, and the Pacific Science Enterprise Centre), develop collaborative strategies to share costs for projects related to assessing risks from sea level rise and storm surge and implementing adaptation measures to mitigate those risks.

B.2.10. Complete structural assessments of District-owned piers including study of the anticipated impact of sea level rise and storm surge.

B.2.11. Incorporate the accounting of coastal natural assets (e.g., beaches, rocky waterfront and intertidal areas) into the District's asset management system where they can be monitored to the same standard as other assets.

Long Term

B.2.12. Encourage the adoption of eco-certification programs for marinas, parks, and local municipal beaches, such as Blue Flag, Green Marina, Clean Marine, or Salmon-Safe.

B.2.13. Explore the possibility to advance green stormwater infrastructure strategies on public and private land (including in coastal areas) which provide rainwater management, reduce urban flooding, and support additional co-benefits such as biodiversity conservation.

B.2.14. Refer to Coastal Marine Management Plan Working Group recommendations whenever work is done on public lands in coastal areas.

C PUBLIC-PRIVATE INTERFACE

NOTE TO THE READER

During the Working Group's tenure, the District initiated research on creating a Foreshore Development Permit Area (FDPA). This FDPA work proceeded alongside the Coastal Marine Management Plan work. At time of final drafting of the CMMP, the District introduced the FDPA concept to Council in June 2021. As work was continuing on the FDPA at time of final drafting of the CMMP, the Working Group is keeping their recommendations for Public-Private Interface as drafted to support the District in its FDPA work.

The Public-Private Interface area outlines objectives and recommended actions to guide the management and development of private properties on the waterfront in order to reduce risk on private lands and to minimize negative impacts to neighbouring properties, habitats, and public lands.

West Vancouver' coastline has attracted steady and significant development over the past century. While the District manages a number of municipal parks and infrastructure rights-of-way, most of the waterfront above the high tide line is privately owned.

Properties along the waterfront are vulnerable to flooding from sea level rise, storm surge events and increasing rates of erosion. Private property owners are responsible for implementing and maintaining flood and erosion protection on their lands and must meet design standards and requirements laid out by District policies, including development permit areas, zoning, and building bylaws. These responsibilities and requirements are typically applied to new developments and construction.

Key Issues

The Working Group has identified the following key issues as a foundation for setting objectives and recommendations in the Plan:

- A large portion of the waterfront is privately owned and there are diverse and potentially competing values between public and private interests that may affect opportunities for collaboration between neighbouring owners, the District, and other key actors including utilities.
- Public and private responsibilities, rights, liabilities, and risks associated with properties in waterfront areas are not well understood. Whether costs associated with a changing environment should be borne by the private landowner or the tax base as a whole has not been determined.
- Private property owners have undertaken a variety of measures to protect waterfront areas from coastal hazards, which in some cases has resulted in negative impacts on neighbouring properties, habitats, and disrupted natural sediment transport processes.
- There is a need for clearer communication from the District to developers and private property owners and recreational users regarding roles, responsibilities, standards, and best practices for coastal management.

Objectives

The following objectives have been defined by the Working Group to guide coastal management at public-private interfaces along the West Vancouver coast.

Key Objective: Establish and clearly communicate property owner responsibilities for coastal management on private property to enable owner-led initiatives with limited impacts on adjacent properties and coastal habitats.

Supporting objectives for this policy area include:

C.1.1 Require future development to incorporate the most up-to-date information about coastal hazards, climate change, and risk exposure.

C.1.2 Restrict any future new private development or re-development within flood hazard that does not include best prtactices, at owners' cost.

C.1.3 Public access to the waterfront should not be diminished by sea level rise. Actions taken by private property owners to mitigate impacts to their property should not limit or reduce public access.

C.1.4 Evaluate opportunities for the District to acquire private lands to promote land uses that can accommodate or mitigate risk (e.g., parkland, wetlands) and to preserve access to beaches as sea levels rise.

