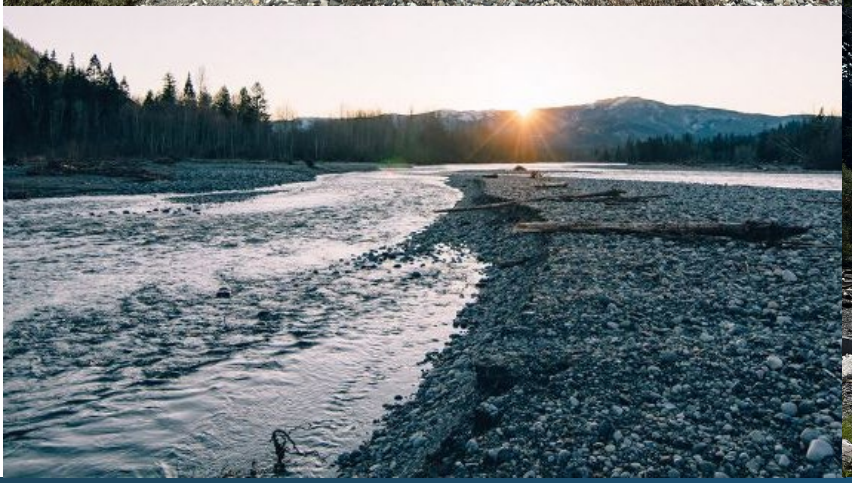
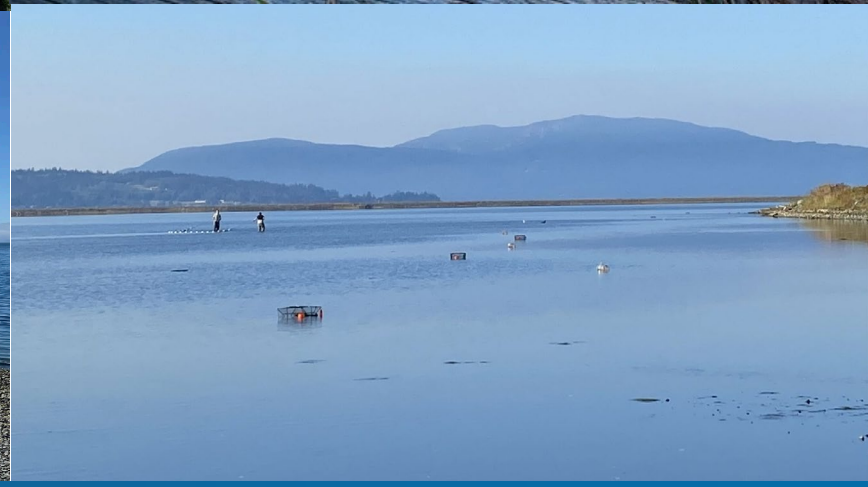




WHATCOM COUNTY FUTURE SHORELINES PROJECT

County Council Presentation

July 22, 2025

DEPARTMENT OF ECOLOGY State of Washington

WHATCOM COUNTY WASHINGTON

HERRERA Science + Planning + Design

MAKERS architecture • planning • urban design

CASCADIA CONSULTING GROUP

nhc

Future Shorelines Project Overview

1. Project **overview**
2. What's **vulnerable to flooding & erosion**?
3. Adaptation strategies for **Birch Bay**
4. Potential **policy and land use strategies**
5. **Deliverables, tools, and next actions**

Project Overview

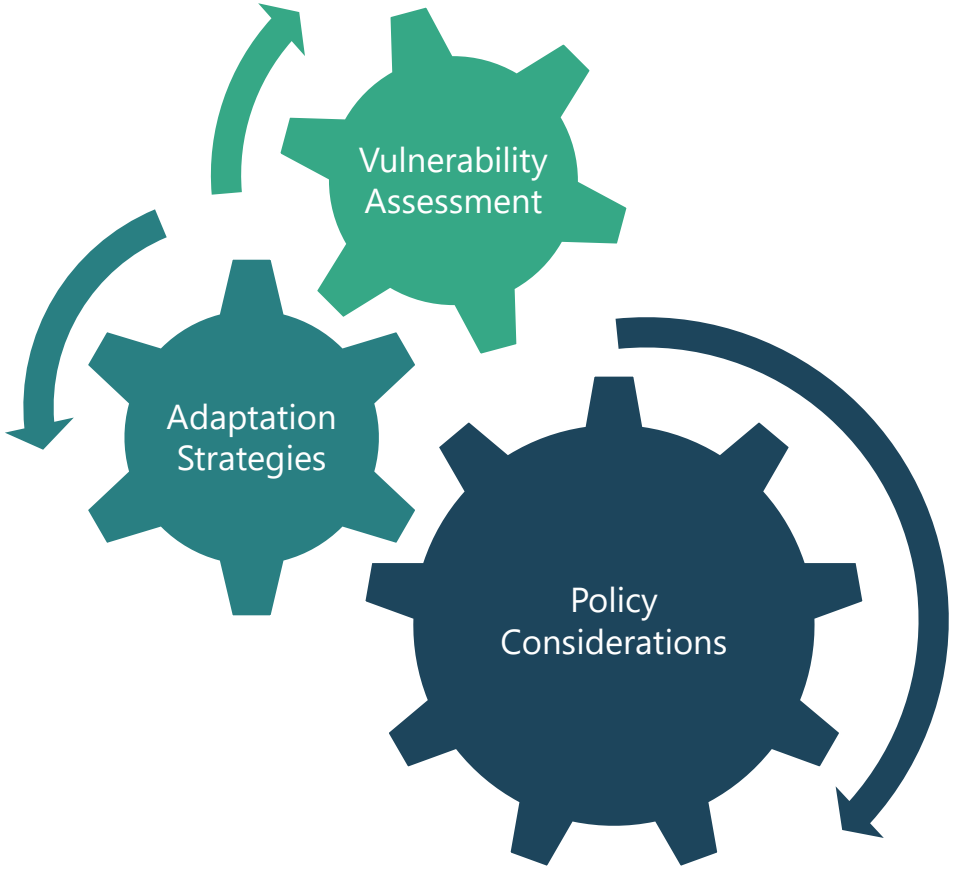
Photo credit: Whatcom County Sheriff's Office

Project Team

What is the Whatcom Future Shorelines Project?

Goals

- Bring together the County, Cities, Tribes, State Agencies, partner organizations
- Assess **future flooding and erosion vulnerability** for shorelines in Whatcom County
- Identify **adaptation strategies for shorelines**, including a pilot adaptation plan
- Recommend **improvements to policies** for impacted communities
- Move the County on a path to a **more resilient future**



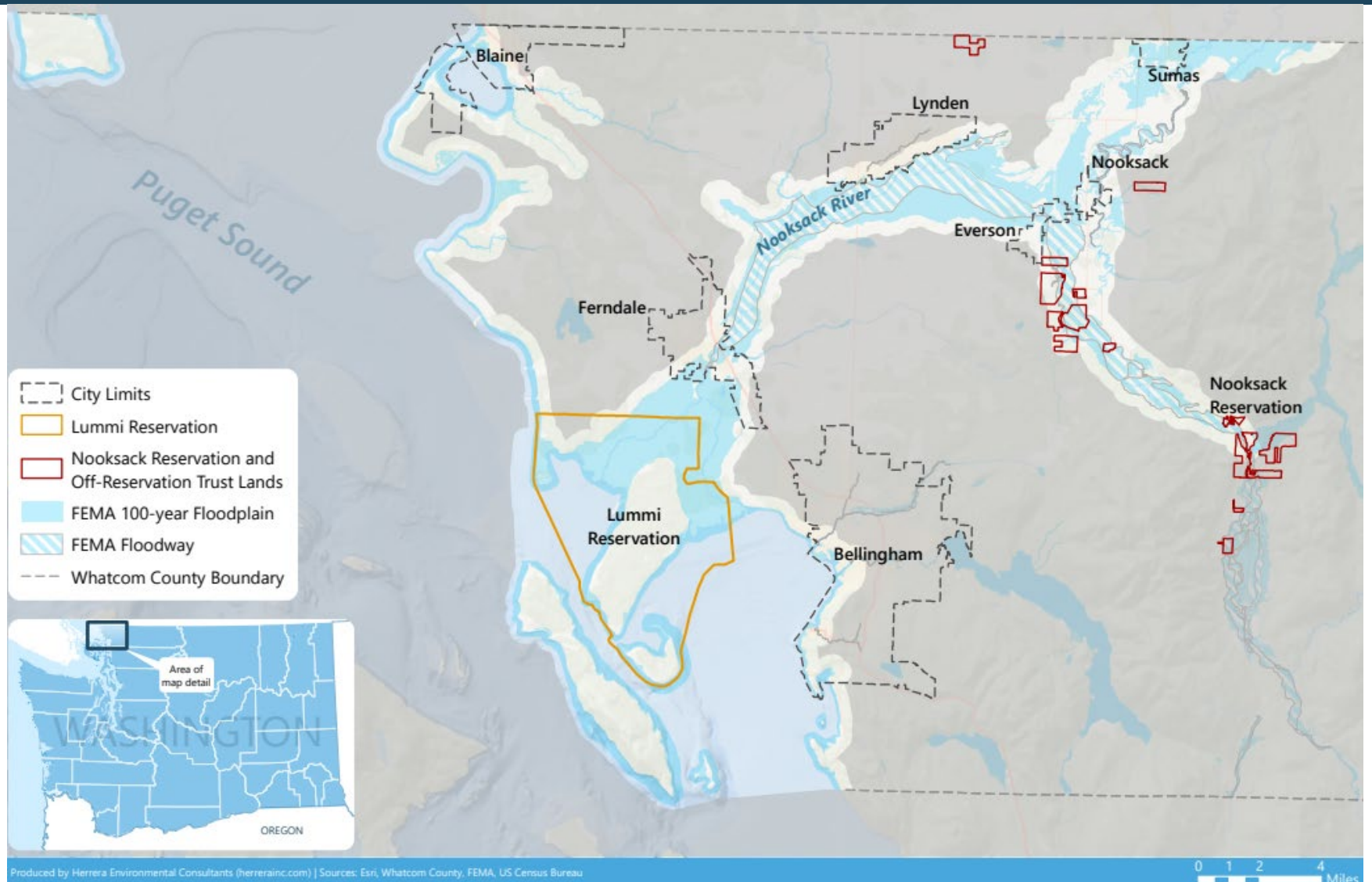
What is unique about this project?

- Countywide assessment of **flood and erosion** vulnerability for **riverine and coastal** areas

- Uses **newest and best-available science**
  - CoSMoS modeling from the USGS
  - Bluff projections from the USGS
  - Compound flooding in the Lower Nooksack River

- Moves from vulnerability assessment to explore **adaptation planning and policy recommendations**

Project Area



What is vulnerable to flooding and erosion?

