

Final for Council Package

23 September 2024 V 2.0

City of Courtenay Flood Management Plan Council Presentation

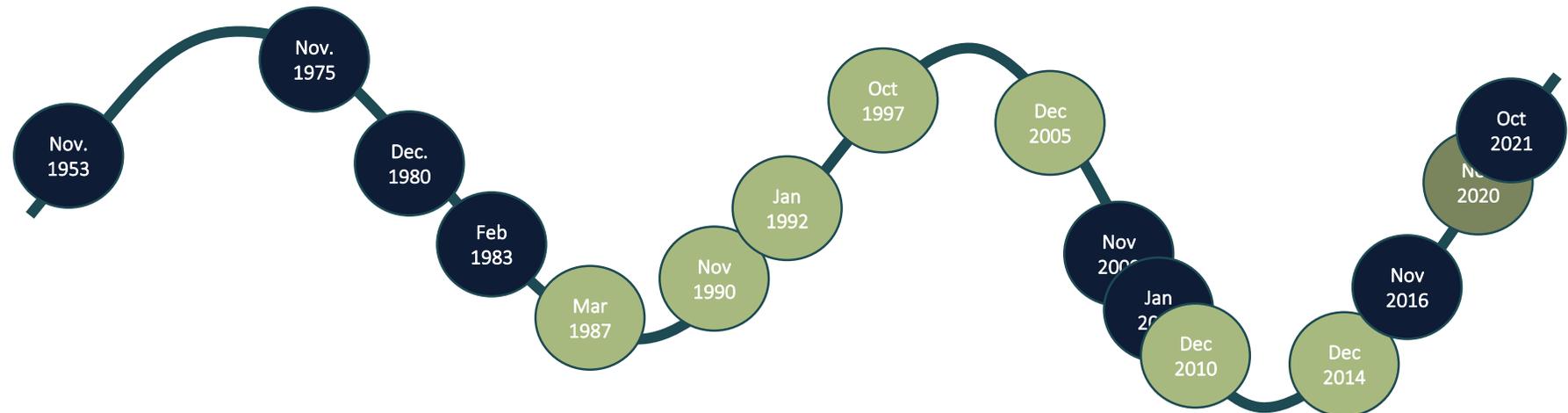
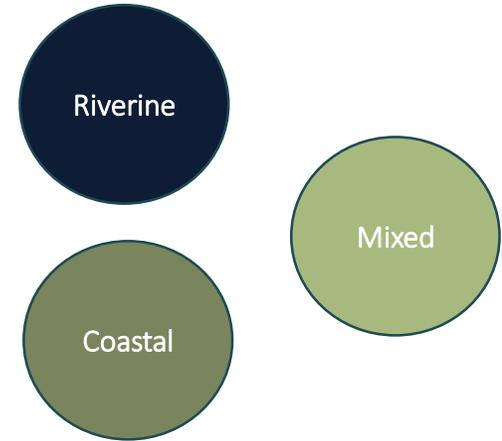
9th October 2024 | City of Courtenay

Tamsin Lyle, M.Eng MRM P.Eng | Principal | Ebbwater Consulting Inc

Flood & the City of Courtenay



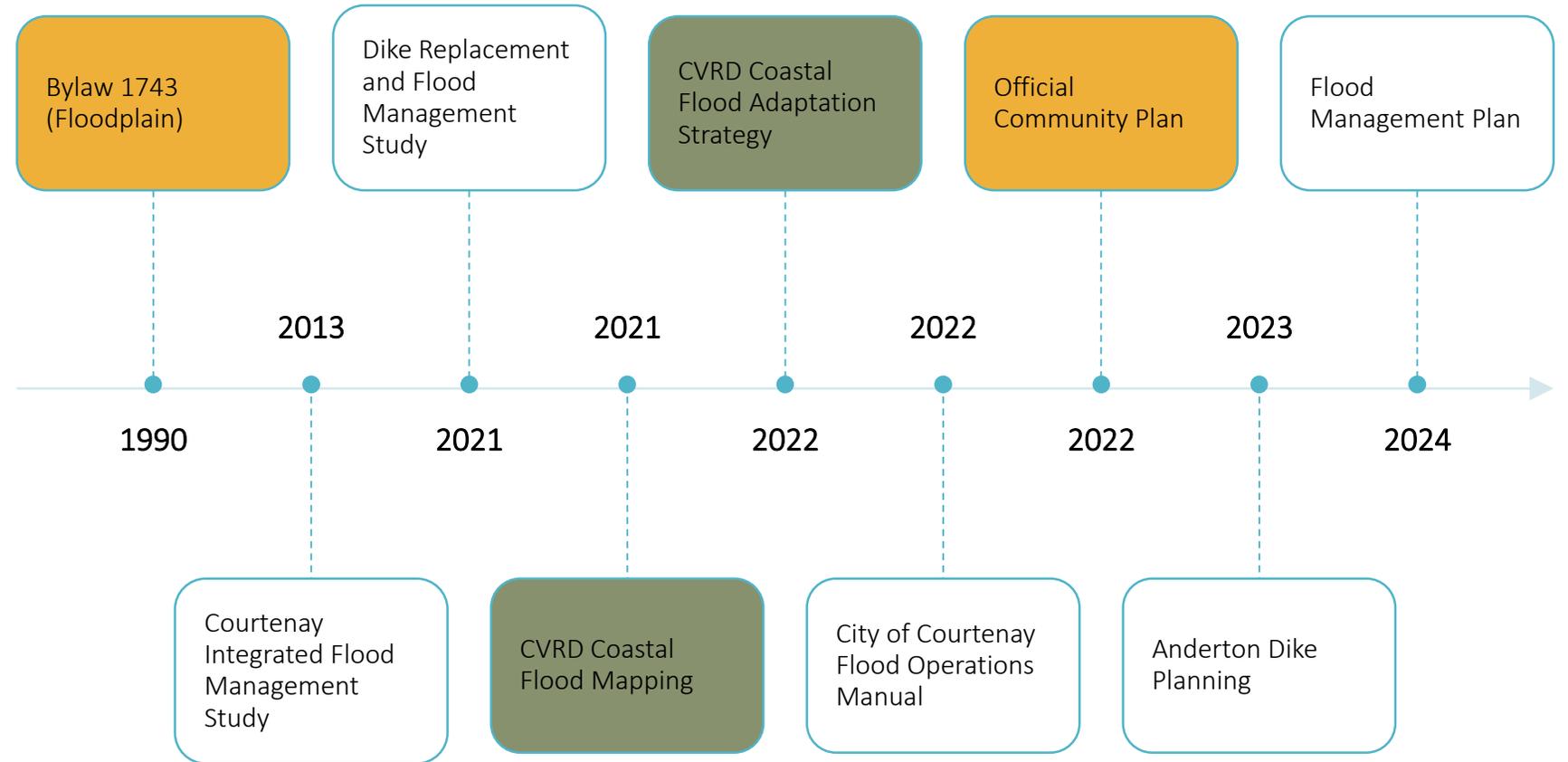
December 2014 Flood. City of Courtenay Image.



Flood Management

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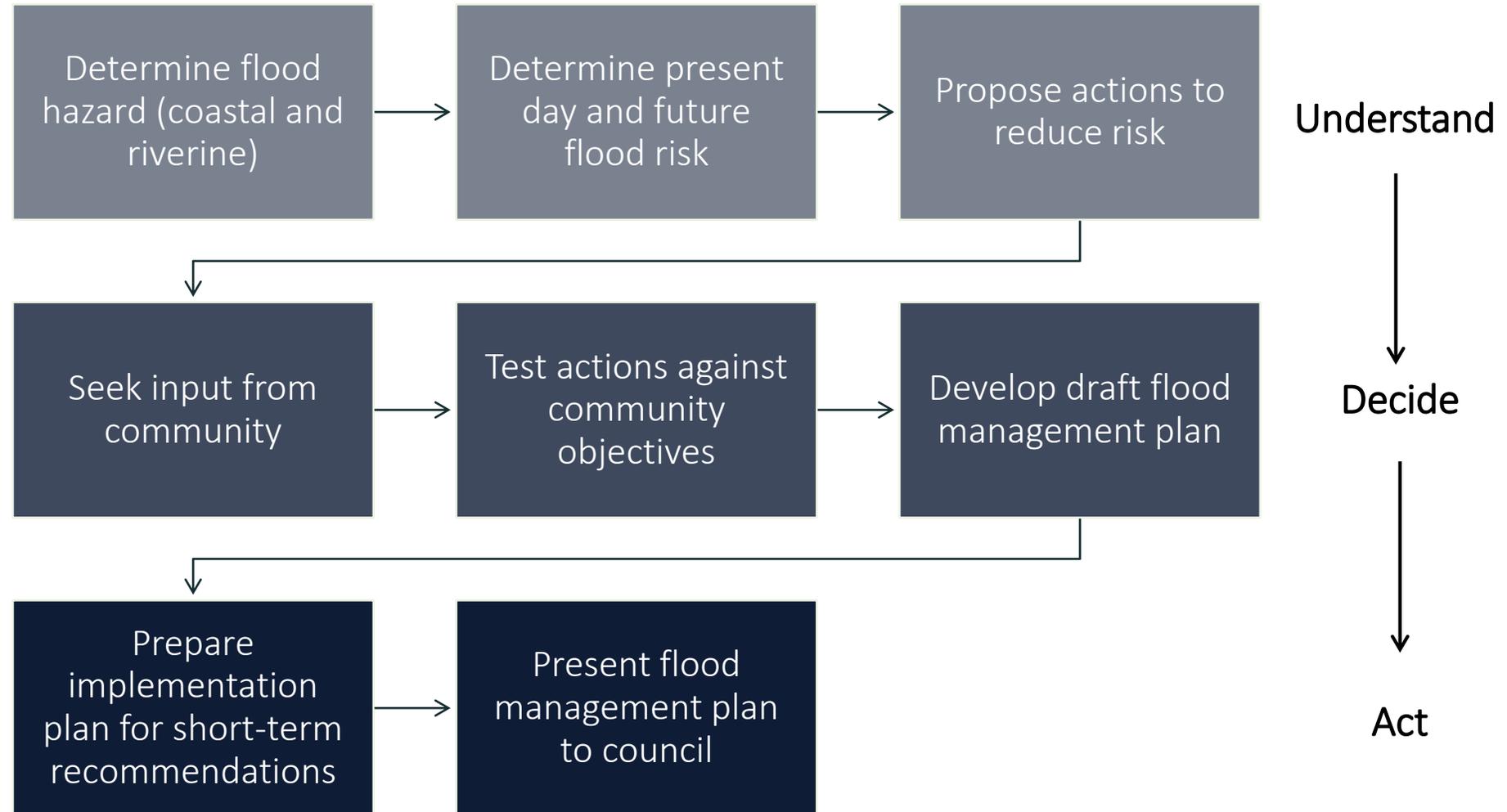
the City of Courtenay



The Flood Management Plan is an action plan to reduce flood risk in the City of Courtenay. It is aligned with community values, senior government regulations, and international best practice.