C.1.5 Encourage habitat restoration and enhancement activities on private lands in areas with high ecological value along shorelines, bluffs, and creeks through education and if feasible, possible financial incentive programs.

Recommended Actions

The Working Group has recommended actions that the District may choose to take to support and implement Public-Private Interface objectives. These recommended actions include:

Short Term

C.2.1 Draw on findings from the West Vancouver Coastal Planning Study (2020) and North Shore Sea Level Rise Strategy (2021) to:

1) determine coastal sub-areas, or "local service areas", that may require community flood management planning instead of individual property-level development management. Designations of risk should be based on site-specific erosion and flood vulnerability assessments that categorize local service areas as low to high vulnerability;

2) develop and implement a sea level rise planning area and coastal / foreshore development permit area to guide flood construction levels (FCLs), shoreline setbacks, and other floodproofing measures (e.g., site grade/drainage, mechanical/electrical systems, access/egress, etc.) in a consistent manner;

3) consider classifying the shoreline into areas of similar coastal hazard exposure (particularly for erosion, storm surge and habitat loss); and

4) consider methods to avoid situations of significantly conflicting FCLs in neighbouring properties; for example, this could be achieved through prescribing the general methods to be used for calculating FCLs and identify the preferred development-shoreline strategies (e.g., Green Shores beaches, sea walls, natural enhancements, etc.).

C.2.2 Provide waterfront property owners and potential purchasers notice of potential risks of flooding through notations on title under Section 219 of the *Land Title Act* or Section 503 of *the Local Government Act.*

Medium Term

C.2.3 Retain legal counsel to provide a jurisdictional and liability analysis that reviews existing agreements (e.g., Head Lease, water lot leases) and provides an opinion on the District's legal liability related to coastal hazards and potential land tenure issues related to a changing natural boundary due to sea level rise.

C.2.4 Once the impact of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and of Bill 41-2019 the Province of BC's Declaration on the Rights of Indigenous Peoples Act is known, the District should identify an appropriate approach to reflect those Declarations in its Coastal Marine Management work.

C.2.5. Establish land use and building floodproofing construction requirement policies for existing (zoned and approved prior to knowledge or after knowledge) and future developments. Policies should use the precautionary approach and support planning on an environmental/floodplain basis and exposure to risk.

C.2.6. Create bylaws requiring low environmental impact design, construction and maintenance techniques for docks, wharves, and other similar structures on the shoreline or in the ocean (e.g., encourage encapsulated foam docks and avoid docks that damage eelgrass beds, forage fish spawning beaches, or other sensitive ecological habitats).

Long Term

C.2.7 Consider opportunities to acquire waterfront parkland and/or use existing District waterfront lands in flood hazard areas to reshape and enhance future intertidal habitat, manage coastal risk, and preserve access to the waterfront.

C.2.8 Consider how local government power under Section 210 of the Community Charter to approve local area services may support the creation of neighbourhood scale sea level rise adaptation projects to protect waterfront properties while providing improved public beach access and environmental benefits (e.g., improved backshore vegetation).

5. PLAN IMPLEMENTATION

The Coastal Marine Management Plan aims to provide a foundation to guide future decision-making and coastal management projects. This section provides guidance to support the implementation of the Plan, including potential funding strategies, collaboration initiatives, project evaluation criteria, and approaches for measuring success and updating the Plan as needed over time.

5.1 FUNDING APPROACHES

Many of the approaches for managing coastal hazards are expensive and should be approached strategically to find the most cost-effective and sustainable way forward. While some of the planning and policy measures may be integrated into existing programs and initiatives at relatively low cost, other options have significant costs such as structural measures to protect coastal areas from flooding or erosion.

Costs will be shared across the District – with private property owners paying for initiatives on their own property and West Vancouver taxpayers contributing to initiatives on public lands.

