

Whatcom County Compound Flood Vulnerability Assessment



Sandy Point Fire Station, January 2023

July 11, 2023

Agenda

- Project overview
- Hazard mapping
- Assessing vulnerability
- Adaptation tools
- Next Steps



Project Overview

Project Goals

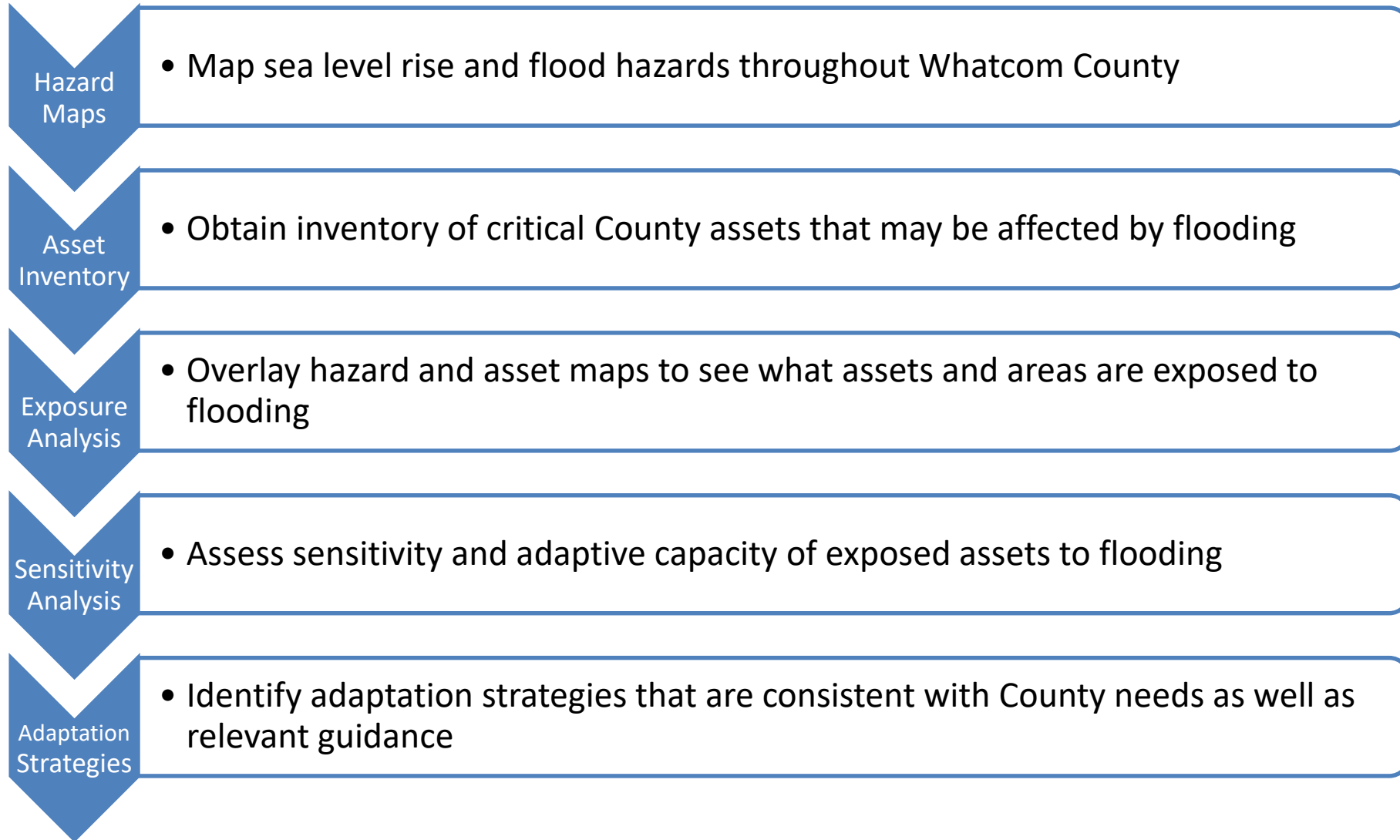
Determine Hazards and Assess Vulnerability