Photo credit: Bellingham Herald

Vulnerability Assessment Approach

IDENTIFY **ASSETS** TO PROTECT

IDENTIFY PRIMARY **HAZARDS** THAT COULD INJURE PEOPLE OR DAMAGE ASSETS

ASSESS **EXPOSURE** WHERE ASSETS AND HAZARDS OVERLAP

ASSESS THE **SENSITIVITY** OF EXPOSED ASSETS

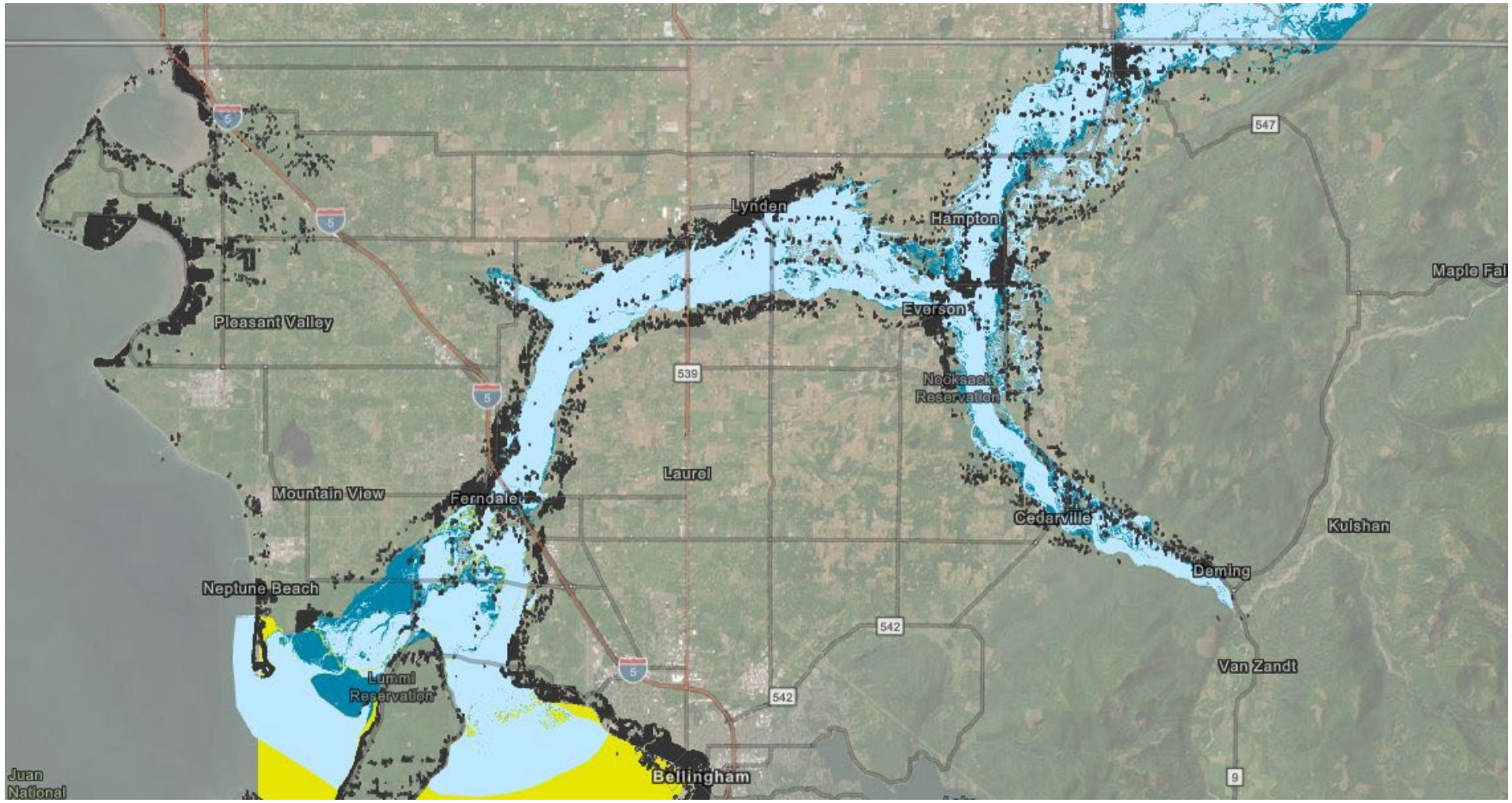
ASSESS THE **ADAPTIVE CAPACITY** OF SENSITIVE ASSETS

DETERMINE THE **VULNERABILITY** OF ASSETS

Vulnerability Assessment - **Assets**

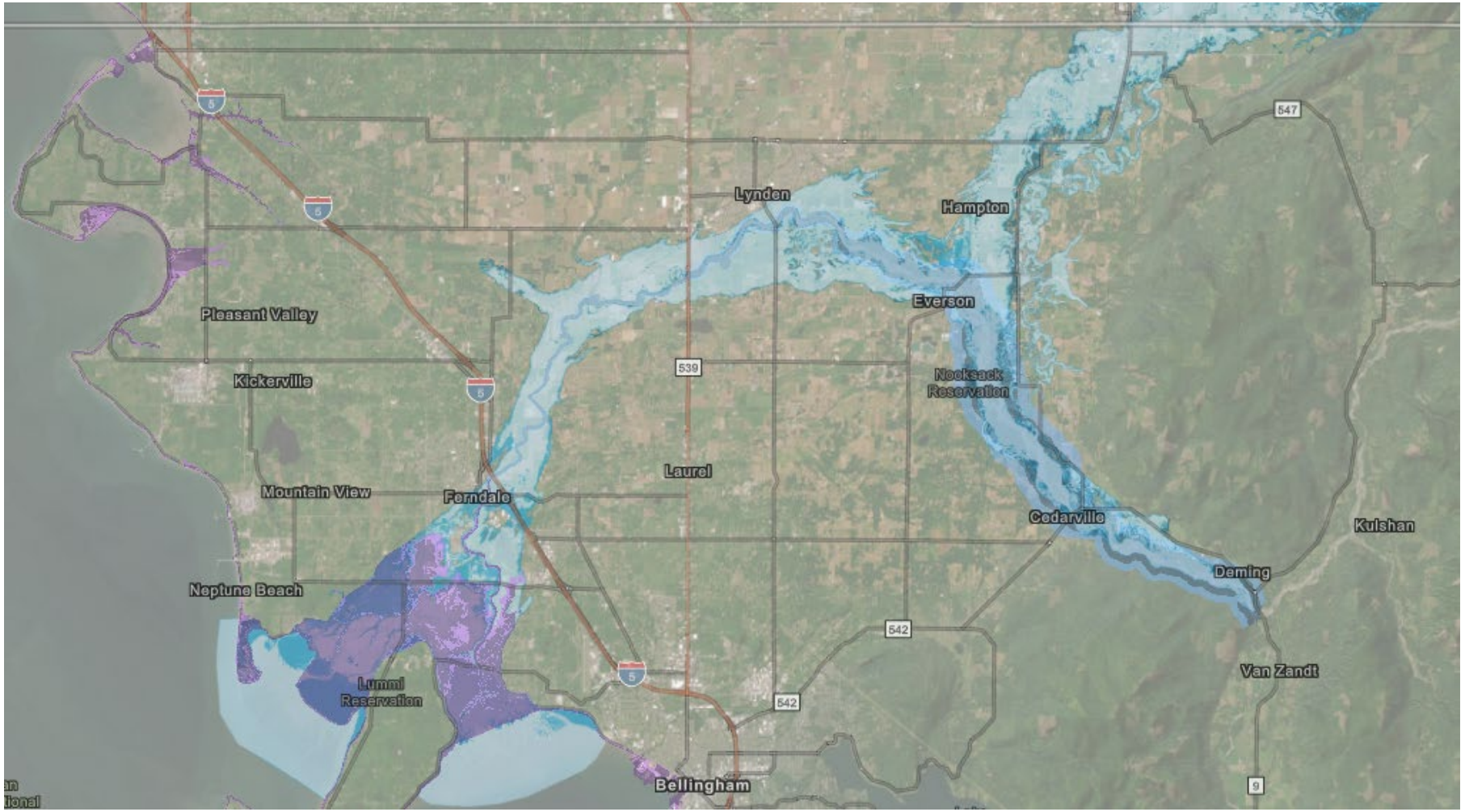
IDENTIFY **ASSETS** TO PROTECT

- *Agriculture*
- *Buildings & infrastructure*
- *Utilities (water, sewer, stormwater, energy)*
- *Natural resources*
- *Recreation*
- *Transportation*



Vulnerability Assessment - **Hazards**

IDENTIFY PRIMARY **HAZARDS** THAT COULD INJURE PEOPLE OR DAMAGE ASSETS



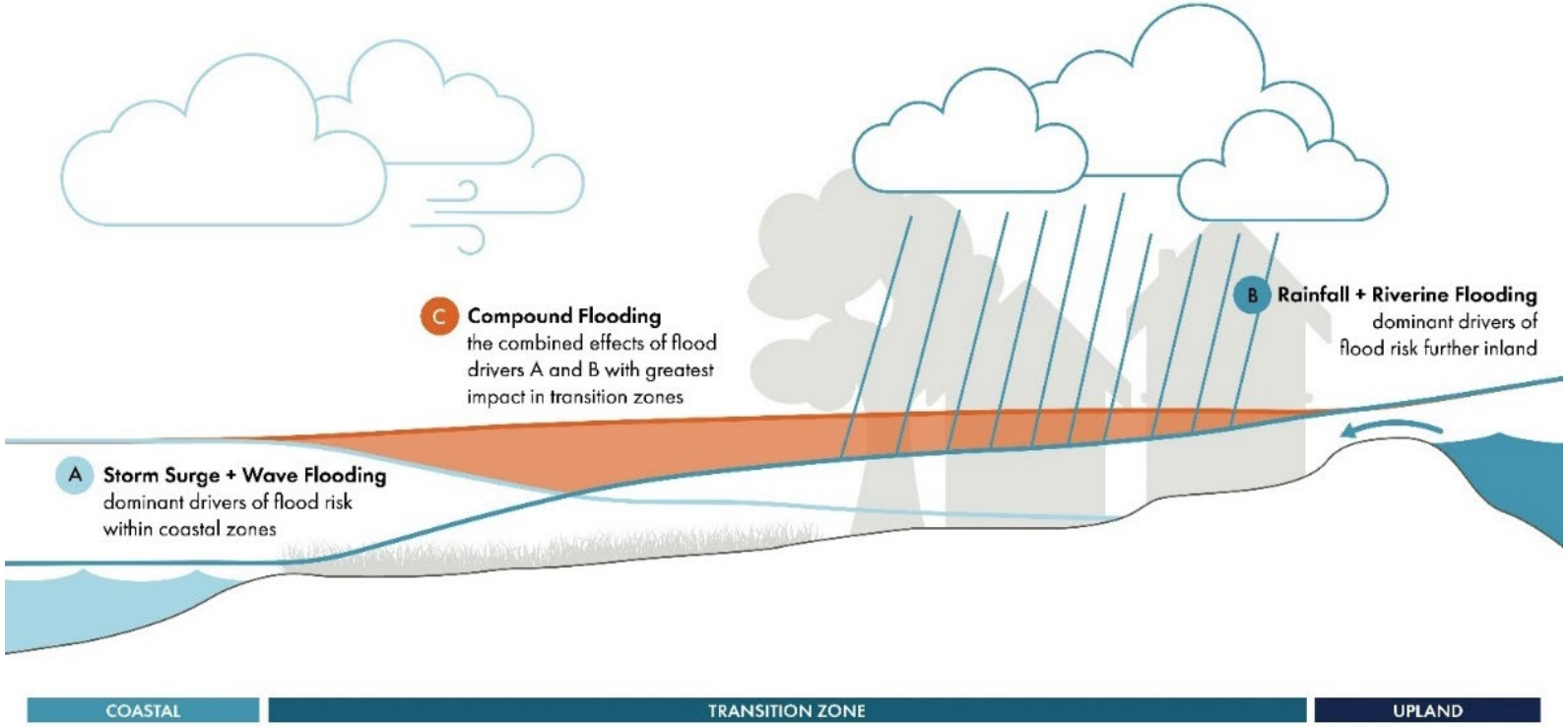
Vulnerability Assessment - **Hazards**

IDENTIFY PRIMARY **HAZARDS** THAT COULD INJURE PEOPLE OR DAMAGE ASSETS

- **Coastal flooding** from storm surge, high tides, and sea level rise
- **Coastal erosion,** including bluff erosion and shoreline change, from higher water levels accelerating land loss
- **Groundwater flooding** from sea level rise, increased river flow, and precipitation
- **Riverine flooding** from the Nooksack River, increased by changes in precipitation and snowpack
- **Riverbank erosion,** and avulsion, where floodwaters trigger changes in riverbanks and channels

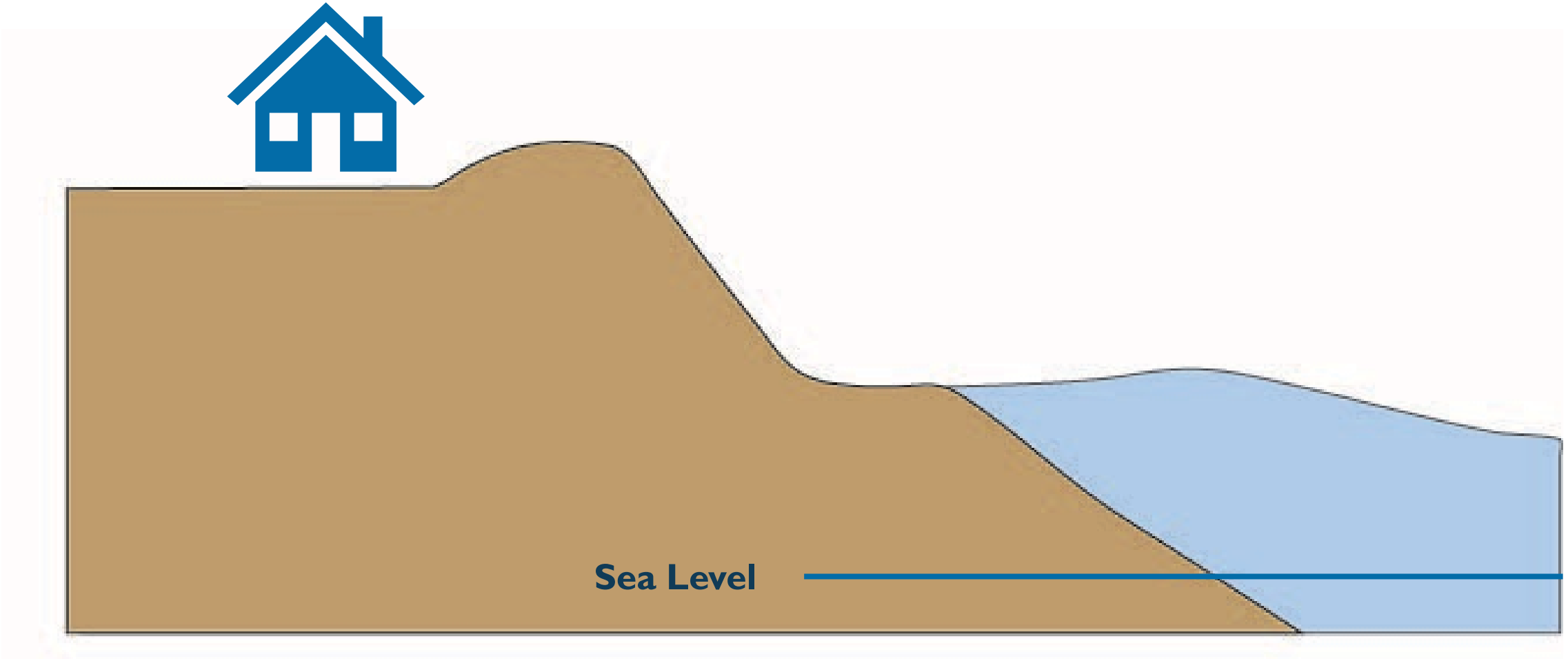
Why are flooding and erosion going to increase?

- **Nooksack River:** changes to rain and snowmelt
- **Coast:** sea level rise
- **Where they meet:** both (compound flooding)