Flood Management

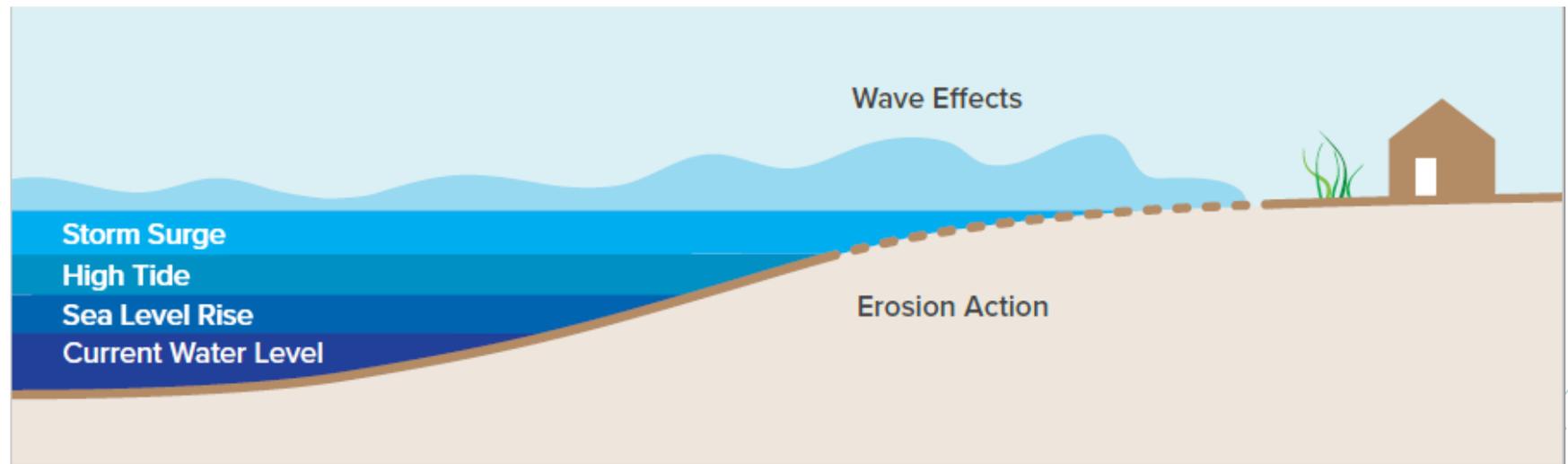
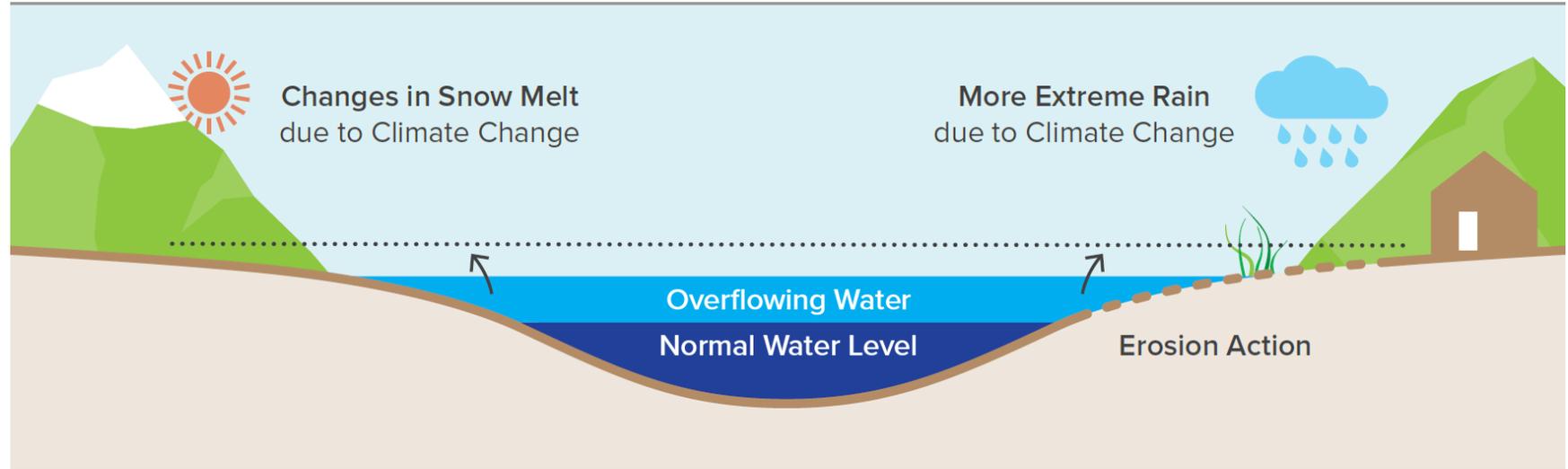
Methodology Overview



Guiding Principle and Context



Flood hazards are diverse and varied (in time and space)





Present day Likely event

Sea level rise – 0 m

Annual rainfall event probability – 5%

River flow increase – 0%



Map Notes

1. Map produced by Ebbwater Consulting Inc. on 31 July 2024.
2. The present-day scenario considers 0 m Sea Level Rise (SLR) and no increase in riverine flows compared to present-day (nominally 2020) conditions (i.e., climate change beyond present-day conditions is not included in this scenario). A likely event has a 5% Annual Exceedance Probability (AEP).
3. Inset map shows an indicative area. It is not meant to necessarily show areas of higher or lesser importance.
4. Depth classifications are based on Flood Hazard Mapping Guidelines for British Columbia (Ebbwater, 2022).
5. This map is intended to support an understanding of risk. IT SHOULD NOT BE RELIED ON FOR ENGINEERING DESIGN OR REGULATORY CONTROLS.

Data Sources

1. The flood hazard extents were received from CVRD on 28 May 2021 (KWL, 2021).
2. Parcel layer data was obtained from the City of Courtenay on 15 July 2022. Current Flood Protection Infrastructure locations were received from CoC on 20 December 2022 (2019/2020 Dike Crest Survey completed by WSP on behalf of the Province).
3. Base Layer (Main Map): OSM Humanitarian Data Model and CARTO's Positron, created using derivatives of OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA). Base Layer (Overview Map): OpenStreetMap data - openstreetmap.org (© OpenStreetMap contributors; cartography license CC BY-SA).

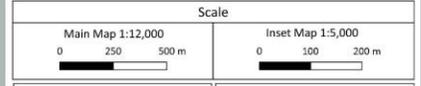
References

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2. Kerr Wood Leidal Associates Ltd. (2021). Coastal Flood Mapping Project. Final Report. Prepared for Comox Valley Regional District.
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Legend

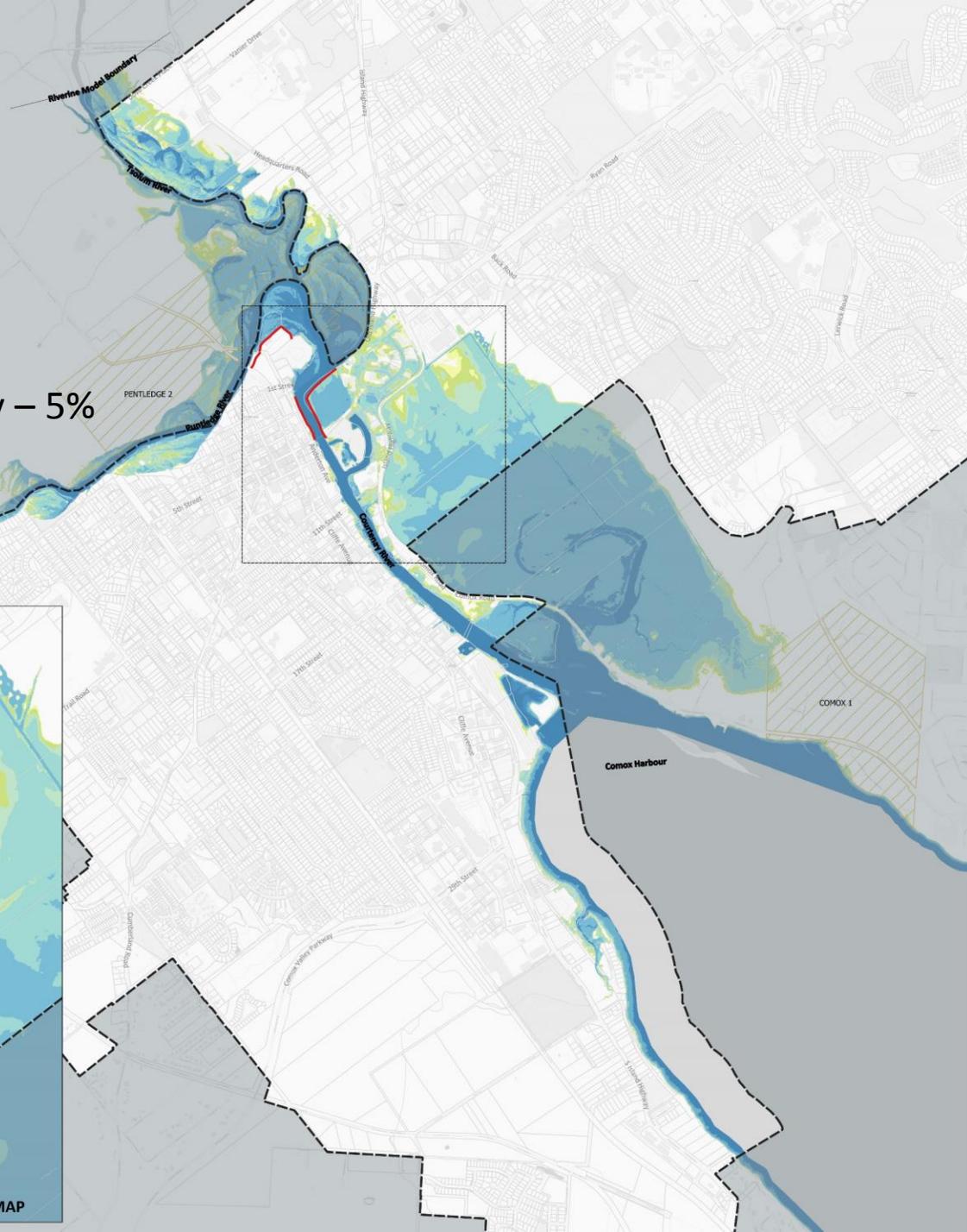
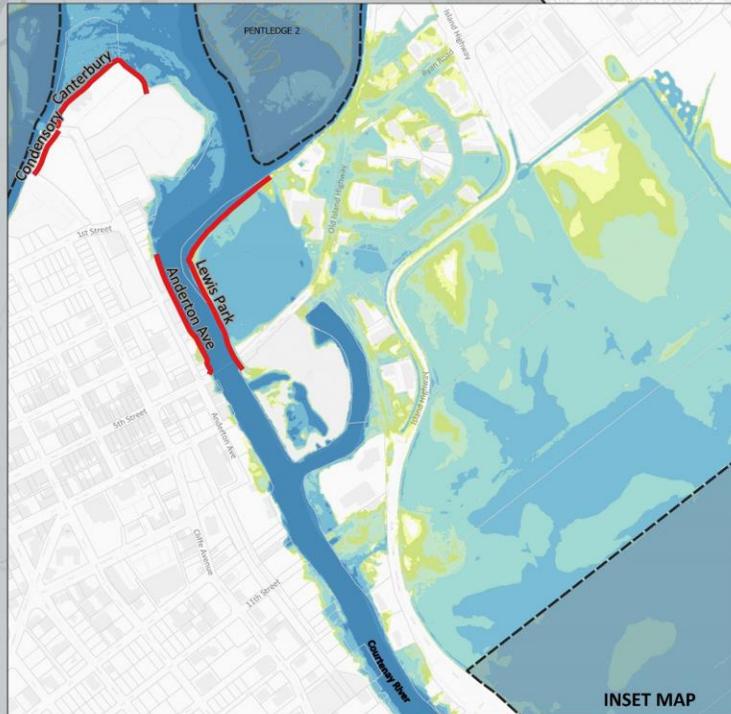
- Background**
- Current Flood
 - Protection Infrastructure
 - ▭ City Boundary
 - ▭ Land Parcels
 - ▭ K'ómoks First Nation Reserve Lands

