



# Advancing Collaboration and Innovation in Climate Adaptation through Cost Sharing

February 19, 2020

Adaptation Canada 2020

Financing Resilience Conference Stream (CS1-FR)



Canada



# Workshop Overview

- Live polling (get ready!)
- Climate adaptation perspectives:
  - Semiahmoo First Nation
  - Infrastructure Canada
  - City of Surrey
- Case studies and activity
- Wrap up discussion

## Speakers and Facilitators:

- Chief Chappell (Semiahmoo First Nation)
- Annie Geoffroy (Infrastructure Canada)
- Guillaume Côté (Infrastructure Canada)
- Carla Stewart (City of Surrey)
- Tjasa Demsar (City of Surrey)
- Erin Desautels (City of Surrey)
- Matt Osler (City of Surrey)



# Audience Response Introduction



## Method #1: Use web browser on a device (easier option)

Requires either:

- A) Device with cellular data (smart phone, tablet), or
- B) Device with wireless internet (laptop, tablet, smart phone).

Network = Sheraton\_meeting

Password = climate2020

Instructions:

- 1) Join the poll by opening your web browser and pointing to the webpage:

**[pollev.com/MattOsler481](https://pollev.com/MattOsler481)**

- 2) Answer the questions as they become visible in your browser

A screenshot of a mobile web browser interface. At the top, the address bar shows 'pollev.com'. Below it is a navigation bar with a 'Poll Everywhere' logo, the text 'Poll Everywhere INSTALLED', and an 'OPEN' button. A dark blue overlay contains an information icon and the heading 'Accept our Cookie Policy'. The text below reads: 'This website and its third-party tools use cookies. Learn more about why these are required in our Privacy Policy. By closing or dismissing this notice or continuing to browse, you accept the use of cookies.' There are 'Agree' and 'Dismiss' buttons. Below the overlay is a form with a 'Name' input field, a blue 'Continue' button, and a 'Skip' link. At the bottom, there is a paragraph: 'Using a screen name allows the presenter and other participants to attach your screen name to your responses. You can change your screen name at any time.'

# Audience Response

## Introduction



### Method #2: Send text messages

Requires:

A) Cell phone that can send text messages

*Note: Standard text message fees may apply depending on your cellular plan*

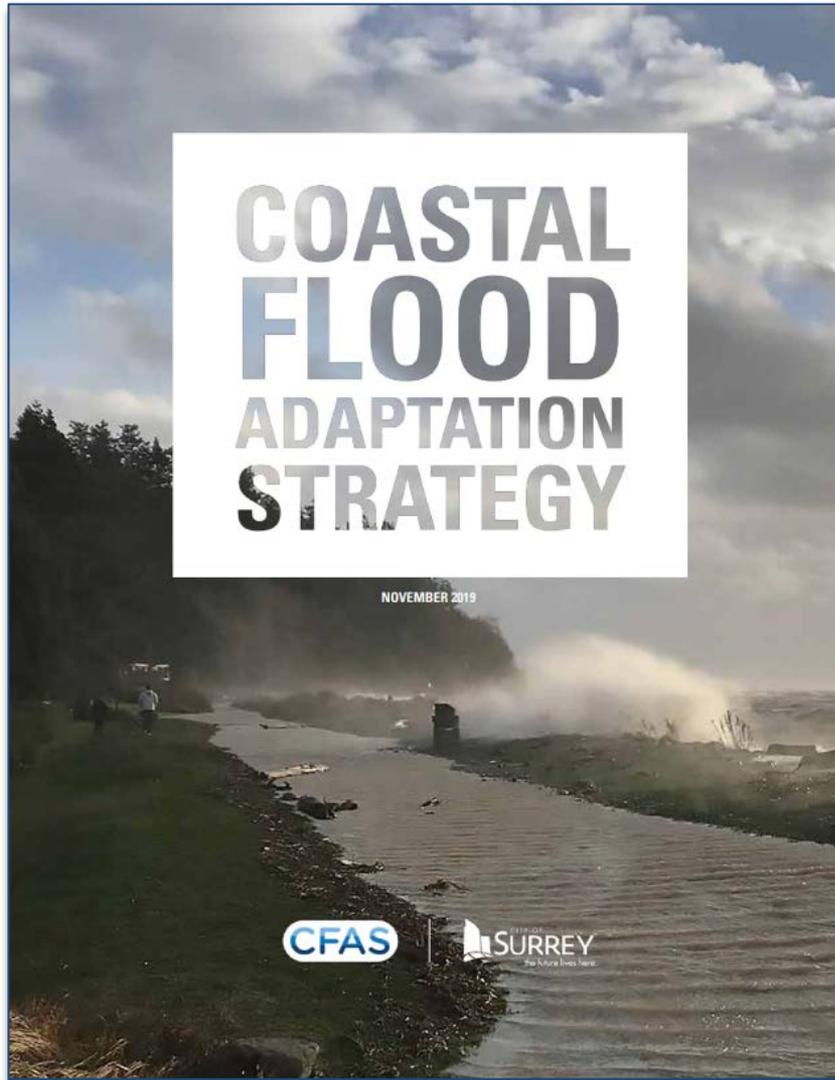
Instructions:

- 1) Make a new contact in your phone with the telephone number **37607**
- 2) Join the poll by sending a text message stating “**MATTOSLER481**” to the new contact and a confirmation text that you have joined will be sent.
- 3) Answer the questions by sending your responses to each question as separate text messages



# Chief Harley Chappell – Semiahmoo First Nation

# Lay the Foundation...



Website:  
[www.surrey.ca/coastal](http://www.surrey.ca/coastal)



# Time to Get to Work

- 2013 – Community Climate Action Strategy
  - Community Energy Emissions Plan
  - Climate Adaptation Strategy
- Climate Adaptation Strategy identified priority actions for different climate risks
- For coastal flooding...

## Priority Action:

“Conduct detailed analysis on Surrey-specific climate impacts, including timelines and extent of sea level rise and its related effects on flood construction levels and floodplain designations”

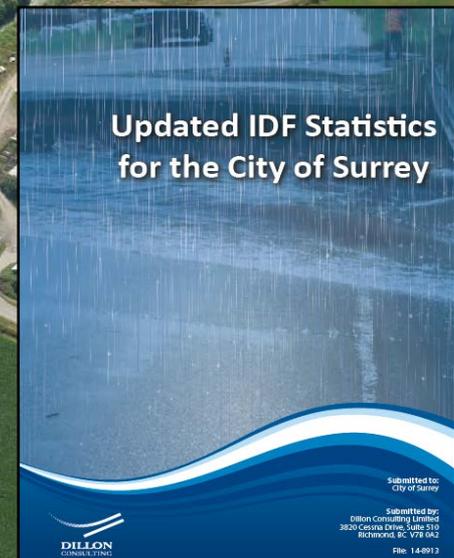


# Lay the Foundation

## Priority Action:

“Conduct detailed analysis on Surrey-specific climate impacts, including timelines and extent of sea level rise and its related effects on flood construction levels and floodplain designations”.

- 2014 - 10 Year Servicing Plan
- new component in the Drainage Utility for Climate Change investigations & strategy development.
- 2014 - Serpentine, Nicomekl & Little Campbell Rivers Climate Change Floodplain Review – Phases 1 & 2
- Preliminary subsidence investigation
- Rainfall trending study and updated IDF curves



# Roll Up Your Sleeves

- Council adopted recommendation to develop a coastal flooding strategy in 2016
- To prepare the City for:
  - a changing climate;
  - proposed legislation; and
  - the protection of Surrey residents and businesses.
- A Surrey coastal strategy would also influence the direction of the Regional Flood Strategy and make possible external funding (e.g. DMAF).