Graphic from The Water Institute

Sea level sets the baseline for flooding and erosion



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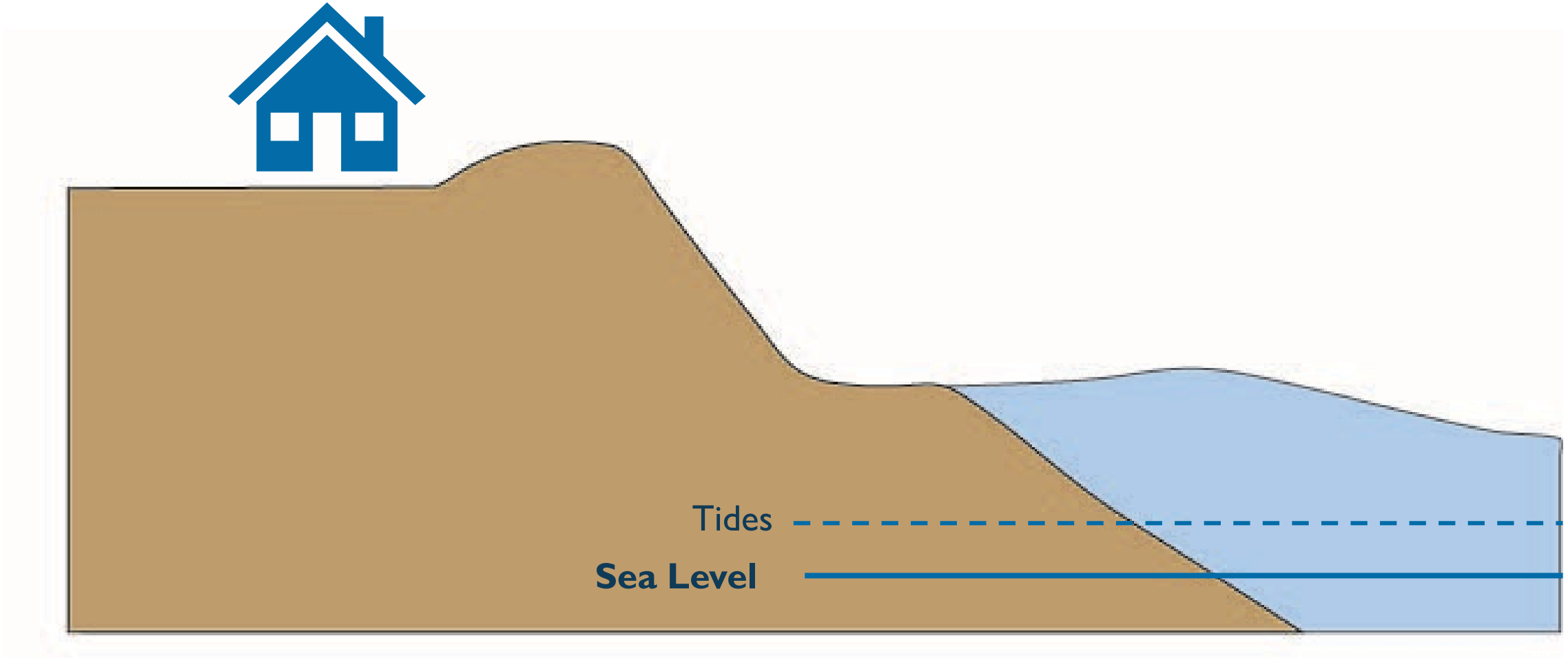
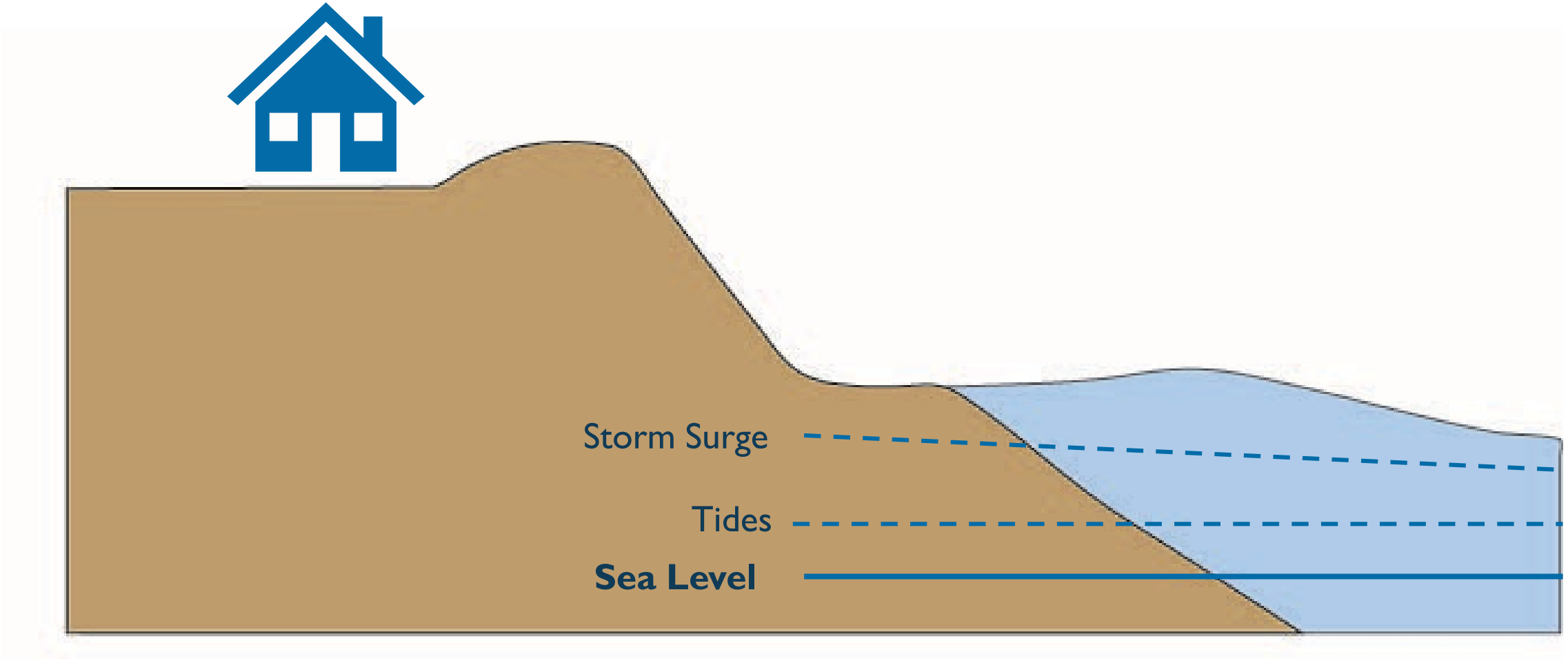
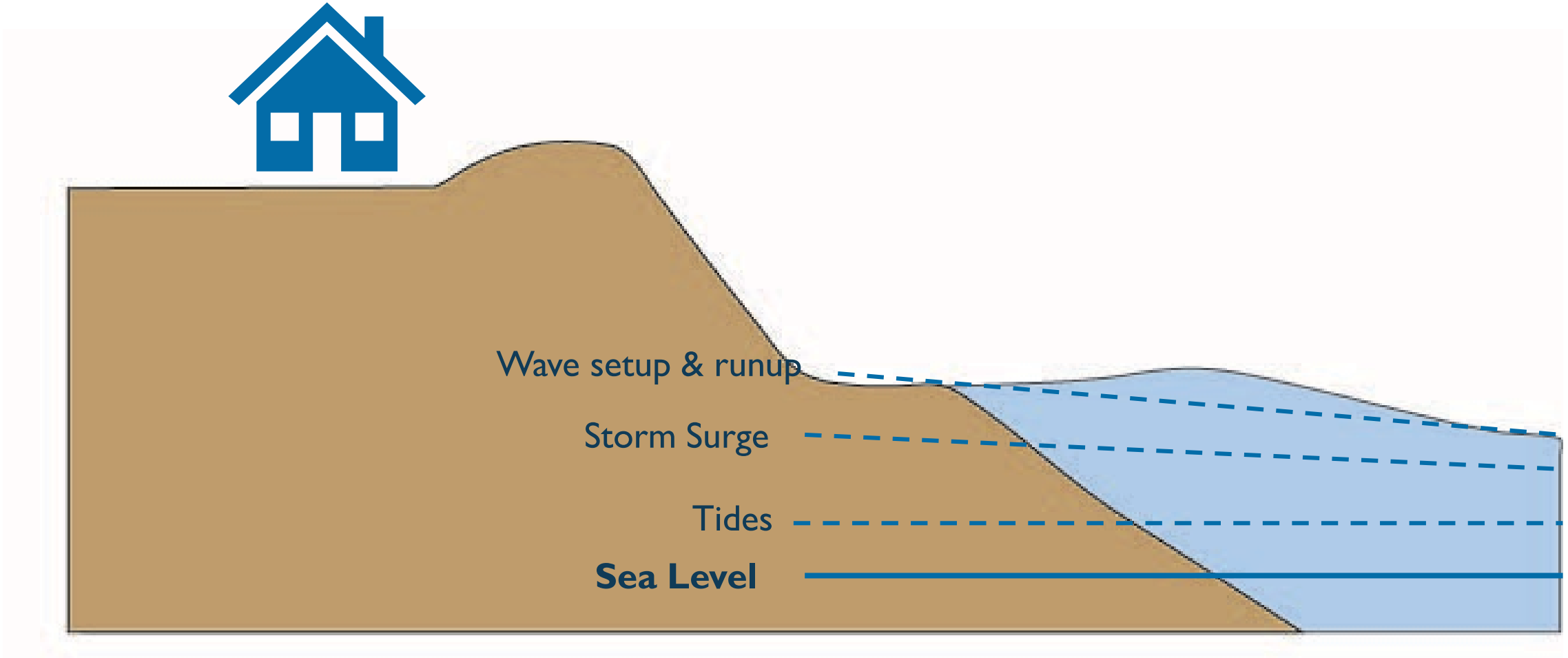


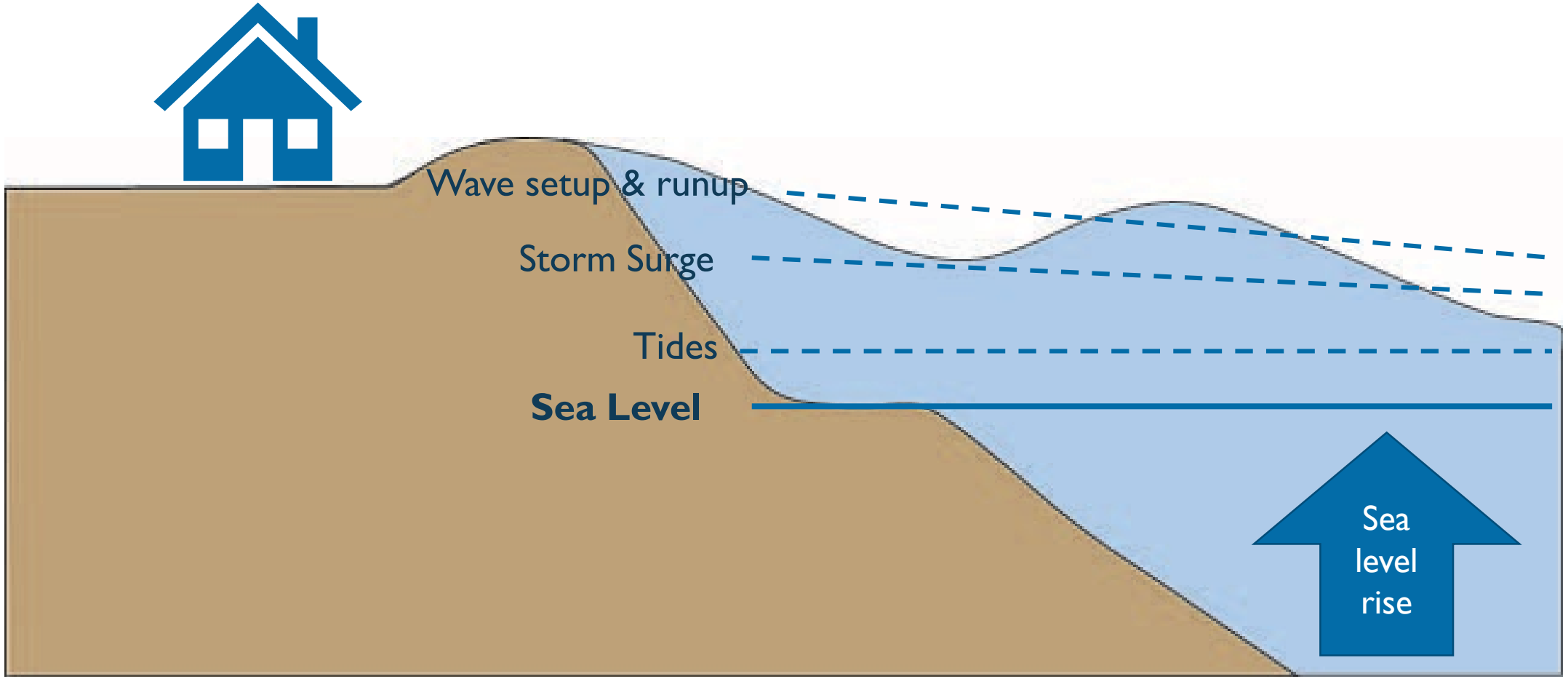
Sea level sets the baseline for flooding and erosion



Sea level sets the baseline for flooding and erosion



Sea level sets the baseline for flooding and erosion



Vulnerability Assessment - Hazards

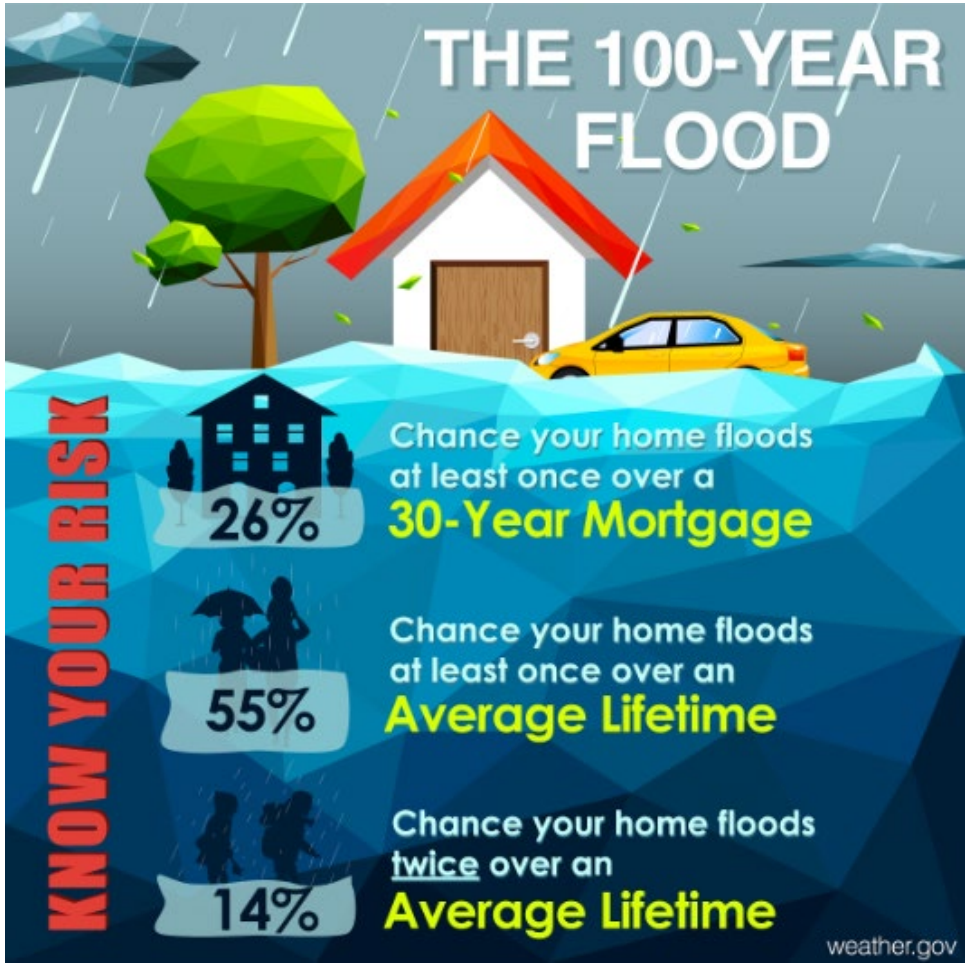
IDENTIFY PRIMARY **HAZARDS** THAT COULD INJURE PEOPLE OR DAMAGE ASSETS

Coastal flooding and sea level rise scenarios.

Scenario	Climate Hazards				
	Coastal flooding	Coastal erosion	Groundwater flooding	Riverine flooding	Riverbank erosion
Source	*USGS and UW-CIG*	*USGS*	*USGS*	*UW-CIG*	*FLIP project*
Near-term scenario	Coastal flooding with 0.8 feet of sea level rise + 20-year coastal storm	Bluff recession with 0.8 feet of sea level rise by 2040	Emergent groundwater flooding with 0.8 feet of sea level rise	Riverine flooding with 1.2x the current 100-year flood, and in the Nooksack River delta assuming 0.8 feet of sea level rise + a king tide event	Erosion forecasted using the Historic Migration Zone (long-term, measured 1933 – 2016) plus High Risk Erosion Hazard Area (25 year)
Mid-term scenario	Coastal flooding with 3.3 feet of sea level rise + 20-year coastal storm	Bluff recession with 3.3 feet of sea level rise by 2080	Emergent groundwater flooding with 3.3 feet of sea level rise	Riverine flooding with 1.75x the current 100-year Nooksack flood and 1.5x for tributaries, and in the Nooksack River delta assuming 3.3 feet of sea level rise + a king tide event	Erosion forecasted using the Historic Migration Zone (long-term, measured 1933 – 2016) plus Medium Risk Erosion Hazard Area (50 year)

What are the probabilities?