- Present-day - Likely Event Flood Depths (m)**
- 0.0 - 0.1: Most buildings expected to be dry; underground infrastructure and basements may be flooded.
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 - 1.0 - 2.0: Ground floor flooded.
 - > 2.0: First (ground) floor and higher levels covered by water.



Date Created: 31 July 2024
 Coordinate System: NAD83, UTM 10N
 Vertical Datum: CGVD 2013

Prepared By: NS
 Reviewed By: SH
 Checked By: TL



Mid-term future Less likely event

Sea level rise – 1 m

Annual rainfall event probability – 0.5%

River flow increase – 15%



Map Notes

1. Map produced by Ebbwater Consulting Inc. on 31 July 2024.
2. The mid-term future climate change scenario considers a 1 m Sea Level Rise (SLR) and a 15% increase in riverine flows compared to present-day (nominally 2020) conditions. A less likely event has a 0.5% Annual Exceedance Probability (AEP).
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Legend

Background

- Current Flood
- Protection Infrastructure
- City Boundary
- Land Parcels
- K'ómoks First Nation Reserve Lands

Mid-Term Future - Less Likely Event Flood Depths (m)

- 0.0 - 0.1: Most buildings expected to be dry; underground infrastructure and basements may be flooded.
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Scale

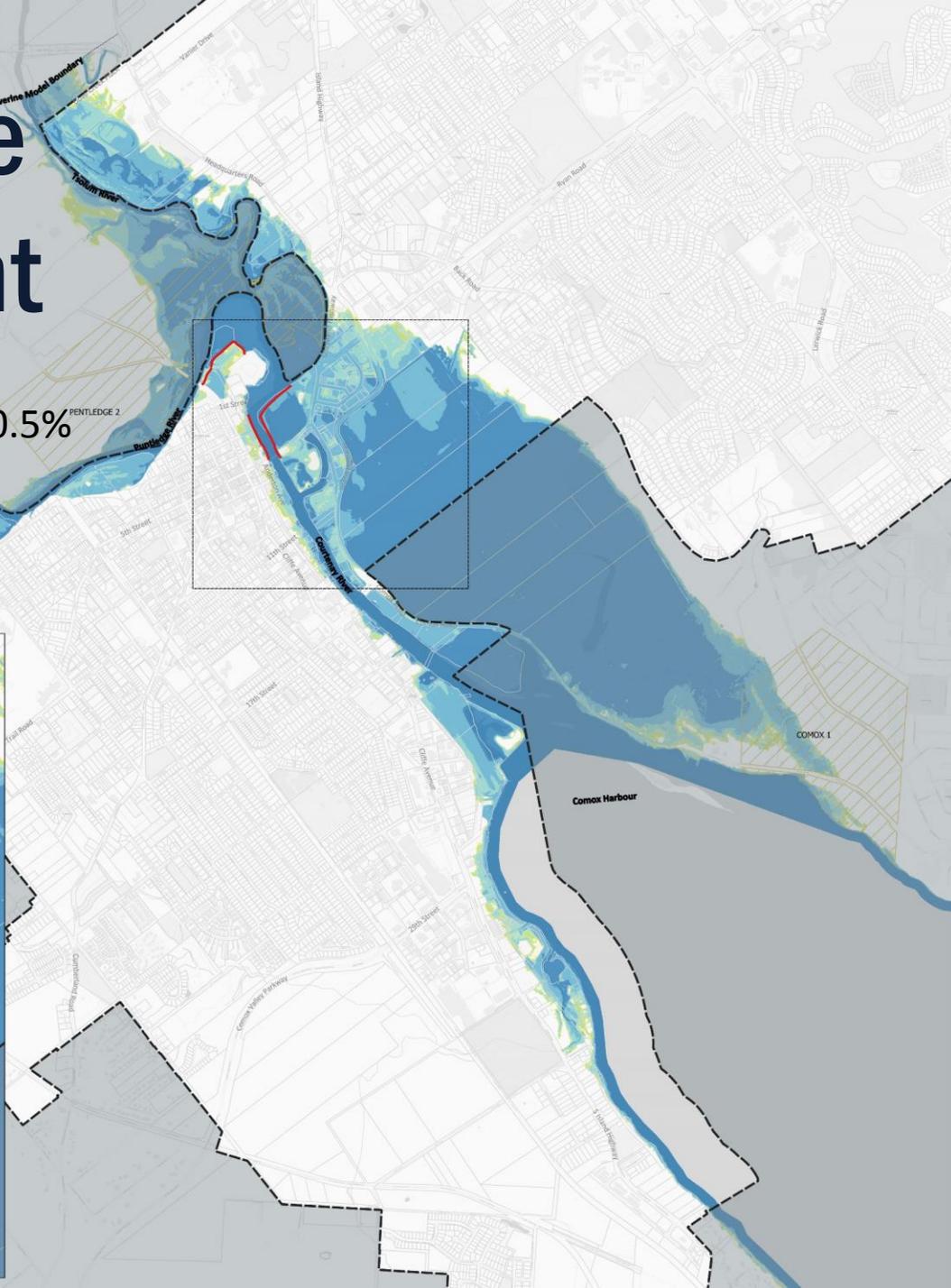
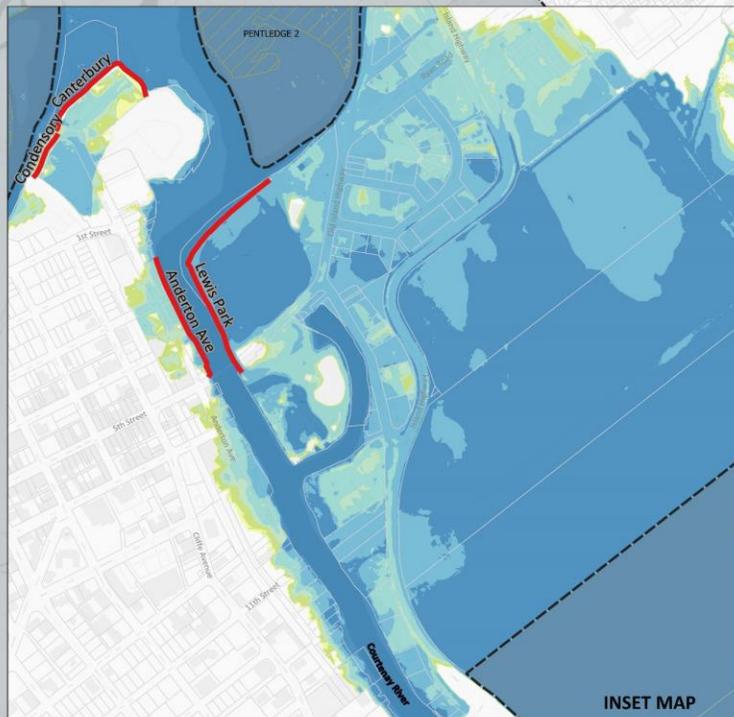
Main Map 1:12,000
 0 250 500 m

Inset Map 1:5,000
 0 100 200 m

Date Created: 31 July 2024
 Coordinate System: NAD83, UTM 10N
 Vertical Datum: CGVD 2013

Prepared By: NS
 Reviewed By: SH
 Checked By: TL







Far future Rare event

Sea level rise – 2 m

Annual rainfall event probability – 0.2%

River flow increase – 30%



City of Courtenay
Flood Risk Assessment
Hazard Map
Long-term Future - Rare Event
Flood Depth

Overview Map



Map Notes

- Map produced by Ebbwater Consulting Inc. on 31 July 2024.
- The long-term future climate change scenario considers 2 m Sea Level Rise (SLR) and a 30% increase in riverine flows compared to present-day (nominally 2020) conditions. A rare event has a 0.2% Annual Exceedance Probability (AEP).
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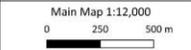
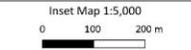
Background

- Current Flood Protection Infrastructure
- City Boundary
- Land Parcels
- K'ómoks First Nation Reserve Lands

Long-term Future - Rare Event Flood Depths (m)