# Values...Values...Values



## RESIDENTS:

*Minimize people displaced*



## AGRICULTURE:

*Reduce permanent loss of agricultural land*



## ENVIRONMENT:

*Minimize impacts to wetland habitats and riparian areas*



## INFRASTRUCTURE:

*Minimize vulnerabilities*



## ECONOMY:

*Minimize loss of local businesses*



## RECREATION:

*Maximize recreational opportunities*



## CULTURE:

*Maximize opportunities for traditional practices*

## Values Ranking:

WORSE ←

NO CHANGE

→ BETTER

# Area-Specific Actions

	2020-30	2030-40	2040-50	2050-60	2060-70	2070-80	2080-90	2090-2100
<b>MUD BAY (see Section 4.2.1 for summary)</b>								
<b>Mud Bay Foreshore</b>								
19 Foreshore enhancements	✓							
20 Sediment augmentation in foreshore area								
<b>Inter River West (west of 152nd St)</b>								
21 152nd St upgrades and raising	✓							
22 Serpentine and Nicomekl sea dams	✓							
23 Upgrade Serpentine left bank and Nicomekl right bank dykes	✓							
24 Install pumps at sea dams in phases								
25 Hwy 99 Works – New dyke west of Hwy 99								
26 Pullback to Hwy 99 Protection Works								
<b>Inter River East (east of 152nd St)</b>								
27 Upgrade Serpentine left bank and Nicomekl right bank dykes								
28 Drainage upgrades – Cloverdale neighbourhood								
29 Serpentine and Nicomekl floodplain storage								
<b>Colebrook</b>								
30 Coordinate with MOTI – Hwy 99/ Colebrook dyke upgrades								
31 Upgrade Colebrook Dyke	✓							
32 Replace Colebrook Drainage Pump Station	✓							
33 'Good neighbour dyke' – Delta								
34 Shared drainage improvements – Delta								
35 Serpentine floodgates – BNSF								
<b>Serpentine North</b>								
36 Upgrade Serpentine right bank and left bank dykes								
<b>Nicomekl South (east of 152nd St)</b>								
37 Upper Nicomekl flood storage								
38 Upgrade Nicomekl left bank dyke								
39 Upgrade drainage system – Morgan Creek area								
<b>Nico Wynd Area</b>								
40 Upgrade Nico Wynd area flood management								
<b>CRESCENT BEACH (see Section 4.2.2 for summary)</b>								
41 Maintenance of Crescent Beach Dyke								
42 Maintenance of Shoreline								
43 Drainage improvements	✓							
44 Expanded edge								
<b>SEMAHMOO BAY (see Section 4.2.3 for summary)</b>								
45 Little Campbell River emergency access	✓							
46 Comprehensive flood improvements								

Notes: ✓ indicates that the project scope is included in Surrey DMAF program and has confirmed funding. See Appendix II for a summary. Planning Area-Specific Actions under \$5M capital cost are omitted for clarity.



Website:  
[www.surrey.ca/coastal](http://www.surrey.ca/coastal)

# Build Partnerships



SEMAIHMOO FIRST NATION



THE UNIVERSITY  
OF BRITISH COLUMBIA



Fraser Basin Council



engineerscanada  
ingénieurscanada

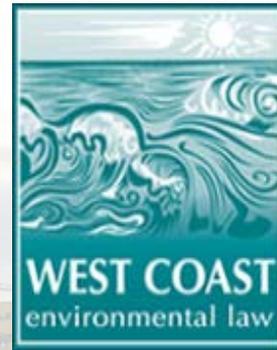


POLYTECHNIQUE  
MONTREAL

WHITE ROCK  
*City by the Sea!*



Climate Action Initiative  
BC AGRICULTURE & FOOD



ENGINEERS &  
GEOSCIENTISTS  
BRITISH COLUMBIA



BIRD STUDIES  
ÉTUDES D'OISEAUX  
CANADA



STEWARDSHIP CENTRE  
FOR BRITISH COLUMBIA



Friends of Semiahmoo Bay Society



FEDERATION  
OF CANADIAN  
MUNICIPALITIES

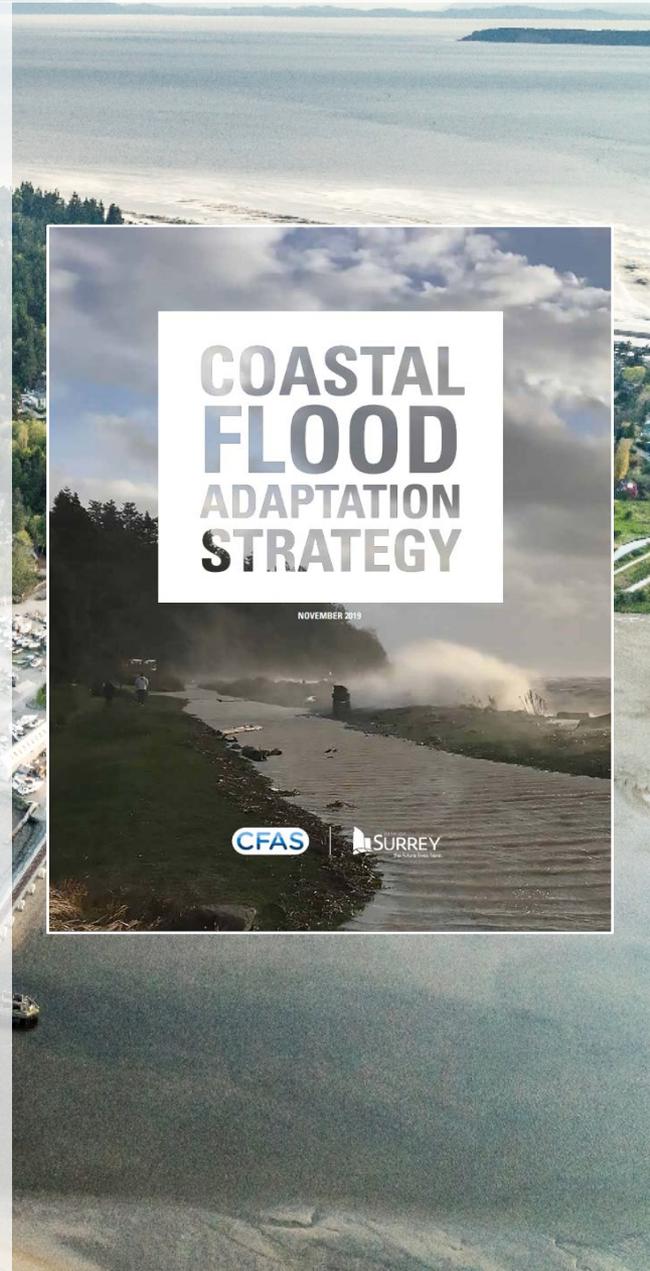
\$449,125 grant funding approved



UNIVERSITY  
OF THE  
FRASER VALLEY

# End Result

- Increased awareness of the impacts of sea level rise
- Stakeholder buy-in
- Partnerships
- High level actions to advance long term strategic directions
- Funding commitments for implementation of capital works



Annie Geoffroy

Director

Infrastructure Canada

# DISASTER MITIGATION AND ADAPTATION FUND (DMAF)

# INVESTING IN CANADA

## \$180 + BILLION INFRASTRUCTURE PLAN OVER 12 YEARS

**Create**  
long-term economic growth

**Build**  
inclusive communities

**Support**  
a low carbon, green economy

### PUBLIC TRANSIT

**\$28.7 BILLION**

Build new urban transit networks and service extensions that will transform the way Canadians live, move and work.

Budget 2016: \$3.4 billion

Budget 2017: \$20.3 billion

Canada Infrastructure Bank: \$5 billion



### GREEN

**\$26.9 BILLION**

Ensure access to safe water, clean air, and greener communities where Canadians can watch their children play and grow.

Budget 2016: \$5 billion

Budget 2017: \$16.9 billion

Canada Infrastructure Bank: \$5 billion



### SOCIAL

**\$25.3 BILLION**

Provide adequate and affordable housing and child care as well as cultural and recreational centers that will ensure Canada's communities continue to be great places to call home.

Budget 2016: \$3.4 billion

Budget 2017: \$21.9 billion



### TRADE AND TRANSPORTATION

**\$10.1 BILLION**

Provide safe, sustainable and efficient transportation systems that will bring global markets closer to Canada to help Canadian businesses compete, grow and create more middle-class jobs.

Budget 2017: \$5.1 billion

Canada Infrastructure Bank: \$5 billion



### RURAL AND NORTHERN COMMUNITIES

**\$2 BILLION**

Grow local economies, improve social inclusiveness and better safeguard the health and environment of rural and northern communities.

Budget 2017: \$2 billion

In addition, the \$400 million Arctic Energy Fund will be delivered under this stream to support energy security in the territories.