Communicate Hazards & Identify Community Priorities

Identify Solutions

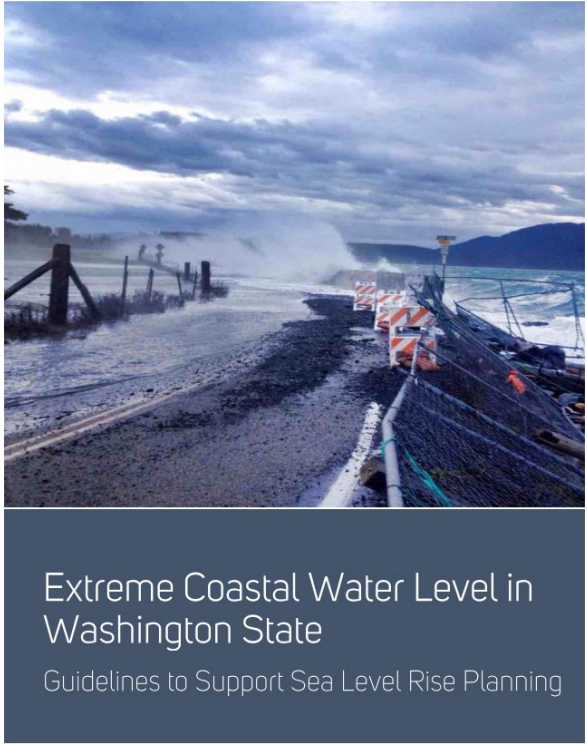
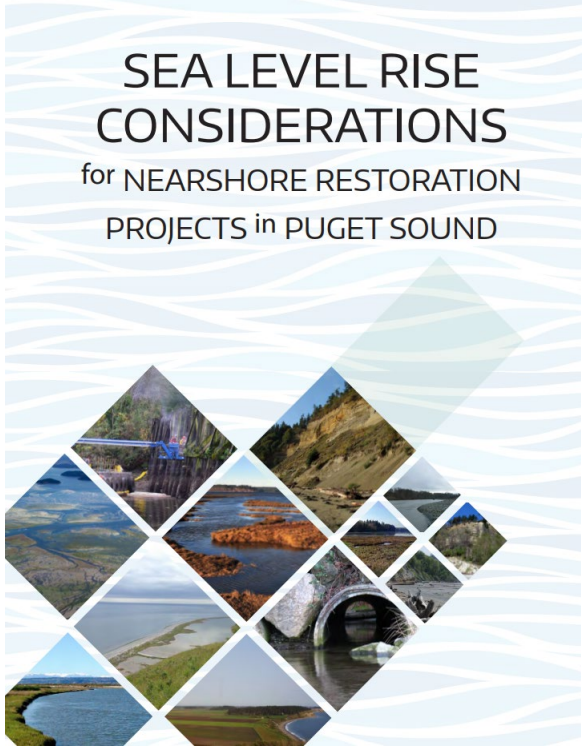
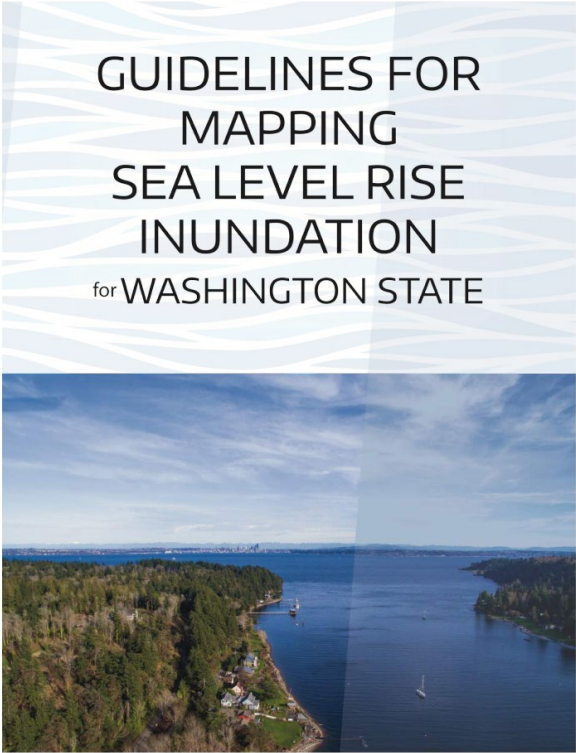
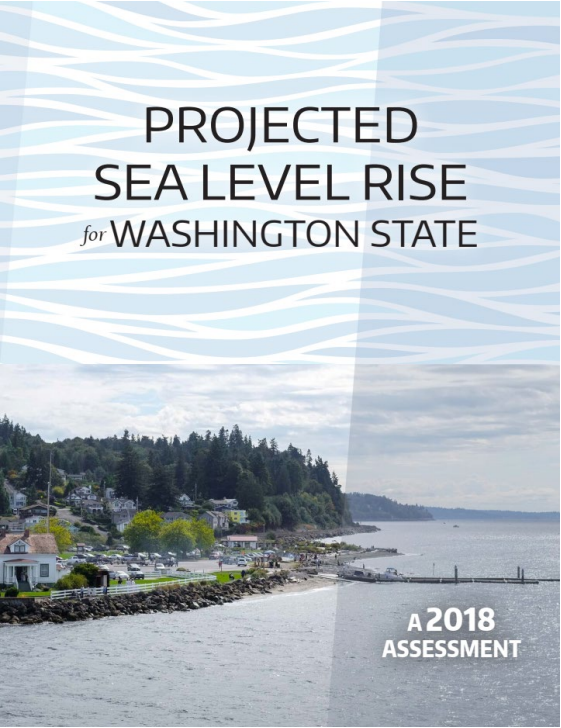