- 0.0 - 0.1: Most buildings expected to be dry; underground infrastructure and basements may be flooded.
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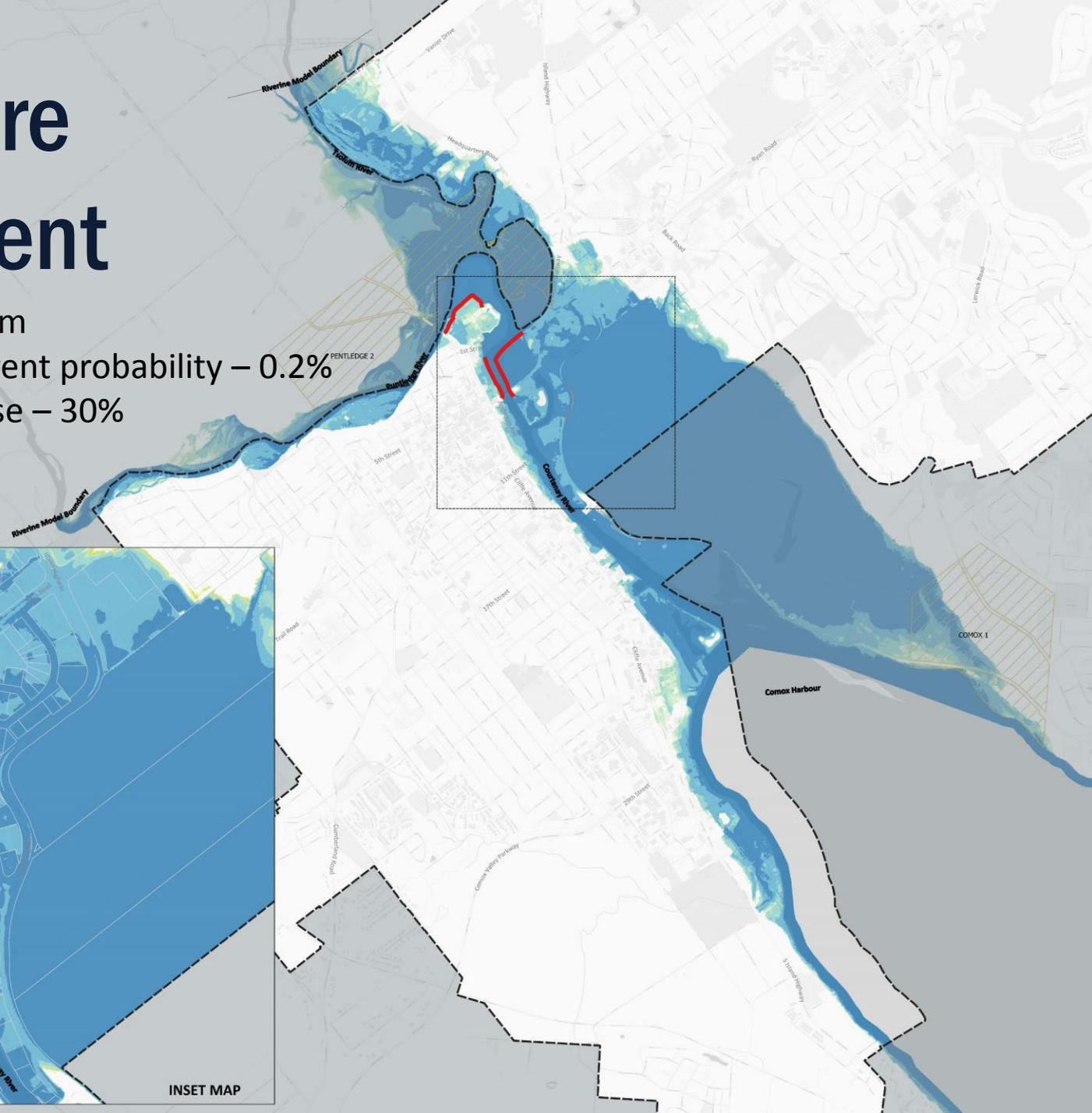
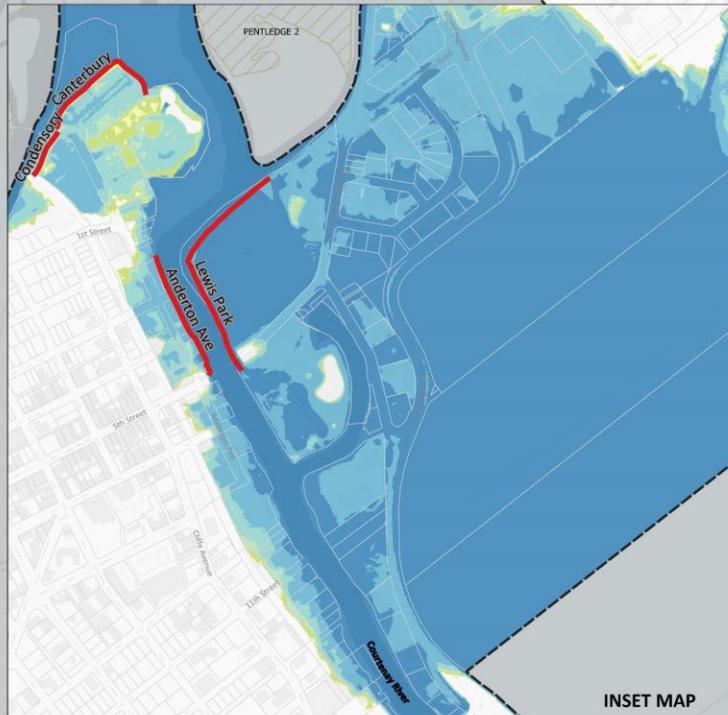
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ANSI D - Map No. S1-3



Guiding Principle and Context



Risk is the basis of plan

Water isn't the problem

*Risk is the intersection
of hazard and the things
we care about*



The goal is to reduce risk, and at a minimum NOT to increase risk



Legend

Affected People per Residential Building (#)

- 2 - 4
- 4 - 6
- 6 - 10
- >10

Present-day - Likely Event Flood Depths (m)

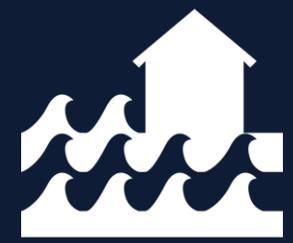
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Background

- Current Flood Protection Infrastructure
- City Boundary
- K'ómoks First Nation Reserve Lands
- Municipal & Commercial Buildings in Flood Hazard Extent
- Building Footprints outside of Flood Hazard Extent

Affected People

Affected People in the Floodplain (#)	290
Affected Residential Buildings	25

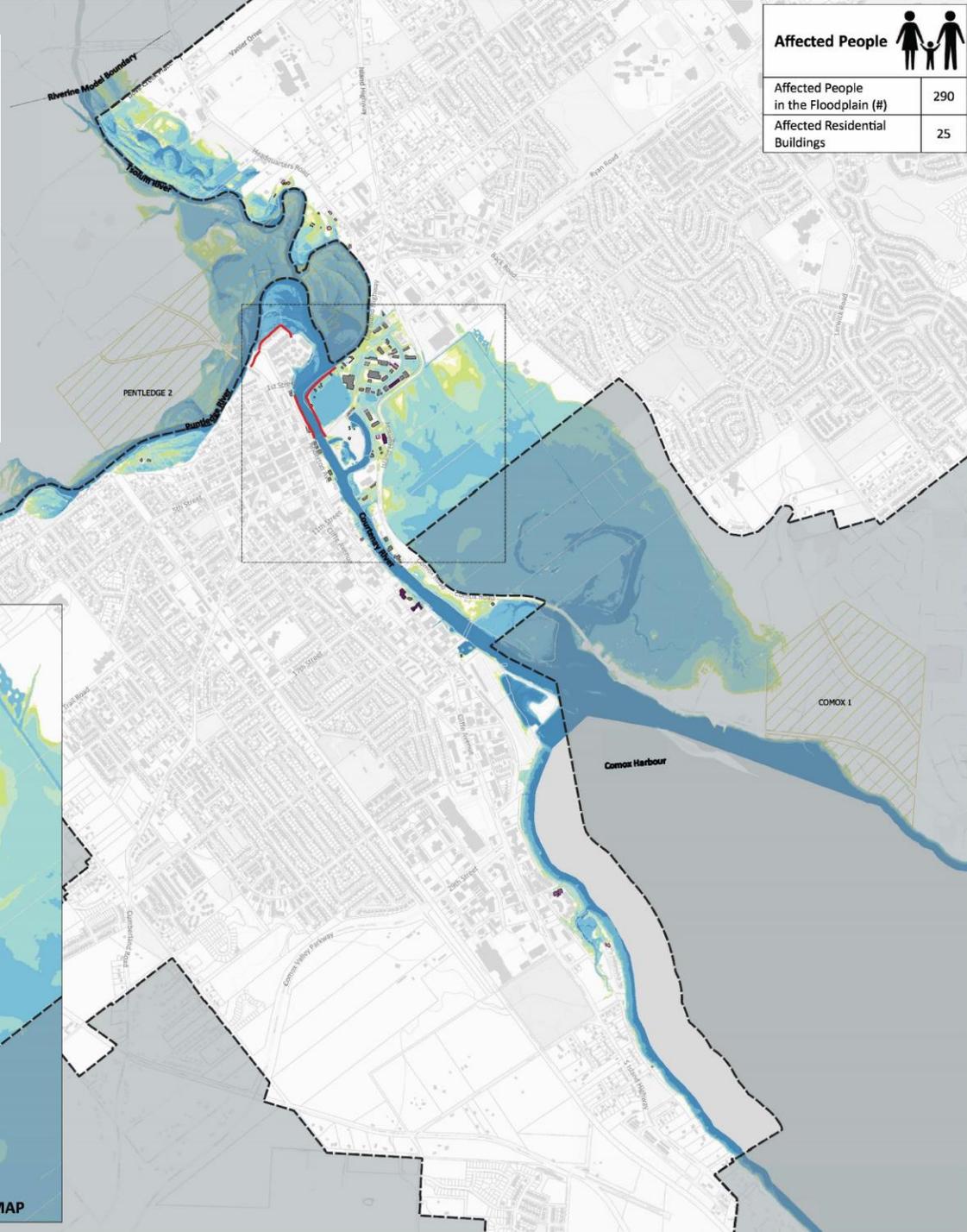
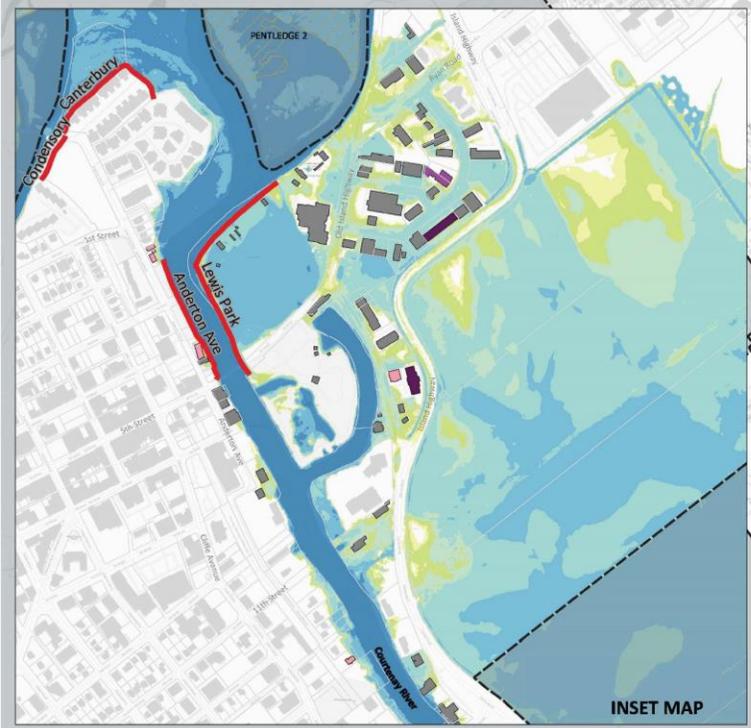
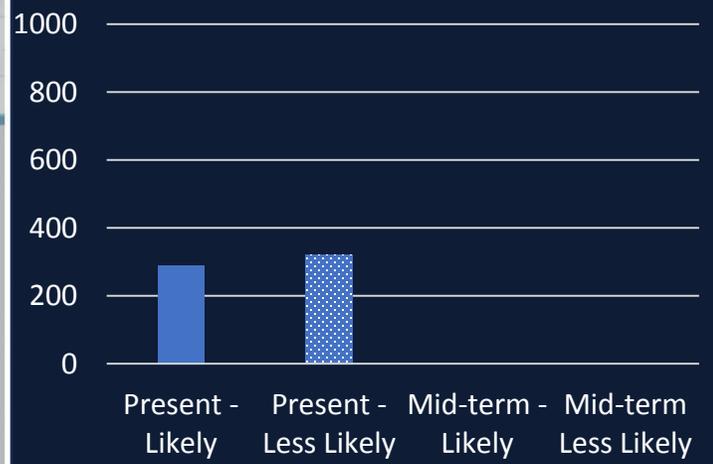