## ✓ DELIVERING THE PLAN

### CANADA INFRASTRUCTURE BANK

Help public dollars go farther and build more infrastructure projects

### BILATERAL AGREEMENTS

Achieve national objectives while providing provinces, territories and municipalities with the flexibility to meet their infrastructure priorities

### SMART CITIES CHALLENGE

Challenge communities of all sizes to improve the lives of their residents through innovation, data and connected technology

### DISASTER MITIGATION AND ADAPTATION FUND

Help communities adapt to a changing climate while mitigating the impacts of future disasters

### INVESTING IN INDIGENOUS COMMUNITIES

Improve community infrastructure and create new opportunities

# Disaster Mitigation and Adaptation Fund – Overview

- Budget 2017 earmarked \$2 billion over 10 years for the creation of the DMAF, to be administered by Infrastructure Canada (INFC). DMAF was launched on May 17, 2018
- The objective of the DMAF is to strengthen the resilience of Canadian communities through investments in large-scale infrastructure projects, including natural infrastructure, to better withstand current and future natural disaster risks, and ensure continuity of services
- DMAF is a national, competitive program. Projects are assessed against merit criteria
- DMAF is a contribution program (federal transfer payment subject to conditions specified in the funding agreement). Funding recipients are required to report on results achieved.

# Disaster Mitigation and Adaptation Fund – Key Program Elements

- Investments must support public infrastructure, which is defined as tangible capital assets that are primarily for public use or benefit, including natural infrastructure. This includes:
  - New construction of public infrastructure; and
  - Modification and/or reinforcement including rehabilitation and expansion of existing public infrastructure
- Eligible expenditures may include design and planning, and capital costs. Ongoing operation and maintenance expenditures are not eligible under the program.

# Disaster Mitigation and Adaptation Fund – Key Program Elements (cont'd)

- Investments must be aimed at reducing impacts triggered by natural hazards and extreme weather events. Projects must therefore increase communities' resilience, measured across 4 factors:
  - local economic loss;
  - % of people directly affected;
  - % of population without essential services;
  - % of missing people and loss of lives.
- DMAF projects must take into consideration current and potential future impacts of climate change in communities and infrastructure at risk
- DMAF projects must complete a Greenhouse gas Mitigation Assessment.

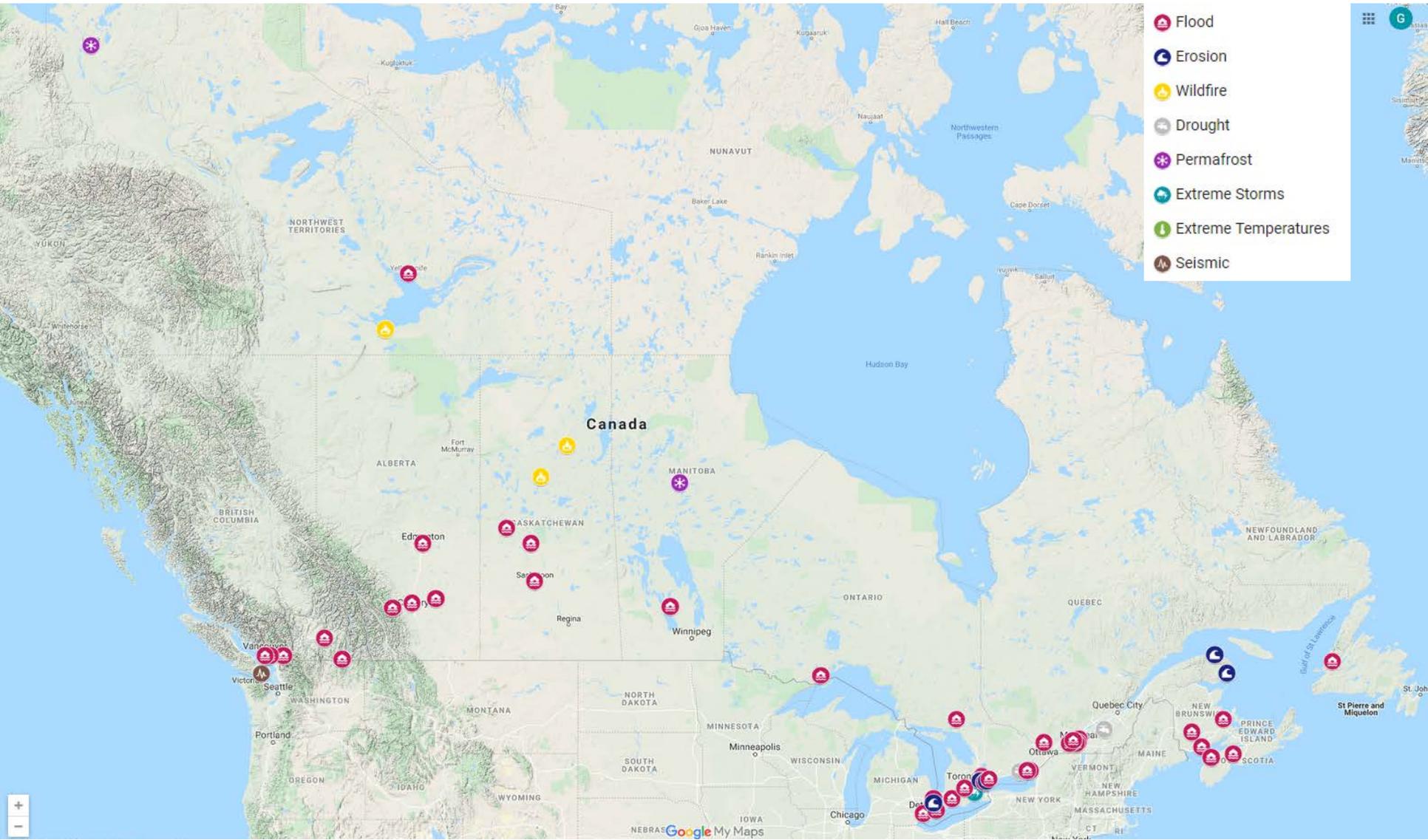
# Disaster Mitigation and Adaptation Fund – Eligible Recipients & Cost Sharing

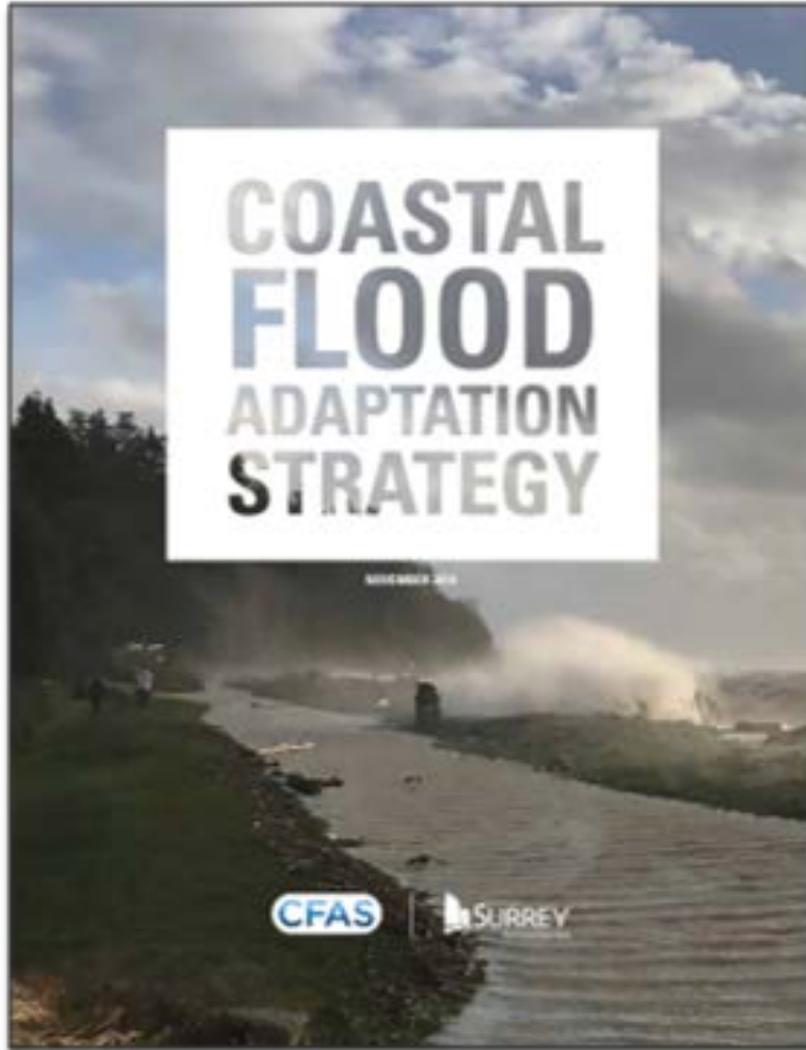
Eligible Recipients <sup>1</sup>	Cost Sharing / Stacking Limit <sup>2,3</sup>
Provinces	Up to 50%
Territories	Up to 75%
Indigenous organizations (Indigenous recipients can access additional funding from any applicable federal source to a maximum federal contribution of 100% from all sources)	Up to 75%
Municipalities and regional governments Public sector bodies Post-secondary institutions and Not-for-profit organizations working in collaboration with a municipality	Up to 40%
For-profit organizations (conditions apply)	Up to 25%
<b>Notes</b> 1. Federal entities, including federal Crown corporations, are not eligible for funding 2. DMAF encourages partnerships where different entities collaborate to systematically reduce the same hazard risk within the same time period 3. The cost sharing is calculated based on asset ownership	

