



Local Response to Climate Change: Swinomish Case Study



**Swinomish Indian Tribal
Community**

Motivations for Swinomish study

- **CO₂ emissions, observations exceeding worst-case scenarios (IPCC, CIG)**
- **Local extreme weather events (Feb. 2006, Nov. 2006)**
- **Connection to community/location (Reservation) requires response**
- **Regional recognition of issues (WA DOE report, Nov. 2006)**

Potential sea level rise, Puget Sound

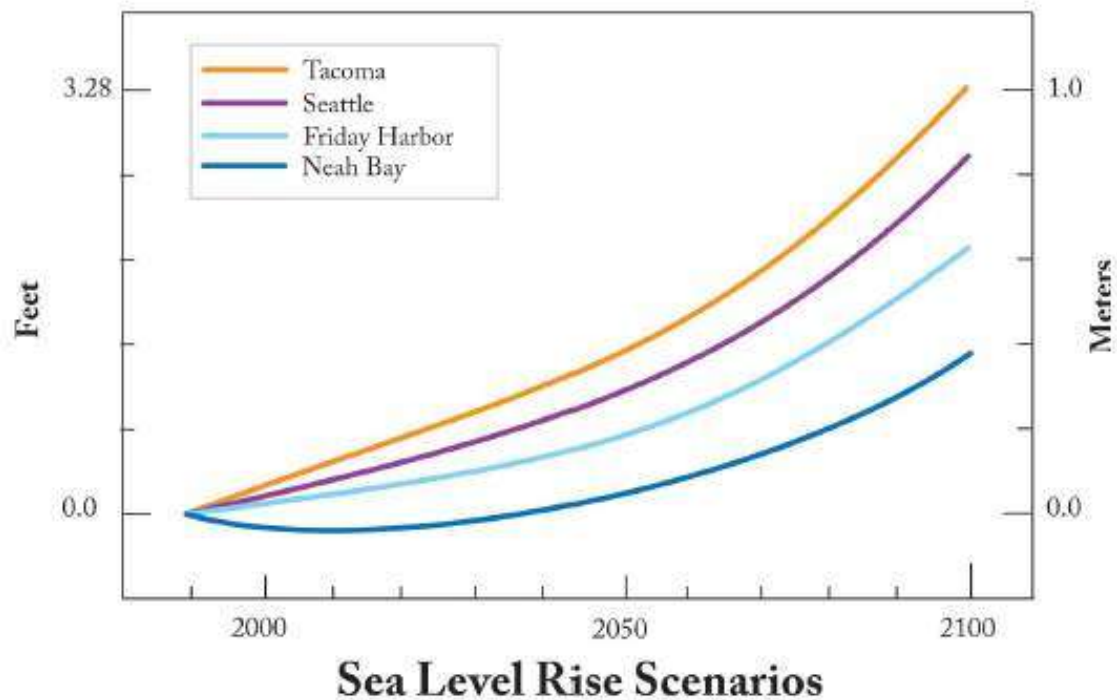
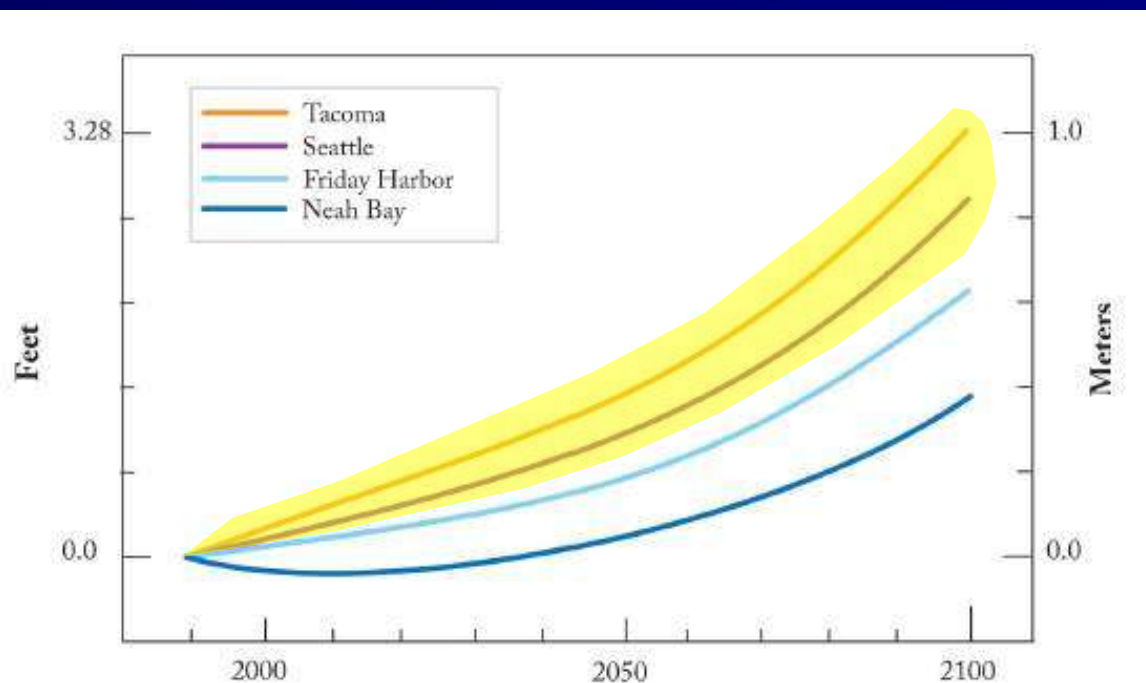


