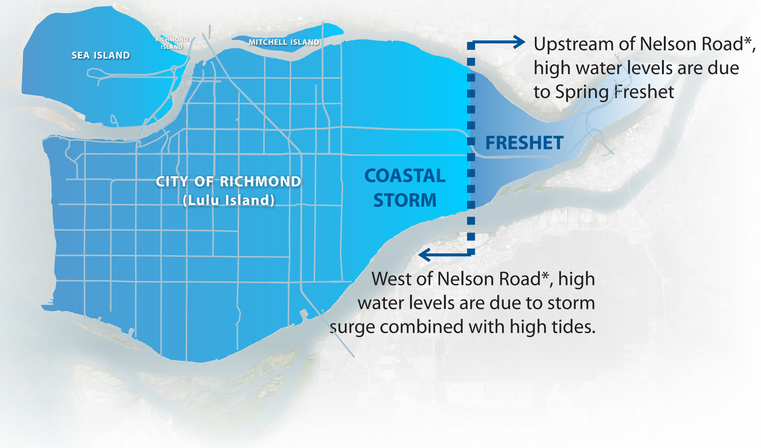
FLOOD HAZARD AND FLOOD PROTECTION

FLOOD HAZARDS AND CLIMATE CHANGE

Flood hazards in Richmond originate from:

- Fraser River spring floods ('freshet')
- Winter storm surge floods ('coastal storm')



King Tide:
The highest tides of the year, caused by the gravitational pull of the sun and moon.

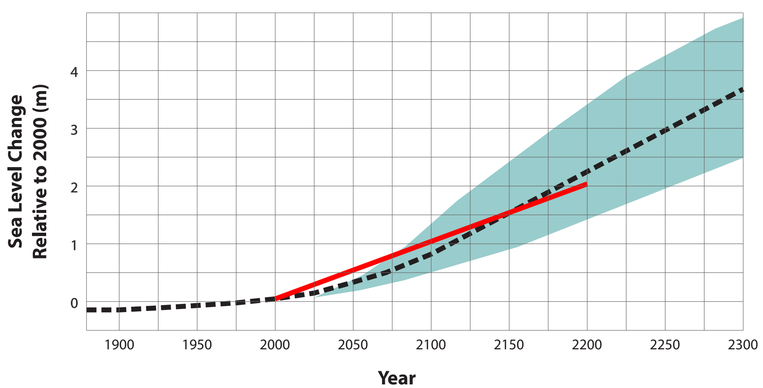
Storm Surge Flood:
High water level created by combination of tide and low pressure weather, typically accompanied by wind/waves and rainfall.

Freshet Flood:
High water level generated by melting ice and snow upstream flowing into the rivers and out to the sea, generally in the spring.

* With 1 m sea level rise and moderate climate change impacts to Fraser River flood.

Climate change is increasing the flood hazards through:

- Increased Fraser River freshet peak flows
- Sea level rise



Ausenco Sandwell, Climate Change Adapatation Guidlelines for Sea Dikes and Coastal Flood Hazard Land Use Draft Policy Discussion Paper, BC Ministry of Environment, January 2011.

FLOOD HAZARD AND RISK

Richmond faces the following primary flood hazards:

- A dike breach that may occur as a result of water overtopping the dike
- The liquefaction of soils under the dikes as a consequence of an earthquake or dike breach
- Piping through a dike caused by water under pressure, eroding soil particles to cause a tunnel through the dike
- Human damage to a dike

Development and population growth increases the consequences of a major flood.

FLOOD PROTECTION IN RICHMOND

The Flood Protection Management Strategy is a high-level document that provides overarching direction for flood protection in Richmond.



FLOOD PROTECTION SYSTEM COMPONENTS

- Perimeter dikes
- Pump stations and floodboxes
- Building flood construction levels and floodproofing
- Land raising and roads (internal dikes)
- Operation, inspection, and maintenance
- Flood response and recovery plans

VISION

STRATEGY PURPOSE

Guide the development of world-class flood protection for Richmond.