- **Recurrence interval:** statistical estimate of how often a flood of a certain size is likely to occur
- '100-year' means 1/100 or 1% chance of occurring in *any given year*
- Probability of flooding accumulates over time



What are the probabilities?

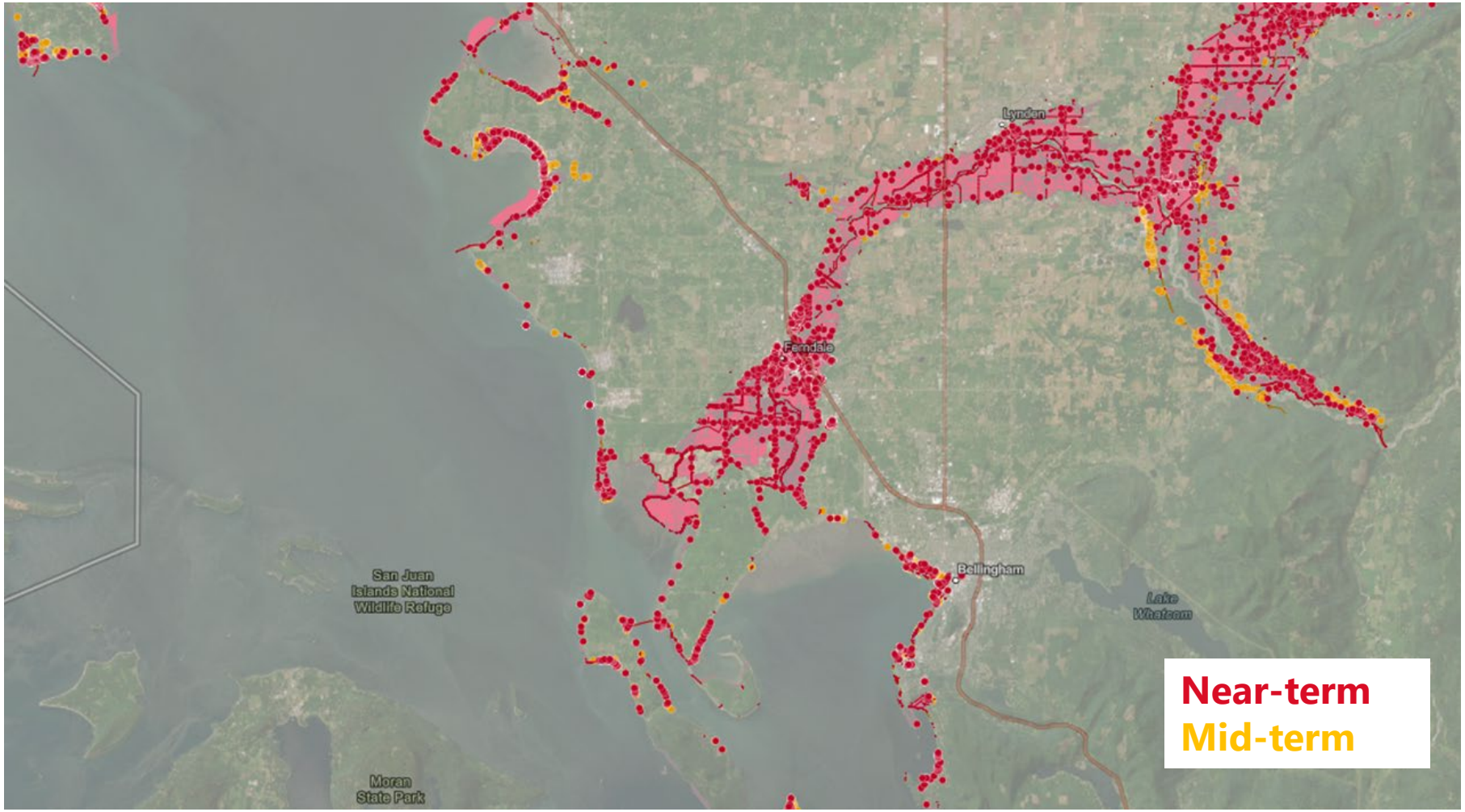
- **When, not if.** For all scenarios, the uncertainty is *when* impacts will be felt, not if they will be felt.
- **Considering the 1% scenario.** These are low-probability but high-impact events. While rare, when they occur, they can be catastrophic.

Table 1. Coastal Flooding and Sea Level Rise Scenarios.

Scenario	Approximate Percent (%) Chance of Water Level Being Met or Exceeded over Time			
	2040s	2060s	2080s	2100s
0.8 feet of sea level rise	~1%	~50%	50-83%	90-95%
3.3 feet of sea level rise	<0.1%	<0.1%	~1%	1-10%

Vulnerability Assessment - **Exposure**

ASSESS
EXPOSURE
WHERE ASSETS
AND HAZARDS
OVERLAP



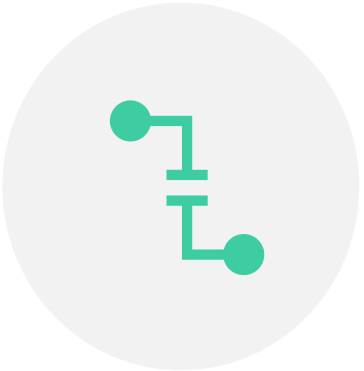
Vulnerability Assessment – Exposure, Sensitivity & Adaptive Capacity

ASSESS **EXPOSURE** WHERE ASSETS AND HAZARDS OVERLAP

Higher scores for assets exposed sooner and/or to multiple hazards

ASSESS THE **SENSITIVITY** OF EXPOSED ASSETS

Higher scores if potential severe impact to human health and safety and/or environmental health



ASSESS THE **ADAPTIVE CAPACITY** OF SENSITIVE ASSETS

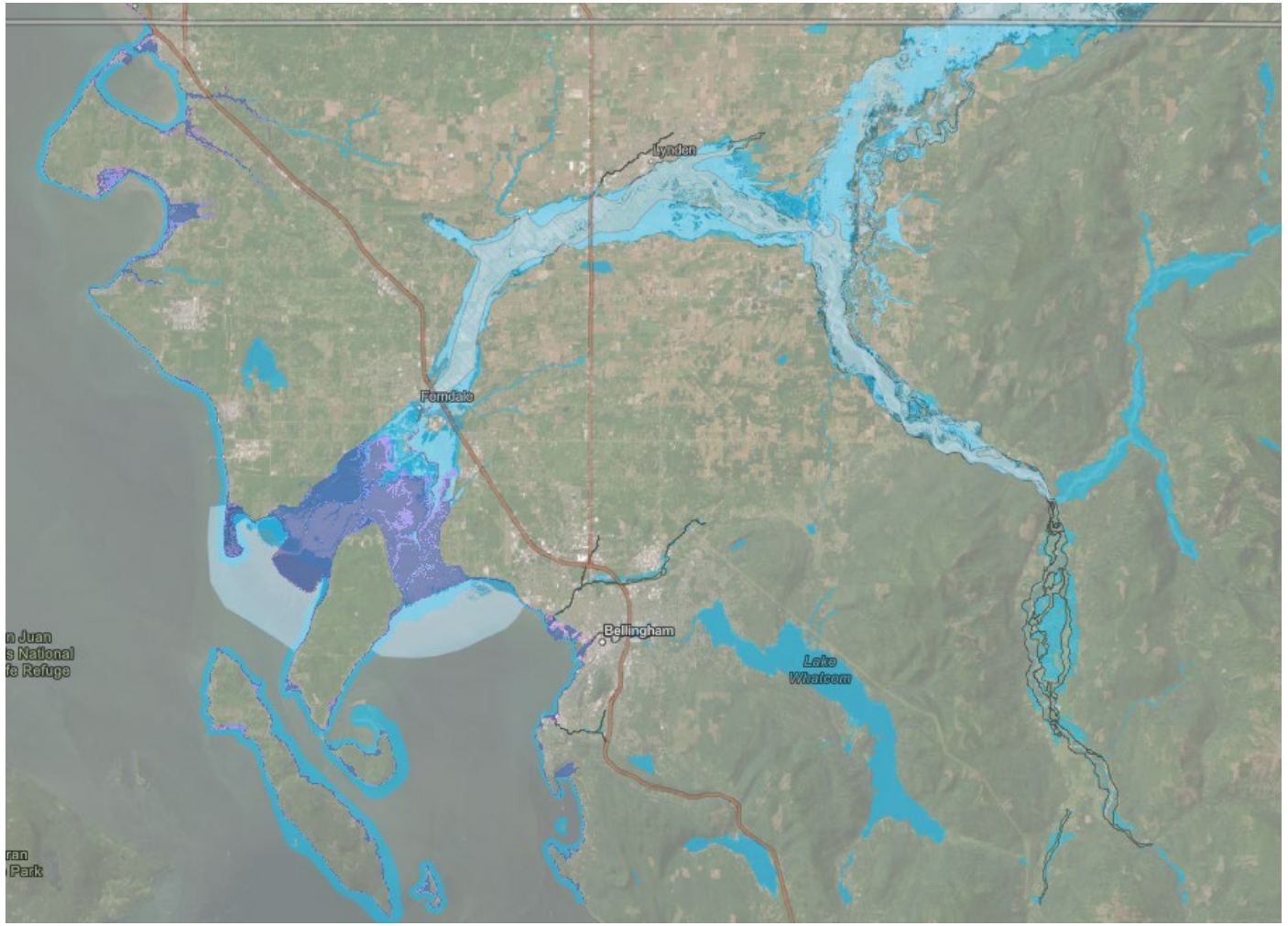
Higher scores if asset is in area with less socioeconomic disparity and/or function would not be severely impacted

Vulnerability Assessment – Vulnerability

Findings – **growing** floodplain area

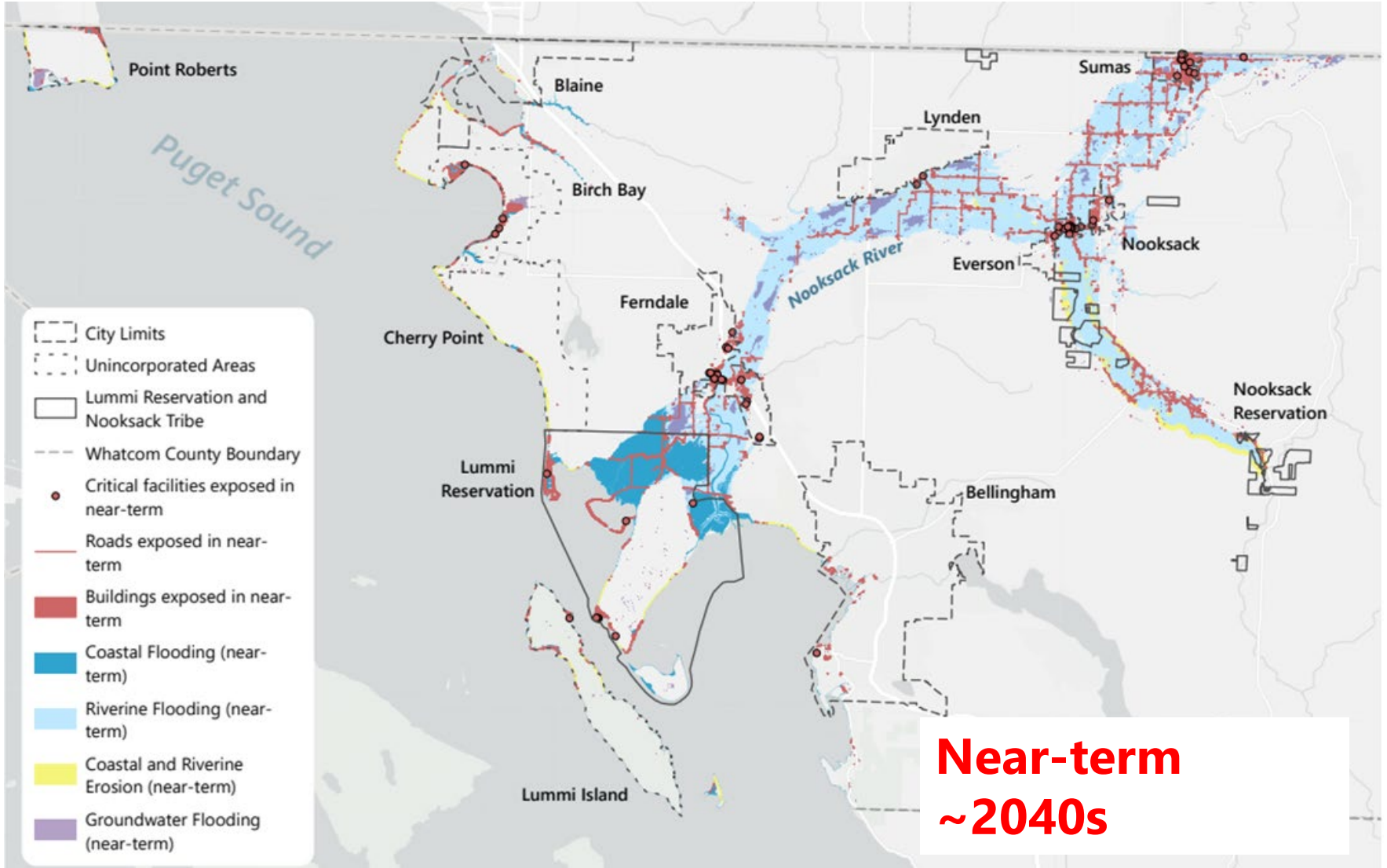
- ~82 square miles in the **current** floodplain