Figure 2-10. Sea Level Rise Anticipated In Several Washington Locations Between the Years 1990 and 2100

Source: Climate Impacts Group.

(DOE report, Nov. 2006)

Potential sea level rise, Puget Sound



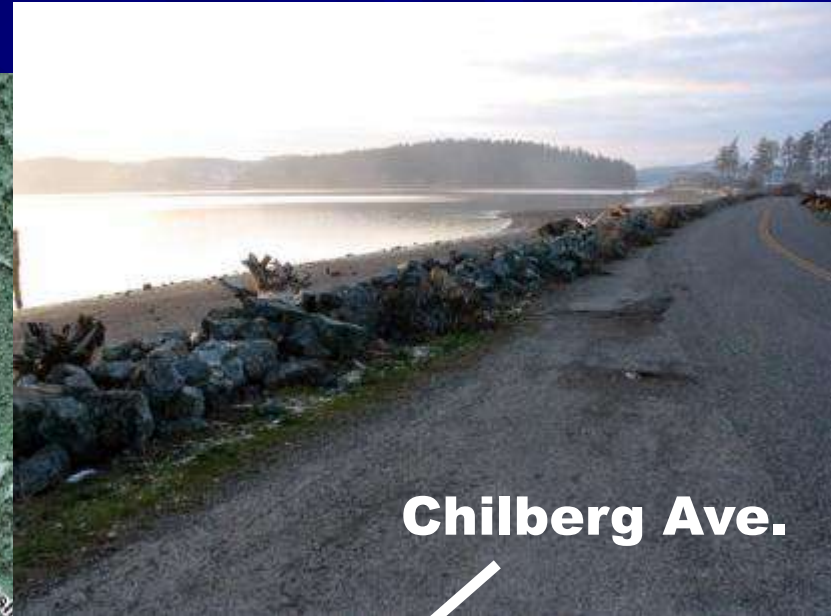
Sea Level Rise Scenarios

Figure 2-10. Sea Level Rise Anticipated In Several Washington Locations Between the Years 1990 and 2100