Project Process



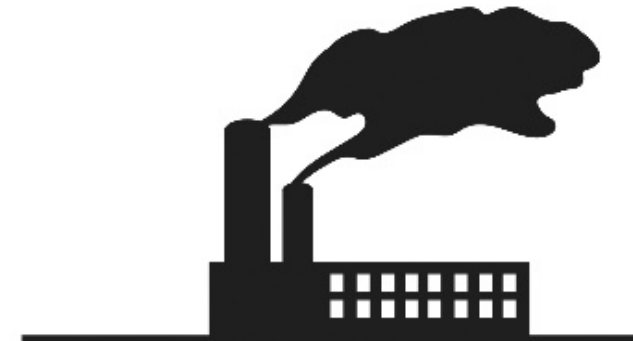
Hazard Mapping

Sea Level Rise Flooding: State Guidance



Sea Level Rise (SLR) Scenarios

- Greenhouse Gas Scenarios
 - RCP 8.5 = “Business as usual”
 - RCP 4.5 = Some emissions reductions
- Level of risk or likelihood
 - Percent of models that predict SLR will exceed the projection
 - E.g., 1% risk means only 1% of models show a higher amount of SLR than the projection
- Timeline
 - Near-term vs long-term



High Emissions Scenario



Low Emissions Scenario

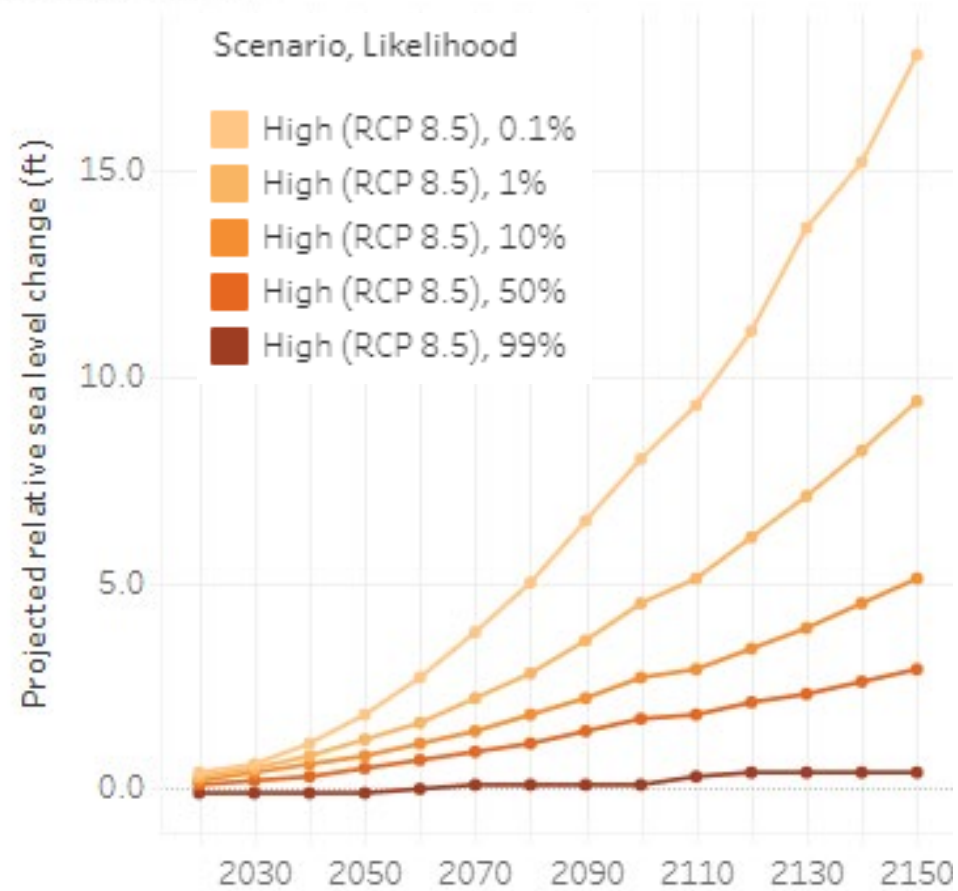
Washington Coastal Resilience Project SLR Projections



RSLR for Selected Location

Projected changes relative to the average sea level over 1991-2009.

Hover for details.