Findings – **24% increase in** floodplain area

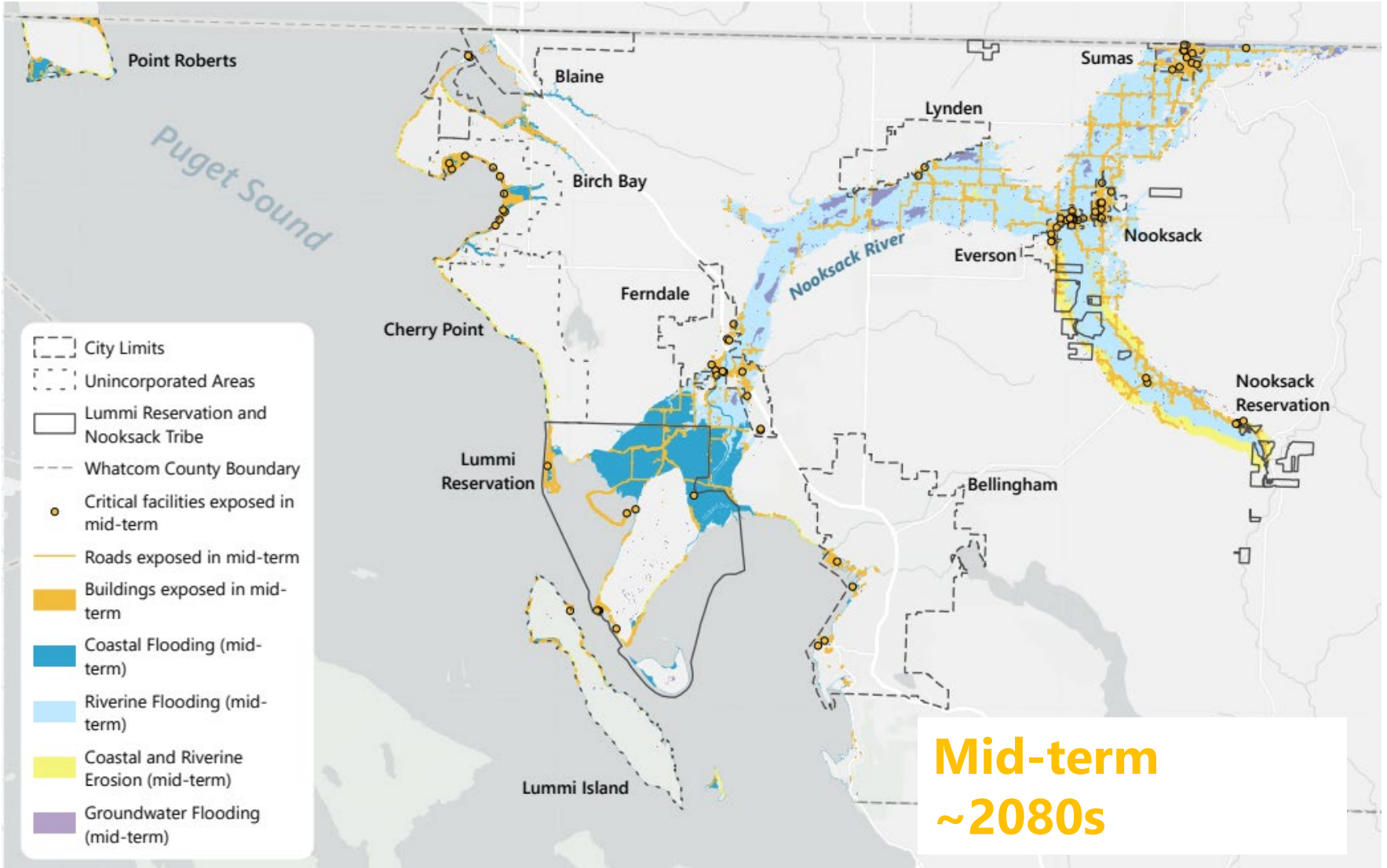


- ~82 square miles in the **current** floodplain
- ~102 square miles in the **future** floodplain

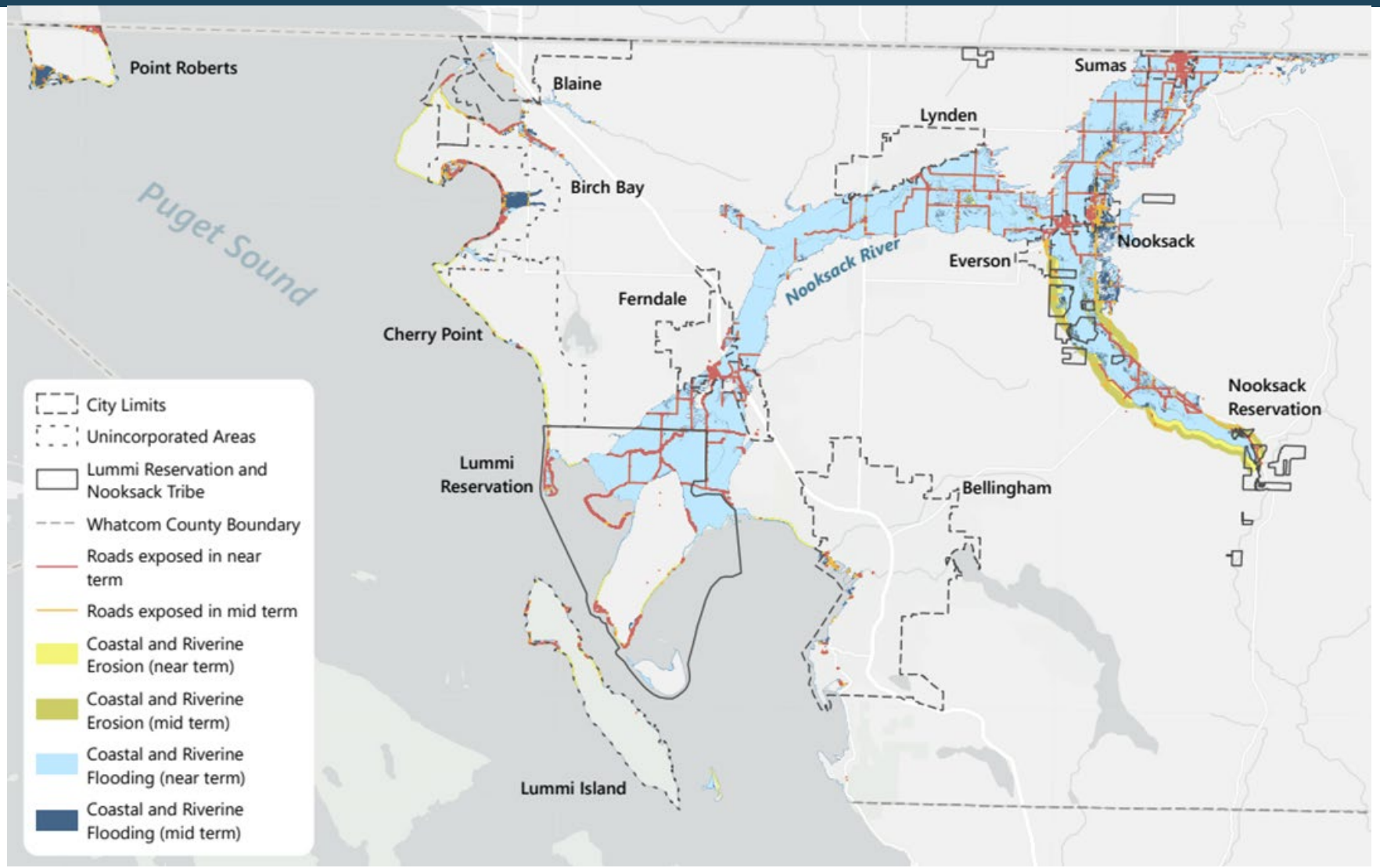
Findings – increasing exposure to buildings, critical facilities, and roads



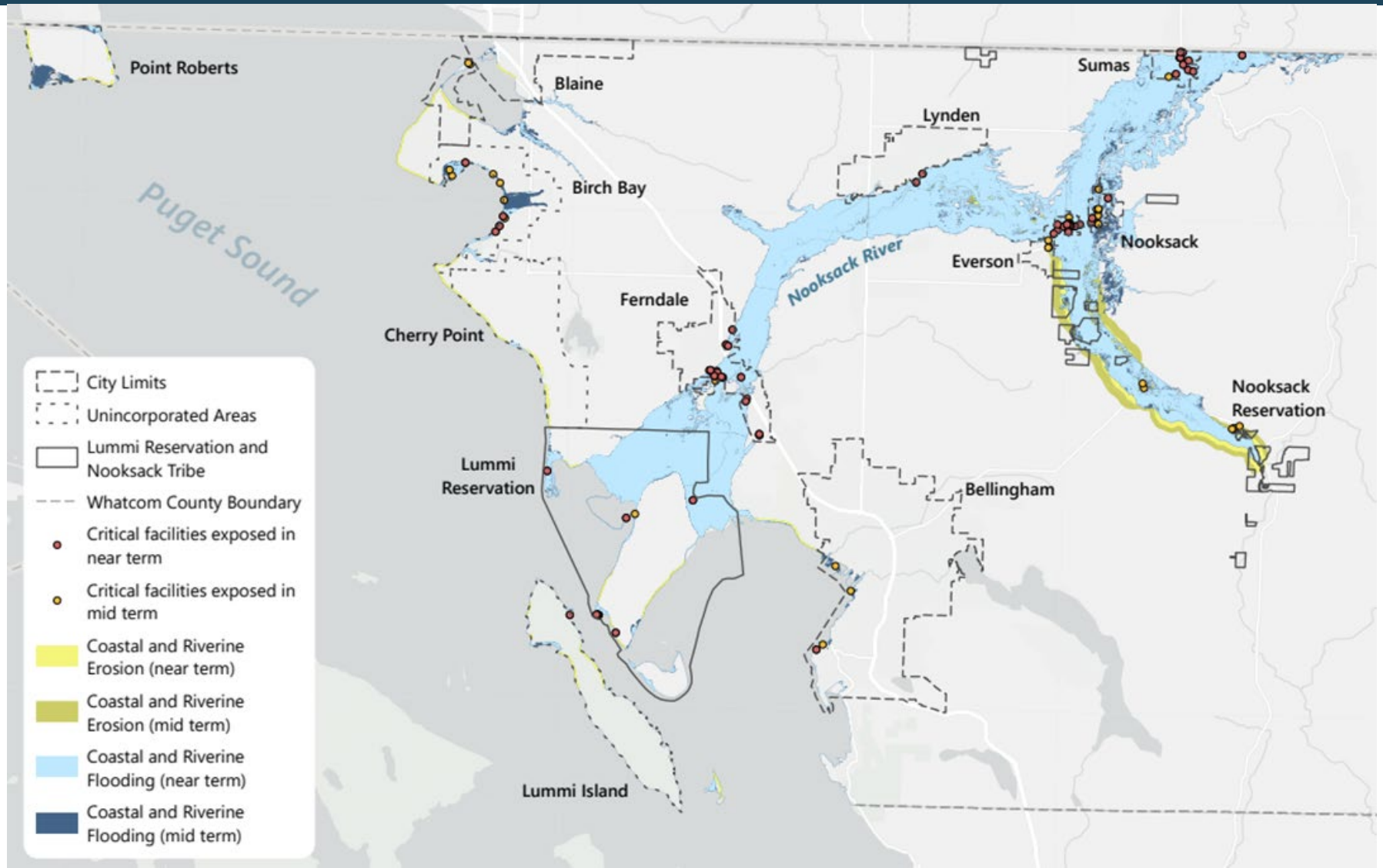
Findings – increasing exposure to buildings, critical facilities, and roads



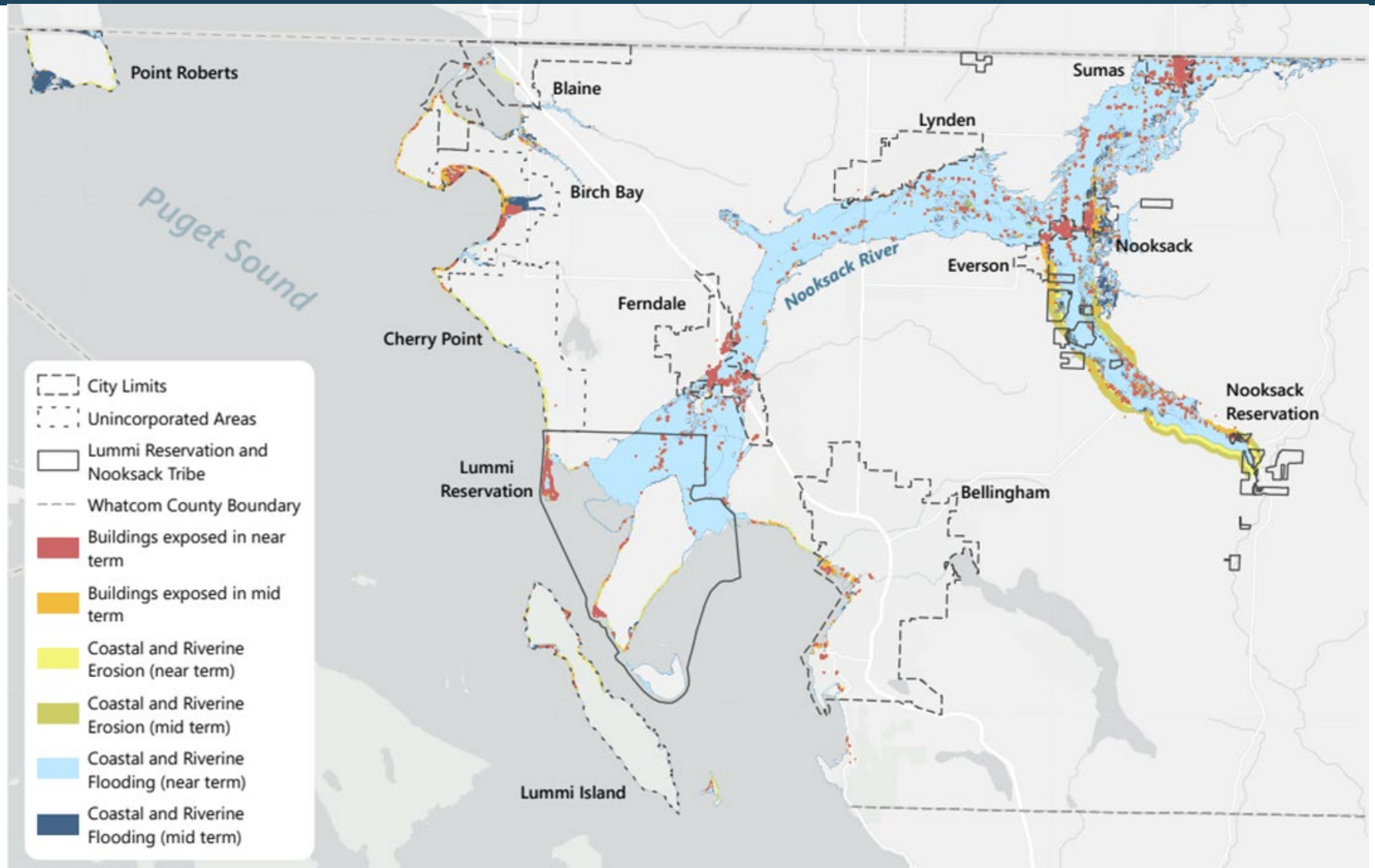
Findings – over 192 miles of roads in future floodplain



