Harrison Hot Springs Waterfront Flood Mitigation

Update to Council

April 17, 2025

Introductions
Project Team

Presenter:

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Hydrotechnical Engineer, **NHC**

Project Team:

HARRISON HOT SPRINGS
Naturally Refreshed

Northwest Hydraulic Consultants
Civil/hydrotechnical engineering
(Prime Consultant)

Space2place
Landscape architecture
Public engagement

Thurber Engineering
Geotechnical/seismic engineering

Legacy Environmental
Environmental/permitting
Indigenous consultation

Presentation Outline

1. Project overview
2. March 2025 public engagement summary
3. Main themes for comments/questions
4. Responses
5. Options for next steps

Project Overview
Components

WWTP Road and Shoreline + Rendall Park earthfill dike (Zones 1, 2 and 6)
– Council has directed staff to proceed with design

Waterfront Dike (Zones 3, 4, 5)
– Design concepts under discussion

March 2025 Public Engagement Summary

Public open house: Monday, March 3, 2025, 5-7 pm, Memorial Hall

Responses:

- 22 community questions compiled pre-open house
- 25 handwritten responses at open house
- 2 email responses

Questions/Comments – Main Themes

1. Project rationale
2. Proposed dike crest level
3. Project cost and available funding
4. Disruption during construction
5. Waterfront experience and view impacts

Questions/Comments

1. Project rationale

- Why isn't the existing dike good enough?
- What happens if the dike is not upgraded?
- The real flood hazard isn't from Harrison Lake. It's from the Fraser River/Miami River/local precipitation (e.g. 2021 atmospheric river)

1. Project Rationale

"The dike has worked so far"

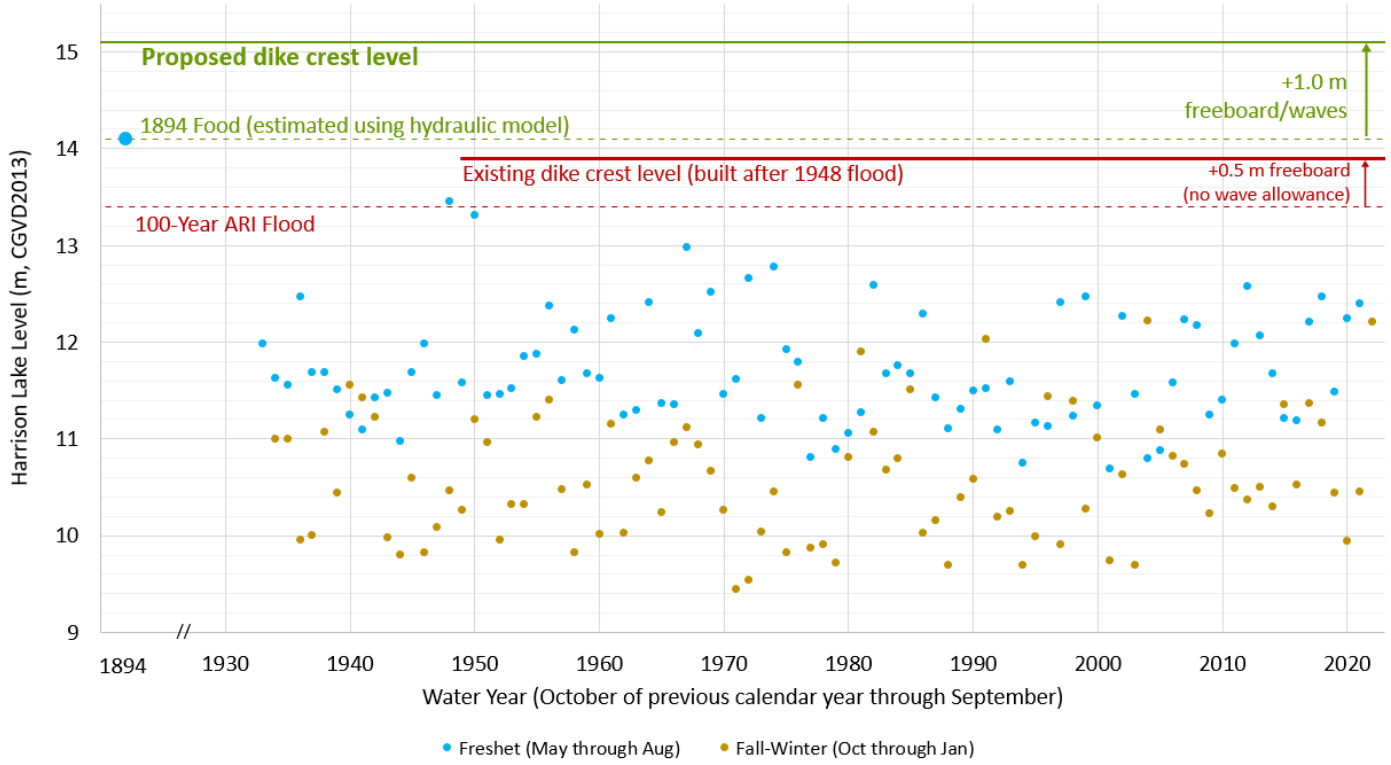
Existing dike protects to ~100-year flood