RSLR = relative sea-level rise

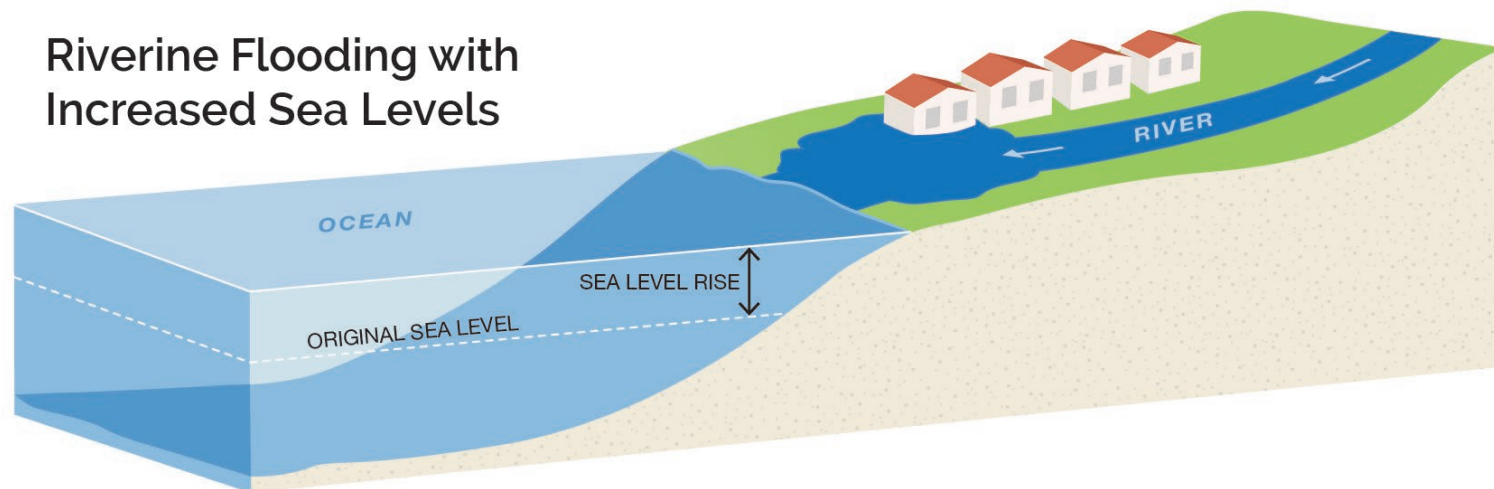
Whatcom County Study Scenarios

- Address scientific uncertainty with scenario planning
- Consider multiple scenarios that provide “bookends” or possible range
- For Whatcom County:
 - RCP 8.5 “Business as usual”
 - King Tides: 0.9 and 3.1 ft of SLR
 - 20-25 year event: 0.9 and 3.1 ft of SLR
 - 100-year coastal event: 0 and 6.6 ft of SLR (most extreme)

	UW CIG Projections		CoSMoS Scenarios	
Anticipated Timeline	Probability of Exceedance by this Date		Sea-Level Rise (ft)	Coastal Return Period
Now	N/A	N/A	0	100-year
Short-term	10% or less by 2030-2050	50% by 2060	0.8	King Tide
				20-year
Mid-term	10% or less by 2070-2120	50% by 2150	3.3	King Tide
				20-year
Long-term	1% or less by 2090-2120	5% by 2150	6.6	100-year

UW CIG Projections			CoSMoS Scenarios		Lower Nooksack River Model Scenarios			FEMA FIRM
Anticipated Timeline	Probability of Exceedance by this Date		Sea-Level Rise (ft)	Coastal Return Period	Sea-Level Rise (ft)	Riverine Return Period	Discharge Increase	Riverine Return Period
Now	N/A	N/A	0	100-year	N/A	N/A	N/A	100-year
Short-term	10% or less by 2030-2050	50% by 2060	0.8	King Tide	0.9	N/A	N/A	N/A
				20-year	0.9	25-year	32%	N/A
Mid-term	10% or less by 2070-2120	50% by 2150	3.3	King Tide	3.1	N/A	N/A	N/A
				20-year	3.1	25-year	72%	N/A
Long-term	1% or less by 2090-2120	5% by 2150	6.6	100-year	N/A	N/A	N/A	N/A
Source: UW CIG 2018, USGS 2023, FEMA 2019								

Hazards: Compound Flooding = Coastal + Riverine Flooding



Hazard Mapping Summary: Coastal

- Today's 100-year coastal storm (think FEMA maps) will occur...
 - every 20 years by 2040-2060 (0.8 ft SLR)
 - every year by 2080-2100 (3.3 ft SLR)



Hazard Mapping Summary: Coastal

- Today's 100-year coastal storm (think FEMA maps) will occur...
 - every 20 years by 2040-2060 (0.8 ft SLR)
 - every year by 2080-2100 (3.3 ft SLR)
- King tides + 3 ft of SLR > today's 100-year storm event

Hazard Maps - Sandy Point



Hazard Maps - Birch Bay



Legend

- 0ft SLR with King Tide
- 0.8ft SLR with King Tide
- 3.3ft SLR with King Tide

Hazard Mapping Summary: Riverine

- Today's 25-year riverine flooding (like the 2009 flood) will occur...
 - every 10 years by 2040-2060 (0.9 ft SLR)
- Today's 100-year riverine flooding will occur...
 - every 25 years by 2080-2100 (3.1 ft SLR)
- Nooksack 10-year discharge + 0.9 ft of SLR = today's 25-year discharge event
- Nooksack 25-year discharge + 3.1 ft of SLR = today's 100-year discharge event

