City of Campbell River

SEA LEVEL RISE PRIMER PART I

INTRODUCTION TO SEA LEVEL RISE, RISKS AND ADAPTATION METHODS

CAMPBELL RIVER

RISING SEAS

NOVEMBER 2018

STRUCTURE OF THE SEA LEVEL RISE ENGAGEMENT SUPPORT PROCESS

The Sea level rise Engagement Support Process is presented in four parts:

I. **Introduction to Sea Level Rise, Risks and Adaptation Methods** – a summary of why sea level rise adaptation is required, introduction to terms and local risks.

II. **Sea Level Rise Adaptation Best Practices** – a guide to common tools to address sea level rise adaptation in Campbell River, highlighting their strengths and challenges.

III. **Local Adaptation Options and Evaluation Process** – a summary of the evaluation process and proposed options to address sea level rise.

IV. **Sea Level Rise Strategy and Action Plan Recommendations** – Reporting on how sea level rise adaptation may be strategically integrated into ongoing city processes and redevelopment in Campbell River.

TABLE OF CONTENTS

STRUCTURE OF THE SEA LEVEL RISE ENGAGEMENT SUPPORT PROCESS I

1.0 PROJECT OVERVIEW 1

PURPOSE 1

WHAT ARE WE TRYING TO ACHIEVE? 2

2.0 SEA LEVEL RISE SCIENCE AND MANAGEMENT 3

FLOOD HAZARD POTENTIAL IMPACTS, TODAY AND FUTURE 4

PROVINCIAL GUIDELINES 5

WHY ACT NOW? 5

ADAPTATION AT TIME OF RECONSTRUCTION 5

SEA LEVEL RISE AND ADAPTATION TERMS 6

COASTAL AND INLAND FLOOD MANAGEMENT AREAS 8

3.0 TYPICAL APPROACHES TO ADAPTATION 10

ADAPTATION METHODS 10

ADAPTATION MENU AND SCALES 11

4.0 WHAT'S AT RISK IF NO ACTION IS TAKEN? 14

PAINTER BARCLAY 14

DOWNTOWN 16

SEQUOIA PARK (MARITIME HERITAGE CENTRE TO EVERGREEN) 18

WILLOW POINT AND SOUTH 20

5.0 WHAT'S NEXT 22

OPPORTUNITIES FOR INPUT 22

NEXT PRIMER 23

FOR MORE INFORMATION 24

CITY OF CAMPBELL RIVER WEBSITE LINKS 24

BACKGROUND INFO FROM OTHER SOURCES 24

BC ADAPTS VIDEO SERIES 24

CONTACT US 24

City of Campbell River

LIST OF FIGURES

FIGURE I-1: STUDY AREAS 1
FIGURE I-2: CAUSE OF SEA LEVEL RISE 3
FIGURE I-3: COASTAL SQUEEZE 4
FIGURE I-4: BUILDING ADAPTATION 5
FIGURE I-5: EXISTING CONDITIONS 6
FIGURE I-6: FUTURE SCENARIO 6
FIGURE I-7: ADAPTATION METHODS 10
FIGURE I-8: FLOOD RISK MAP AFTER 1.0 M SEA LEVEL RISE IF NO ACTION TAKEN 15
FIGURE I-9: PROJECTED DOWNTOWN FLOODING 16
FIGURE I-10: FLOOD RISK MAP AFTER 1.0 M SEA LEVEL RISE IF NO ACTION TAKEN 17
FIGURE I-11: PROJECTED MHC-EVERGREEN FLOODING 18
FIGURE I-12: FLOOD RISK MAP AFTER 1.0 M SEA LEVEL RISE IF NO ACTION TAKEN 19
FIGURE I-13: PROJECTED WILLOW POINT FLOODING 20
FIGURE I-14: FLOOD RISK MAP AFTER 1.0 M SEA LEVEL RISE IF NO ACTION TAKEN 21

Ken Forde Boat Ramp, Campbell River. (Credit: Sanctuary Studios)

1.0 PROJECT OVERVIEW

PURPOSE

Climate change and sea level rise are environmental phenomena occurring globally over the past century. Rising sea levels and more extreme storms create increasing hazards like flooding and erosion for seaside communities. The City of Campbell River is one of many coastal municipalities in British Columbia preparing to deal with the effect of rising seas now, and in the future, as we adapt to our changing environment.

As a seaside community, the City of Campbell River has a history of flooding in low-lying areas, property damage, and coastal erosion from winter storms. Given the importance of the foreshore to ongoing residential, commercial, recreational, environmental, and infrastructure development priorities, the City of Campbell River recognizes that a long-term foreshore strategy is required.

Planning includes: assessing the impacts of sea level rise in combination with extreme weather and tide events, and site considerations and constraints in terms of possible future development, erosion risk, infrastructure exposure, and environmental damage and habitat loss.

The City of Campbell River is examining the community's entire coastline to determine the best course of action that will adapt existing buildings and infrastructure, avoid placing buildings and infrastructure in harms way, and develop appropriate flood and storm surge mitigation measures. Examples in this primer focus specifically on the following four areas: Painter Barclay, Downtown, MHC-Evergreen, and Willow Point. Studies have been conducted for the Campbell River Estuary and a 3.5 acre site downtown and are detailed in separate documents. Sea level rise adaptation is also being considered in current designs for Highway 19A improvements.

> *"We have to consider sea level rise and climate change impacts to ensure that new buildings and infrastructure are resilient into the future."*
>
> – Deborah Sargent, City Manager

Figure I-1: Study Areas

WHAT ARE WE TRYING TO ACHIEVE?

PROTECT PEOPLE

Coastal flooding has the potential to endanger human life during sudden-onset storm events, and to gradually displace people from their homes and businesses as land is permanently lost.

SUSTAIN ENVIRONMENTAL VALUES

Coastal habitats will be affected as wetlands, freshwater fish habitat, and riparian areas are increasingly exposed to flooding and salt water. Coastal squeeze occurs when urban shore protection and rising seas reduce the natural foreshore habitat.

ADAPT INFRASTRUCTURE

Transportation and service utility infrastructure can be damaged or destroyed in storm events, and as land is lost to sea level rise. Roads and storm drains are at special risk along with hydro transformers and communication systems.

RESPECT ECONOMIC VALUES (PUBLIC AND PRIVATE)

Private property and buildings belonging to coastal residents and businesses can be damaged by or completely lost to storm surges and sea level rise. If infrastructure is damaged, service interruptions can disrupt the flow of goods and services and customer access, leading to economic losses.

SUSTAIN RECREATION AND CULTURE VALUES

Coastal recreation resources like parks, trails, and marine access points will be affected by storms and sea level rise. One of Campbell River's defining qualities is the view of Discovery Passage and the islands and the experience of the Rotary Seawalk.