The Working Group has identified several funding strategies that the District can draw on to balance and offset the cost for coastal management, including:

- Access grant programs available from the federal and provincial governments, utilities, and non-profit organizations. The District should monitor grant opportunities and design initiatives to meet grant program objectives wherever possible. For example, grant programs include the Federal Disaster Mitigation Adaptation Fund and Investing in Canada Infrastructure Program, the UBCM Community Emergency Preparedness Fund, Gas Tax Fund, Green Municipal Fund, and BC Housing Grants.
- Establish a Natural Capital/Environmental Levy Fund that provides a reserve for managing District natural assets, including those in coastal areas. To support this, the District would first need to lead a valuation of natural capital assets to determine the reasonable cost for maintaining the important ecosystem services they provide.

- Establish a sea level rise foreshore protection Reserve Fund as part of the District's Natural Capital/Environmental Levy. While most coastal management initiatives involving large scale capital works may not be required for many years, significant public investments will be required when the time comes. By establishing a designated reserve for coastal projects, the District can prepare for this future investment so that the burden of climate change adaptation is shared among generations.
- Integrate sea level rise costs and projects into District capital and operating budgets going forward. Sea level rise will continue to have an impact on waterfront infrastructure, coastal habitats, and private property.
- Form cost-sharing agreements with neighbouring groups for initiatives with shared benefits, including neighbouring communities, industry and property owners, academic organizations, community non-profit groups, or other special interest groups. This could involve an agreement to cover costs from own sources, or through application to applicable grant programs, which often value regional or collaborative initiatives. In cases where external groups fully fund initiatives at no cost to the District, the District should be involved in the initiatives to support the group and ensure project outcomes align with District policies and objectives.
- Create a framework and clear expectations for developer or property-owner funding. This could be done through community benefit contribution requirements for new development or setting clear development permit and building bylaw requirements for flood protection, erosion management, and floodproofing standards.

5.2 COLLABORATION & ENGAGEMENT

The District of West Vancouver has a long history of collaboration with neighbouring communities, utilities, and volunteer groups on coastal management and restoration. The District's active role in the North Shore Sea Level Rise Strategy (2021) is just one recent example and sets a foundation for ongoing collaboration around flood protection and coastal management work.

Collaboration between District departments and with external groups will support the successful implementation of this plan, particularly in areas with overlapping jurisdiction. Building awareness among property owners and the general public about their rights, responsibilities, and the importance of sustainable coastal management is also critical for the effective management of lands in waterfront areas.

Working Group members have recommended the following approaches to encourage increased collaboration and meaningful engagement between staff departments and with neighbouring governments, stakeholders and the public:

- Enhance cross-departmental sharing of information in areas of overlapping authority such as new coastal marine policies, development, parkland, beach access, marinas, piers, and other infrastructure.
- Make use of the services of local engineering and environmental firms with the requisite experience and collaborate where appropriate with local universities and the Pacific Science Enterprise Centre to develop solutions to practical problems arising out of coastal marine management in West Vancouver.
- Create a "Coastal Dynamics" or "Coastal Marine Management" volunteer advisory group comprised of knowledgeable members of the community whose expertise can be called upon when required to consider proposed coastal marine management projects and/or future coastal management projects. Possible expertise could include a coastal engineer and/or a construction engineer, a marine biologist, etc.
- Collaborate with senior government agencies, such as Fisheries and Oceans Canada and the Canadian Hydrographic Service.
- Continue to work in partnership with volunteer groups and citizens on coastal management projects, where possible. Such collaboration encourages community involvement and allows the District to maintain control of projects and to ensure that liability issues are addressed as appropriate under the Head Lease. The manner of collaboration will be determined by the type of project and groups involved.