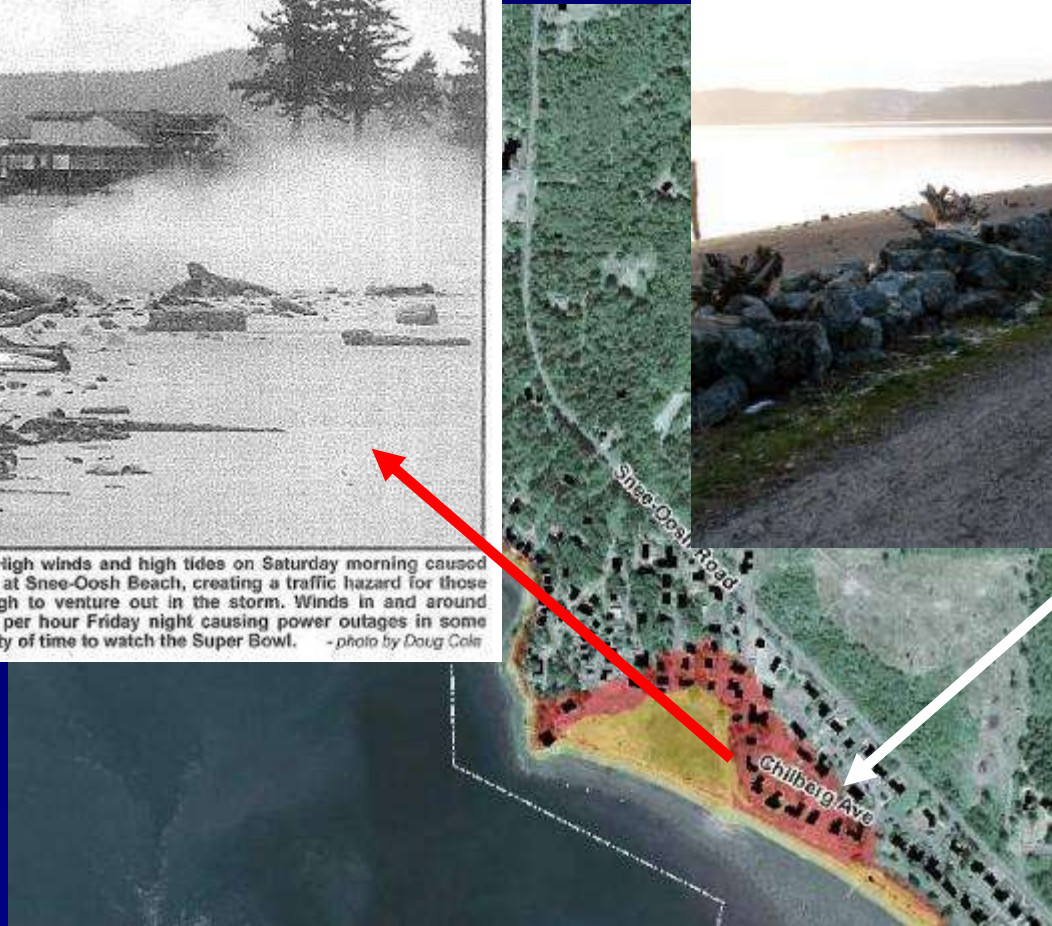
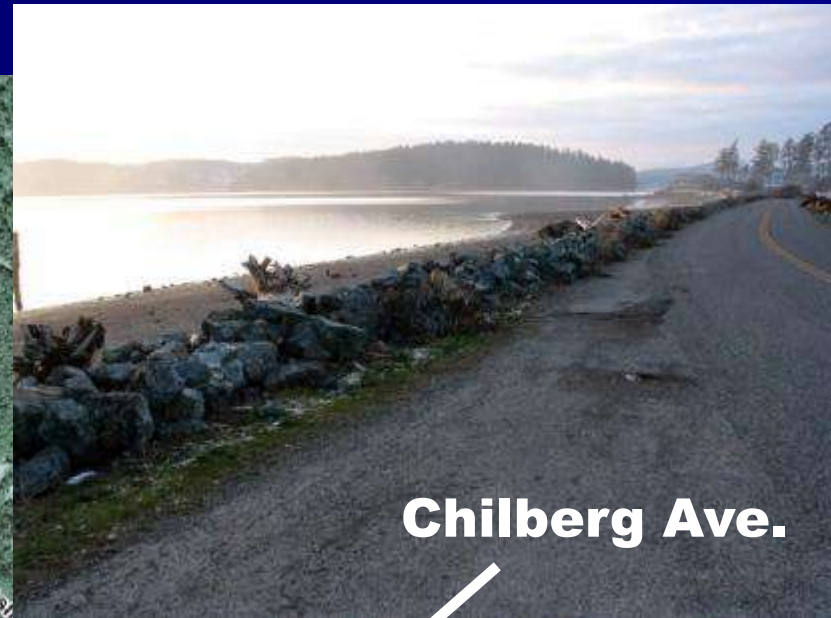
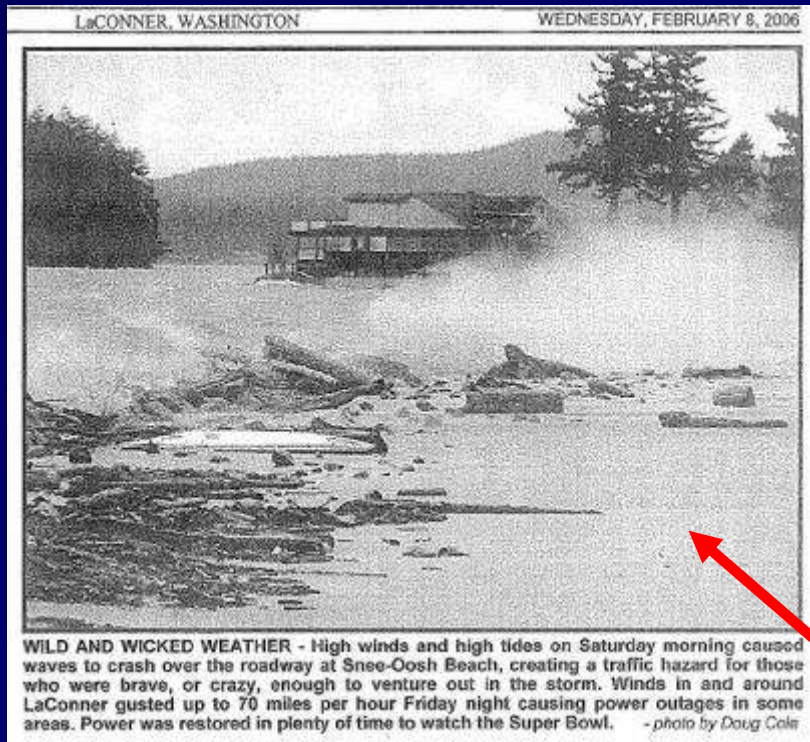
Source: Climate Impacts Group.