MANAGE ON-GOING RISK

Sea level rise has begun and will continue for centuries. It is the responsibility of governments to support planning today that can help minimize or avoid potential hazards in the future. Implementing adaptation will involve both public and private sectors.

PURSUE VALUE FOR INVESTMENT

Adapting to sea level rise can include a broad spectrum of different actions and strategies that require varying degrees of capital investment and maintenance. Financial analyses can compare structural and non-structural adaptations to reveal the most efficient investment required to meet the broad needs of the community.

Of the 484 households surveyed during the 2017 Emergency Preparedness Week Survey in Campbell River, 81% of respondents stated that addressing the issue of human induced climate change is a priority for them.

2.0 SEA LEVEL RISE SCIENCE AND MANAGEMENT

HOW HIGH ARE LEVELS RISING?

During the 20th century global sea levels rose 17 cm at an average rate of 1.7 mm per year; however, since 1993 this rate has increased, with sea levels estimated to be rising at over 3 mm per year. This rate of sea level rise is projected to continue increasing.

WHAT IS CAUSING SEA LEVEL RISE?

Increased greenhouse gas emissions, due largely to human activity, are the primary driver of sea level rise. As global atmospheric temperatures increase, ocean waters undergo thermal expansion. This expansion, coupled with the accelerated melting of glaciers and ice sheets, is resulting in sea level rise worldwide.

Sea level rise is not felt uniformly around the world, or even within British Columbia. One reason for this is glacial isostatic adjustment: land masses, once depressed by large sheets of ice during glaciation, are in the process of rising again. This explains why 2013 data from Fisheries and Oceans Canada indicates that Prince Rupert has seen 8.8 cm of sea level rise per century, while Victoria has seen 3.1 cm of sea level rise per century. In Campbell River, sea level rise is happening faster than the land is rebounding.

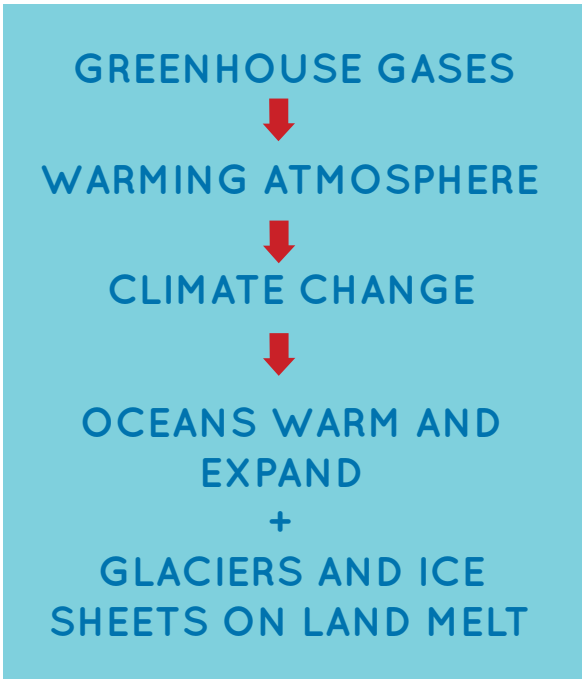


Figure I-2: Cause of sea level rise

Big Rock Boat Ramp, January 2018

Frank James Park. January 2018

FLOOD HAZARD POTENTIAL IMPACTS, TODAY AND FUTURE

As a seaside community, Campbell River has a history of storms and flooding in low-lying areas.

SEA FLOOD HAZARDS AND IMPACTS

Today, Campbell River experiences coastal flooding during times of high tide coupled with storm surges—sea level rise will increase the impacts of both.

Sea Flood Hazards Today

- Damage developed lands
- Erode coastal land
- Temporarily inundate land
- Waves overtop or wash out shoreline defenses
- Damage cultural amenities (e.g. parks, seawalk)
- Disrupt or destroy plant and wildlife habitat

Sea Flood Hazards in the Future

- Increase duration and frequency of today's hazards
- Threaten human health and safety
- Increase salt contamination in soils, groundwater, and surface water resources
- Inundate land for extended periods
- Increase coastal squeeze pressures. Diagrams pictured below
- Damage or disrupt service and transportation infrastructure (e.g. sewer, water, telecommunications)
- Interrupt business operations

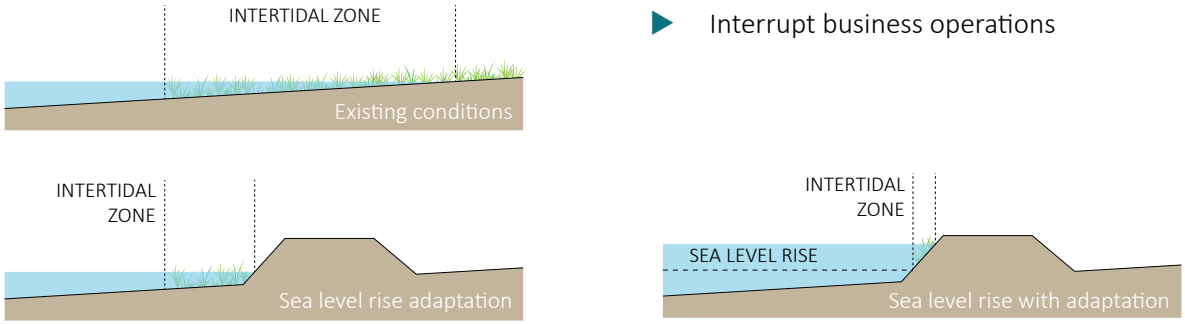


Figure I-3: Coastal squeeze

PROVINCIAL GUIDELINES

The Province of BC's Flood Hazard Area Land Use Management Guidelines (amended January 1, 2018) encourage municipalities to introduce:

- requirements for buildings, subdivision, and zoning that account for 0.5 m of sea level rise by the year 2050, 1 m of sea level rise by the year 2100, and
- land use adaptation strategies in Official Community Plans and Regional Growth Strategies that account for 2 m of sea level rise by the year 2200 and beyond.

Municipalities are advised to require minimum floor elevations and define building setback requirements for new construction that take into account factors such as:

- sea level rise flood levels
- wind-blown waves
- wave-tossed debris
- shoreline erosion

WHY ACT NOW?

The rate of sea level rise will increase depending on how greenhouse gas emissions are managed at the global scale. As a seaside community, the City of Campbell River has a history of storms and flooding in low-lying areas. With climate change, these will become more regular and more severe as higher seas push damaging storm surges farther inland, weather events become more destructive, and heavier rainfall floods the Campbell River and other local watercourses.