Nooksack River

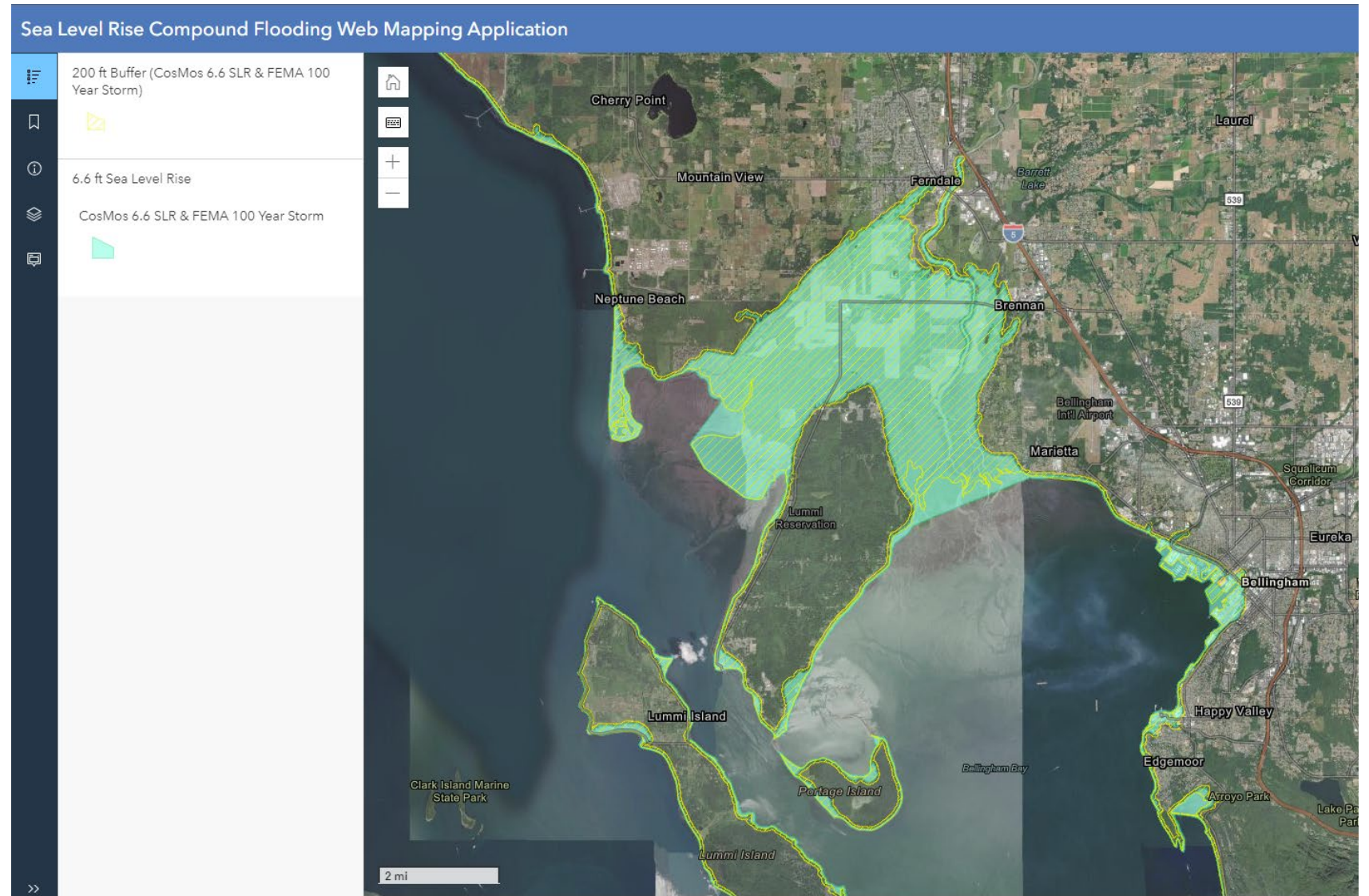


Legend

- 0.8ft SLR with 20-yr storm
- 3.3ft SLR with 20-yr storm

Web viewer

<https://www.arcgis.com/apps/instant/sidebar/index.html?appid=656f1dc771504a71acf0532053b72835>