Findings – over **90** critical facilities in future floodplain



Findings – over **8,888 buildings in future floodplain**

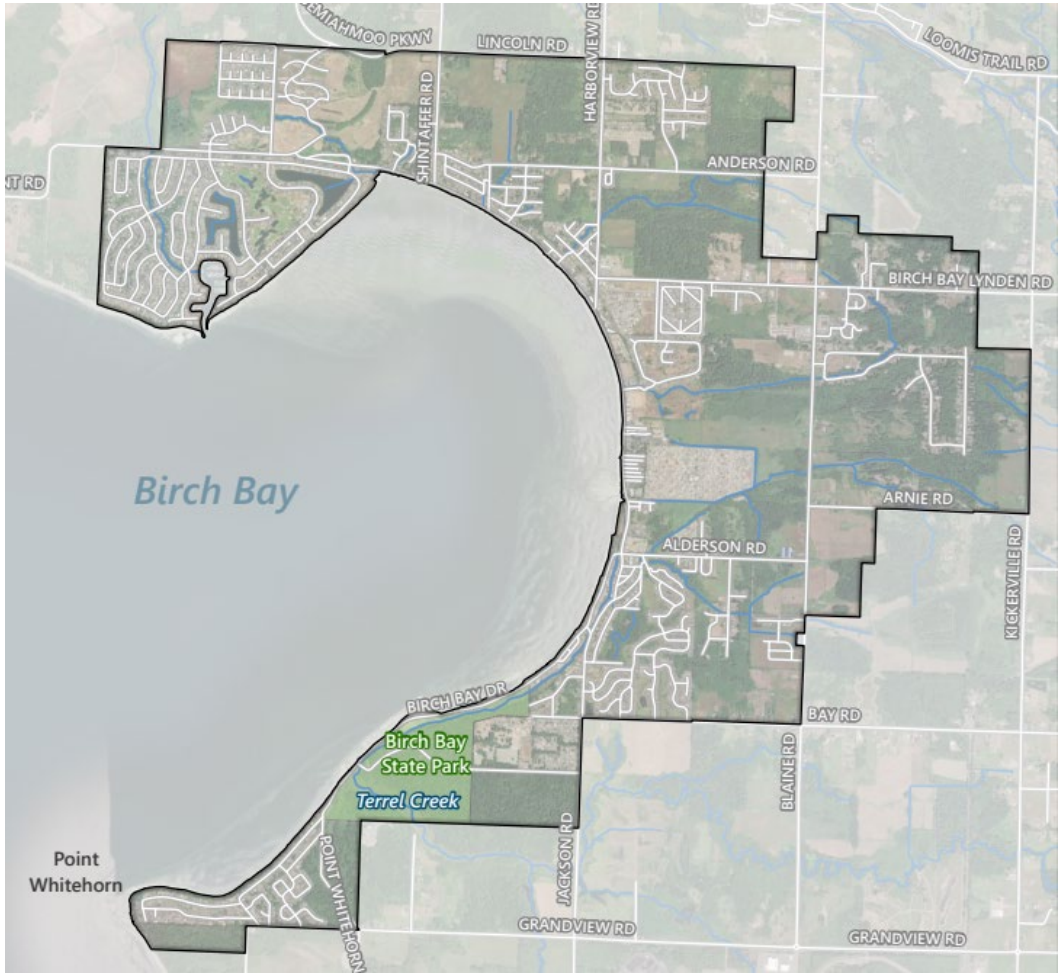


Adaptation Strategies for Birch Bay

Photo credit: Bellingham Herald

Why Birch Bay?

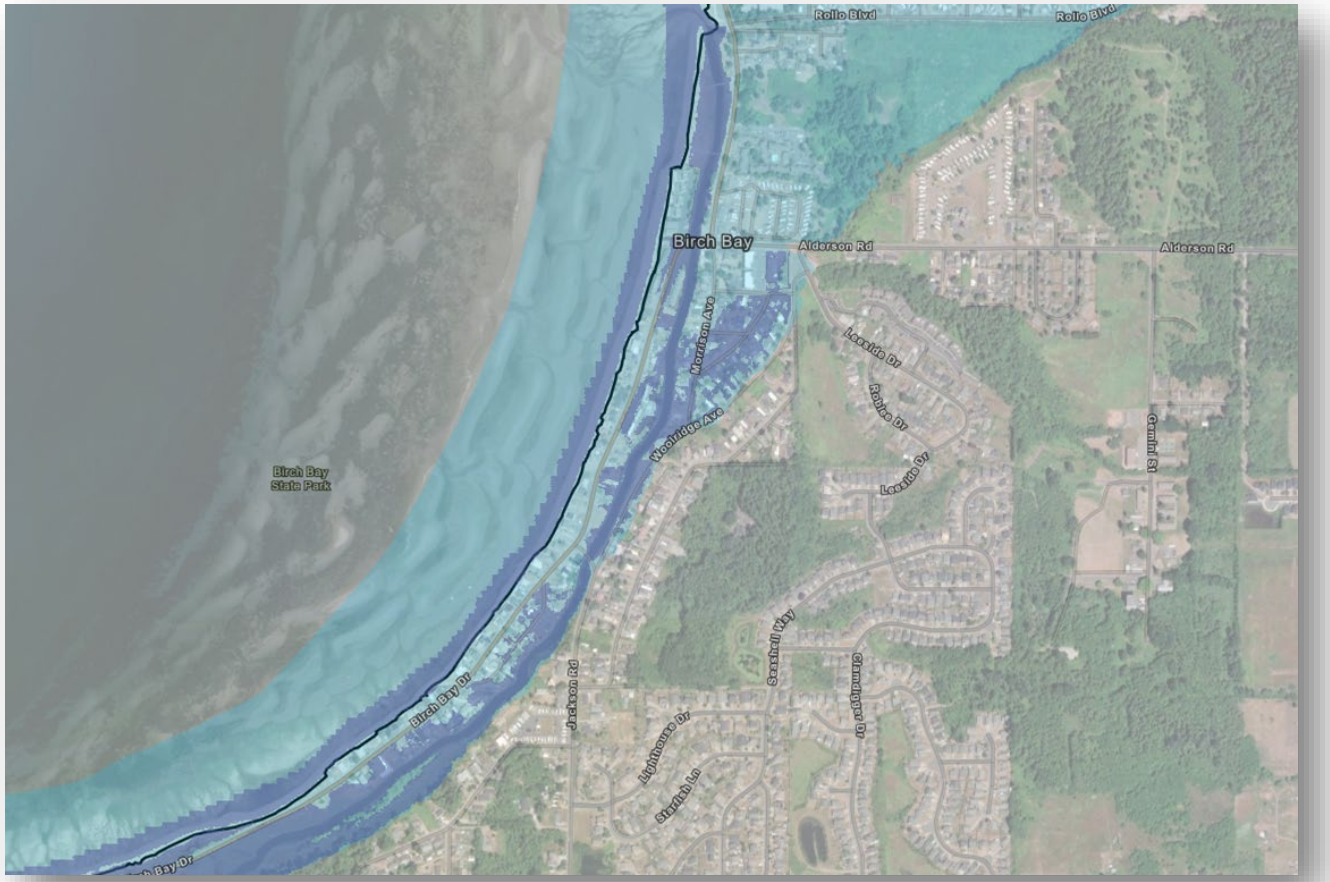
- Low-lying areas very vulnerable to flooding
- History of decades of coastal flooding and erosion impacts
- Coastal impacts anticipated to intensify
- Recent investments with the Birch Bay berm
- County Urban Growth Area (UGA)
- Focus from Phase 1 assessment



Birch Bay Vulnerabilities – Flooding

- **Current 100-year** floodplain (1% annual chance)

Birch Bay Vulnerabilities – Flooding



- **Current 100-year** floodplain (1% annual chance)
- **0.8 ft sea level rise + King Tide**
  - Past 10 years: ~1.8 days/year
  - 2040s: ~ 4 days/year

Birch Bay Vulnerabilities – Flooding

- **Current 100-year** floodplain (1% annual chance)
- **0.8 ft sea level rise + King Tide**
  - Past 10 years: ~1.8 days/year
  - 2040s: ~ 4 days/year
- **3.3 ft sea level rise + King Tide**
  - 2080s: ~25 days/year

Birch Bay Vulnerabilities – Erosion

- **Current bluff crest**
  - Historic: 0.4 – 0.7 feet/year of erosion

Birch Bay Vulnerabilities – Erosion

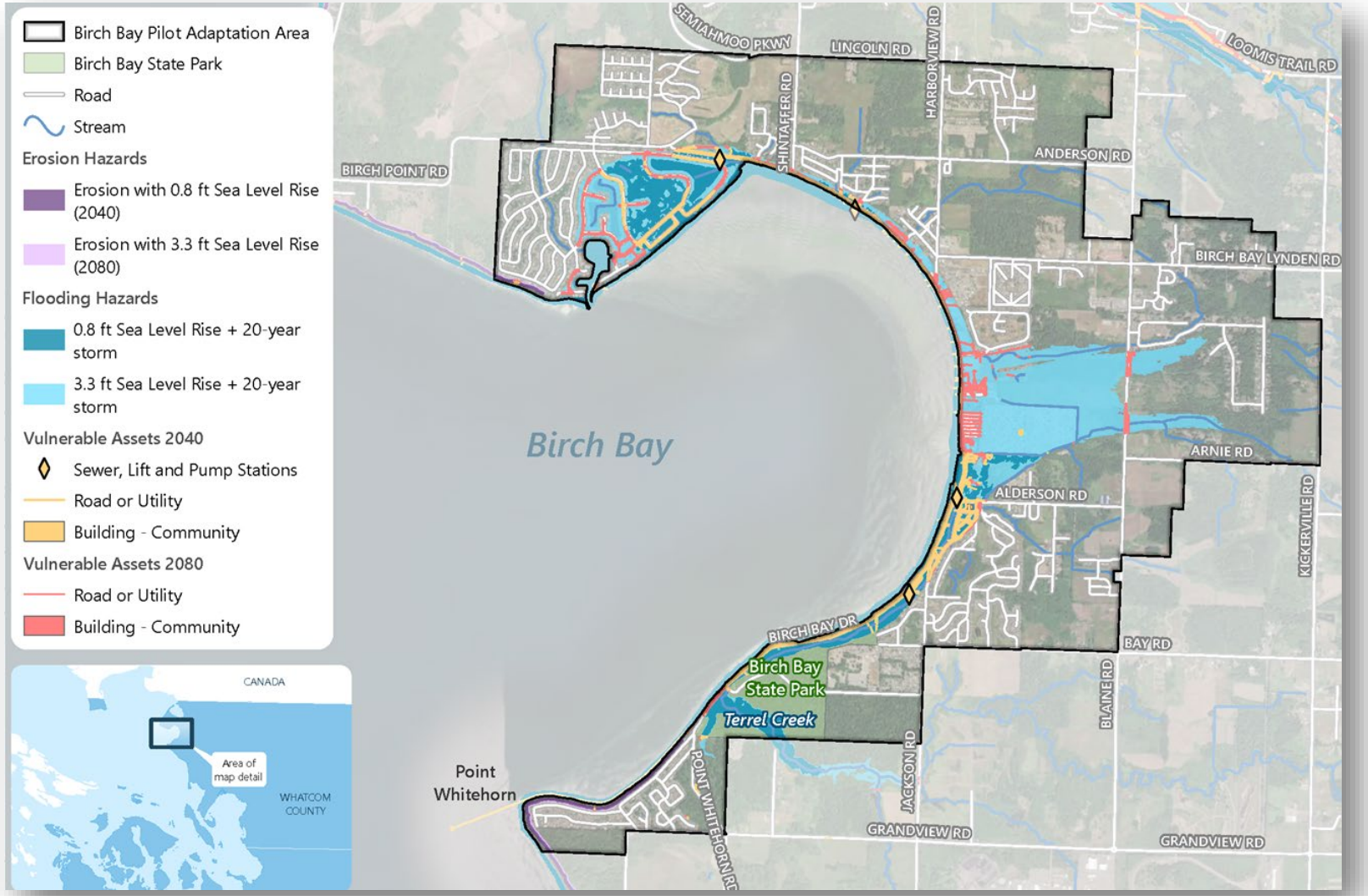
- **Current bluff crest**
  - Historic: 0.4 – 0.7 feet/year of erosion
- **2040s potential bluff crest**
  - 0.6 – 0.9 feet/year of erosion

Birch Bay Vulnerabilities – Erosion

- **Current bluff crest**
  - Historic: 0.4 – 0.7 feet/year of erosion
- **2040s potential bluff crest**
  - 0.6 – 0.9 feet/year
- **2080s potential bluff crest**
  - 0.9 – 1.4 feet/year

Birch Bay Vulnerabilities – Community Assets

- Key roads
- Buildings
- Sewer lines and lift stations
- Water lines
- Stormwater outfalls



Birch Bay Vulnerabilities – Housing

- Significant near-term exposure for Birch Bay's residential parcels.
- UGA also slated for growth under 2025 Comprehensive Plan.
- Planning and zone changes needed to direct future growth outside of areas exposed to flooding and erosion.