To meet the provincial goals of adaptation, the City of Campbell River must take the necessary steps to ensure that new construction in the coming decades will withstand these hazards. Planning today can help avoid and minimize damage in the future, and help improve resiliency to winter storms and coastal flooding already experienced in Campbell River.

ADAPTATION AT TIME OF RECONSTRUCTION

All buildings and infrastructure eventually come to the end of their serviceable time and require reconstruction. Reconstruction is often the best time to incorporate sea level rise and flood risk adaptations.

To be safe from evolving sea level rise, it is necessary to estimate sea levels and conditions that may occur for the duration of the building or infrastructure serviceability, which might be 80 to 100 years into the future.

Figure I-4 illustrates the concept that each generation of building would be designed to be safe for sea level rise at the end of asset serviceability – each generation adapted to different conditions than the one before.

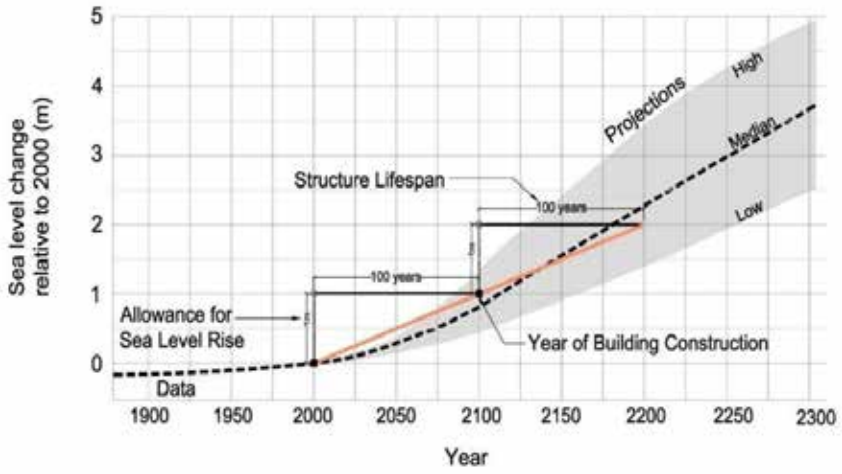


Figure I-4: Adaptation needs to anticipate sea level rise at end of structure serviceability

SEA LEVEL RISE AND ADAPTATION TERMS

The key terms and concepts related to coastal flooding and adaptation are illustrated in Figures I-5 and I-6. The sections and definitions describe common terms used in the science of coastal management and adaptation.

Common elements of adaptation include designing habitable parts of buildings to be above flood risk levels, by setting Flood Construction Levels (FCLs). Building waterfront setbacks are established to minimize risks from wave-driven spray, logs and debris. The required minimum FCL or setback will vary depending on site exposure, wave effects, terrain and land use.

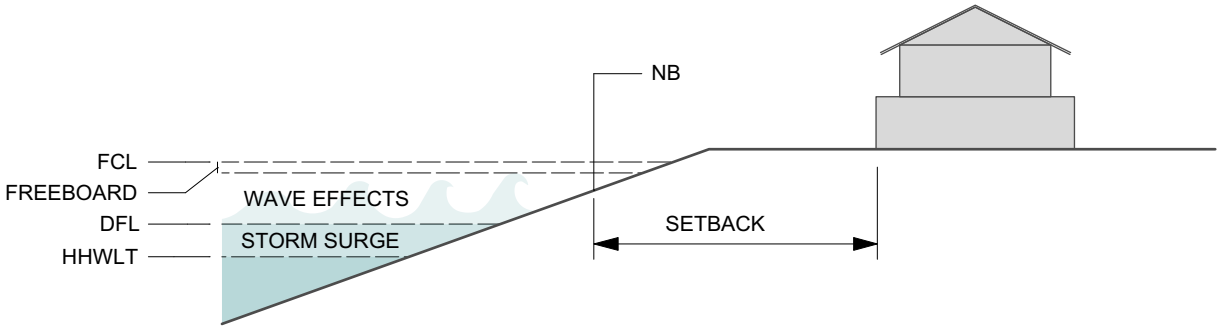


Figure I-5: Existing conditions

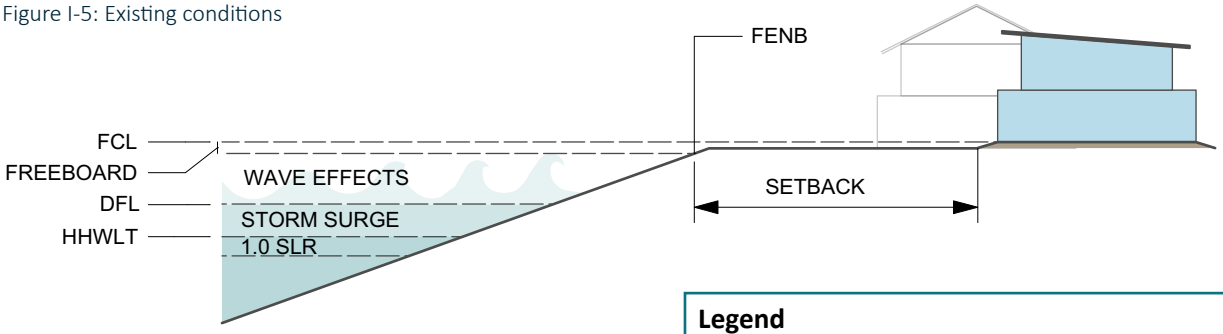


Figure I-6: Future scenario

Legend
NB- Natural Boundary
FENB- Future Estimated Natural Boundary
FCL- Flood Construction Level
DFL- Design Flood Level
HHWLT- Higher High Water Large Tide

Higher High Water Large Tide (HHWLT) is an existing high water level that often occurs during winter spring tides. These tides happen several times a month and are associated with the occurrence of a full moon or a new moon, approximately every two weeks.

Storm Surge occurs during a coastal storm due to strong winds and low air pressure, which can bring the water above tide levels.

The Design Flood Level (DFL) is the anticipated still water level that considers both HHWLT and Storm Surge.

Flood Construction Level (FCL) is the required minimum elevation for the base of a floor structure for habitable floors or for the storage of valuable goods. FCL includes the Design Flood Level, plus Wave Effects, and a Freeboard allowance.

Freeboard is a vertical distance between the anticipated Wave Effects and the Flood Construction Level. It allows for unknowns including a more rapid sea level rise than anticipated, specific details of an individual land parcel and particulars of the waters immediately offshore of a property.

Wave Effects considers the actions and effects of waves along the shoreline that causes water to rise above the design flood level. These effects vary considerably depending on the shoreline exposure, its character and the presence of coastal structures including seawalls or steep shorelines. These effects drive the spray and debris that may affect a building located close to the shoreline.