Present Day Likely Flood



Exposed Population

290





Legend

Affected People per Residential Building (#)

- 2 - 4
- 4 - 6
- 6 - 10
- >10

Present-day - Likely Event Flood Depths (m)

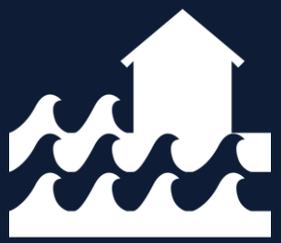
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Background

- Current Flood Protection Infrastructure
- City Boundary
- K'ómoks First Nation Reserve Lands
- Municipal & Commercial Buildings in Flood Hazard Extent
- Building Footprints outside of Flood Hazard Extent

Affected People

Affected People in the Floodplain (#)	898
Affected Residential Buildings	105

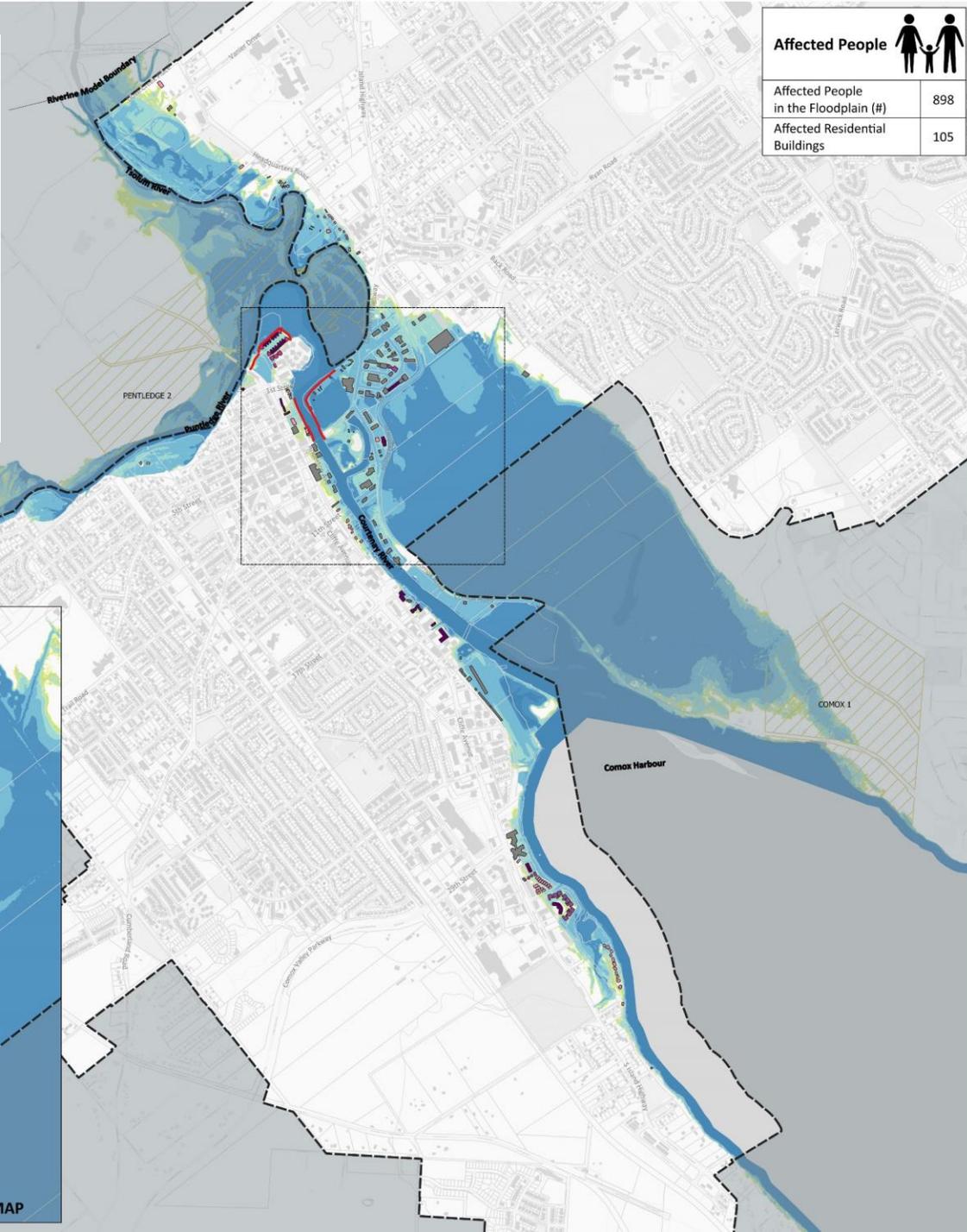
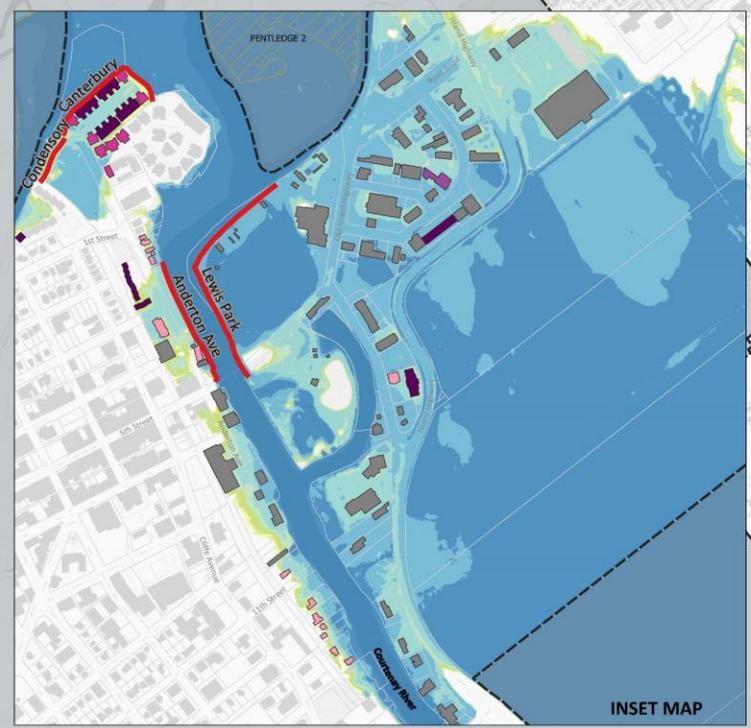
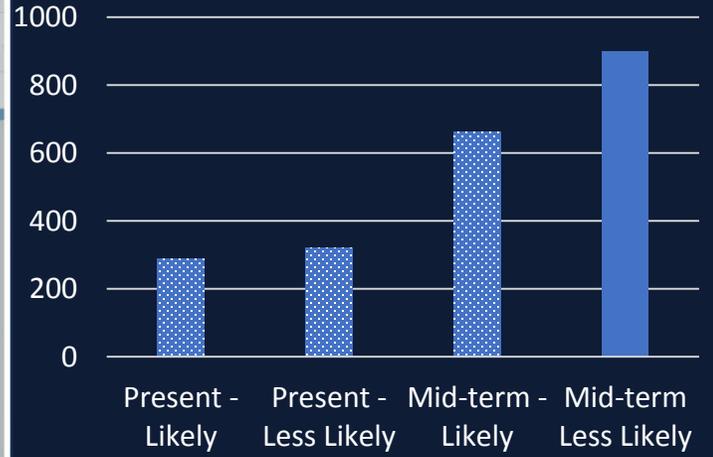


Mid-term
Less Likely
Flood



Exposed
Population

900





Legend

Affected Parks/Sensitive Areas

- Species and Ecosystems at Risk
- Conservation Areas
- Parks
- Groundwater Wells

Affected Potential Contamination Sources

- Auto Dealers, Repair Shops, Body Shops, or Potential Sites
- Gasoline/Diesel Bulk Plants (Former and Present)
- Gasoline/Diesel Outlets (Former and Present)
- Gas/Diesel Outlets and Auto Dealers, Repair Shops, Body Shops, or Potential Sites (Former)

Present-day - Likely Event

Flood Depths (m)