# Disaster Mitigation and Adaptation Fund – Program Implementation

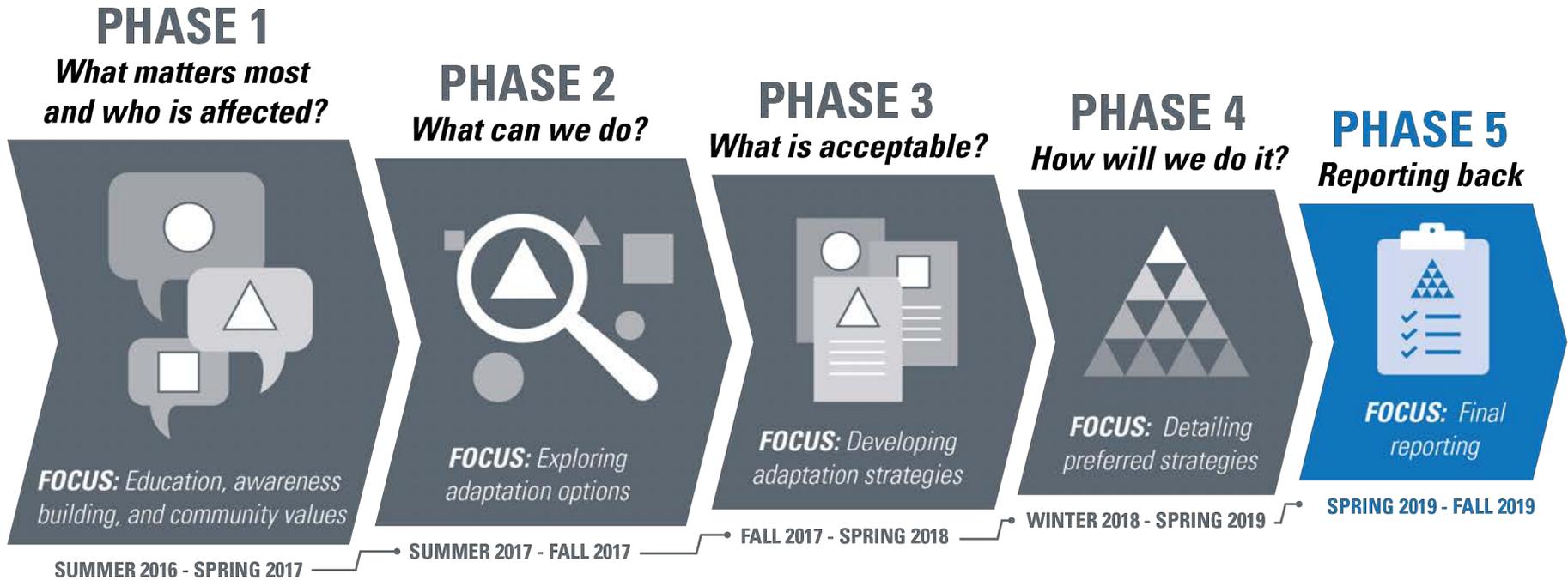
- DMAF and its first project intake were launched in May 2018 and closed in January 2019
  - A total of 59 projects have been approved for a total federal contribution of \$1.76B
  - 2/3 of projects are related to flooding
  - 2/3 of funding recipients are municipalities
- A second program intake is anticipated to be launched, but the timing has not yet been determined.

# Disaster Mitigation and Adaptation Fund - Approved Projects (59) by Hazard Types





# Financing Resilience



# Application for DMAF

- 13 projects valued at \$187 million, implementing short-term CFAS actions that are required no matter what long-term adaptation direction is chosen
- Government of Canada investment of over \$76 million
- Projects make smart investments in the protection of residential neighbourhoods, businesses, significant habitat areas and critical infrastructure by:
  - Establishing multiple lines of defense against coastal flooding
  - Lowering nationally significant **coastal** and riverine flood and seismic vulnerabilities
  - Improving emergency response connectivity and disaster recovery time



\* Second location in Delta between 88 and 96 St on Boundary Bay

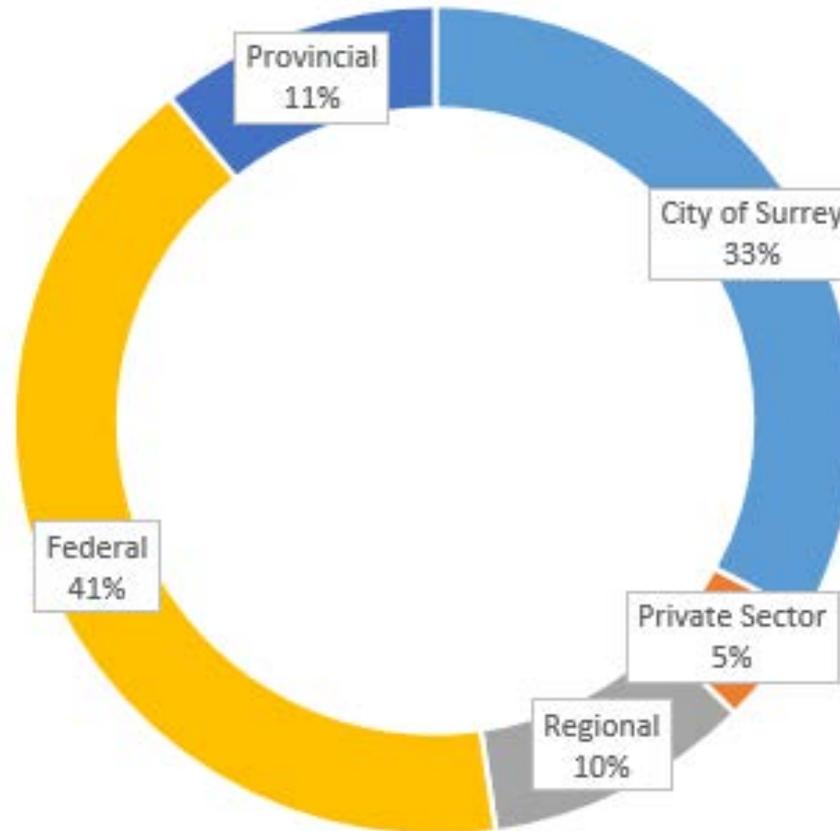
#	Name	Asset Type	Hazard Mitigation	Community Co-benefits	Values Protected	Project Partners
1	Colebrook Dyke Upgrades	Coastal Dyke		Recreation, bird watching, food security		Province of BC
2	Colebrook Drainage Pump Station Replacement	Drainage Pump Station		Increased agricultural productivity and food security		
3	Sea Dam – Serpentine River	Sea Dam (drainage and irrigation)		Agriculture irrigation, fish passage, worker safety		
4	152 St Road Upgrades and Raising	Integrity of Transportation Network and Asset		Congestion relief, transportation safety, accommodate growth, cycling, pedestrian		Translink FortisBC Energy
5	Nicomekl Riverfront Park - Phase 1	Flood storage alternative to riverine dyking		Recreation (blue way), nature trails, wetlands, culture, open space		
6	King George Boulevard Bridge and Nicomekl River Sea Dam Replacement	Arterial Bridge (integrated with one sea dam) Integrity of Transportation Network and Asset		Congestion relief, transportation safety, accommodate growth, cycling, pedestrian, integrated to Nicomekl Park, fish passage, agriculture irrigation		Metro Vancouver Ministry of Transportation & Infrastructure
7	Crescent Beach Storm Sewer System Upgrades - Perforated Piping	Flood Protection increases transportation resilience		Street beautification/ road improvements, transportation safety		
8	Dyking - Lower reaches of Nicomekl and Serpentine	Flood Protection (nuisance and extreme event)		Food security and transportation flood safety		
9	Serpentine SRY Rail Link Bridge Replacement and Dyking	Flood Protection (nuisance and extreme event)		Economy (freight and heritage railway), worker safety and goods movement		SRY LINK (Southern Railway of BC)
10	Burrows Drainage Pump Station Upgrade	Drainage Pump Station		Increased agricultural productivity and food security		
11	Stewart Farm Sanitary Pump Station Coastal Flood Proofing	Integrity of Sanitary Sewer Network		Sanitation, worker safety and water quality		
12	Campbell River Pedestrian and Emergency Access Bridge Replacement	Integrity of Transportation Network		Emergency access, Multi Use Path		Semiahmoo First Nation
13	Foreshore Enhancements	Structural and nature based flood control and environmental enhancements		Wetlands (birds, fish, clams) and food security		City of Delta