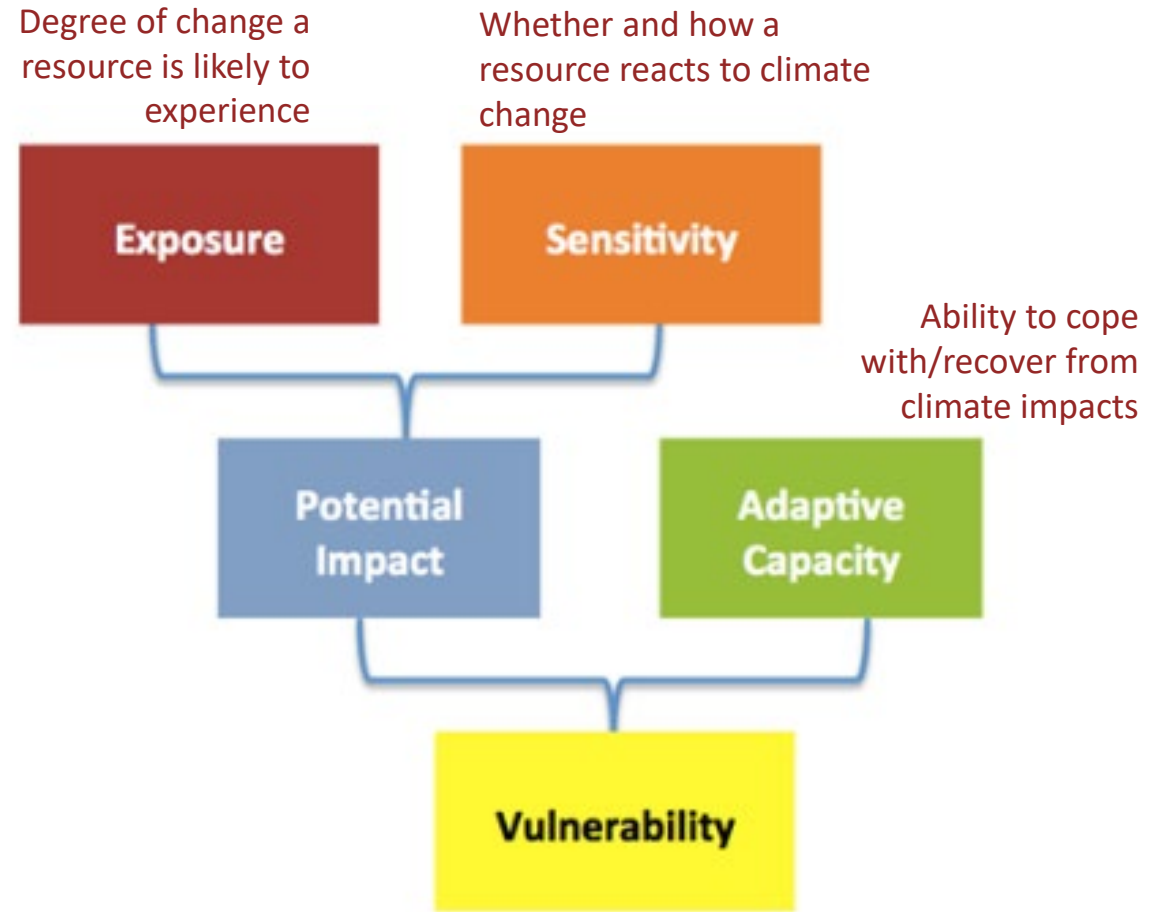


Assessing Vulnerability

Defining Vulnerability

IPCC 2007

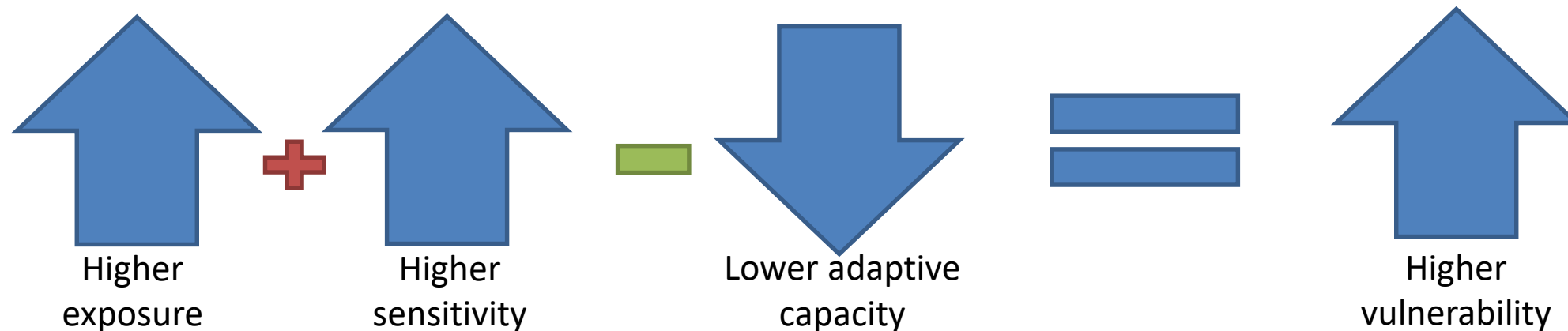
Vulnerability is the degree to which a resource is susceptible to and unable to cope with adverse impacts of climate change.



$$\text{Vulnerability} = (\text{Exposure} + \text{Sensitivity}) - \text{Adaptive Capacity}$$

Finer-scale Vulnerability Assessment

- Project advisory team selected Birch Bay and Sandy Point for more detailed analysis
 - Scoring of projected future exposure, sensitivity, and adaptive capacity
 - Combine to determine vulnerability



$$\text{Vulnerability} = (\text{Exposure} + \text{Sensitivity}) - \text{Adaptive Capacity}$$