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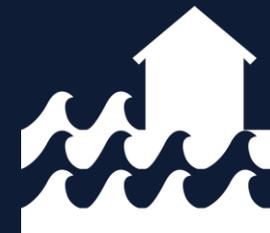
Background

- Land Parcels & Building Footprints
- Current Flood Protection Infrastructure
- City Boundary
- K'ómoks First Nation Reserve Lands
- Potential Contamination Sources
- Parks/Sensitive Areas

Economy



Total Building Value in the Floodplain (M\$)	42.3
Total Buildings in the Floodplain (#)	96
Total Agriculture Area in the Floodplain (ha)	85.01

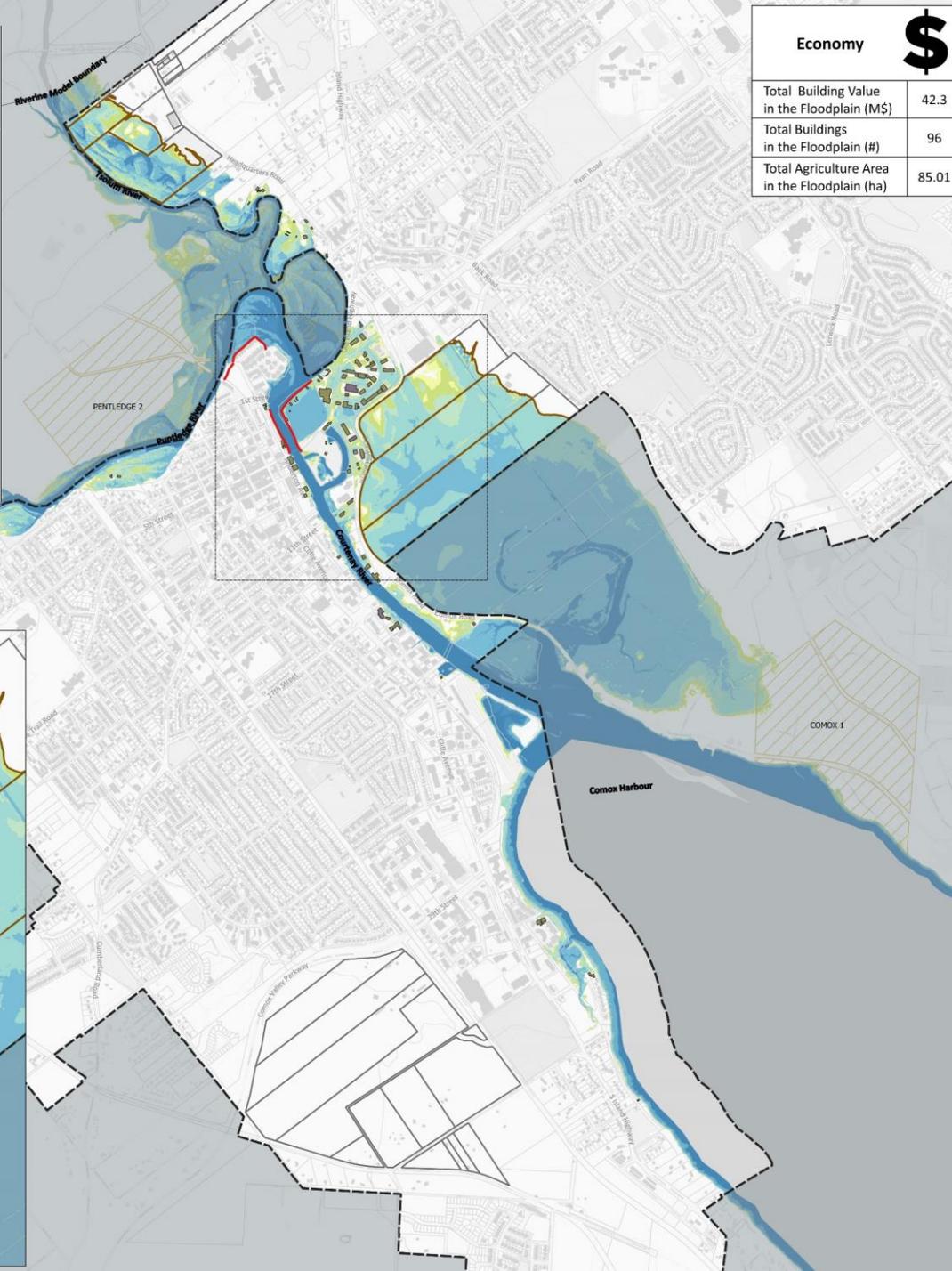
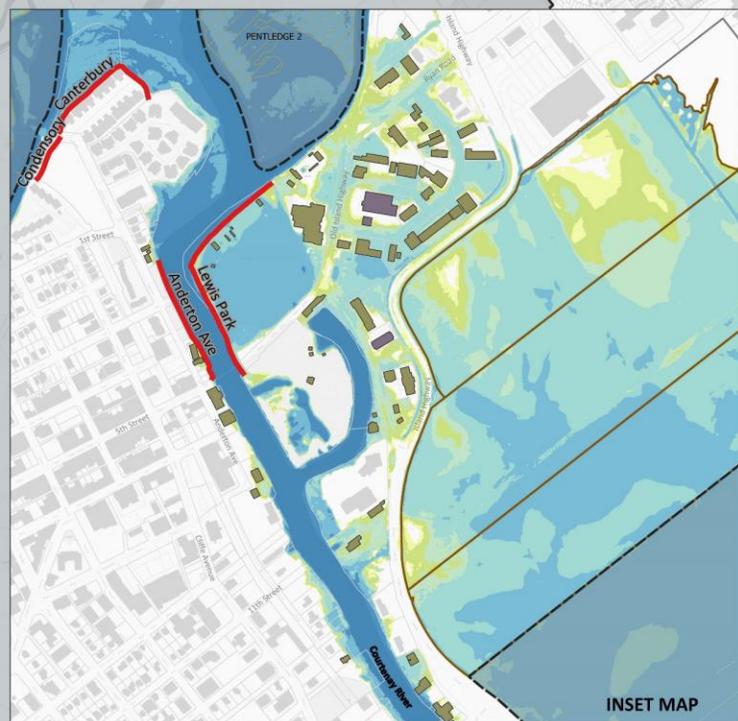
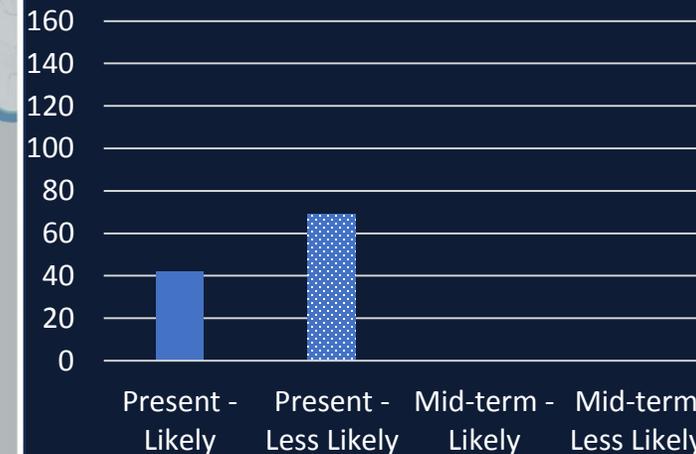


Present Day Likely Flood



Economy/ Financial Losses

42 Million





Legend

Affected Parks/Sensitive Areas

- Species and Ecosystems at Risk
- Conservation Areas
- Parks
- Groundwater Wells

Background

- Land Parcels & Building Footprints
- Current Flood Protection Infrastructure
- City Boundary
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- Potential Contamination Sources
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Present-day - Likely Event

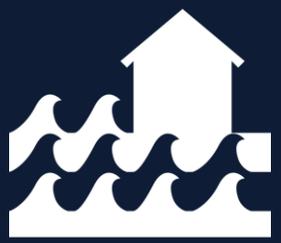
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Economy



Total Building Value in the Floodplain (M\$)	139.5
Total Buildings in the Floodplain (#)	208
Total Agriculture Area in the Floodplain (ha)	91