- Continue to work with non-profit groups to support regional studies and initiatives. In the past, the District has worked with the Howe Sound Biosphere Project, Ocean Wise Conservation Association, Burrard Inlet Action Group, North Shore Sea Level Rise Committee, and Howe Sound/Átl'ḵa7tsem Marine Reference Guide Group.
- Collaborate with neighbouring local governments, First Nations, and utilities, to develop shared strategies and projects to mitigate damage from coastal and climate change hazards to their infrastructure and lands that are adjacent to District assets (e.g., Squamish Nation, Tsleil-Waututh Nation, Vancouver Fraser Port Authority, CN Rail, Metro Vancouver, Federal Government).
- Collaborate with local First Nations on environmental science and stewardship initiatives in Burrard Inlet, including through the new Burrard Inlet Environmental Science and Stewardship Agreement signed by Tsleil-Waututh Nation and the Federal Government.
- Share information about the risk of sea level rise on the District's website and through notations on title under Section 219 of the *Land Title Act* for high risk properties to ensure notice to potential purchasers.

- Develop user-friendly educational materials and web content for the general public to build an understanding of coastal and climate change hazards, the importance of habitat conservation, and the role recreational users play in managing these hazards in an ecologically sustainable way.
- Lead a targeted awareness campaign communicating directly with potential high to low risk property owners to clarify responsibilities, liabilities, insurance, and resources for erosion and flood protection work. As part of this, add targeted web content to build property owner understanding about owner responsibilities for managing impacts on private property, existing standards and regulations, risk management, and the importance of protecting adjacent coastal habitat.

5.3 INITIATIVE DESIGN & EVALUATION CRITERIA

The Coastal Marine Management Plan outlines a set of objectives to guide the design and implementation of future coastal management initiatives in the District. In addition to these objectives, a set of evaluation criteria is proposed to support District staff in reviewing, selecting, and fine-tuning preferred coastal management initiatives.

The evaluation criteria are consistent with the criteria outlined in the North Shore Sea Level Rise Strategy (2021) and include the following seven criteria to consider when selecting and designing coastal management initiatives:

1. Risk Reduction Effectiveness: What magnitude of risk reduction is achieved through implementing this initiative? Does this initiative increase risk elsewhere or for particular sectors?
2. Uncertainty Tolerance: Does this initiative continue to effectively reduce risk with changing sea level rise projections? If projections increase greatly, is the approach still effective? Are there fail-safe measures if this initiative fails?
3. Environmental Impact/Benefit: Does this initiative have a positive or negative impact on the surrounding aquatic and terrestrial environment? Are there opportunities for environmental co-benefits such as carbon sequestration, habitat creation, or other environmental gains?
4. Social Impact/Benefit: What are the social impacts of this initiative? Are there groups of people that are disproportionately burdened by, or benefit from, this initiative?
5. Economic Impact/Benefit: What are the economic implications of this initiative? How does it impact the local jurisdiction (e.g., tax base), neighbouring jurisdictions, the local business community, and the regional or national economy?
6. Cost: How much does the initiative cost (capital and maintenance) compared to other initiatives? Do the benefits outweigh the costs? What funding streams can the partners draw upon to fund this initiative?
7. Phasing: Can the initiative be implemented gradually over time or does it need to be constructed all together? What is the impact or risk if the initiative is only partially completed by the targeted service date? What control does the local jurisdiction have over ensuring completion of the initiative by the service date?

5.4 IMMEDIATE NEXT STEPS

The Coastal Marine Management Plan has been developed under the leadership of the Working Group, with input from District Council and staff. Successful implementation of this pan will require it to be communicated broadly across District departments so that its objectives can be integrated into ongoing and future initiatives across the organization.