- 1% probability each year
- 22% probability within 25 years
- 53% probability within 75 years

Proposed dike protects to ~500-year flood

- 0.2% probability each year
- 5% probability within 25 years
- 14% probability within 75 years

There has not been a large enough flood to overtop the dike since 1948



1. Project Rationale

Dike Condition

Main concern: inadequate crest level

Upgrades contemplated in 1990s through Provincial Fraser River Flood Control Program

2015 Provincial Lower Mainland Dike Assessment

- **Crest elevation rating: 2 out of 4**
  "the dike does not meet minimum requirements"
- Overall condition rating: 2.63 out of 4
- Limited geotechnical data available

Dike Segment Deficiency Matrix

Region 2: Lower Mainland
Authority: Harrison Hot Springs, Village of
Dike 76: Harrison Hot Springs
Dike Segment 1: 0+000 to 1+550

Rating values range from 1 (Unacceptable) to 4 (Good)

Crest Elevation Rating 2
Avg. Dike Seg. Rating 2.63

Rating Item	Rating	Lib.Ref.Codes	Rationale
1. Crest Elevation vs DCL	2	OR-013; OR-014	The DCL is the 13.9m design flood level (reported by nhc) plus a 0.6m freeboard for a total elevation of 14.5m whereas the crest elevation at a mid chainage of 0+750 is 13.8m. Some crest elevations are reported to be higher than the design flood level, however overall the dike does not meet minimum requirements.
2. Geometry	3	HAR-OM-M-2; W-2872	Dike sections adjacent to the Miami Creek floodbox have designed crest width of 6m. Landside and waterside slopes with riprap protection is 2H:1V. However newer works in front of Harrison Hot Springs Hotel have a reported riverside slope of 1.5H:1V (with riprap protection) and does not meet standard.
3. Geotechnical Stability - General	3	DIR-090	No seepage, erosion, or obvious geotechnical issues reported. Construction drawings show an impervious core which will help landside stability and should reduce seepage issues through the dike. Dike is 2H:1H which is steeper than recommended, although it is riprapped. No geotechnical data available
4. Geotechnical Stability - Seismic			No geotechnical data available.
5. Erosion Protection	3	W-2872; DIR-091	Riprap protection in front of Harrison Hot Springs Hotel added to repair sections where existing riprap and soil had been eroded during recent storms. It is possible that storm activity since 2007 has continued erosion of riprap however no issues have been reported in recent dike inspection reports.
6. Vegetation/Animal Control	1	DIR-090	Trees growing <2m from toe of landside slope.
7. Encroachments	3	OR-013; Google Earth	Boat Launch approximately 12m wide crosses dike.
8. Appurtenant Structures	3	iMaps-BC; OR-002	Stairs, Pump Station, 2 Flood Boxes, 1 Retaining Wall, Outlet with no issues reported.
9. Administrative Arrangements	3	DIR-090	Annual inspection, O&M Manual, no ROW access issues reported