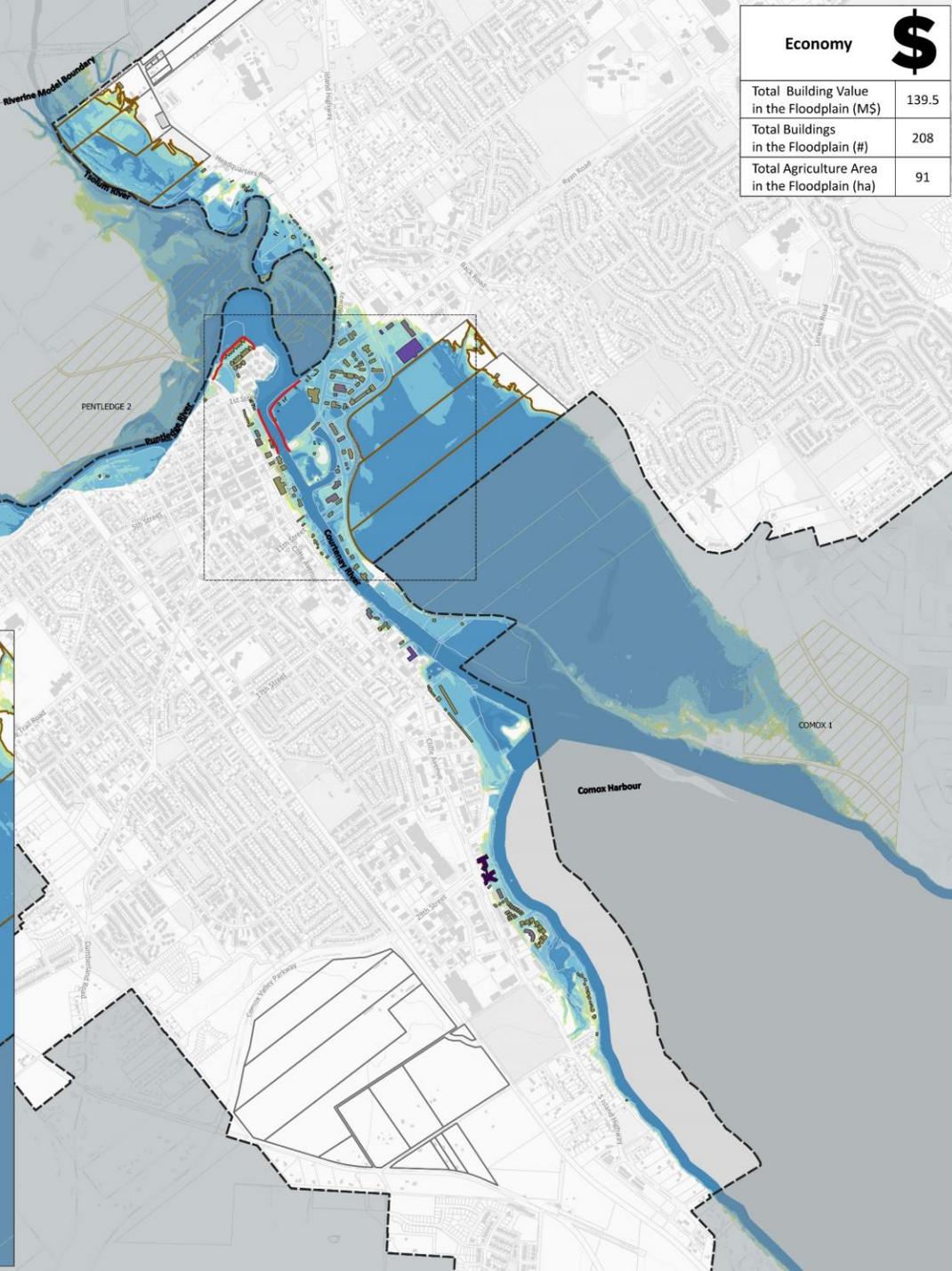
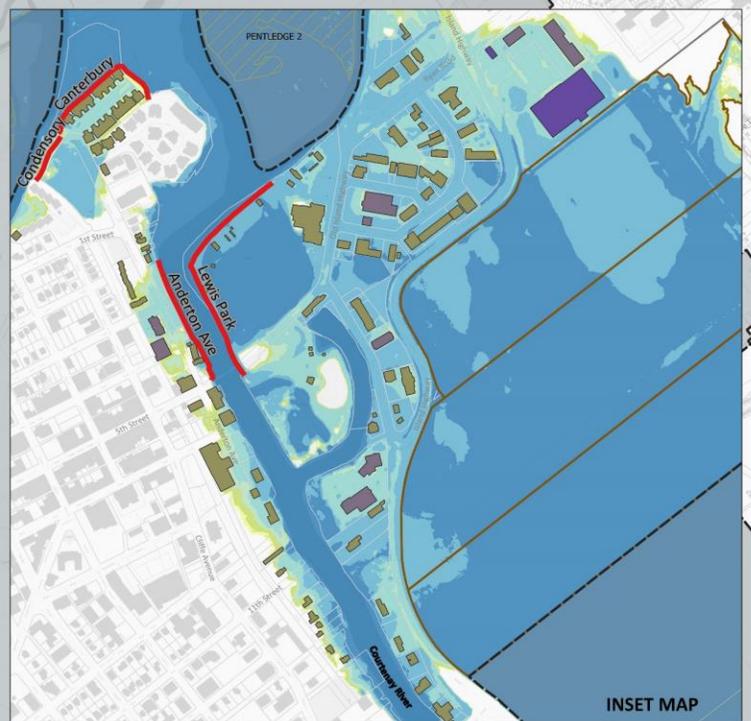
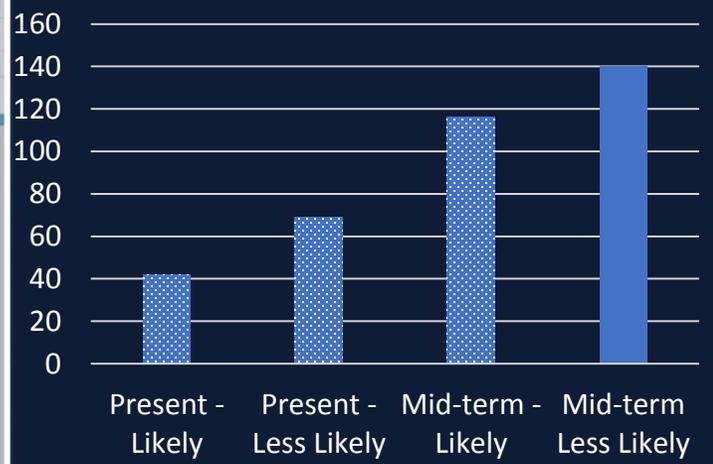


Mid-term
Less Likely
Flood

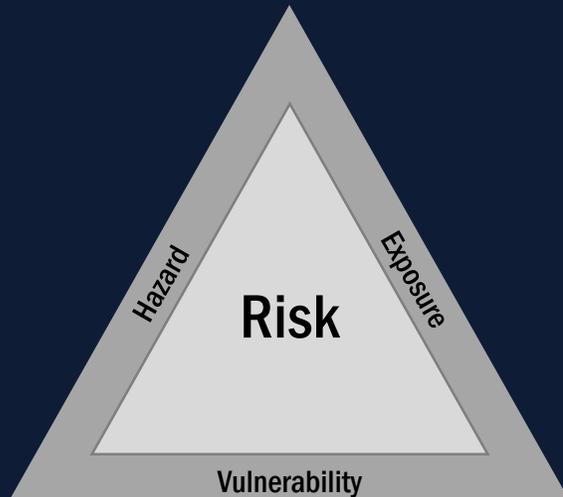


Economy/
Financial Losses

140 Million



Risk Today & In Future



	PEOPLE	ECONOMY			ENVIRONMENT			CULTURE		CI & DISRUPTION	
Scenario description/details	Affected People (#)	Buildings (#)	Total Building Value (M\$)	Total Agricultural Land (ha)	Contamination Sources (#)	Species/ Ecosystems at Risk & Conservation Lands (ha)	Greenspace, Parks (ha)	Total Cultural Sites (#)	Community Buildings (#)	CI Facilities (#)	Total Road lengths (km)
Present-day Likely (No SLR/increase in riverine flows; 5% AEP)	290	96	42	57	26	9	41	30	14	3	3.1
Present-day Less Likely (No SLR/increase in riverine flows; 0.5% AEP)	320	128	69	58	31	10	45	33	15	5	5.5
Mid-term Future Likely (1 m SLR; 15% increase in riverine flows; 5% AEP)	660	166	116	58	30	11	47	33	15	6	5.7
Mid-term Future Less Likely (1 m SLR; 15% increase in riverine flows; 0.5% AEP)	900	208	140	59	32	12	48	37	19	6	6.5



There is flood risk today and it will get worse in future due to climate change, which is outside the control of the City. The City should ensure that risk is not worsened from increased exposure or vulnerability, which is within the control of the City.

Guiding Principle and Context



There is a large toolbox of risk reduction actions



Protect



Avoid



Accommodate



**Resilience
Building**



**Managed
Retreat**



Portfolios of tools are required to manage the full range and diversity of risks within the City.

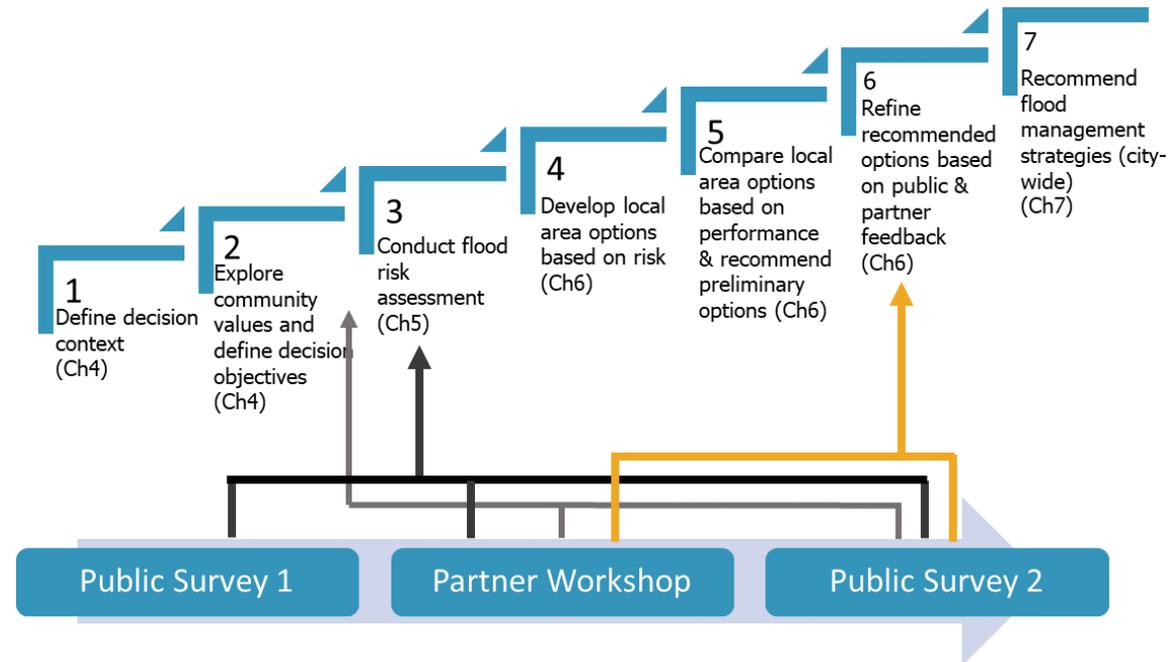
For details on PARAR, see this backgrounder:

<https://www.courtenay.ca/assets/City~Hall/Project~Gallery/2023~Flood~Management~Plan/Ways%20to%20Take%20Action%20Backgrounder.pdf>

Guiding Principle and Context



Analysis of flood risk reduction actions



- Local community values & best practice in risk reduction used to develop specific and measurable objectives.
- Systematic review of toolbox to determine which suite of tools most appropriate given risk profile.



City of Courtenay - Flood Management Plan Recommendations Overview

City-wide Recommendations



Avoid

- Develop flood risk-based zoning bylaw.
- Avoid new residential development in the floodway.
- Recommended floodway land uses include: agricultural, recreational, and parks.
- New development in the flood fringe must accommodate flood waters.
- Over the long term, opportunistically acquire land in the floodway .



Retreat

- Develop a managed retreat strategy to convert residential land uses in the floodway to land uses that are compatible with the flood risk.



Protect

- Clarify Provincial expectations for vegetation management on dikes that only offer erosion protection.
- Manage vegetation along all dikes in accordance with Provincial expectations.
- Complete annual inspections for all dikes, as required by the Dike Maintenance Act.



Resilience-Building

- Develop a comprehensive Communications Campaign to educate the public, residents of the floodplain, and property owners in high risk areas about flood risk, and actions to reduce the risk.
- Update monitoring and warning procedures.
- Update emergency response plan.
- Develop flood recovery and post-disaster plans.
- Work with insurance companies to address residual risk.
- Collaborate regionally on emergency preparedness and response.