The Working Group recommends the following short-term actions to support implementation and successful integration of the Plan into District operations:

1. Present the final plan to Council for input and approval as a guidance document that Council and staff can draw on to inform future decision-making.
2. Hold a meeting with senior managers within District departments to share the Plan and discuss strategies to integrate these objectives into ongoing and future initiatives. The importance of cross-departmental sharing of information on specific project proposals that may be affected by coastal dynamic hazards that may have an ecological impact cannot be over emphasized.
3. Assign a District staff member to participate in ongoing regional collaboration efforts for sea level rise adaptation, and to be responsible for the coordinated implementation of the Plan's recommendations with periodic reporting to Council.
4. Create educational materials for the public generally, and for private property owners specifically, to build their understanding of:

    - sea level rise, climate hazards, and coastal dynamics;
    - the importance of preserving ecological habitats; and
    - the responsibility for managing coastal hazards on private property.

    These materials could include mail-outs, brochures, interpretive signs in waterfront parks, and updates to the District's website with links to relevant bylaws, standards, reports relating to coastal management, planning documents (e.g., this plan, the Coastal Planning Study, and the North Shore Sea Level Rise Strategy), and information about ongoing initiatives.

5.5 REVIEW & UPDATE

The content and direction in this plan should be reviewed by District staff every five years to consider whether updates are required to align with new community priorities and contexts. When an update is needed, the District should establish a citizen working group of residents with an interest and background in coastal dynamics and ecosystems to inform updates to the Plan.

SCHEDULE A – GLOSSARY

Accretion	The deposition of sediments by natural forces as in the addition of sand, silt, or other material to a beach by ocean currents or streams.
Bathymetry / Bathymetric	Measurement of depth of sea water.
Adaptive Management	A structured process of improving decision making and practices in the face of uncertainty by using monitoring to learn from project outcomes and make adjustments over time.
Best Management Practices	Generally agreed upon procedures, activities, or prohibition of activities which have been determined to be the most effective means of reaching a desired outcome and/or ensuring compliance with guiding legislation, regulations, or policies.
Biodiversity	The number of different species contained within a habitat or ecosystem.
Biophysical	Describes the combination of abiotic and biotic features that characterize an ecosystem or site such as the geology, soils, vegetation, plant and animal species, and habitat types present.
Coastline	Broad term referring to the entire length of shoreline, including natural systems and developed areas.
Coastal Dynamics	Coastal sediment transport and erosion.
Coastal Squeeze	Intertidal habitat loss arising from the high water mark being fixed by a defence such as a cliff or wall and the low water mark migrating landwards as a result of SLR.
Erosion	The removal of sediments or materials from a beach by natural forces such as waves and currents.
Fetch	Area of water surface over which the wind blows in an essentially constant direction, thus generating waves. The term is also used as a synonym for fetch length, which is the horizontal distance over which wave generating winds blow.
Fish Habitat	Area providing spaces or resources for fish, which may include spawning substrates, riparian habitats which contribute insect food and the intertidal zone which is periodically available.
Floodplain	An area of low-lying ground adjacent to a river or ocean that is subject to flooding.
Foreshore	The area of shoreline specifically located between the high water mark and the low water mark. This is synonymous with “intertidal area”, defined below.
Geomorphology	Study of the physical landforms, including their origin, evolution, form, and distribution on the surface of the Earth.