1. Project Rationale

Flooding in Village of Harrison Hot Springs

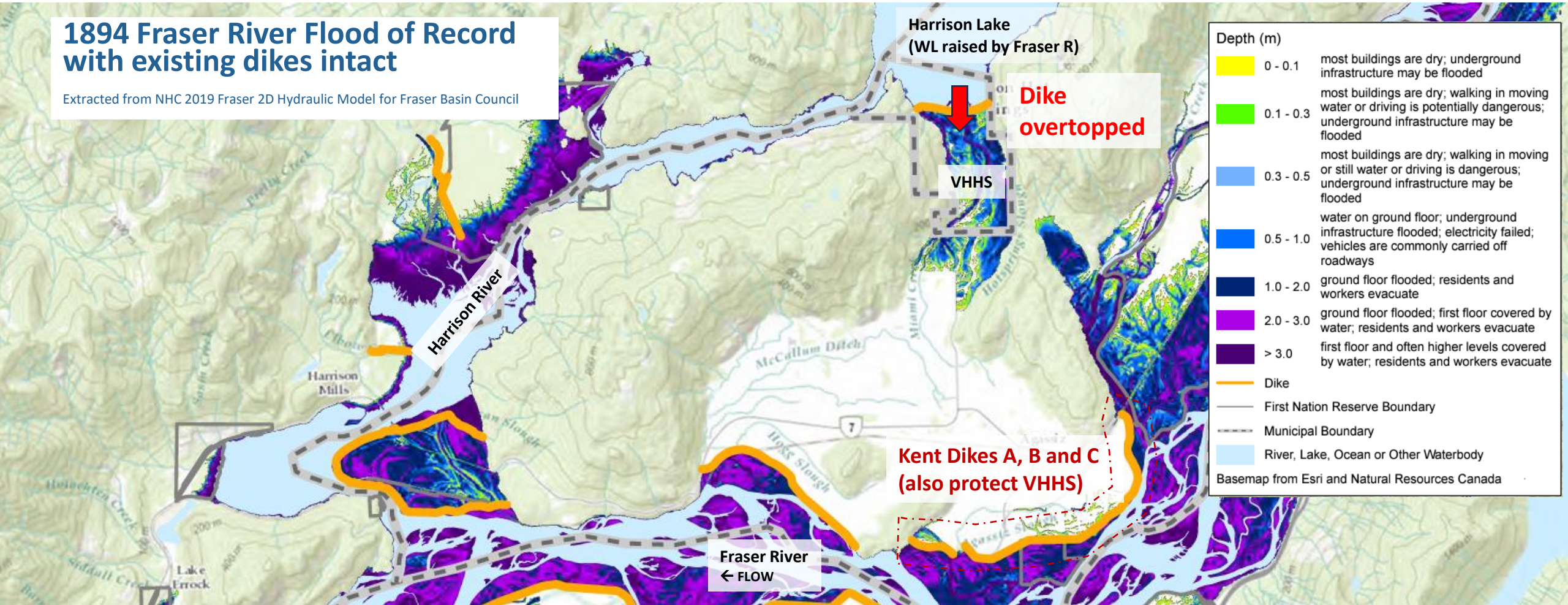
- **Design Event: Fraser River freshet flood**
  (spring/early summer snowmelt)

- **Other flood hazards**
  - **Harrison Lake inflow flooding (fall/winter)**
    Also managed by dike, but water levels lower
  - **Local stormwater/drainage, Miami River**
    Managed by pump station/floodbox
    (upgraded 2016, designed for 200-year Miami River flow)
  - **Landslide generated waves**
    Slope failure along Harrison Lake shoreline (tsunami wave, up to 20-25 m high) – not managed by dike