Natural Boundary (NB) defines the seaward boundary of a property where the prolonged presence of water creates a change in vegetation and the character of the land itself (see Land Title Act). The foreshore of the Natural Boundary is Provincial and Crown property.

The Future Estimated Natural Boundary (FENB) is the predicted location of the future Natural Boundary as the result of sea level rise. Setbacks for future new buildings should move inland with the Future Estimated Natural Boundary to preserve the protection that exists at the shoreline. Provincial guidelines suggest that calculation of the Future Estimated Natural Boundary can be based on the Flood Construction Level minus the Freeboard allowance.

Setback is the required minimum horizontal distance between the Natural Boundary (or Future Estimated Natural Boundary) and any flood construction level related structures that would be susceptible to wave impact or erosion.

Coastal flooding. Sunshine Coast, BC (Credit: Sunshine Coast Regional District)

COASTAL AND INLAND FLOOD MANAGEMENT AREAS

Coastal planning recognizes two types of flooding areas:

- **Coastal Flooding Areas** include areas directly adjacent to the shoreline, where wave effects run up the shore terrain. In beach environments the wave runup may be gentle, while in steep rock slopes or seawalls the waves energy may be directed upward with splash, foam and debris. Shorelines may be subject to erosion. Sea water and wave overtopping of shoreline defenses may occur, leading to water moving inland towards low areas or low buildings. Coastal flooding is dynamic, with flooding and overtopping pulsing with arriving waves.

Coastal flood management area. Sunshine Coast, BC (Credit: Sunshine Coast Regional District)


Shoreline erosion. Parksville, BC (Credit: Sanctuary Studios)


Seawall erosion failure. Parksville, BC (Credit: Sanctuary Studios)

- **Inland Flooding Areas** may be created on flatter terrain away from the shoreline. The floodwaters may come from heavy rainfall concurrent with a waterfront high tide and storm surge, creating conditions where inland flood waters cannot drain to the outfall at the sea until the storm surge and tides drop. This inland flooding can be made worse by shoreline wave overtopping of shoreline defenses, or by concurrent flooding from rivers and creeks. Inland flooding is relatively still water, not influenced by wave effects unless the area of flooding is very large and very deep.

Inland flood management area. Sunshine Coast, BC (Credit: Sunshine Coast Regional District)

Flood Construction Levels (FCLs) will differ:

- for Inland Flood Management Areas, one FCL may apply across the community, primarily based on still water levels plus freeboard.
- for Coastal Flood Management Areas, there may be several different FCL levels depending on the allowance for wave effects, which varies by site exposure, water depth and shoreline shape. A length of coastal shoreline with similar conditions is called a 'reach'. Each reach is provided a single FCL for ease of administration.

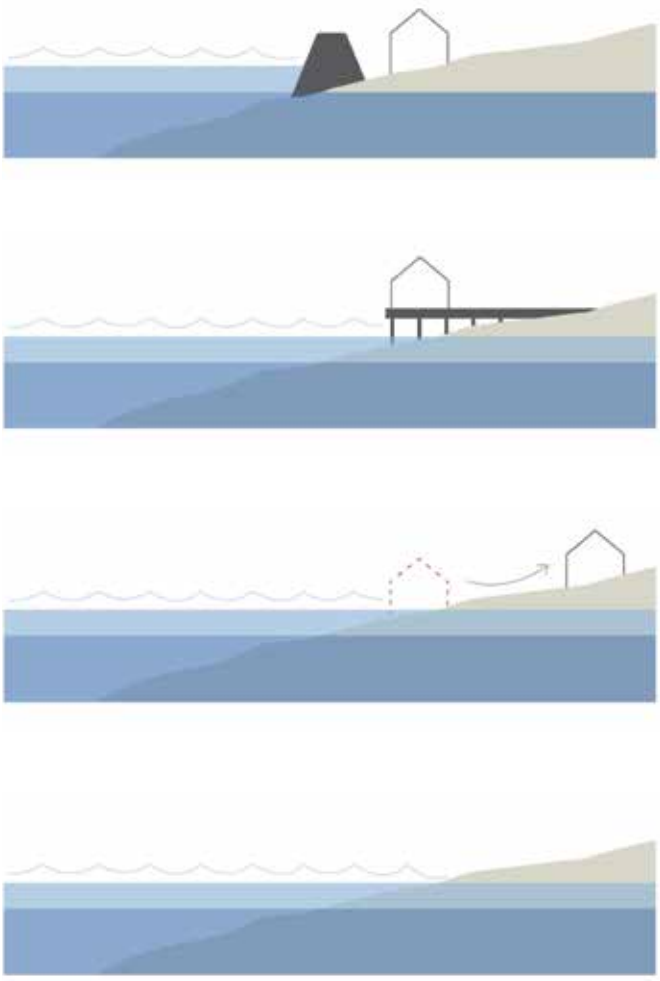

Inland flood management area. Sunshine Coast, BC (Credit: Sunshine Coast Regional District)

3.0 TYPICAL APPROACHES TO ADAPTATION

There is no “one size fits all” approach to sea level rise adaptation. The City of Campbell River is identifying a range of possible solutions applicable to specific areas, and the selected approaches will be informed by technical analysis with priority values determined in part by public consultation. Most adaptation would be implemented at the time of reconstruction of buildings or infrastructure that is too old for continued use.

ADAPTATION METHODS

The following high-level adaptation methods are used by numerous communities planning for sea level rise.



PROTECT

Construct barriers against flood waters.

ACCOMMODATE

Modify human activities, buildings, and infrastructure to accommodate increased flooding.

RETREAT / RE-ALIGN

Relocate people and infrastructure within the floodplain over time.

AVOID

Limit development within the floodplain through planning.

Figure I-7: Adaptation methods

COMBINATIONS

A combination of these approaches will likely be used in Campbell River.

ADAPTATION MENU AND SCALES

A broad menu of typical adaptation methods is introduced in the following two pages. More detail on each adaption method is provided in Primer II.

Adaptation may be divided into two scales- methods that may involve an entire bay or neighbourhood, including both public foreshore and private lands; and smaller-scale methods undertaken at the building or lot scale.