Residential Property Exposure in Birch Bay UGA

Exposure Category	Exposed Parcels (Est.)
Total estimated residential parcels exposed to inundation or erosion by 2040	**1,371**
Total estimated residential parcels exposed to inundation or erosion by 2080 (in addition to 2040)	**861**

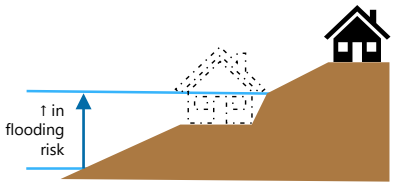
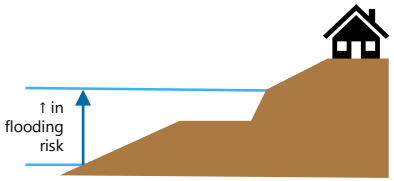
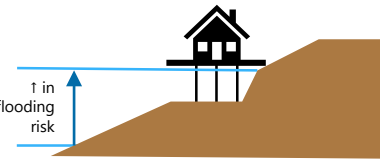
Proposed Growth in Birch Bay UGA (2025 Comprehensive Plan)

DEIS Alternative	Population	Housing Units
No Action	3,007	1,791
Alt 1- Medium Growth	2,313	936
Alt 2 - Multi-Jurisdictional Resolution	**2,662**	**1,051**
Alt 3 – High Growth: population	3,490	1,324

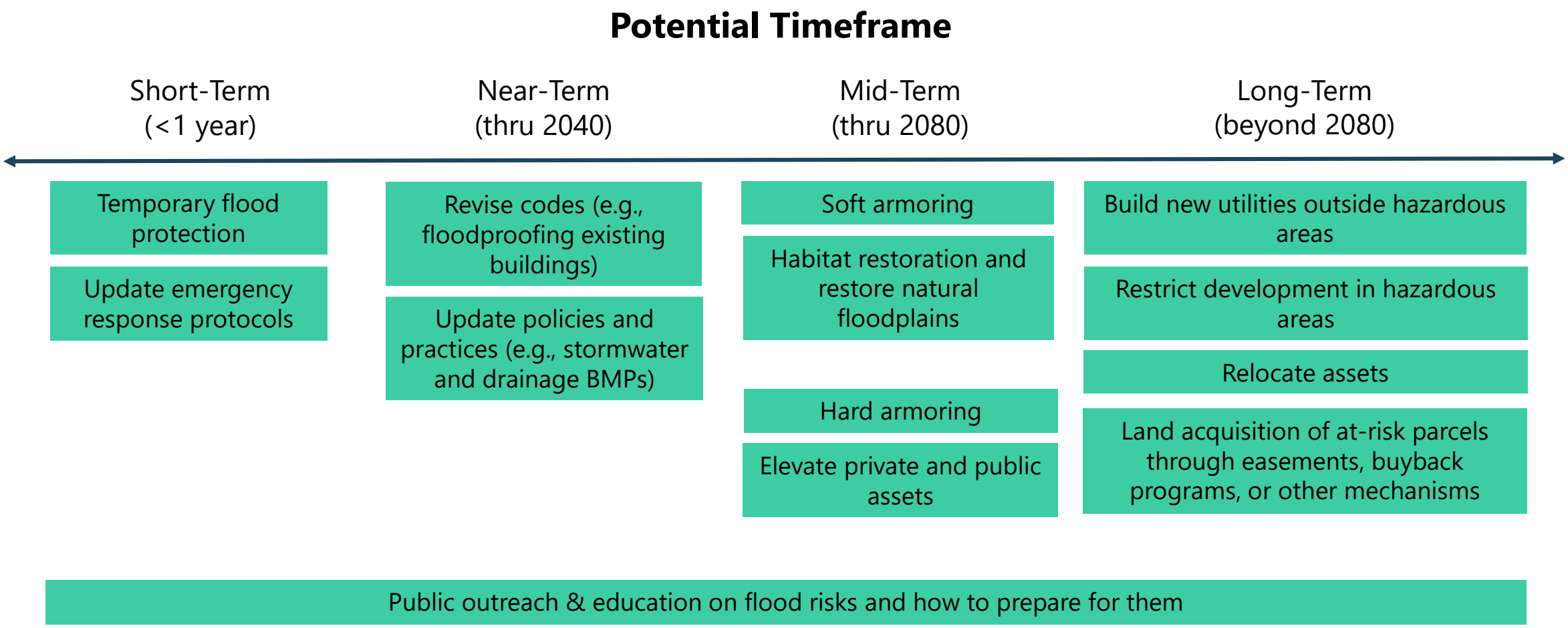
Objectives for Adaptation

- **Mitigate and reduce** hazard exposure
- **Enhance the capacity** of systems to cope with future risks
- When possible, **support other co-benefits** (e.g., health and wellbeing, cost savings, economic development, etc.)
- **Starting now** reduces future costs and damages.

Building Resilience to Coastal and Riverine Flooding and Erosion Hazards

Category	Relocate	Avoid	Accommodate	Protect
Definition	Reduces risk by moving people or assets out of the hazard zone.	Limits new development in hazardous areas.	Reduces flooding exposure or sensitivity by modifying systems to enable habitability.	Reduces flooding by blocking inland propagation of flooding through hard or soft structures.
Examples	Incentives, land buyouts, or redevelopment to shift people or structures out of hazard areas permanently or semi-permanently	Zoning updates to limit or restrict development, increase slope setback distances	Elevating public assets, building codes for flood resilience, early warning systems, restoring habitats	Temporary flood barriers, beach nourishment, flood berms around key infrastructure
Tradeoffs	Political or social buy-in may be difficult; can be expensive; will require time and planning in the medium to long-term	Can be politically challenging to gather buy-in; trade-offs with competing uses of other land uses outside of hazard areas	May require political support for implementation; enforcement needs; may need to be modified as hazards worsen	May require maintenance; hard armoring may need to be updated in the future as hazards worsen
Conceptual Diagram				

Adaptation Pathways



Birch Bay Pilot Adaptation Plan – May 6 workshop

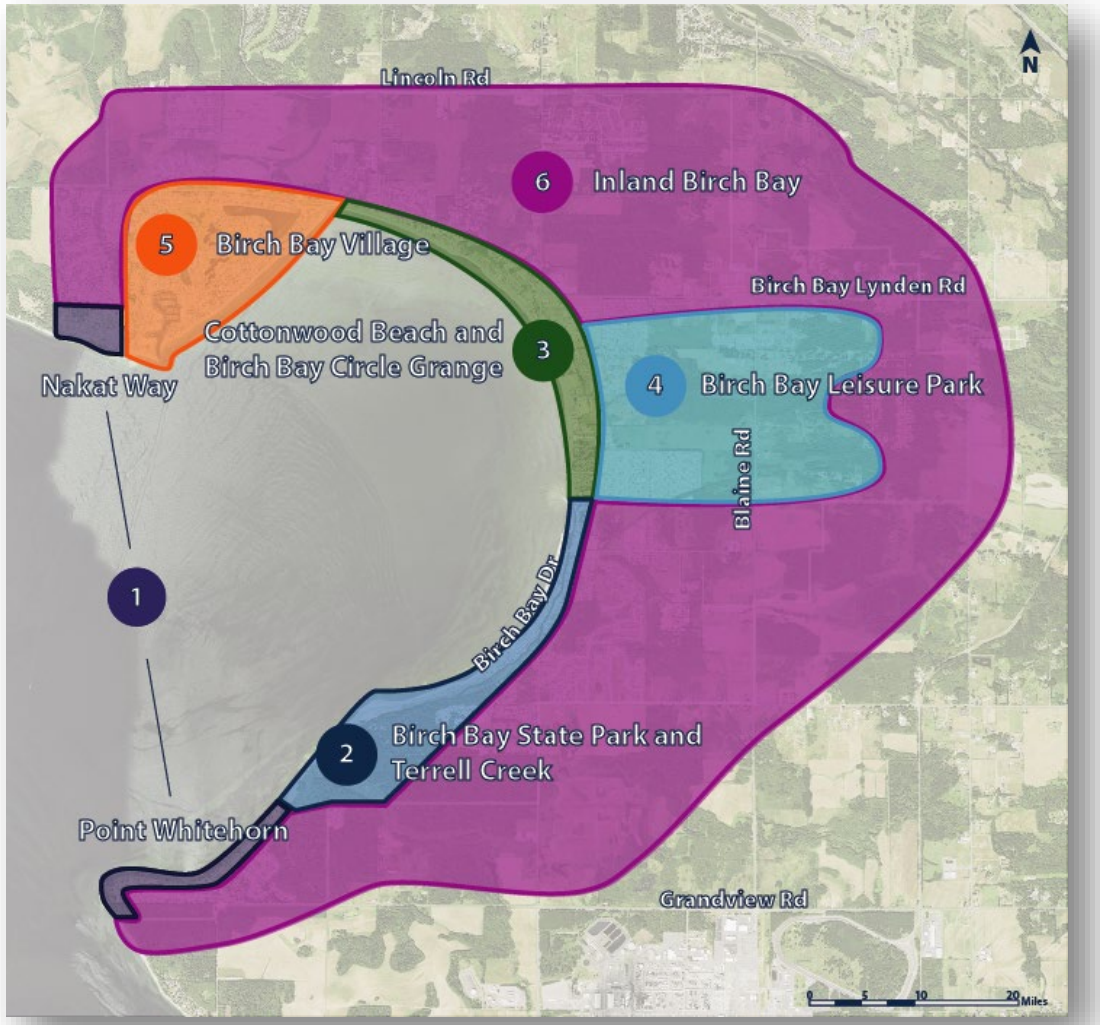
SUB-AREA 2

POTENTIAL ADAPTATION STRATEGIES

Hazard Profile	Climate Vulnerability	Assets at Risk
• Coastal flooding and flooding from Terrell Creek • Groundwater flooding	HIGH	• Birch Bay Drive • Birch Bay State Park • Sewer lines, lift station, stormwater outfalls, and water lines • Buildings

	Potential Strategy	Comments
COMMUNITY	Beach nourishment along the coast PROTECTION: SHORT- to MID-TERM	
COMMUNITY	Modify or elevate sewer lift stations PROTECTION: MID-TERM	
PARCEL	Increase building elevation requirements & flood proofing PROTECTION: MID-TERM	
COMMUNITY	Relocate sewer lift stations PROTECTION: LONG-TERM	
NEIGHBORHOOD	Limit redevelopment in flood risk area PROTECTION: LONG-TERM	
COMMUNITY	Move road and utilities inland PROTECTION: LONG-TERM	
PARCEL	Move buildings out of flood risk area PROTECTION: LONG-TERM	
COMMUNITY	Restore natural habitats PROTECTION: LONG-TERM	

Birch Bay Pilot Adaptation Plan



Example adaptation pathway for subarea 1

Near-Term Action	Mid-Term Action	Long-Term Action
	COMMUNITY: **Restrict new development near bluff crest.**	COMMUNITY: **Restore natural habitats along the bluff** to mitigate future erosion risks and provide natural buffers.
NEIGHBORHOOD: **Improve stormwater and vegetation management on coastal roads** to reduce erosion risks from stormwater runoff and increase stability of soils near coastal roads.		NEIGHBORHOOD: **Move transportation and utility assets, such as Holeman Avenue and sewer and water lines, away from bluff crest** and outside future erosion hazard zones.
	PARCEL: **Support residents with best management practices and nature-based solutions** – such as vegetation management, stormwater improvements shoreline armor removal, and restoration.	PARCEL: **Move buildings away from bluff crest** and outside future erosion hazard zones.

Potential Policy and Land Use Strategies

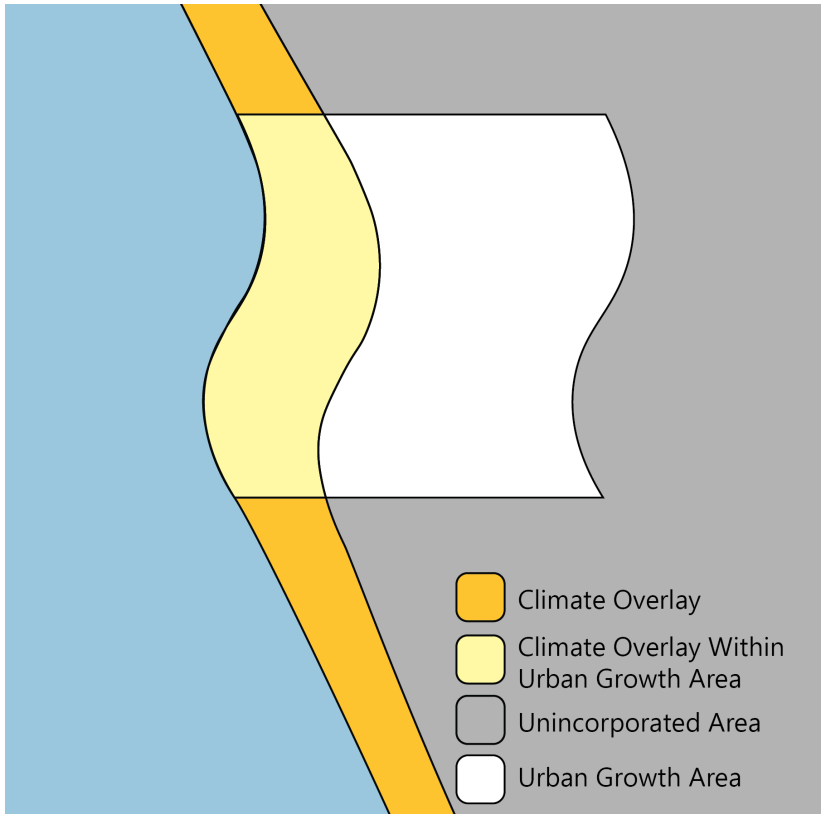
Photo credit: Christopher Ramirez

Develop a Climate Overlay

- Climate Overlay: **regulatory tool** to apply additional rules specific to geographic areas that are, or will be, exposed to climate hazards

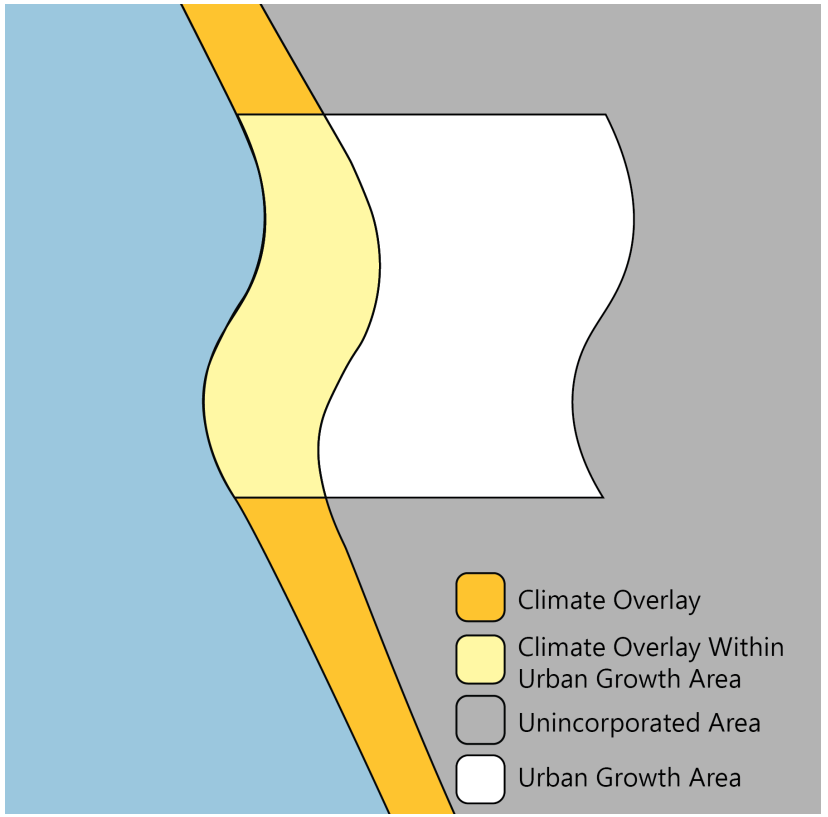
- Apply to multiple, nested hazards
  - **Coastal Climate Overlay**
  - **Riverine Climate Overlay**

- Define by mid-term climate scenarios



Climate Overlay Strategies

1. Restrict new development within the climate overlay.
2. Direct growth outside the climate overlay.
3. Support relocation and risk reduction programs.