**Hazard Mitigation**  
 = flood   = seismic   = drought

**Values Protected**  
 = economy   = infrastructure   = environment   = communities

\$187M 8-year program (\$76.6M federal contribution)

# Surrey-Delta-Semiahmoo First Nation DMAF Funding

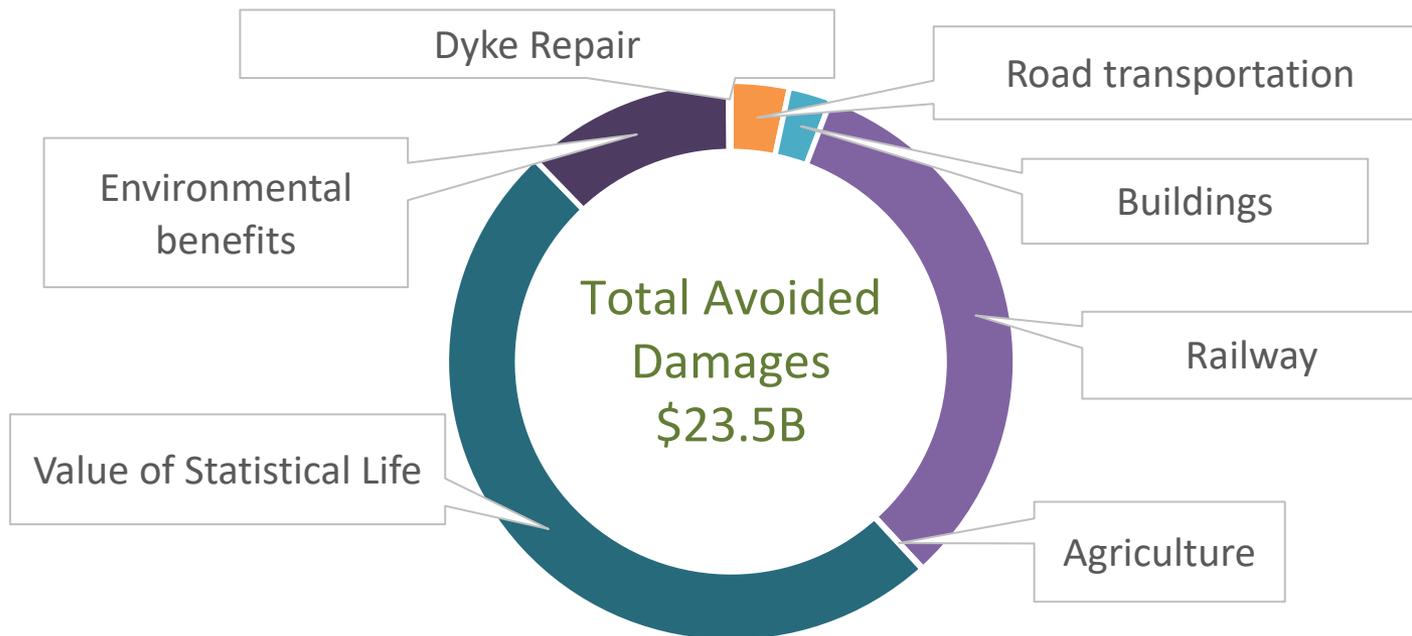


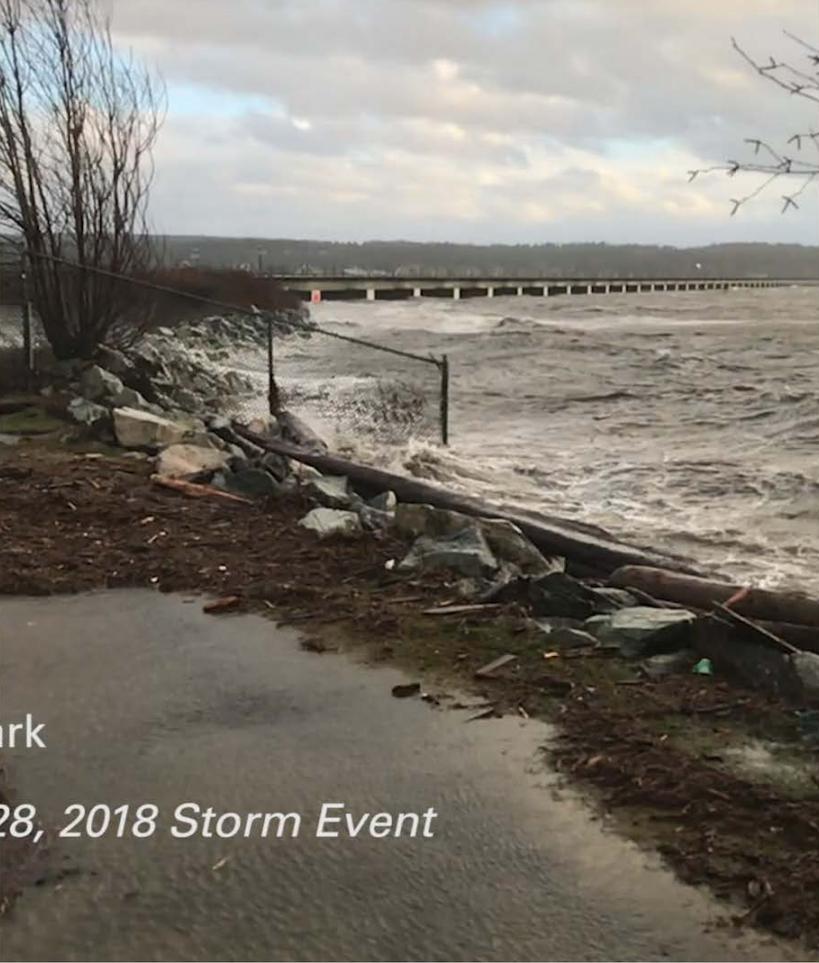
Total Estimated Funding \$187,000,000



# Return on Investment

- Nationally significant infrastructure is protected
- Avoided damages calculated over life of assets
- Benefit to Cost ratio 126:1
- Financially sustainable