Hardened Shoreline	"Hard" risk mitigation or adaptation approaches that tend to rely on more traditional engineering design and don't incorporate significant nature-based approaches. "Hard" approaches could include sea walls, bulkheads, or other concrete or rock structures built for shoreline protection.
Hydrodynamic	Forces exerted by water on the shoreline.
Intertidal Area/Zone	The area of shoreline between the high water mark and the low water mark. This is synonymous with "foreshore", defined above.
Local Area Service	A local area service is a municipal service that is to be paid for in whole or in part by a local service tax of residents within the service area, as allowed under section 216 of the Community Charter.
Naturalization	To make more natural or bring into conformity with the natural environment.
Precautionary Approach	An approach to innovations with potential for causing harm when adequate scientific knowledge is lacking.
Riparian	The vegetated zone along shorelines and the banks of watercourses – important to the ecology of aquatic and marine environments.
Riprap	Human-placed stone or rock used to protect shorelines or other structures from erosion.
Sea level	The elevation of the water surface of the ocean at a location and time. Sea level varies due to several processes within a wide of timescales. This includes astronomical tides which occur daily, weather and storm events which occur seasonally, and climate and geologic processes with scales spanning from centuries and longer.
Sea Level Rise (SLR)	The gradual rise in the base sea level due to various processes including thermal expansion of the oceans and loss of glaciers/land ice caused primarily by anthropogenic factors, which have significantly increased the level of greenhouse gases within the atmosphere.
Sediment Transport	The movement of sediment by waves, currents and watercourses to the shorelines and the movement on the shore by waves and currents.
Soft Shoreline	"Soft" risk mitigation or adaptation approaches that use bioengineering, vegetation, natural substrates, or other low impact measures to reduce to stabilize shorelines against erosion while maintaining or improving natural habitats.
Storm Surge	The temporary rise in water level due to weather processes including atmospheric pressure changes, not including wind and wave effects.
Subtidal	The area of shoreline below the low water mark which is always covered by water.
Waterfront	General term used to refer to developed areas along the shore.
Wave Run Up	Maximum vertical extent of wave up rush on a shore or structure above still water level.

SCHEDULE B - HISTORICAL SHORELINE PROTECTION PLANS

The executive summaries of the 2012-2015 Shoreline Protection Plan and the 2005 Ambleside-Dundarave Long Term Shoreline Planning Framework are below. Complete copies of these documents are available from the District of West Vancouver.

2012-2015 Shoreline Protection Plan

EXECUTIVE SUMMARY

During a single heavy rain event in the winter of 2007, McDonald and Lawson Creeks deposited over 600 m^3 of sand, gravel and cobble onto the shore of West Vancouver, with an estimated value of over $250,000. Prior to West Vancouver's Shoreline Protection Plan (SPP) these sediments would have been swept away by waves and tidal currents resulting in the increased erosion of the District's biggest public amenity – the Waterfront.

While the 2007 rain event was relatively unique in its order of magnitude, the process of erosion and deposition occurs 24 hours a day, seven days a week, forever. When these processes produce a stable foreshore a more balanced ecological system, with diverse plant and animal communities can flourish. At present, the West Vancouver shoreline is not stable.

The growth of West Vancouver has seen the 'urbanization' of its waterfront and watersheds resulting in the hardening of shorelines with concrete and rip rap sea walls and the channelization of watercourses. These effects have unbalanced the sediment transport system that historically fed the shoreline causing an increase in sediment losses and a decrease in deposition. The result is an accelerating process of erosion with negative impacts to the environment and infrastructure. This damage to West Vancouver's shoreline is further exacerbated by the predicted changes in climate and rise in sea levels – estimated to be as much as 1 m in the next 100 years with increasingly severe and frequent storms[4]. Left unchecked, these processes acting in concert will continue to cause increased capital costs to repair and maintain West Vancouver's waterfront.

The publishing of the Engineering Advisory Committee's (EAC) 'Long-Term Shoreline Planning Framework' and the formation of the West Vancouver Shoreline Preservation Society (WVSPS) in 2005 were the catalysts for a move from more than 30 years of study to action, marked by formalization of a Shoreline Protection Plan (SPP). Utilizing the EAC framework the SPP created a workable, efficient and cost-effective list of tasks to begin the process of shoreline restoration and protection. The SPP is a living document that will evolve with the shoreline, directing available funds opportunistically to maximize restoration and protection values. The SPP represents the District of West Vancouver's commitment, laid forth in its mission statement and Official Community Plan, to protect and enhance one of its greatest natural assets.