NEIGHBOURHOOD SCALE

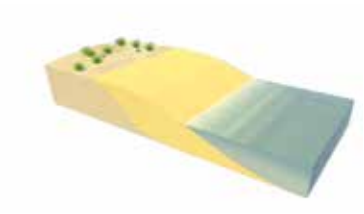
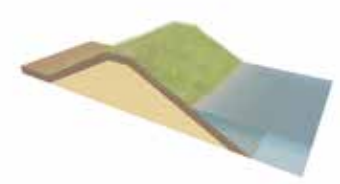
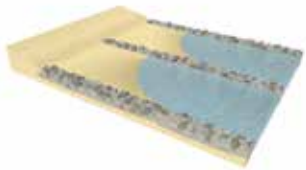
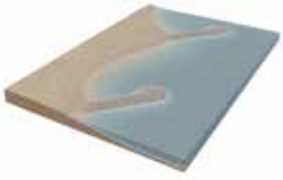
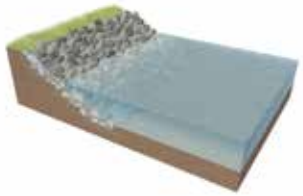
Neighbourhood adaptation approaches use larger areas of coastline, often changing the foreshore to protect land and habitat from damage caused by storm surges and sea level rise. These aims are achieved by stabilizing coastal lands from erosion, reducing wave energy, stopping the flow of floodwaters, and removing development from high-risk locations.

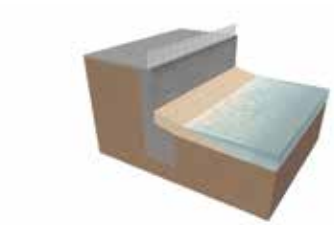
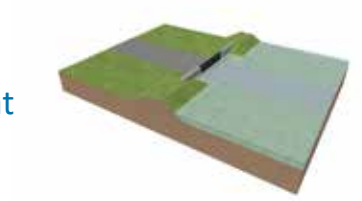
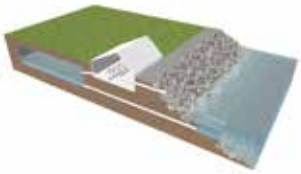
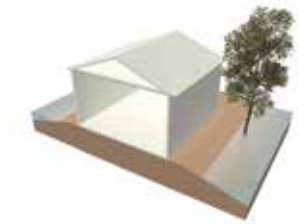
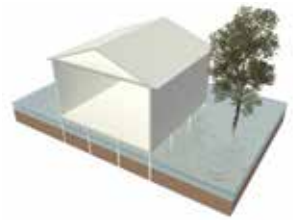
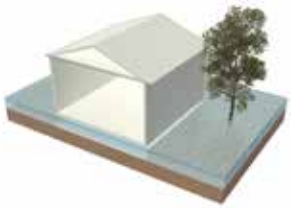
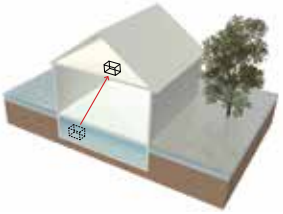
BUILDING / LOT SCALE

Building/lot adaptation strategies aim to prevent damage to buildings, property within buildings, and to occupants of buildings. These goals can be achieved by keeping flood waters out of buildings or lots, avoiding flood waters by raising the elevation of land, or by building structures that accept and accommodate water.

Existing policy in Campbell River supports the most "soft" approach possible with a goal of enhancing the shoreline ecology.

Pocket beach at Ken Forde Boat Ramp Park (Credit: Sanctuary Studios)

ADAPTIVE STRATEGY	SCALE	BENEFITS/LIMITS
Beach Nourishment 	Neighbourhood / reach	• Expands the usable beach area, allowing for increased public access and use • Reduces wave runup and wave effect elevations at natural boundary
Living Shorelines 	Neighbourhood / reach	• Provides increased complexity of intertidal habitat and coastal vegetation • May help improve water quality • Provides educational opportunities • Must be sheltered from erosion
Dikes 	Neighbourhood / reach	• Will resist storm waves when surface is properly armoured • Land on top of dikes can be used for paths or roads • May block views of the sea
Groynes 	Neighbourhood / reach	• Can extend lifespan of beach nourishment projects • Wide range of construction methods and materials • Inconvenience to walking along the shore • Can increase beach erosion
Offshore Reefs / Breakwaters 	Neighbourhood / reach	• Can create marine habitat • Provide recreational opportunities • May be augmented as seas rise • Potential visual impact and navigation hazard
Pocket Beach / Headland 	Neighbourhood / reach	• Use a combination of gravel beach nourishment and offshore stone headlands • Provide recreational opportunities • Can be relatively expensive
Rock armouring 	Neighbourhood / reach	• Unlikely to fail catastrophically, and when properly engineered have an indefinite lifespan • Leads to coastal squeeze and intertidal habitat loss • Creates wave splash, but less than seawall

ADAPTIVE STRATEGY	SCALE	BENEFITS/LIMITS
Seawalls 	Neighbourhood / reach	• Smaller footprint compared to other strategies • Can be designed to allow for public use of the waterfront • Not recommended for exposed areas due to high wave runup and overtopping elevations • Leads to habitat loss
Temporary Flood Barriers at Driveways 	Neighbourhood / reach	• Relatively easy to install • Appropriate where grades do not allow raising roadways • Barrier must be placed in advance of storm
Floodbox / Pump Station 	Neighbourhood / reach	• Used to drain large areas that have been inundated by coastal and/or inland floodwaters when storm drains are overwhelmed • Expensive to build and can have high energy consumption
Elevate on Fill 	Building / Lot	• At appropriate elevations, can provide continued protection from flooding due to coastal storms or sea level rise • Neighbouring constraints may limit space for fill slope • May require maintenance to prevent erosion
Elevate on Piles 	Building / Lot	• Provide protection for the broadest range of flooding conditions • May provide for additional parking space under the building. • Emergency access is restricted
Wet Floodproofing 	Building / Lot	• Recognizes some uses like crawl spaces, parking or storage could accept flooding • Does not stop flooding
Protect Building Systems 	Building / Lot	• Relocate critical equipment above flood level • Can often be applied to buildings in place • Can be used in conjunction with other strategies to provide additional protection • Can allow quicker building recovery • Does not stop flooding