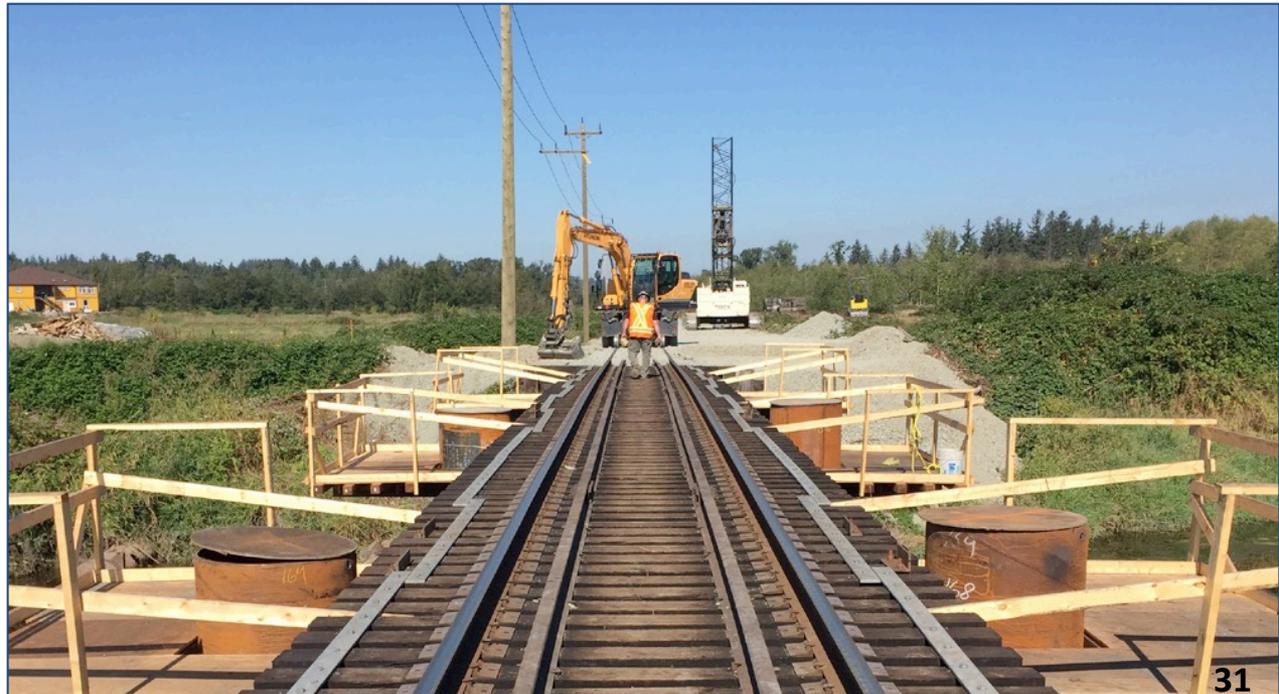


Mud Bay Park  
Surrey, B.C.  
*December 28, 2018 Storm Event*

<https://youtu.be/DQxpig9kH4c>

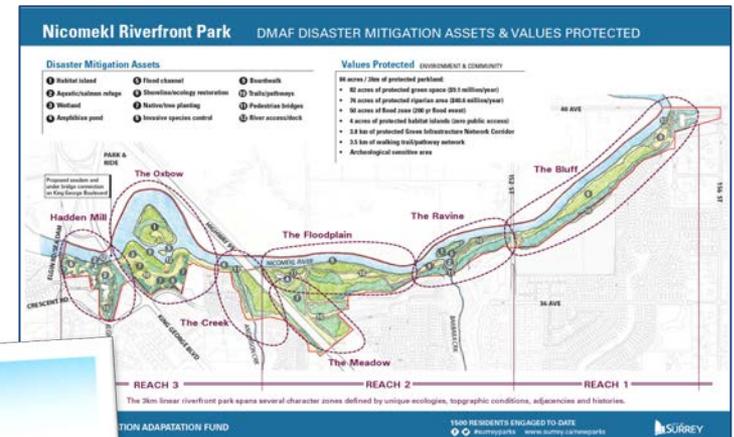
# Shovel-Ready Projects

- City of Surrey
  - Colebrook Dyke Upgrades
  - Stewart Pump Station
  - Burrows Pump Station
  - SRY Rail Link Serpentine Bridge
- City of Delta
  - Boundary Bay Dyke Upgrades



# High Priority Projects

- Nicomekl King George Blvd Bridge
- Nicomekl Riverfront Park
- 152<sup>nd</sup> St Raising and Widening
- Colebrook Pump Station



# Innovative Projects

- Nature-based solutions



# Adaptation Case Study Activity

## Objective:

- Learn how a climate adaption project gets implemented

## Why:

- To finance resilience, it helps to think through all the phases of a project

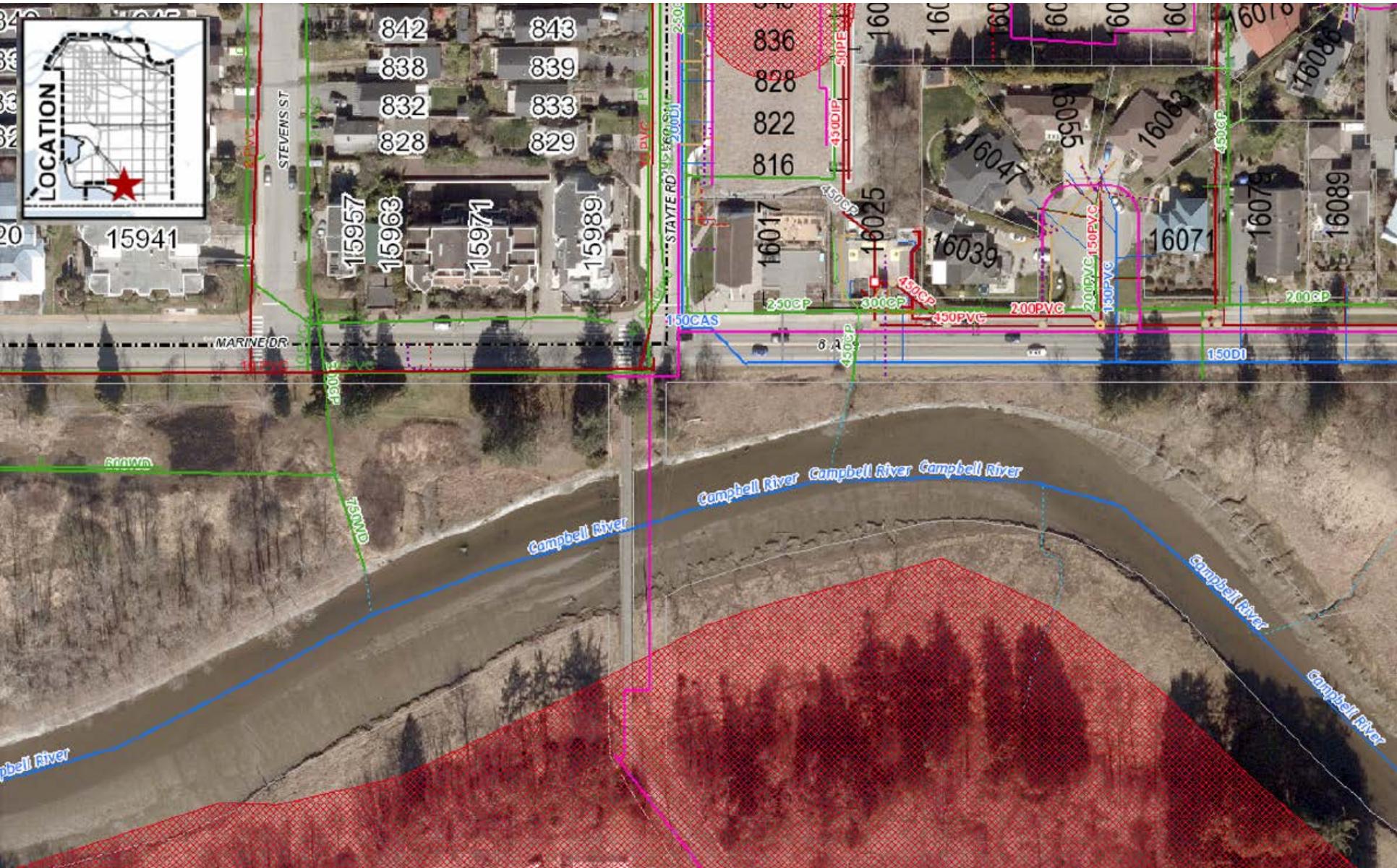
## How:

- Each table group chooses their case study:
  - A) Little Campbell Pedestrian Bridge
  - B) Mud Bay Foreshore Enhancements
- Table facilitators will lead discussion on their selected case