Most Vulnerable Assets: Sandy Point

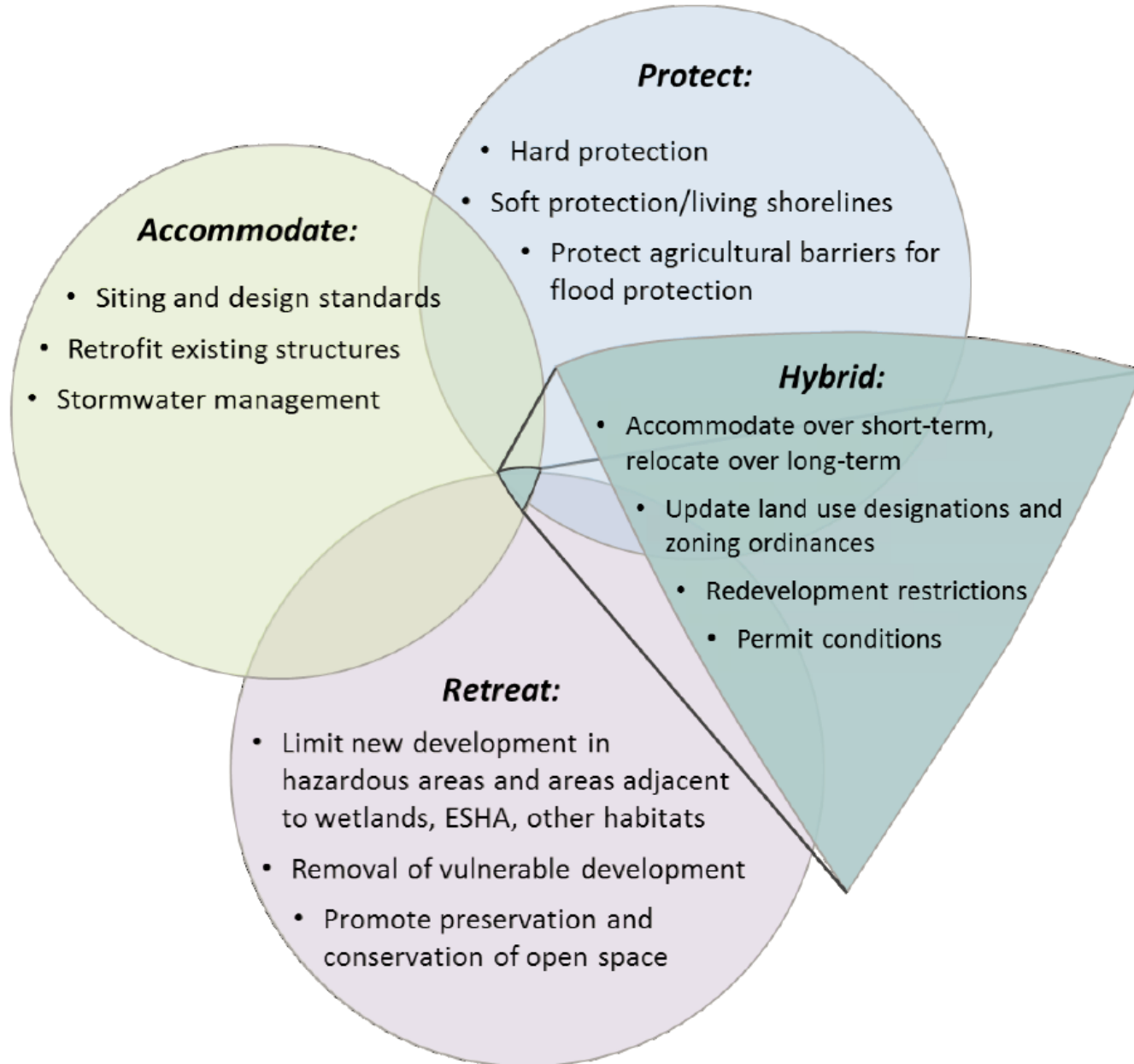
Asset Category	Asset	Potential Exposure to Hazard	Sensitivity to Hazard	Adaptive Capacity of Asset	Vulnerability
Structures	Fire Station	High	High	Medium	High
Roads	Sucia Dr Saltspring Dr	High	High	High	Medium-High
Natural Resources	Kelp and eelgrass beds Beaches Wetlands Freshwater pond (Agate Lake)	Medium	High	Low	Medium-High
Recreation	Parks Sandy Point Gardens	High	High	Medium	Medium-High

Most Vulnerable Assets: Birch Bay

Asset Category	Asset	Potential Exposure to Hazard	Sensitivity to Hazard	Adaptive Capacity of Asset	Vulnerability
Structures	Bay Center Market	Medium	High	Medium	Medium-High
Sewer Infrastructure	Lift Stations	Medium (7)	High	Low	Medium-High
Roads	Birch Bay Drive	High	High	High	Medium-High
Natural Resources	Kelp and eelgrass beds Beaches Wetlands Freshwater ponds	Medium	High	Low	Medium-High