[4] (Thomson, et al. 2008)

The first actions of the SPP were the creation of nine municipally funded pilot projects located between the Capilano Groyne and Navvy Jack Point. Although these projects varied in scale, cost and focus; each shared the key goals of providing improved shoreline protection from waves, reducing erosion, promoting sediment accretion, creating natural habitat and improving public amenities. Each project involved an array of coastal engineering and habitat enhancement strategies to restore sites to a more natural state and provide self sustaining 'soft' shoreline protection measures. Benefits realized include:

- reduced wave energy,
- more balanced sediment transport mechanisms,
- increased riparian, intertidal and subtidal biodiversity,
- improved creek access for salmon and spawning species,
- reestablishment of functioning surf smelt habitat ,
- increased public access through the installation of bridges and near-shore pathways,
- naturalization of the shoreline through removal of over 200 m of concrete sea wall, and,
- improved shoreline stability and high beach habitat through the accumulation of large woody debris and organic material.

The success of the pilot projects paved the way for five privately sponsored projects. Private stakeholder participation in the shoreline protection works demonstrates the potential for a more sustainable approach for the entire 30 km of West Vancouver's privately and publicly owned waterfront. Private works have resulted in more than $3 million of shoreline restoration work between Dundarave and Horseshoe Bay.

The constantly changing local and global environment requires the SPP to be a living document that is able to monitor and adapt to these changes. A process of regular (annual) evaluation of the goals, strategies and successes, and subsequent adjustment of the SPP will ensure the continued success of the shoreline protection works. In order to develop naturally sustaining systems, the SPP projects must be flexible in order to react opportunistically to available resources and take into account the long timelines associated with coastal processes. The evolution of the SPP is represented in its description of the current status of projects; it outlines new works and changes to existing projects in order to maximize shore protection and habitat benefits, including:

- tuning and adjustment of existing projects,
- new priority projects
- new long term projects
- privately funded projects.

Priority projects include the tuning and adjustment of existing pilot sites between Ambleside Pier and McDonald Creek, with the expansion of existing riparian habitat and reef structures and the creation or relocation of tombolo structures. The SPP 2012-2015 also extends shoreline protection westward to the area between Navvy Jack Point and Dundarave Pier, with strategic works planned at Marr Creek to promote sediment retention and reduce wave impacts. Larson Creek has been identified as a site in need of restoration, to improve access and habitat for fish, birds and other wildlife. The long-term projects continue to target subtidal contour realignment and habitat enhancement in order to support intertidal beach works, as well as adjustment of pier structures to restore sediment pathways along the shoreline. In addition to wave protection and habitat enhancement, the islet projects propose ocean-loop heat exchange systems to provide renewable energy and reduce green house gas emissions. Privately funded projects will continue to be based on previous shoreline successes and established whenever funding, materials and potential sites become available.

In order to afford greater public access to the SPP and its projects, information will be provided on the West Vancouver and WVSPS websites and the DWV's GIS (Geographic Information System). New communications and outreach initiatives and increased signage at the project sites will be used to share the vision of the SPP with waterfront users, to increase public awareness of the shoreline and the SPP.

This Shoreline Protection Plan 2012-2015 provides a description of the works completed to date, the challenges and their successes. It includes a description of projects for immediate consideration, potential improvements for existing projects and identifies new minor and major projects for the future. Like West Vancouver's shoreline, the SPP will forever evolve in response to changing circumstances and future issues. It is a document that describes the actions needed to create a sustainable waterfront for all that is natural, sustainable and ecologically productive.

2005 Ambleside – Dundarave Long Term Shoreline Planning Framework

EXECUTIVE SUMMARY

On July 5th, 2004 Council passed the following motion:

> *"Council authorizes the formation of an EAC subcommittee to prepare a report to the EAC with recommendations on action that can be taken by the Municipality to reduce erosion, preserve habitat and best manage maintenance costs for the Ambleside and Dundarave waterfront areas."*

The subcommittee has reviewed over twenty reports (dating back to 1963) and has discussed shoreline issues with District staff and interested specialists and agencies. Based on this review process the EAC has prepared the report that follows.