4.0 WHAT'S AT RISK IF NO ACTION IS TAKEN?

PAINTER BARCLAY

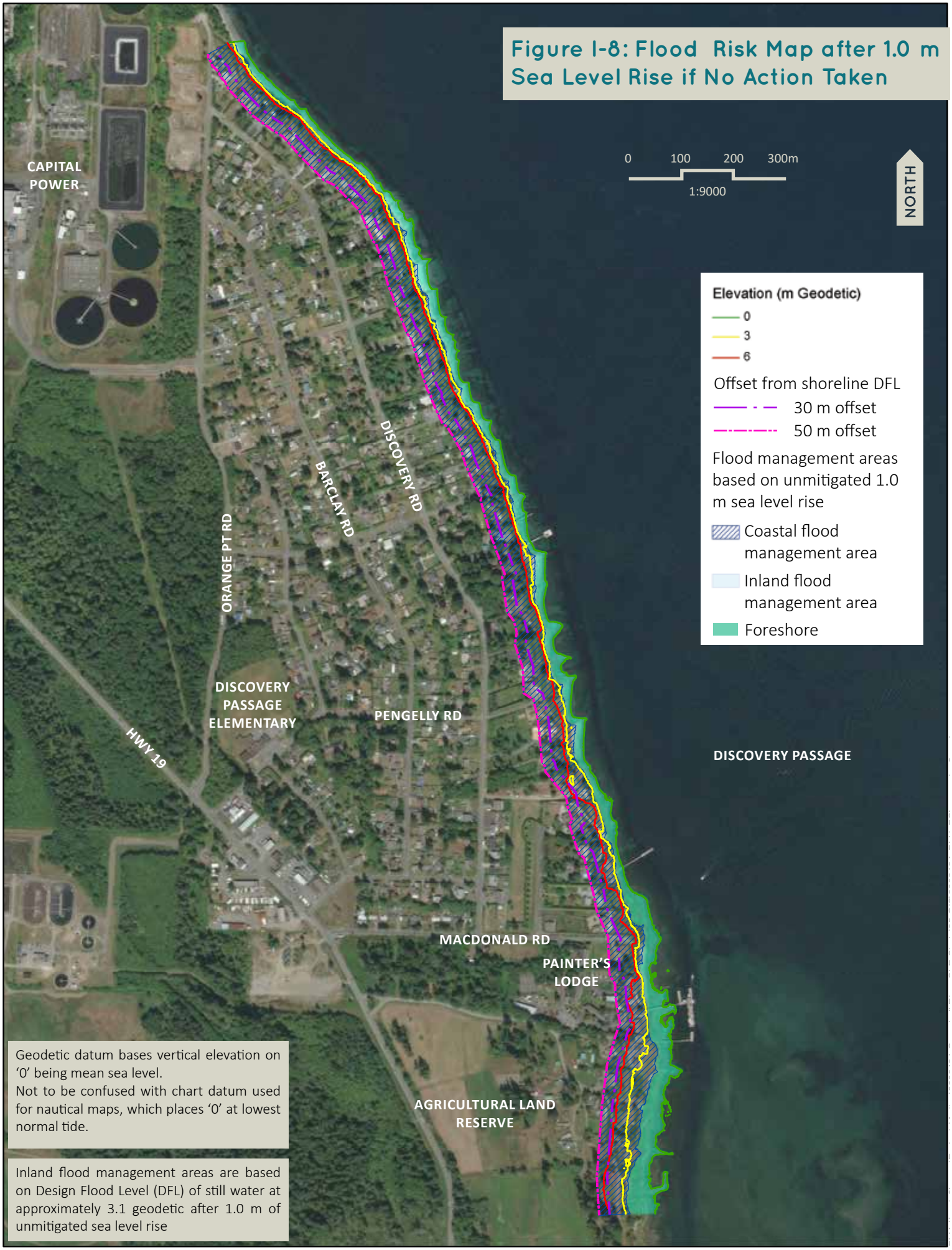
The Painter Barclay area in north Campbell River has many homes overlooking Discovery Passage. Two resorts have sea frontage. A large Agricultural Land Reserve (ALR) area with residential buildings is the south boundary.

KEY PAINTER BARCLAY FEATURES AT RISK IF NO ACTION IS TAKEN WOULD INCLUDE:

- Lower floor areas of several buildings in the Agricultural Land Reserve
- Pocket beaches
- Environmentally sensitive shoreline
- The bluffs area, where erosion and slide risk will occur as sea levels rise, with waves running up and eroding the toe of the bluff. Once toe materials are removed, it is likely that increased bluff sliding will occur at the crest.
- Without mitigation the ongoing toe of bluff erosion and consequential top of bluff inland progression could threaten building sites of existing residences.
- Utility and stair routes from buildings at bluff crest down the slope to the beach are at risk due to potential erosion and slides.

Painter Barclay. March 20, 2012 (Credit: Sanctuary Studios)

Figure I-8: Flood Risk Map after 1.0 m Sea Level Rise if No Action Taken



Geodetic datum bases vertical elevation on '0' being mean sea level.
Not to be confused with chart datum used for nautical maps, which places '0' at lowest normal tide.

Inland flood management areas are based on Design Flood Level (DFL) of still water at approximately 3.1 geodetic after 1.0 m of unmitigated sea level rise

DOWNTOWN

When a global sea level rise of one metre has occurred, parts of downtown Campbell River will be below a projected still-water flood level of 3.1 m average. In a strip along the shoreline, flooding events will become more frequent and extensive as storm wave effects run up the shore, spilling seawater and debris over coastal defenses.

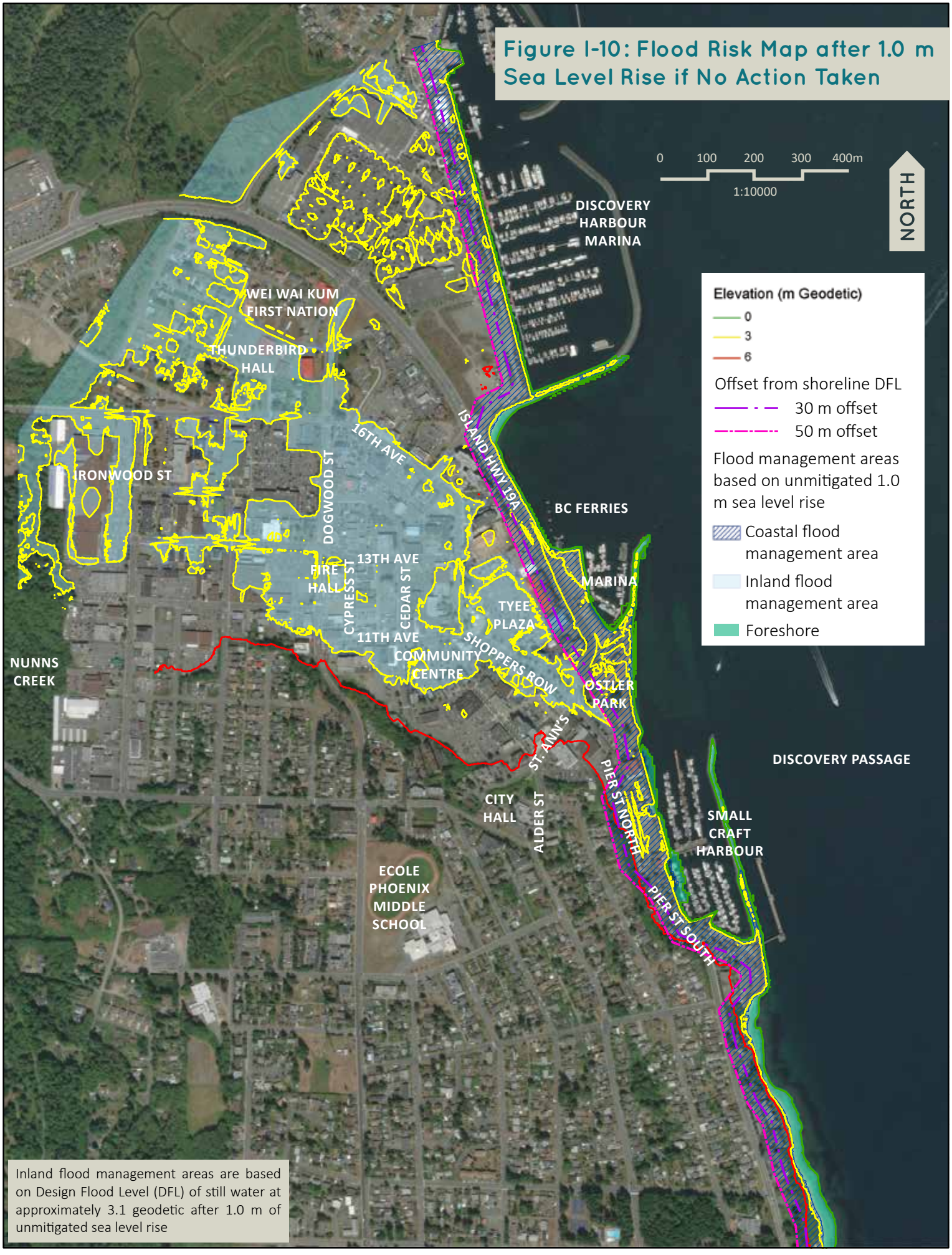
Figure I-9: Projected downtown flooding (3.1 m) if no flood prevention action taken (coastal wave effects not shown)