1. Project Rationale

Fraser River flooding from District of Kent

- Harrison Hot Springs dike overtops first



1. Project Rationale

Consequences of flooding

Fraser River Flooding

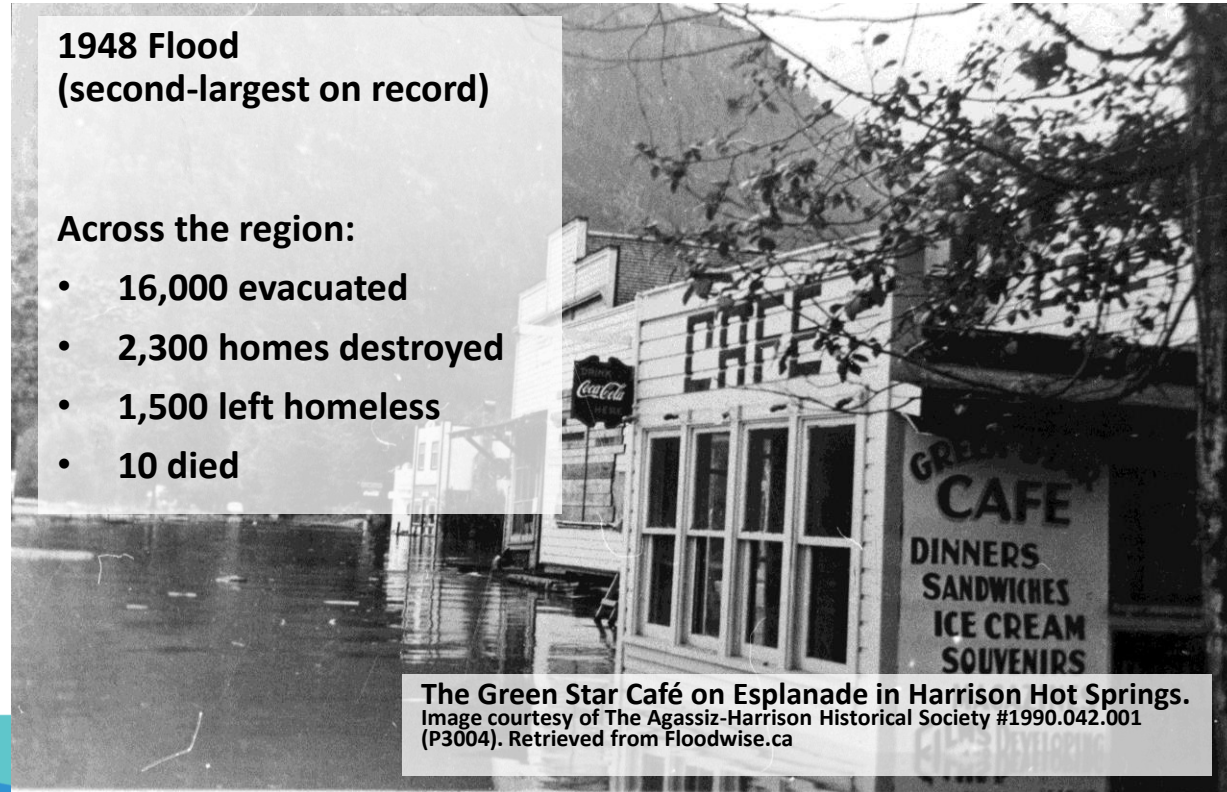
If 1894 flood happened today:

- Area is more populated than during historic floods: greater consequence
- Most areas inundated >1 m depth
- Limited evacuation routes
- Regional disaster (~$30B in losses across region) – would leave resources for response depleted

1894 Flood of Record

"The bridge across the big Slough between Agassiz and Harrison Hot Springs is covered with water and rendered impassible. Boats have been used to ferry people across. The Hot Springs Hotel is surrounded by water, and has been closed for the present, travel being at a complete standstill."

- Interview with Captain Jemmett
  Daily Columbian, 5 June 1894
  (reproduced from *High Water: Living with the Fraser Floods*, K.J. Watt, 2006)



The Green Star Café on Esplanade in Harrison Hot Springs.
Image courtesy of The Agassiz-Harrison Historical Society #1990.042.001 (P3004). Retrieved from Floodwise.ca

1. Project Rationale

Consequences of flooding: recent floods in BC
Grand Forks – May 2018

- Return period >200-year
- One third of residents forced to evacuate
- Over 100 rescues
- 400 homes and 100 small businesses destroyed
- Cost of damages: $38M

Recovery:

- Flood mitigation infrastructure (new dikes)
- Voluntary home buyouts and expropriations on floodplains

Photo: CBC

1. Project Rationale

Consequences of flooding: recent floods in BC
Princeton – November 2021

- Dike breached
- 290 properties evacuated
- Drinking water supply damaged, boil water advisory in place for 3 years
- Homes and municipal infrastructure destroyed
- Some still displaced two years after flood

Photo: Castanet

1. Project Rationale

Consequences of flooding: recent floods in BC
Merritt – November 2021

- Dikes failed
  - Deficiencies previously documented, but no upgrades
- $150M in damage
- All 7,000 residents evacuated to Kamloops or Kelowna
- Sewage treatment plant failed
- Over 600 homes damaged or destroyed, some residents still displaced months later
- Flood recovery is ongoing – funding challenges in rebuilding dikes

Photo: Bailee Allen, from CBC

2. Proposed dike crest level

- Why does the dike need to be raised so much?

2. Proposed dike crest level

Current provincial standards

- Adopted after the existing dike was constructed
- Refined flood estimates = higher design levels

A regional issue

2015 Lower Mainland Dike Assessment:

- 54% of dikes had crest below design flood level
- Only 4% fully met crest level standards

Provincial Design Crest Elevation Criteria

water level (200-yr or Flood of Record)
+ settlement
+ climate change (future)
+ wave runup
+ freeboard