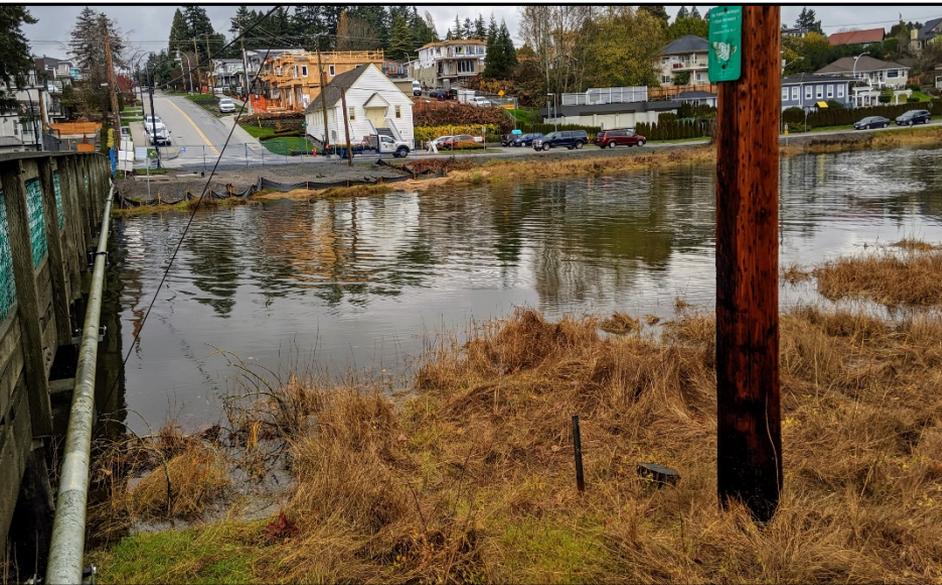
## What:

- Discuss: Tasks, Timelines, Resources and Requirements at each phase of selected project
- Discuss: Key challenges and critical steps

# Little Campbell River Bridge



# Little Campbell River Bridge





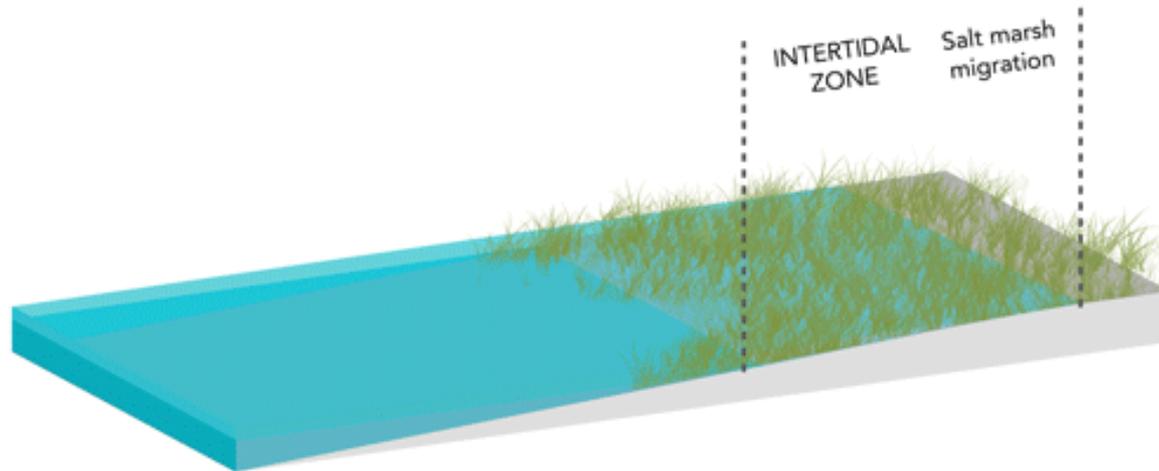
## Mud Bay Foreshore Enhancements

### Salt marshes

- ➔ important habitat for wildlife (high biodiversity)
- ➔ exist between mud flats and dykes
- ➔ enhance water quality
- ➔ stabilize the shoreline
- ➔ attenuate waves

# Mud Bay Foreshore Enhancements

>>>Coastal Squeeze<<<



# Mud Bay Foreshore Enhancements

Foreshore protection

Nature-based solution for coastal squeeze and coastal flooding



Existing salt marsh at risk from coastal squeeze in Boundary Bay

# Mud Bay Foreshore Enhancements

## Boundary Bay Living Dike Roundtable

### Steering Committee:

- Lower Fraser Fisheries Alliance and First Nations Emergency Planning Secretariat,
- West Coast Environmental Law,
- FLNRORD,
- First Nations,
- DFO,
- Canadian Wildlife Service; and
- BC Municipalities.

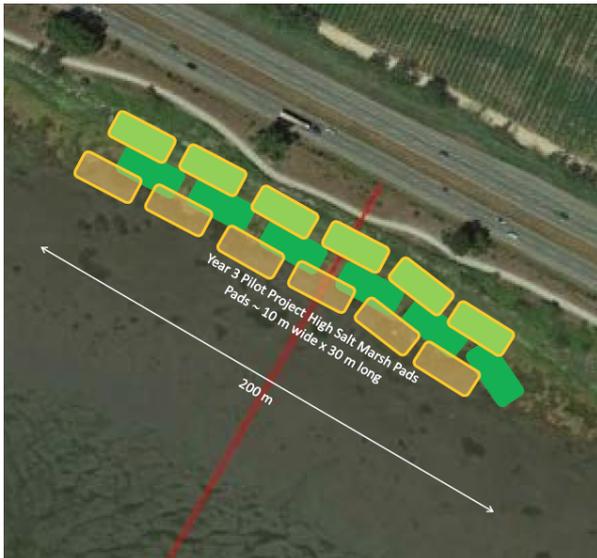


# Mud Bay Foreshore Enhancements

From an idea  
adding sediment and  
planting to mimic  
natural marsh  
formation

Innovative  
Collaborative  
Nature-based  
Multiple objectives

To a project  
bundled as one of  
DMAF projects



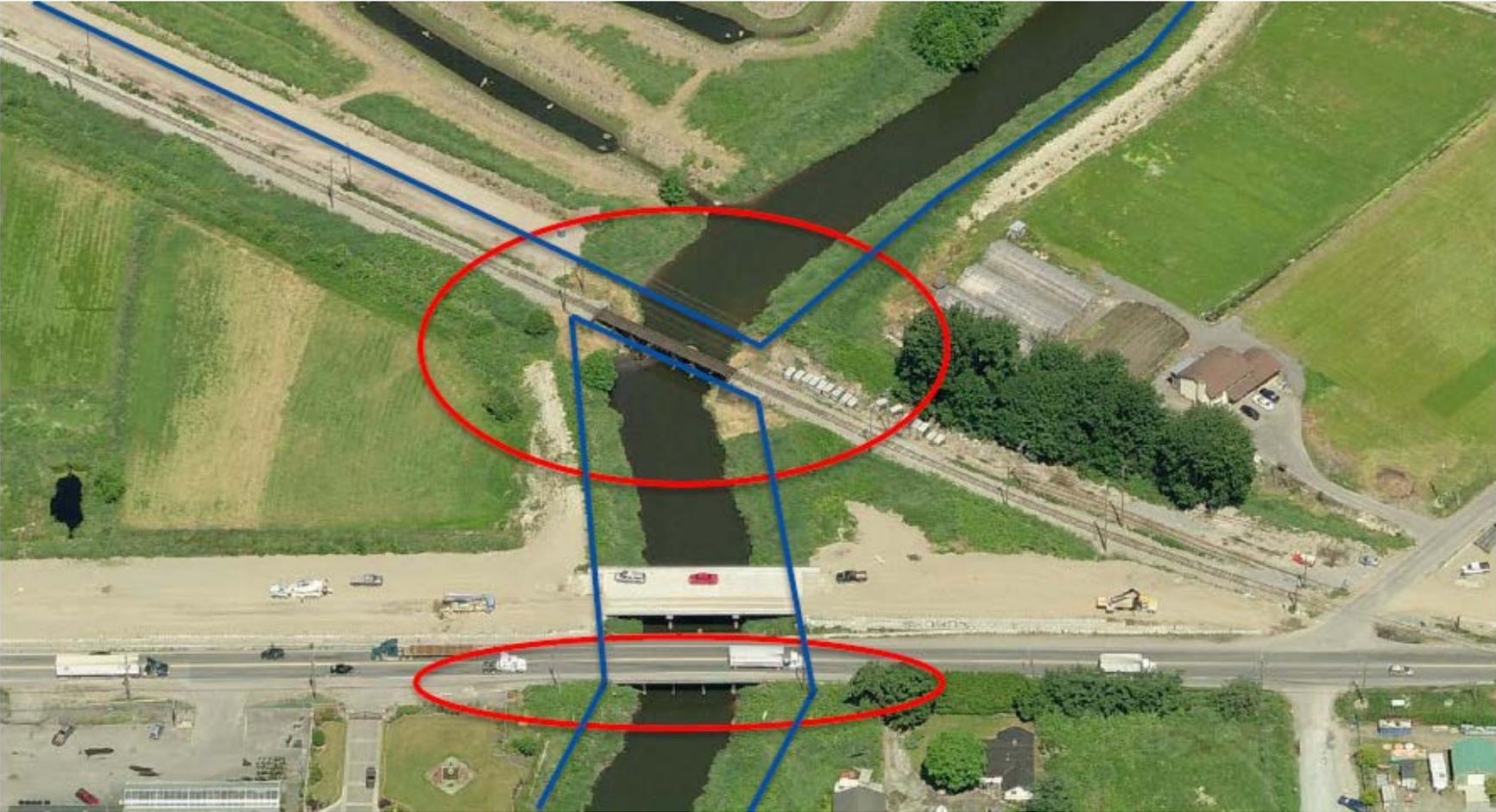
# Adaptation Case Study Activity

- Each table group chooses their case study:
  - A) Little Campbell Pedestrian Bridge
  - B) Mud Bay Foreshore Enhancements
- Table groups discuss Tasks, Timelines, Resources and Requirements at each phase of selected project
  - 1) **Planning** (*dentification of problems, constraints, prioritization*)
  - 2) **Doing** (*Decision to proceed*)
  - 3) **Implementation** (*Construction*)
  - 4) **Maintenance and Operations**
- Key challenges and critical steps