STRATEGY VISION

The City of Richmond will continue to be a leader in achieving excellence and innovation in flood protection management.

UPDATING THE STRATEGY

An update is warranted to fully encompass new learnings, analysis, and re-emphasize the City's commitment to achieving world-class flood protection.

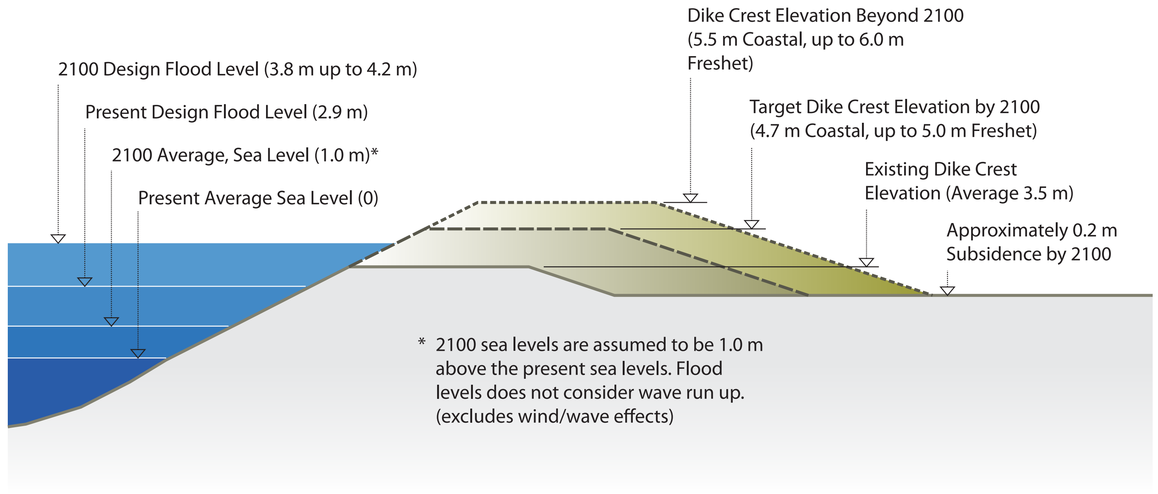
The Flood Protection Management Strategy is a living document – one which evolved over time as new science, information, concepts, techniques, programs and cost sharing opportunities arose. The updated Flood Protection Management Strategy 2019 provides this information and recommendations for future work related to flood protection.

LEVEL OF PROTECTION

WHAT IS IT?

Level of protection is the degree to which flood impacts are managed.

In British Columbia, the Fraser River flood of 1894 has historically been used as the basis for the level of protection. Historically, it was understood that the flood was a 200-year return period event, which has an annual probability of 0.5%. This is known as a 'hazard-based' approach to level of protection where a flood return period is directly selected as policy.



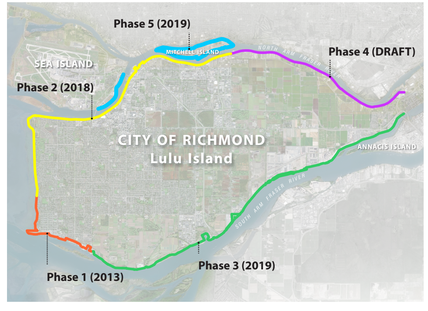
PROPOSED LEVEL OF PROTECTION IN STRATEGY 2019

Current planning:

- 500-year return period (0.2% annual probability) with sea level rise (1-2 m) and 'moderate' climate change increase to Fraser River peak flow

Long-term goal:

- World-class level of protection
- Consider additional sea level rise (e.g. 2 m+) and greater climate change impacts based on emerging science



The Strategy Update Identifies Several Focus Areas And Initiatives:

PROGRAM MANAGEMENT



HIGHLIGHTS INCLUDE:

- Updated vision and level of protection to obtain a world-class standard
- Level of utility funding review
- Other funding sources and collaboration with external authorities
- Additional technical studies (wave hazard analysis, dike modelling study, seismic study) and on-going monitoring (wave level, waves, dike performance)
- On-going operation and maintenance of dike and drainage system

STRUCTURAL MEASURES



HIGHLIGHTS INCLUDE:

- Perimeter dike upgrades and dike master plans
- Secondary dike planning (roads and land raising)
- Environmental protection and habitat banking
- Drainage system upgrades (pump stations)

POLICY AND NON-STRUCTURAL MEASURES



HIGHLIGHTS INCLUDE:

- Flood bylaw update and development control
- Perimeter dike corridor development permit area
- Widespread land raising
- Infrastructure management criteria in dike corridors

RESPONSE AND RECOVERY



HIGHLIGHTS INCLUDE:

- Emergency planning
- Flood response
- Flood recovery

FLOOD PROTECTION ROLES AND RESPONSIBILITIES

CITY OF RICHMOND

The City is the primary actor and service provider for flood protection.

1. FLOOD PROTECTION: The City is responsible for local flood protection and management including the ongoing operation and maintenance of its drainage system and dikes.
2. EMERGENCY MANAGEMENT: The City has a legislated duty to respond first to emergency situations and to have an emergency plan in place.
3. FLOODPLAIN MANAGEMENT: The City has the authority to designate a floodplain and to set construction requirements for development, with consideration of provincial guidelines.
4. DEVELOPMENT: The City reviews development applications and has the authority to set conditions for development approval, including registration of restrictive covenants.

PROVINCIAL GOVERNMENT

1. DIKES: Under the Dike Maintenance Act, responsibility and general supervision relative to construction and maintenance of dikes lies with the office of the Inspector of Dikes.
2. GUIDELINES, STANDARDS AND RESEARCH: Provides guidelines for development in flood hazard areas, guidance and technical information.
3. GRANT FUNDING: Provides periodic grant funding for projects.
   - In 2012, the City was awarded $3.6 million for pump station upgrades.
   - In 2016, the City was awarded $16.6 million for pump station and dike upgrades.
   - In 2017, the City was awarded $400,000 for flood protection planning.
   - Ongoing Provincial funding is encouraged.
4. EMERGENCY MANAGEMENT: Provides coordinated emergency response and recovery through Emergency Management BC.

FEDERAL GOVERNMENT

1. PUBLIC SAFETY: The focus of Public Safety Canada (PSC) includes critical infrastructure protection, emergency preparedness; and disaster mitigation.
2. RESEARCH: Supports research on pertinent subjects (e.g., climate change).
3. FUNDING: Provide grant funding for studies and capital projects.
   - In 2013, $2 million was awarded to Richmond through the Federal and Provincially funded BC Building Canada Fund;
   - In 2016, $1.7 million was awarded to Richmond through the Federal and Provincially funded National Disaster Mitigation Fund; and
   - In 2017 the City of Richmond was awarded $1.1 million for flood protection planning through the National Disaster Mitigation Program.
   - Ongoing Federal funding is encouraged.
4. LAND MANAGEMENT: There is considerable federal land along the perimeter dikes on Lulu Island and Sea Island. The City works together with the Fisheries and Oceans Canada, as well as other Federal stakeholders, on a project-specific basis to identify any concerns or opportunities while completing flood protection upgrades.

OTHER AGENCIES

FRASER BASIN COUNCIL (FBC)

Supports regional flood protection initiatives. This includes a recent update of the Fraser River flood profile, and a current initiative to prepare the Lower Mainland Flood Management Strategy.

PORT OF VANCOUVER

Manages navigation and completes periodic dredging of the South Arm of the Fraser River.

VANCOUVER AIRPORT AUTHORITY

Sea Island Dike and connector bridge.

CITY OF NEW WESTMINSTER

Lulu Island Dike (Queensborough)



The City of Richmond is committed to intergovernmental partnerships with the provincial and federal governments and encourages their flood protection programs and funding assistance.