Dike construction and upgrades must be approved by Provincial Inspector of Dikes

2. Proposed dike crest level

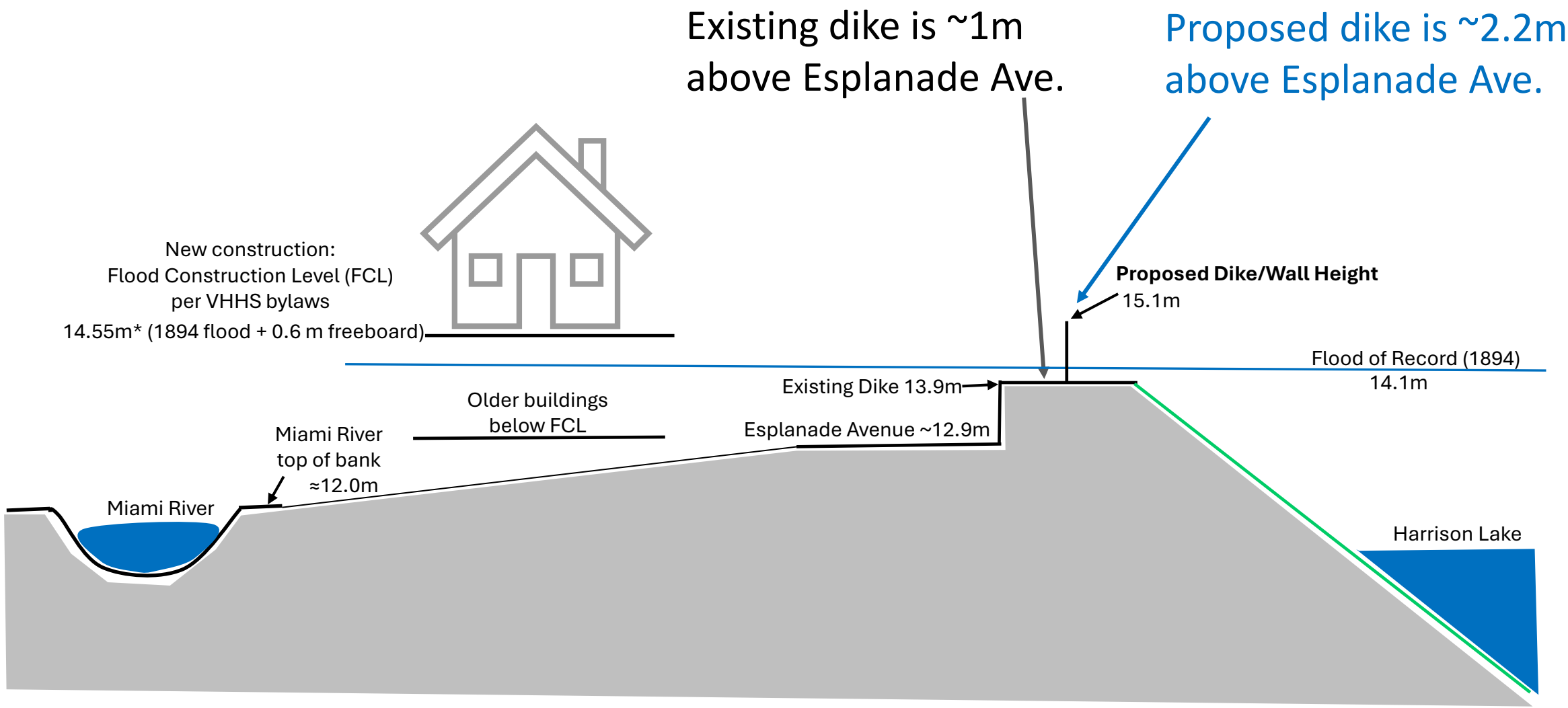
Existing dike crest elevation	13.9 m
Water level (Flood of Record):	14.1 m
+ settlement	~0 m
+ climate change (future)	0.8 m to 1.7 m
+ wave runup (but manageable on land side):	0 m to >0.6 m
+ freeboard	0.6 m
Possible Range	15.1 m to 17.0 m
Proposed Minimum Design Crest Elevation	**15.1 m**

Proposed dike crest level is 1.2 m higher than existing dike

Notes:

- Meets Provincial standard for design lake level
- Wave overtopping likely during a large flood
- Future climate change adaptations likely required
- Approach is subject to Inspector of Dikes approval

2. Proposed dike crest level



*Elevations above are in CGVD2013 vertical datum. Bylaws state FCL as El. 14.55 m CGVD28 = 14.7 m CGVD2013

3. Project cost and available funding

- How much will the upgrades cost?
- What happens if cost exceeds available funding?