Accommodate

- Update floodplain bylaw (new flood construction levels & erosion setbacks).
- Consider Development Area Permit for flood and erosion hazards.
- Encourage property-level flood barriers to reduce damages to properties in the floodplain.
- Use temporary flood barriers as an emergency response measure.
- Floodproof City-owned facilities and infrastructure (including lift stations).
- Develop tools to track all flood related covenants registered on property titles. Inform property owners of the covenant requirements and seek enforcement.
- Work with residents, business owners, the Airpark, agricultural producers, and City Operations to minimize contamination sources (septic systems, hazardous material storage).
- Consider regulation of hazardous material storage in floodplain.
- Improve the resiliency of park infrastructure to flooding (through Park Master Plans).
- Work together with K'ómoks First Nation to identify solutions for Indigenous sites at risk that are supported by their community.

Local Area Recommendations

Condensory & Canterbury:

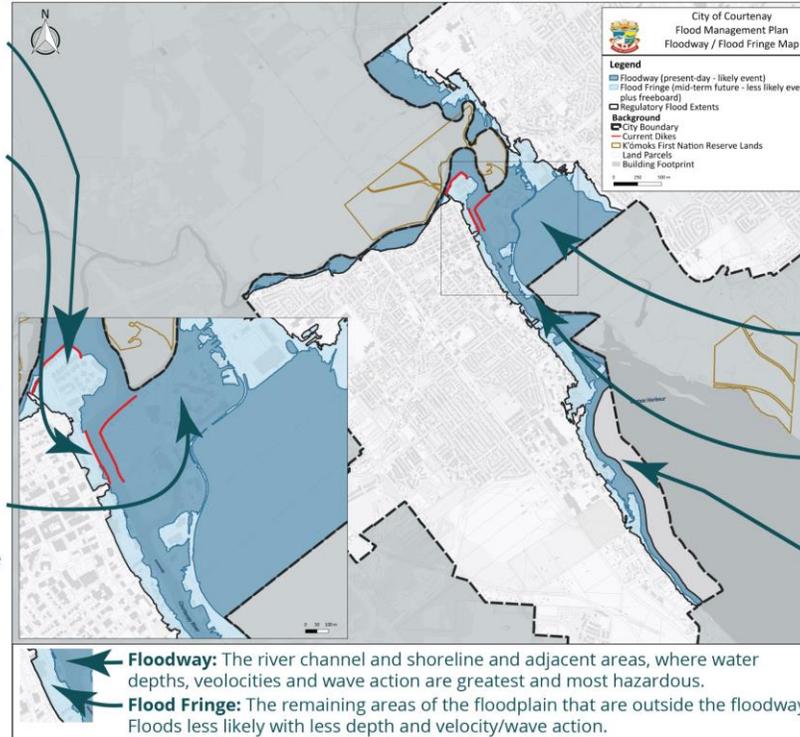
- Resolve the ownership dispute associated with Canterbury Dike by working with the Province and the strata.
- Ensure inspections of Canterbury Dike are conducted, and any required repairs are made.

Anderton Avenue:

- Conduct additional inspections and monitoring needed to ensure public safety.
- Develop plans to remediate Anderton Dike, including removal of the wall and naturalization of the shore.

Puntledge Road Commercial Area:

- Ensure City-owned buildings and infrastructure, including the Lewis Recreation Centre, LINC Youth Centre, Memorial Outdoor Pool, and outbuildings are floodproof and resilient to flood damages.
- Complete repairs of Lewis Park Dike, and consider naturalizing the shore over the long-term.
- Floodproof Puntledge Road lift station.
- Develop a detailed evacuation plan for the area, with a focus on traffic management, signage, and public education.
- Maintain TideFlex valves in the area, and consider the installation of additional TideFlex valves.
- Update, repair, and maintain culverts along the Rye Road Flood corridor, and in Lewis Park.
- Remove tall wall, and replace with a traffic barrier, if required.
- Change Tiger Dam from seasonal deployment in current location to targeted critical infrastructure protection on an event-basis.
- Work with the Ministry of Transportation and Infrastructure on Highway 19A upgrades.



Agricultural Area:

- Communicate flood risk and resources to reduce risk to local agricultural producers as part of communications campaign. Align with the CVRD Comox Valley Agricultural Plan information.
- Encourage minimizing agricultural contamination sources.

Kus-kus-sum Site:

- Continue restoration and naturalization at Kus-kus-sum site.

Coastal Area:

- Restrict new development in coastal erosion setback.
- Continue working with Airpark to avoid potential contamination sources.
- Over the long-term, consider increasing erosion protection given sea level rise and associated coastal erosion, with a Green Shores approach.

Flood Management Plan



Flood Management Plan

City-wide



Protect

- Clarify Provincial expectations for vegetation management on dikes that only offer erosion protection.
- Manage vegetation along all dikes in accordance with Provincial expectations.
- Complete annual inspections for all dikes, as required by the *Dike Maintenance Act*.



Resilience Building

- Develop a comprehensive Communications Campaign to educate the public, residents of the floodplain, and property owners in high risk areas about flood risk, and actions to reduce flood risk.
- Update monitoring and warning procedures.
- Update emergency response plan.
- Develop flood recovery and post-disaster plans.
- Work with insurance companies to address residual flood risk.
- Collaborate regionally on emergency preparedness and response.

Flood Management Plan

City-wide



Avoid

- Develop flood risk-based zoning bylaw.
- Avoid new residential development in the floodway (the area of highest hazard where water is deepest and fastest).
- Limit land uses to agricultural, recreation, and parks within floodway.
- Any new development in the flood fringe (area with shallower, slower water) must accommodate flood waters.
- Over the long-term, opportunistically, acquire land in the floodway.



Managed Retreat

- Develop a managed retreat strategy to convert residential land uses in the floodway to land uses that are compatible with the flood risk.

Flood Management Plan

City-wide

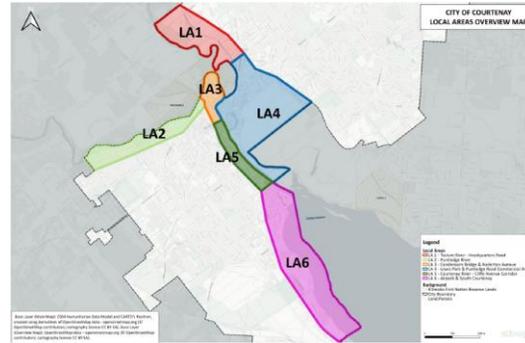


Accommodate

- Update floodplain bylaw (with new Flood Construction Levels and Setbacks); started under this project.
- Consider Development Permit Area Permit for flood and erosion hazards.
- Encourage property-level flood barriers to reduce damages to properties in the floodplain.
- Use temporary flood barriers as an emergency response measure.
- Floodproof City-owned facilities and infrastructure (including lift-stations)
- Develop tools to track all flood related covenants registered on property titles. Inform property owners of the covenant requirements and seek enforcement.
- Work with residents, business owners, the Airpark, agricultural producers, and City Operations to minimize contamination sources (septic systems, hazardous material storage).
- Consider regulation of hazardous material storage in the floodplain.
- Improve the resiliency of park infrastructure to flooding (through Park Master Plan).
- Work with K'ómoks First Nation to identify solutions for Indigenous sites at risk.

Flood Management Plan

Site Specific



In addition to City-wide recommendations, there are site specific recommendations for six local areas.

Accommodate				
 Implement updated FCLs	Flood-proof buildings & critical infrastructure	Share resources on flooding with agricultural operators	Work with K'ómoks First Nation to minimize impacts to Indigenous sites	Encourage Property-level Flood Barriers
Retreat				
	Longer term: Retreat residential buildings (including RVs and mobile homes) in floodway (e.g., opportunistic buy-outs, as they become available (~10 permanent buildings in the floodway) and convert to natural systems)			
Avoid				
	Avoid new residential and commercial development via planning tools (e.g., zoning bylaw that builds on current statements within the OCP) Discussion: Avoid strategies would allow for re-imagining land use with fewer people and amenities in the floodplain. Further, it provides opportunities for (sustainable) agriculture and ecological restoration.			
Resilience-building				
	Flood-resilient agriculture		Residential awareness-building and preparedness	

Flood Management Plan



Plan Implementation

1. 5-Year Capital Plan
 - A. Operational Activities
 - B. Special Projects
2. Medium to long-term actions
 - 80+ specific recommendations each with a timeline and budget.

Accommodate - Floodplain Bylaw Update			
AC-1	Update Floodplain Bylaw: Collaborate with CVRD to align floodplain bylaws in the region. Consider distinct riverine and coastal approaches. Explore inclusion of specific exemptions, requirements and hazardous materials storage, approach for ensuring quality by qualified professionals (e.g., assurance statement), and restrictive covenants.	Immediate	\$30,000
AC-2	Conduct targeted engagement before updated bylaw adoption: Inform impacted stakeholders (i.e., property owners) before bylaw adoption.	Immediate	\$20,000
AC-3	Targeted education and awareness campaigns after bylaw adoption: E.g. for local realtors and industry representatives.	Immediate	\$20,000
AC-4	Update coastal mapping for FCL: Complete detailed hydrodynamic mapping for Comox Estuary to ensure high-quality maps for coastal FCLs. This could be developed in cooperation with Town of Comox and CVRD, as well as combined with potential modelling for Anderton Ave. Updated coastal FCLs would require a bylaw amendment, should the floodplain bylaw be updated before this becomes available.	Short-term	\$200,000
AC-5	Covenant data management: Develop tools and start tracking and managing existing covenants for parcels in the floodplain and inform property owners about covenants. Work with property owners to ensure compliance with existing covenants.	Short-term	\$10,000
AC-6	Add covenants: Expand covenant on title for the extents of the new regulatory floodplain. Require that the location in regulated floodplain be disclosed on property title. This would apply whenever the opportunity arises.	Immediate	\$2,000

Example extract from implementation plan (Chapter 8).

An aerial photograph of a flooded agricultural landscape at sunset. The sky is filled with dramatic, layered clouds in shades of orange, yellow, and grey. The sun is low on the horizon, casting a warm glow over the scene. In the foreground, a large body of water reflects the sky and the surrounding landscape. The water is surrounded by green fields, some of which are partially submerged. There are several buildings, including a large white structure and a red building, scattered throughout the landscape. In the background, there are rolling hills and mountains under the sunset sky.

Thank you

Contact

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