# Example: SRY Rail Link Serpentine Bridge



# Example: SRY Rail Link Serpentine Bridge



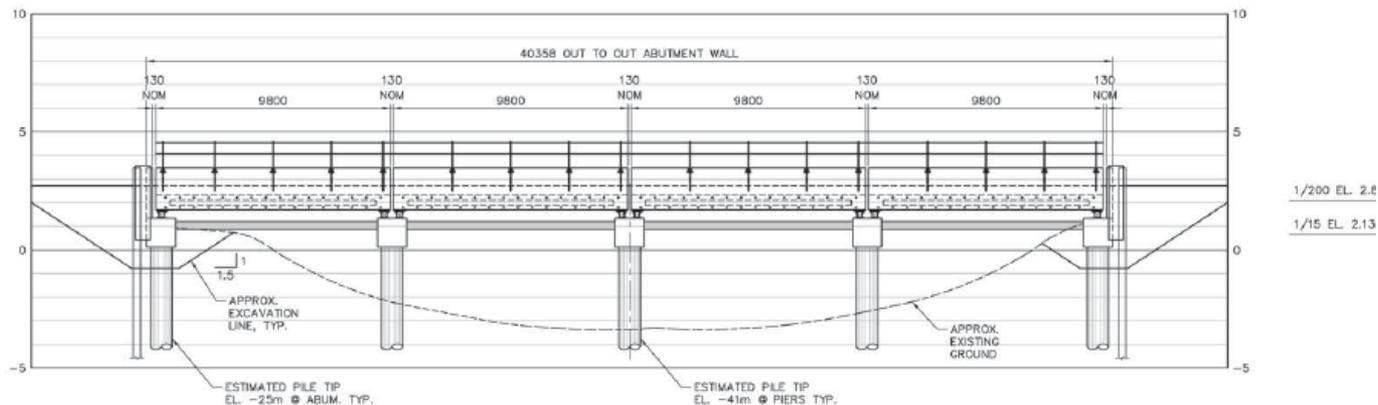
# Example: SRY Rail Link Serpentine Bridge

## Phase: Planning

- Development of many alternatives
- Identification land owner vs tenant vs regulator responsibilities and established flood warning system
- Identification of lowest cost options for each party (Railway and City)
- Modelling to establish the level of risk and how sea level rise will increase the risk
- Legal opinions on liability, cost allocation, discussions with regulators
- BC Hydro relocated some infrastructure in advance

## Phase: Doing

- Detailed design of each parties key aspects
- Iterated back and forth between Planning and Doing with staff turn over and no firm funding commitments
- Initial permits applied for in January 2019, Summer 2019 permit applications indicated more permits required



# Example: SRY Rail Link Serpentine Bridge

## Photos:

Photo 1 – Train passing over bridge



Photo 3 – Bridge Struts



Photo 2 – Bridge Deck Complete Pre-Ballasting



# Example: SRY Rail Link Serpentine Bridge

## Phase: Implementation

- Expedited final permitting
- Challenging conditions to build abutments during winter limited track closure window
- Specialized input from structural, geotechnical and environmental engineers



# Example: SRY Rail Link Serpentine Bridge

## Phase: Maintenance and Operations

- Rights-of-way for aspects of shared interest
- Dyke height will lower overtime through settlement and ground subsidence and result in differential settlement with bridge
- Flexible infrastructure built to accommodate future height increases, may require jacking bridge and welding extensions to flood walls



# Key Challenges and Critical Steps

## Key Challenges:

- Multi-disciplinary design challenges (transmission powerlines, provincial highway)
- **Cost** allocation and sharing
- Shorter term view (**tenant**)
- **Information** sharing across parties and data gaps
- High water level and railway shut down
- Technical and managerial staff turnover
- Regulatory backlog of applications

## Critical Steps:

- **Relationships** built through numerous meetings
- Engineering studies on **vulnerability/risk** and **cost estimates** and **peer reviews**
- Different **triggers** to make investment
- Extensive correspondence required to develop shared understanding and perspective
- Urgency of funding application escalated decision to senior management to resolve
- **Shovel ready** design ready before federal funding program intake
- **Persistence....** Systematically overcoming critical data gaps required resources



# Table Exercise

- **Choose:** Little Campbell Pedestrian Bridge OR Foreshore Enhancements
- **10 minutes: Tasks, Timelines, Resources and Requirements**
  - 1) Phase: Planning** (*identification of problems, constraints, prioritization*)

Typically includes background work, data analysis, engagement, identifying problems, problem solving, identification of triggers and priorities, project scoping and funding pre-application preparation (if applicable).
  - 2) Phase: Doing** (*Decision to proceed*)

Typically includes obtaining funding approvals, detailed review of alternatives, developing preliminary design, management and political project approval.
  - 3) Phase: Implementation** (*Construction*)

Typically includes obtaining final permits, finalizing designs, issuing tenders, contracts with partners and contractors, construction, project close out. Ongoing scope and budget/cashflow management. Addressing unforeseen conditions. Stakeholder and rightsholder management.
  - 4) Phase: Maintenance and Operations**

Typically includes repairs, ongoing upgrades, monitoring and emergency response.
- **5 minutes to discuss key challenges and critical steps**

## Audience Response



### Instructions:

- 1) Rejoin the poll by opening your web browser and pointing to the webpage:

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- 2) Answer the questions as they become visible in your browser

# Lessons Learned

- **NO** adaptation is **NOT** an option
- Proactive planning shapes infrastructure investment decisions
- Engagement and collaboration were key to problem solving and built relationships
  - Indigenous values, priorities and traditional knowledge included in solutions
- Start with “no-regret” Actions that address pressing issues of stakeholders and rightsholders
  - Be adaptive and flexible
- Cost sharing opportunities increased collaboration and ultimately innovation
  - Search far and wide for sources of funding
- Federal DMAF criteria shaped our decisions
  - \$20M minimum stretched us to think about bundled projects and making new partnerships
  - Nature base solutions were possible and stretched us to advance new approaches
  - Long term thinking of avoided damages over infrastructure lifespan solidified business case



# Ongoing Adaptation

- **New data** – or changes in the data such as acceleration in sea level rise
- **New policies/directives** – global, national, provincial, regional, and local
- **New participants and collaborations** – new partners and actions taken by stakeholders
- **New funding** – and the requirements/opportunities that come with them
- **Extreme Events** – occurrence of an extreme coastal flood or other disasters



## Learn More

- 1) Engineers Canada Sustainability in Practice Course
  - SDES 101–Polytechnique Montréal  
<https://catalogue.edulib.org/en/courses/polymtl-sdes101/>
  - Next intake expected spring 2020
- 2) CFAS Planning
  - [www.surrey.ca/Coastal](http://www.surrey.ca/Coastal)
- 3) CFAS Implementation
  - [www.surrey.ca/CoastalTakingAction](http://www.surrey.ca/CoastalTakingAction)
- 4) Various NGO websites related to coastal flooding:
  - <https://www.ducks.ca/sea-level-rise/>
  - <https://www.wcel.org/program/coastal-communities>
  - [https://www.fraserbasin.bc.ca/water\\_flood.html](https://www.fraserbasin.bc.ca/water_flood.html)