3. Project cost and available funding

Project is fully grant-funded:

$11M of grant funding approved

- $6M UBCM Strategic Priorities Fund
- $5M Provincial Community Emergency Preparedness Fund

Objective is to remain within grant funding

If costs are higher:

- Phase work to construct higher-priority components
- Locally use lower-cost temporary flood protection until permanent dike can be constructed (e.g. flexible tube barriers)
- Seek additional funding sources

4. Disruption during construction

- How long will construction take?
- How will disruptions be minimized?

4. Disruption during construction

Construction duration not fully known until design is complete, but rough estimates:

- 3-4 months for earthfill dikes and WWTP road
- 3-4 months for flood wall

Possible mitigations:

- Construct only outside of peak season (e.g. avoid July and August)
- Reduce traffic and parking disruptions on Esplanade Ave. where possible
- Phase construction over multiple years if required

5. Waterfront experience and view impacts

- The dike will disrupt views. Use more deployable dike sections.

5. Waterfront experience and view impacts

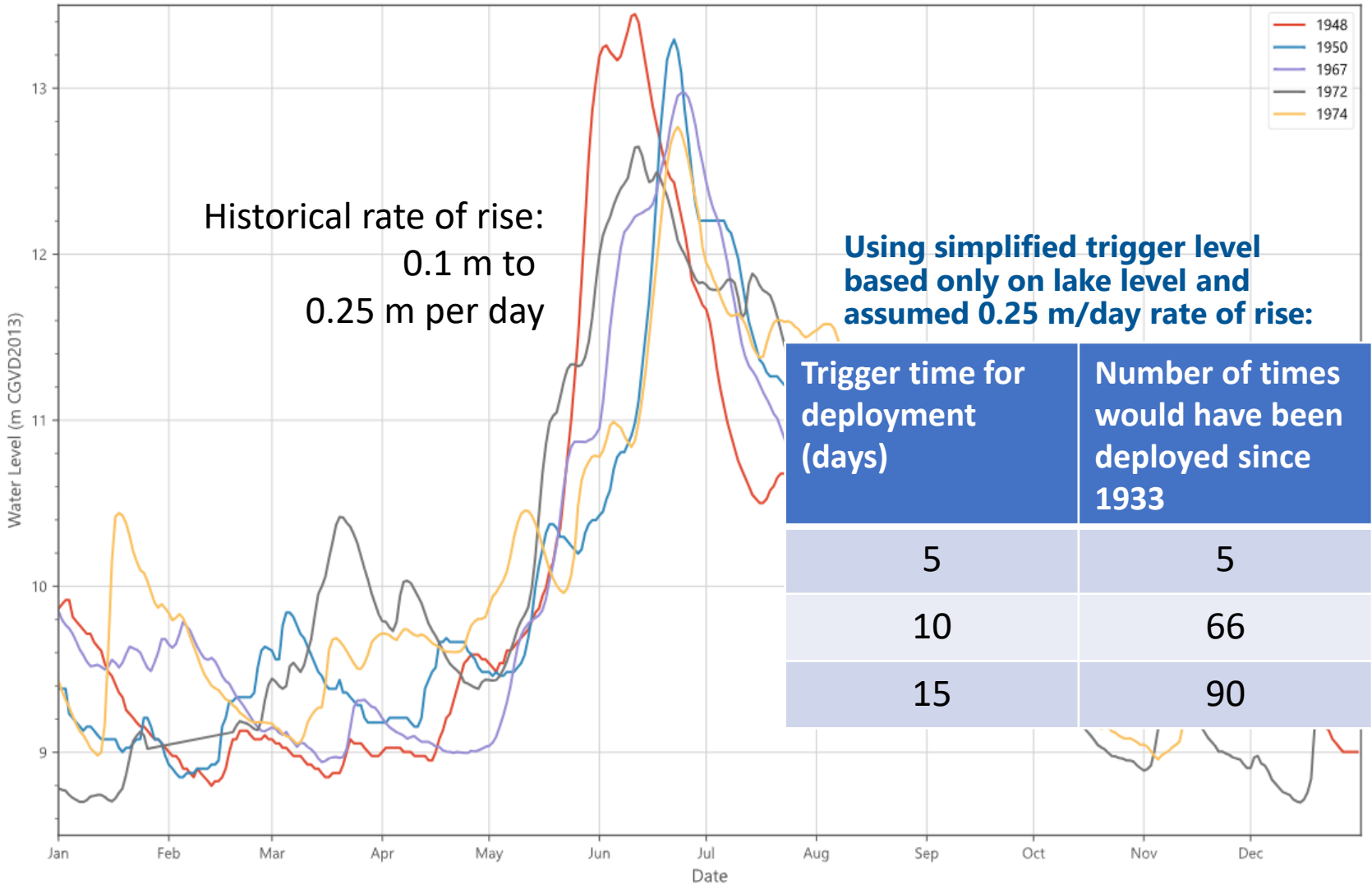
Main considerations for deployable dike

- Flood protection performance
- Operations
  - Deployment time
  - Storage
- Cost