Birch Bay Climate Overlay Strategies

4. Define appropriate restrictions for new development within the Coastal Climate Overlay.

5. In the Birch Bay UGA, update zoning in areas outside the Coastal Climate Overlay to provide more opportunities for development.

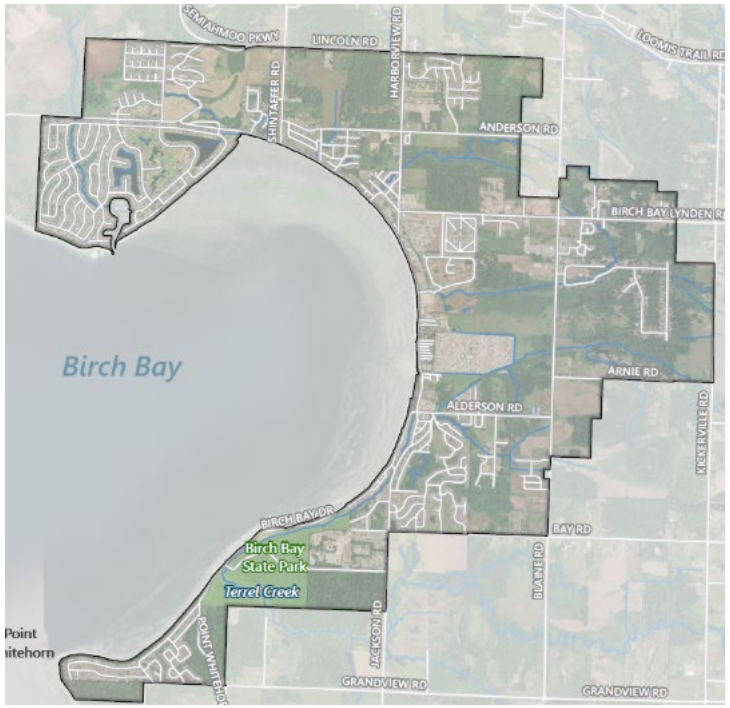
6. Expand program guidelines for the Purchase of Development Rights through the Conservation Easement Program.

7. Implement applicable recommendations to implement a Coastal Transfer of Development Rights (TDR) program.

8. Conduct education and outreach in Birch Bay.

9. Monitor insurance trends to identify impacts to Birch Bay property owners.

10. Increase programmatic support and capital investments to reduce risk and promote relocation of private and public infrastructure to areas outside the Climate Overlay.



Land Use Strategies for **Riverine Areas**

11. Establish appropriate restrictions for development within the Riverine Climate Overlay.

12. Establish appropriate limitations on new development and appropriate uses consistent with ongoing floodplain integrated planning process within the proposed Climate Overlay.

13. Consider existing flood protection infrastructure improvement needs and coordinate with local jurisdictions on integrated floodplain planning, capital infrastructure planning, and incorporation of additional adaptation and resilience actions.

Growth Management and Countywide Resilience Planning

14. Ensure a regionally consistent and coordinated growth strategy by planning for population growth and development outside of the Climate Overlay across Urban Growth Areas (UGAs), city limits, and unincorporated Whatcom County.

15. Update development regulations for consistency with HB 1181 requirements and the Whatcom County Climate Element. Evaluate applicability of new regulatory approaches to reduce the risk due to climate impacts within Climate Overlay by updating Whatcom County Code, including modifications to sections listed in the "Potential Code Modifications" section above.

16. Promote ongoing regionally consistent and collaborative resilience planning efforts across the County to balance future growth and climate adaptation.

Land Use and Policy Updates to Support Resilient Affordable Housing

17. Increase the diversity and affordability of housing outside of the Climate Overlay.

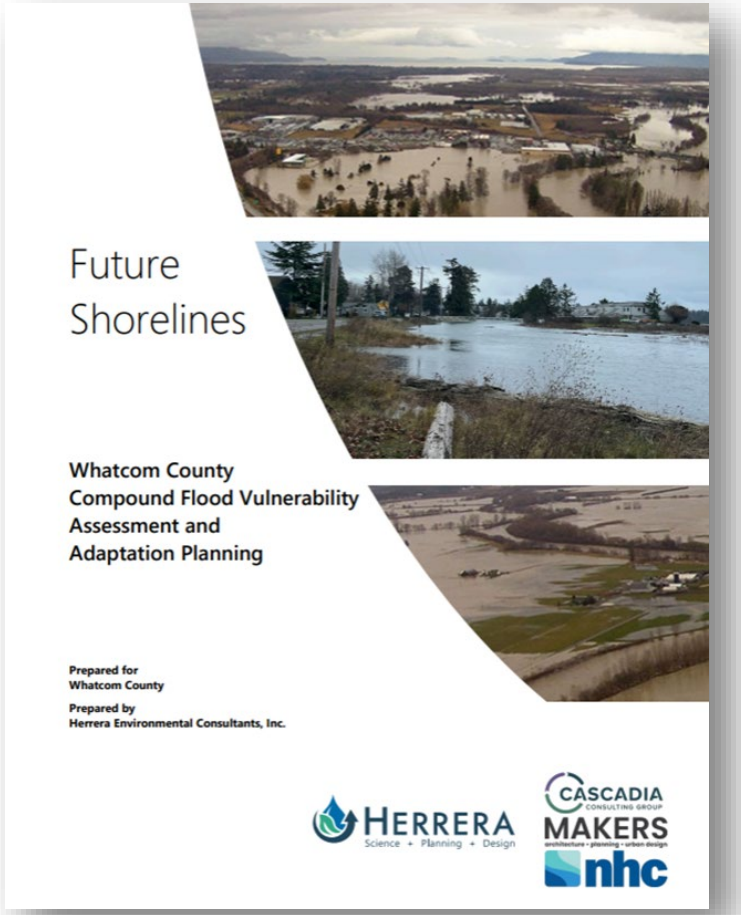
18. Update Whatcom County Code to restrict new low income housing and vulnerable housing types in the Climate Overlay and amend land use designations to allow affordable housing development in more areas outside of the Climate Overlay.

Project Deliverables & Tools

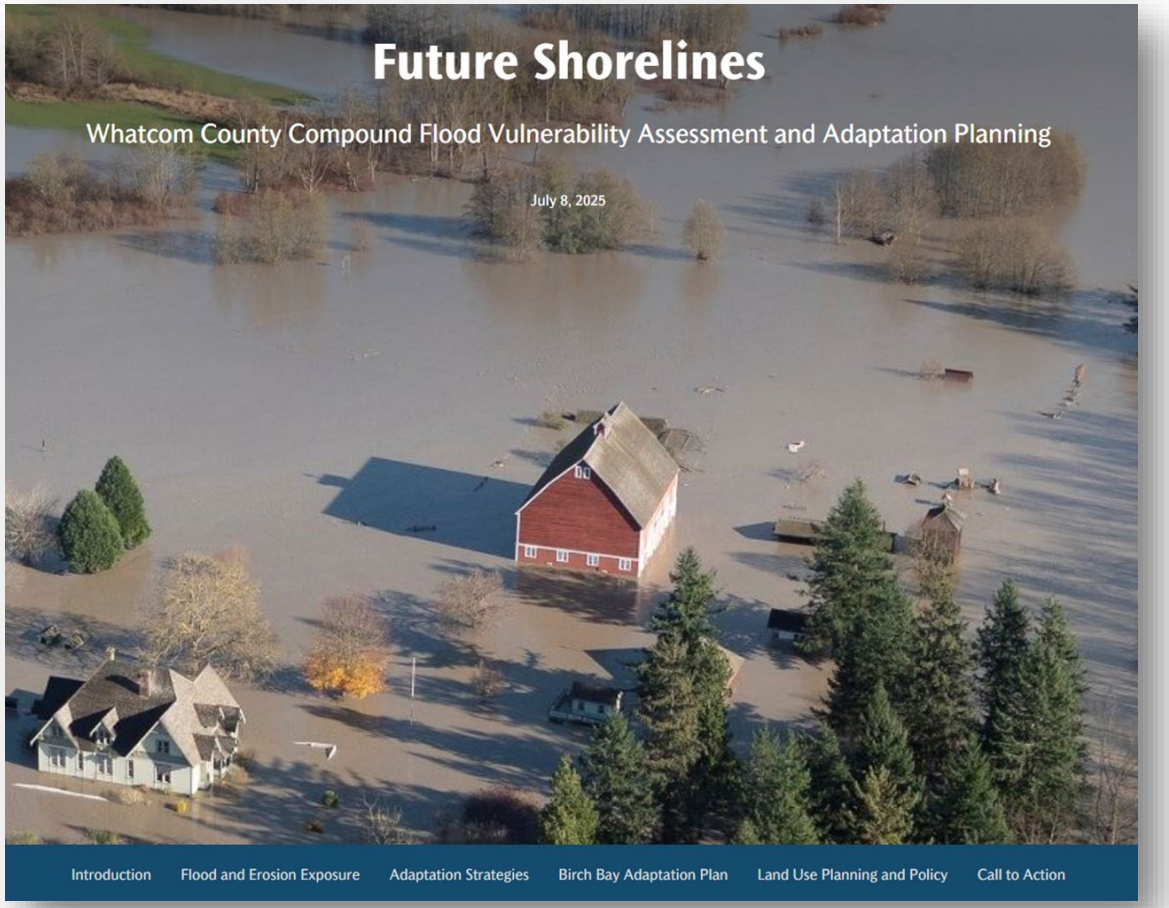
Photo credit: Larry McCarter

Final Deliverables

Report

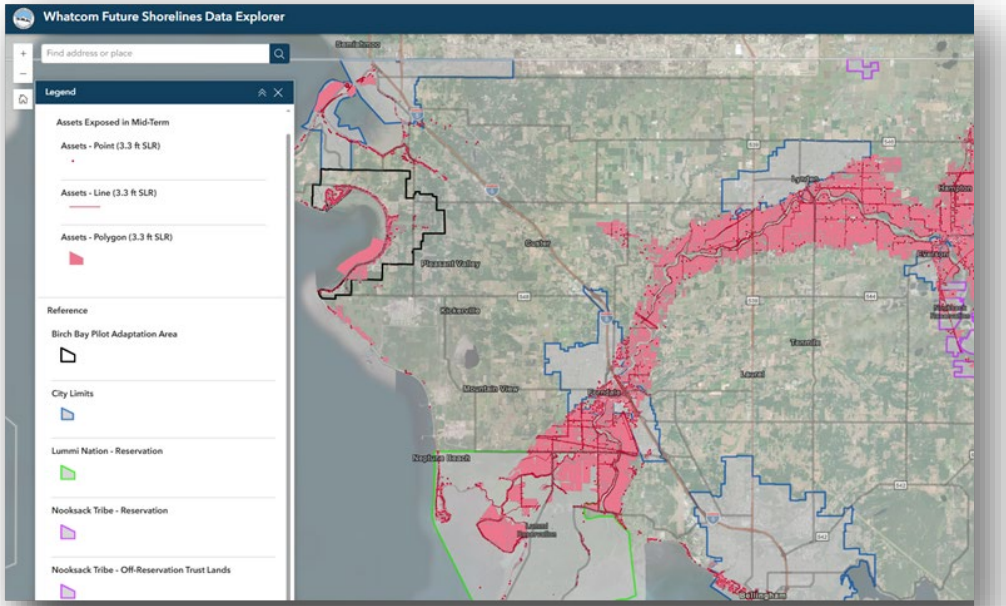


StoryMap



Tools to Support Continued Planning

Data Explorer



Adaptation Strategy Library

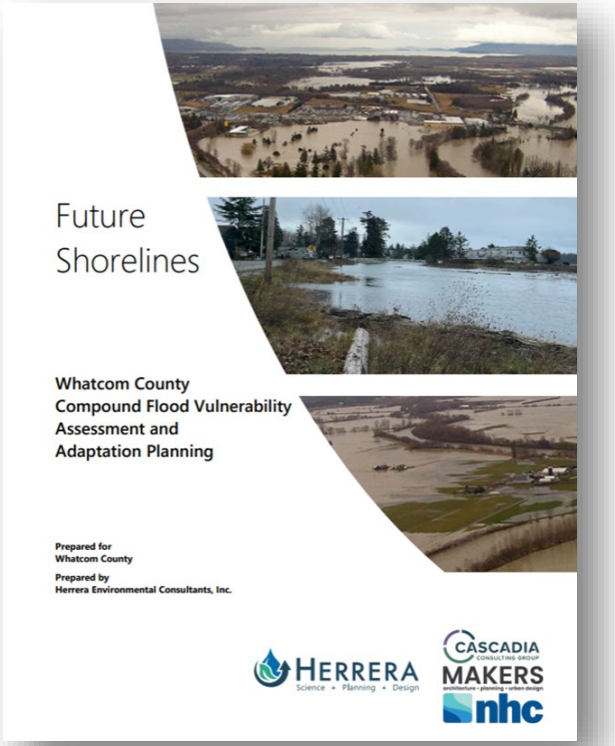
Library of Flooding and Erosion Adaptation Strategies

The full library and database of adaptation options.

ID	Adaptation Category	Adaptation Strategy	ID - Adaptation Option	Description
1	Accommodate	Elevate public assets	1 - Elevate public assets	Elevate public assets - such as public buildings, utilities, transit assets - using architectural features (e.g., stilts or pile foundations, elevated platform/founda
2	Accommodate	Floodproof utility assets	2 - Floodproof utility assets	Waterproof assets that provide services power, sewer, water systems to reduce damage or risk of failure from repeated
3	Accommodate	Elevate private assets	3 - Elevate private assets	Elevate private assets - such as homes using variety of tactics such as stilts, pile-on foundations, platform elevation above flood level, or rebuilding grades.
5	Avoid	Surface drainage management	5 - Surface drainage management	swales, gutters, diversion berms, and downspouts to reduce saturation and erosion.
6	Avoid	Subsurface groundwater management	6 - Subsurface groundwater management	groundwater levels near bluff edges, reducing the risk of landslides and slumping.
7	Protect	Beach nourishment	7 - Beach nourishment	Beach nourishment or replenishment is artificial placement of sand on an erod shore to maintain the amount of sand
8	Multiple	Coastal habitat restoration	8 - Coastal habitat restoration	Restore coastal habitats - such as eelg beds, kelp forests, wetlands - to improv
9	Protect	Large wood selective placement	9 - Large wood selective placement	Large woody debris - such as tree trunk and logs - can reduce shoreline erosion
10	Protect	Seawalls or rock revetments	10 - Seawalls or rock revetments	stone to protect land from waves, storm surges, and coastal flooding

Next Actions

- **Maintain dialog and coordination** among the Project Team
- **Communicate anticipated flood and erosion impacts** to community members and decision makers
- Utilize the vulnerability assessment results to **inform planning**
- Consider creation of a **Climate Overlay** for planning
- **Iteratively refine strategies** from this project as planning efforts from other projects overlap
- **Coordinate on implementation** between County, City, and Tribal Governments



Thank you

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