We Found:

- That no District department (Parks, Planning, Engineering) is accountable for preserving the long term integrity of the West Vancouver Shoreline.
- That recommendations from past reports to enhance the knowledge base related to coastal processes and aquatic habitat, to mitigate erosion and to enhance public access to the foreshore… have generally not been implemented.
- That shoreline structures (piers, groynes, seawalls, culverts) which intrude into the shore zone from Dundarave Pier to Ambleside were originally located without consideration to their impact on shoreline sediment transport and habitat values.
- That the foreshore relies on a supply of sediment discharged from creeks along the West Vancouver foreshore. These sediments naturally move from west to east. The piers and groynes between Dundarave and Ambleside alter and diminish the westerly transport of these sediments such that it is has been considered necessary to import sand from outside sources to maintain Ambleside beach.
- That: the seawalls on District and private property (many of which encroach on the inter- tidal zone); The 2 km rip-rap section between 24th and 21st Streets; and the concrete lock- block seawall east of Dundarave Pier… have eliminated original low gradient shoreline. These man-made works have steepened the upper shoreline resulting in accelerated erosion and impacts during storm events.
- That there is minimal opportunity for the public to safely access the waters edge between Dundarave Pier and 21st Street because of the lock-block and the uninterrupted rip-rap. In this section, natural habitat for fish, birds and aquatic plants has been lost or diminished due to erosion.

We believe:

- That improved awareness of West Vancouver's shoreline processes and environments is essential to enable a long term reduction of erosion and maintenance costs while enhancing environmental values.
- That the District's 1991 Waterfront Directions Study remains a sound investment that should be re-visited to review progress made and opportunities outstanding.
- That the District requires a "Long Term Shoreline Directions Plan" that will serve as a guidance document for all future activities along the Dundarave-Ambleside foreshore.
- That in order to responsibly prepare a "Long Term Shoreline Directions Plan" the District needs to commission studies that provide the knowledge base and analysis required to develop measures that will enhance both environmental and public use opportunities and provide long-term maintenance cost savings.
- That pilot projects should be constructed in the next few years to demonstrate to both the District and the regulatory agencies that subtle changes to the existing rip-rap works can reduce wave damage and provide enhanced fisheries habitat and public access. For example; create pocket beach by relocating existing rip-rap to offshore shallow reef and by placing boulders (from District building excavations) to form the beach, habitat and public access.

The EAC has formulated a list of more than 30 items warranting attention and action (see Appendix 1). The list requires review by staff and Council for prioritization and resource allocation. Some of the action items can be readily implemented at nominal cost while others require dedication of funding or resources.

We Recommend:

1) Priority Recommendation:

- That the District formulate a specific Three Year Initiative "Focus on the Shoreline" with the goal of addressing knowledge gaps and advancing shoreline pilot projects.
- That the District create a specific project budget for this initiative with a 50% allocation for advancing the knowledge base and the remaining 50% to fund tangible work to reduce maintenance costs and to construct pilot projects.
- That, in order to foster integration across departments, the District create a cross- departmental team with funding and deliverables split evenly between Parks, Engineering and Planning.

- That the District review progress after three years to assess ongoing action and priorities.

2) Core Recommendations

- That staff re-visit previous studies and particularly the 10 to 15 year implementation goals of the 1991 “Waterfront Directions Study” to review progress made and update approaches to enhance implementation, planning and knowledge base for the next 20 years.
- That the West Vancouver Geographic Information System and modelling tools address the negligible data currently shown for the District’s shore zone and work with other levels of government agencies and interested partners to advance the information base at least cost.
- That the District prioritize obtaining baseline information recommended herein or identified in previous West Vancouver District Reports over the next five years.
- That the District develop a cross departmental team with responsibility to develop a “Long Term Shoreline Directions Plan” that will not only address the issues of erosion control, habitat preservation and mitigation of maintenance costs but that will also serve as a guidance document for future activities that can impact the foreshore.