KEY DOWNTOWN FEATURES AT RISK IF NO ACTION IS TAKEN WOULD INCLUDE:

- Lower part of Highway 19A and Dogwood Street
- Shoppers Row and other streets throughout low areas
- Stormwater, electrical, communications, and other utilities under roads and public lands
- Parking areas at Tyee Plaza
- Lower floor areas of buildings in flood zones
- Fire and emergency centre
- Parts of Ostler Park

Ostler Park. March 20, 2012

Figure I-10: Flood Risk Map after 1.0 m Sea Level Rise if No Action Taken



Inland flood management areas are based on Design Flood Level (DFL) of still water at approximately 3.1 geodetic after 1.0 m of unmitigated sea level rise

SEQUOIA PARK (MARITIME HERITAGE CENTRE TO EVERGREEN)

The shoreline between the Maritime Heritage Centre (MHC) and Evergreen includes Sequoia Park and Hidden Harbour. Much of the shoreline has rock armouring, some in poor repair. Behind the armouring are steep slopes. Limited buildings are near the waterline—most well above foreseen flood risk.

Figure I-11: Projected MHC-Evergreen flooding (3.1 m) if no flood prevention action taken (coastal wave effects not shown)

KEY SEQUOIA PARK FEATURES AT RISK IF NO ACTION IS TAKEN WOULD INCLUDE:

- Publicly accessible beach areas
- Intertidal habitat
- Sanitary gravity sewers that connect waterfront developments to the force main. The existing force main on the foreshore is being re-routed along Highway 19A.
- Existing parking areas and low-lying buildings at the shore
- Stability of shoreline steep slopes if wave erosion occurs at the toe

Shoreline between MHC and Evergreen. July 24, 2018 (Credit: Sanctuary Studios)


Figure I-12: Flood Risk Map after 1.0 m Sea Level Rise if No Action Taken
MARINE HERITAGE CENTRE
0
100
200
300m
1:7500
NORTH
Elevation (m Geodetic)
0
3
6
Offset from shoreline DFL
30 m offset
50 m offset
Flood management areas based on unmitigated 1.0 m sea level rise
Coastal flood management area
Inland flood management area
Foreshore
CENTENNIAL POOL
MUSEUM AT CAMPBELL RIVER
SEQUOIA PARK
ALDER ST
2ND AVE
HWY 19A
DISCOVERY PASSAGE
EVERGREEN RD
Inland flood management areas are based on Design Flood Level (DFL) of still water at approximately 3.1 geodetic after 1.0 m of unmitigated sea level rise

WILLOW POINT AND SOUTH

The shores of Willow Point and area South are very exposed to high storm winds and waves from the open reaches of the Strait of Georgia. Waves have been eroding the shoreline and also pulling sand and small materials off shore.

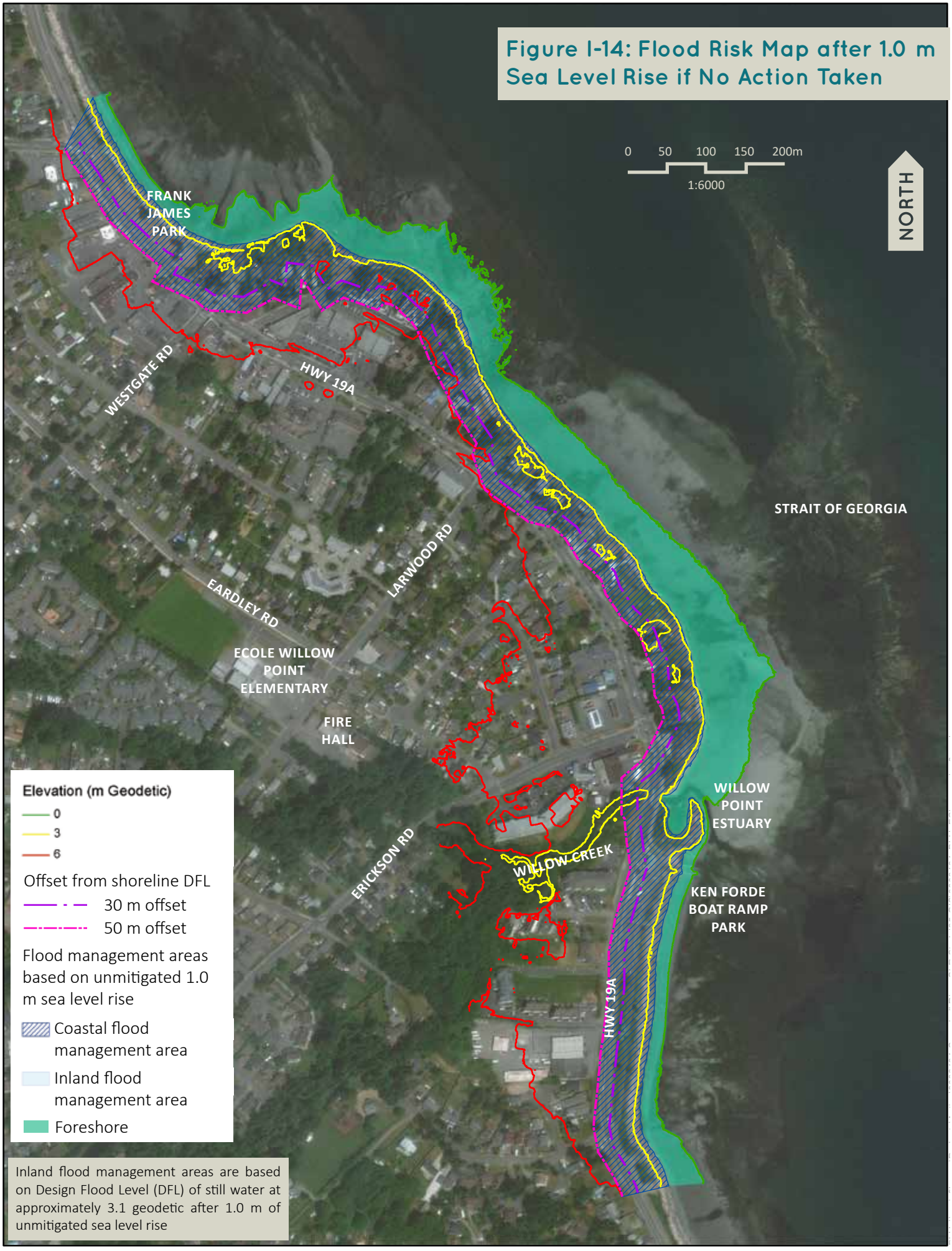
Figure I-13: Projected Willow Point flooding (3.1 m) if no flood prevention action taken (coastal wave effects not shown)