5. Waterfront experience and view impacts

Deployment time

- **Quickly deployable system required to minimize unneeded deployment**
- Stoplogs: < 1 week deployment for full waterfront
- Flexible tube barriers: ~2 week deployment for full waterfront



Historical rate of rise:
0.1 m to
0.25 m per day

Using simplified trigger level based only on lake level and assumed 0.25 m/day rate of rise:

Trigger time for deployment (days)	Number of times would have been deployed since 1933
5	5
10	66
15	90

5. Waterfront experience and view impacts

Deployable dike: cost and tradeoffs

- Using more formal mitigation design (e.g. stoplogs), full deployable waterfront unlikely to be achievable within grant funding
  - Expected 300 m to 500 m stoplogs achievable

- More informal options (e.g. flexible tube barriers) possible for longer length
  - Challenges: performance, deployment time

Potential Strategies for Dike Design

1. Partially deployable

- Complete design with 300 m to 500 m deployable sections; use permanent diking elsewhere.
- Strategy for deployable diking:

  A. Regular **"view windows"**

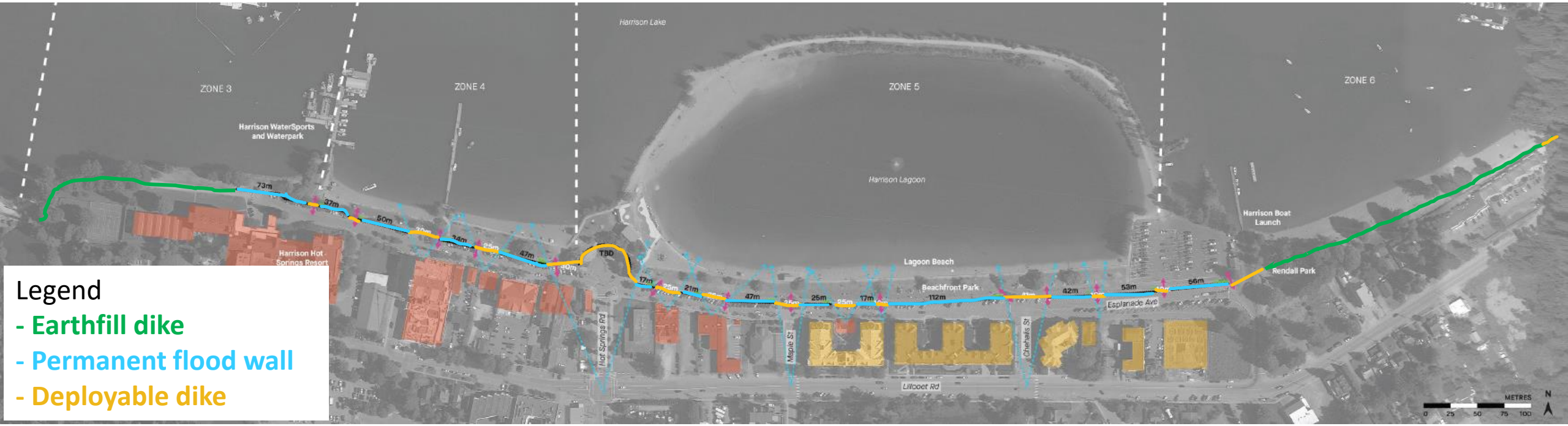
  B. Extended deployable section in front of businesses

2. Fully deployable

- Complete design for zones 3, 4 and 5 with stoplogs
- Prioritize and defer some construction
- Use flexible tube barriers until additional funding available