Adaptation Tools

Types of Adaptation Strategies



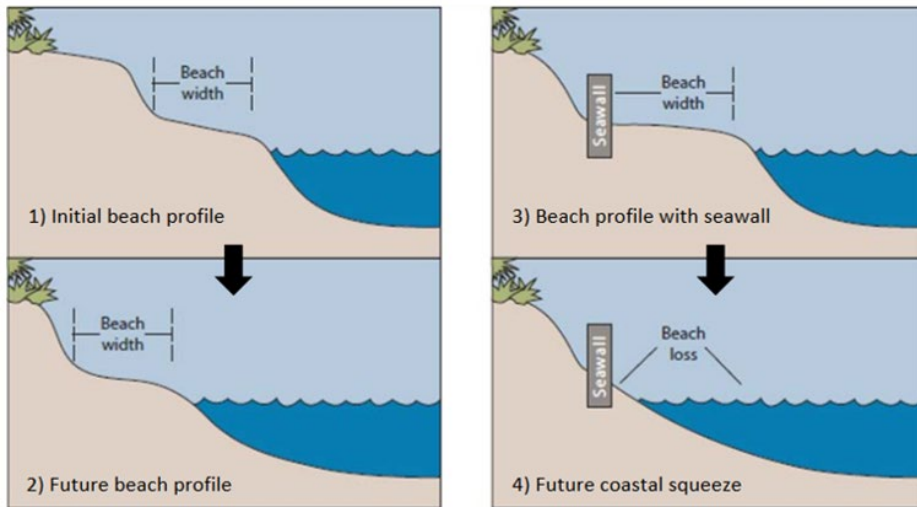
Existing Adaptation Strategies

- Whatcom County Climate Action Plan
- Lummi Nation Climate Change Mitigation and Adaptation Plan 2016-2026
- Nooksack Indian Tribe Climate Adaptation Plan for Key Species and Habitats
- Addressing SLR in SMPs
- Lessons Learned from Local Governments Incorporating SLR in SMPs
- Sustainable Remediation: Climate Change Resiliency and Green Remediation

Example Adaptation Strategies

Non-Structural Measures

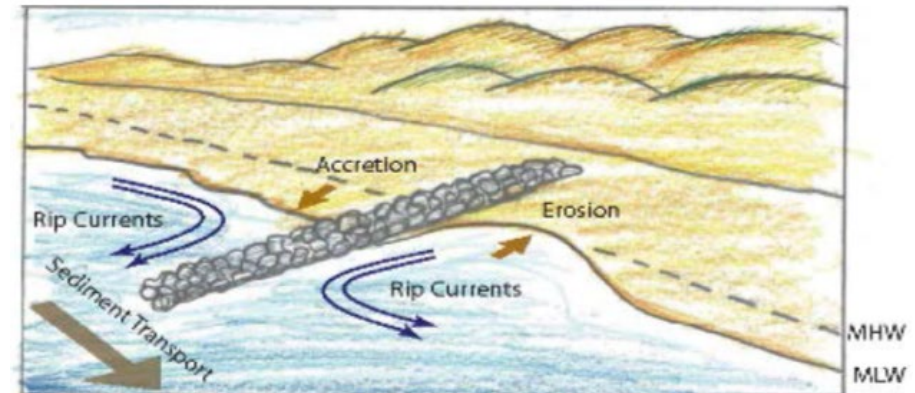
1. Beach Nourishment
2. Habitat Restoration
3. Coastal Bluff Erosion Best Management Practices (BMP)
4. Managed Retreat



SOURCE: California Coastal Commission, 2018

Structural Measures

1. Beach Retention Structures: Groins or Breakwaters
2. Shoreline Protection Devices
3. Elevating or Waterproofing Structures and Infrastructure
4. Elevating Property Grades



SOURCE: ESA

Tools, Funding Sources, & Financial Mechanisms

Existing Tools

- Comprehensive Plan
- Shoreline Master Program (SMP)
- Natural Hazards Mitigation Plan
- Capital Improvement Program
- Transportation Improvement Plan
- Administrative policies, procedures, and initiatives
- Comprehensive Flood Hazard Management Plan
- Other County code and development regulations

Implementation Programs/Policies

- Regional Coordination:
 - USACE
 - State of Washington
 - Tribal Governments
 - Coastal Hazards Resilience Network
- Education and Outreach Programs:
 - Property owner's guides
 - Technical information and guidance
 - Citizen's monitoring program
 - Formalization of sea-level rise education for high school students
- Community Plans
- Overlay Zones
- Flood Resiliency Standards
- Real Estate Disclosure

Next Steps

Next Steps

1. Expand the Vulnerability Assessment
2. Develop a full Adaptation Plan
3. Implement adaptation strategies through local planning documents

Whatcom County Compound Flood Vulnerability Assessment

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Photo from Teresa McKinnon, Jan 2022