KEY WILLOW POINT FEATURES AT RISK IF NO ACTION IS TAKEN WOULD INCLUDE:

- Stormwater, electrical, communications, and other utilities under roads and public lands
- Sanitary sewer and pump stations/ washrooms
- Lower floor areas of several buildings, lower yard areas
- Boat ramp and associated parking areas
- Grounds and boat house of Sybil Andrews heritage area
- Walking access and habitat along the foreshore, reduced due to coastal squeeze
- Increased risk of rock armouring failure or overtopping due to increased wave heights

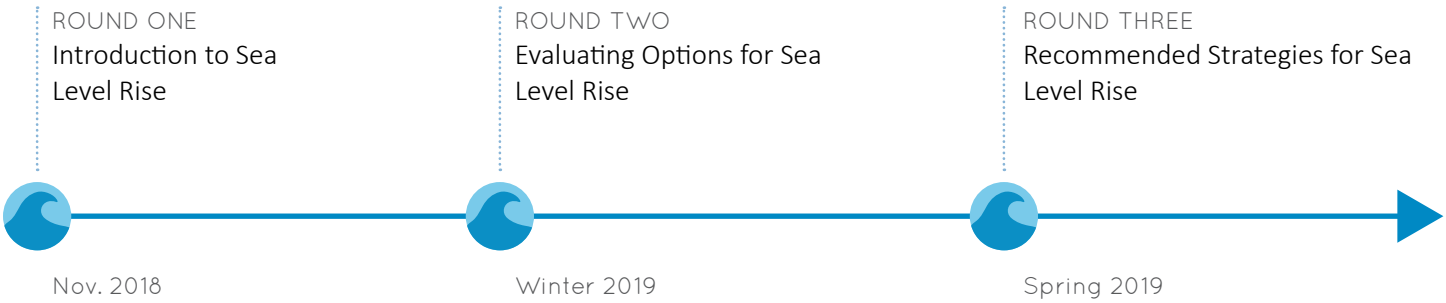
Frank James Park. July 24, 2018 (Credit: Sanctuary Studios)

Figure I-14: Flood Risk Map after 1.0 m Sea Level Rise if No Action Taken



Inland flood management areas are based on Design Flood Level (DFL) of still water at approximately 3.1 geodetic after 1.0 m of unmitigated sea level rise

5.0 WHAT'S NEXT



OPPORTUNITIES FOR INPUT

- November 28, 2018: Introduction to Sea Level Rise (Small-group Public Workshop #A1)
- November 29, 2018: Introduction to Sea Level Rise (Small-group Public Workshop #A2)
- Winter 2019: Understanding Values and Evaluating Options for Sea Level Rise
  (Small-group Public Workshop #B)
- Spring 2019: Recommended Sea Level Rise Strategies (Small-group Public Workshop #C)
- Online at www.campbellriver.ca/rising-seas
- By email: policy@campbellriver.ca
- By phone: (250) 286-5727

NEXT PRIMER

Primer II: Sea Level Rise Adaptation Best Practices
A guide to common tools to address sea level rise adaptation in Campbell River, highlighting their strengths and challenges.

Painter Barclay shoreline (Credit: Sanctuary Studios)

FOR MORE INFORMATION

CITY OF CAMPBELL RIVER WEBSITE LINKS

www.campbellriver.ca/rising-seas

BACKGROUND INFO FROM OTHER SOURCES

Engineers and Geoscientists BC
Legislated Flood Assessments in a Changing Climate in BC
https://www.egbc.ca/getmedia/f5c2d7e9-26ad-4cb3-b528-940b3aaa9069/Legislated-Flood-Assessments-in-BC.pdf.aspx

Flood Hazard Area Land Use Management Guidelines (2018)
https://www2.gov.bc.ca/assets/gov/environment/air-land-water/water/integrated-flood-hazard-mgmt/flood_hazard_area_land_use_guidelines_2017.pdf

Ausenco Sandwell
Climate Change Adaptation for Sea Dikes and Coastal Flood Hazard Land Use
http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/draft_policy_rev.pdf

Ministry of Forests, Lands and Natural Resource Operations
Coastal Floodplain Mapping – Guidelines and Specifications (June, 2011)
http://www.env.gov.bc.ca/wsd/public_safety/flood/pdfs_word/coastal_floodplain_mapping-2011.pdf

BC Ministry of Environment and Climate Change
Sea Level Rise Adaptation Primer A Toolkit to Build Adaptive Capacity on Canada's South Coasts (January 2013)
https://www2.gov.bc.ca/assets/gov/environment/climate-change/adaptation/resources/slr-primer.pdf

BC Ministry of Environment and Climate Change
Professional Practices in Assessing Flood Protection Guidelines (June 30, 2014)

BC ADAPTS VIDEO SERIES

Includes a BC Climate Change Backgrounder, plus six video shorts on Coastal Flood Management
www.gov.bc.ca/gov/content/environment/climate-change/adaptation/bc-adapts

CONTACT US

Long Range Planning and Sustainability - Sea Level Rise
Email: policy@campbellriver.ca
Phone: 250-286-5725

City of Campbell River

nhc northwest hydraulic consultants

LANARC