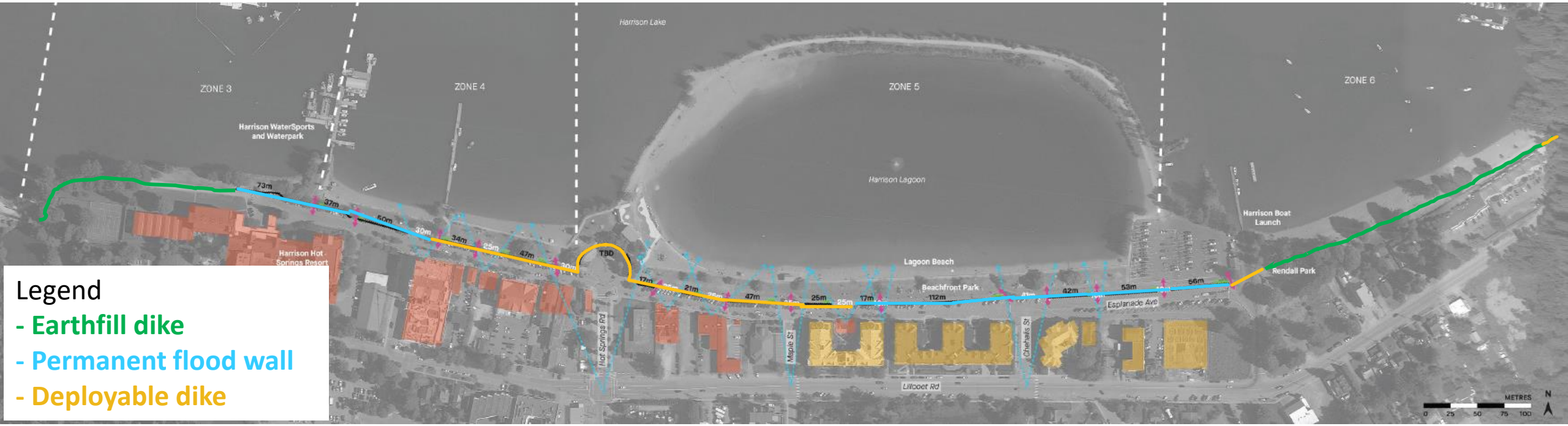
Strategy 1A: Partially Deployable, "View Windows"

- Presented at January 29 Council meeting and March 3 public open house
- Regular 25 m to 30 m deployable sections



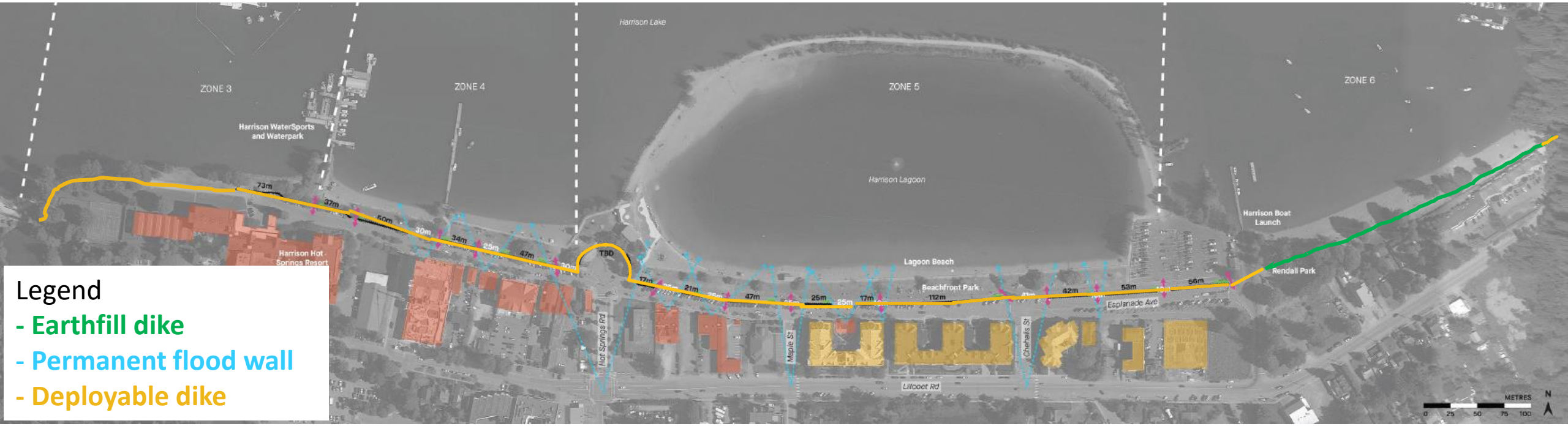
Strategy 1B: Partially Deployable, Extended Deployable Section

- Continuous 300 m to 500 m long deployable section in front of businesses



Strategy 2:
Fully Deployable

- Complete design for zones 3, 4 and 5 with stoplogs
- Prioritize and defer some construction
- Use flexible tube barriers until additional funding available



Thank you

Questions and Discussion