(DOE report, Nov. 2006)

Storm surge, February 2006



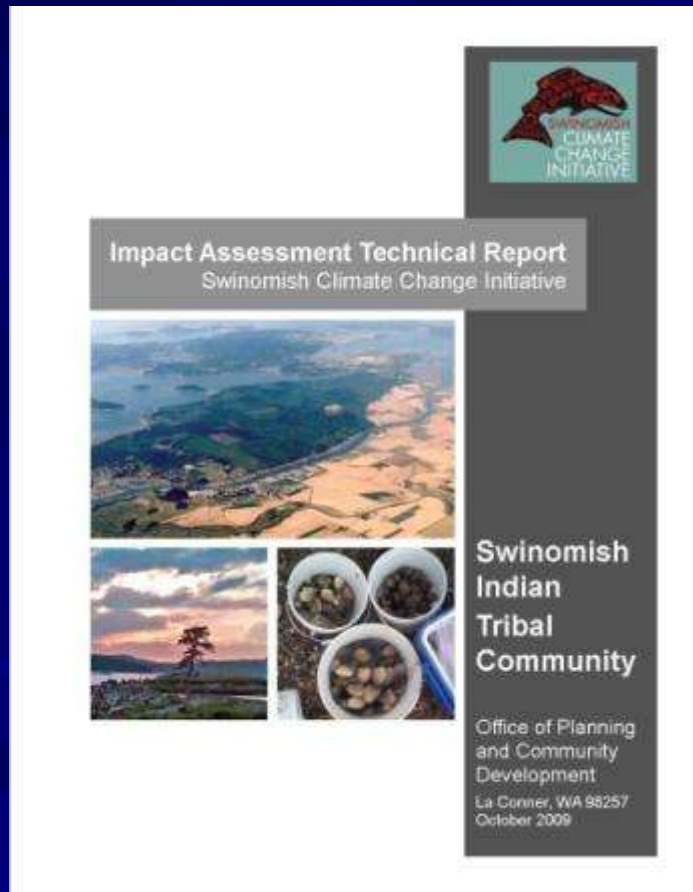
Storm surge, February 2006



Swinomish Climate Change Initiative

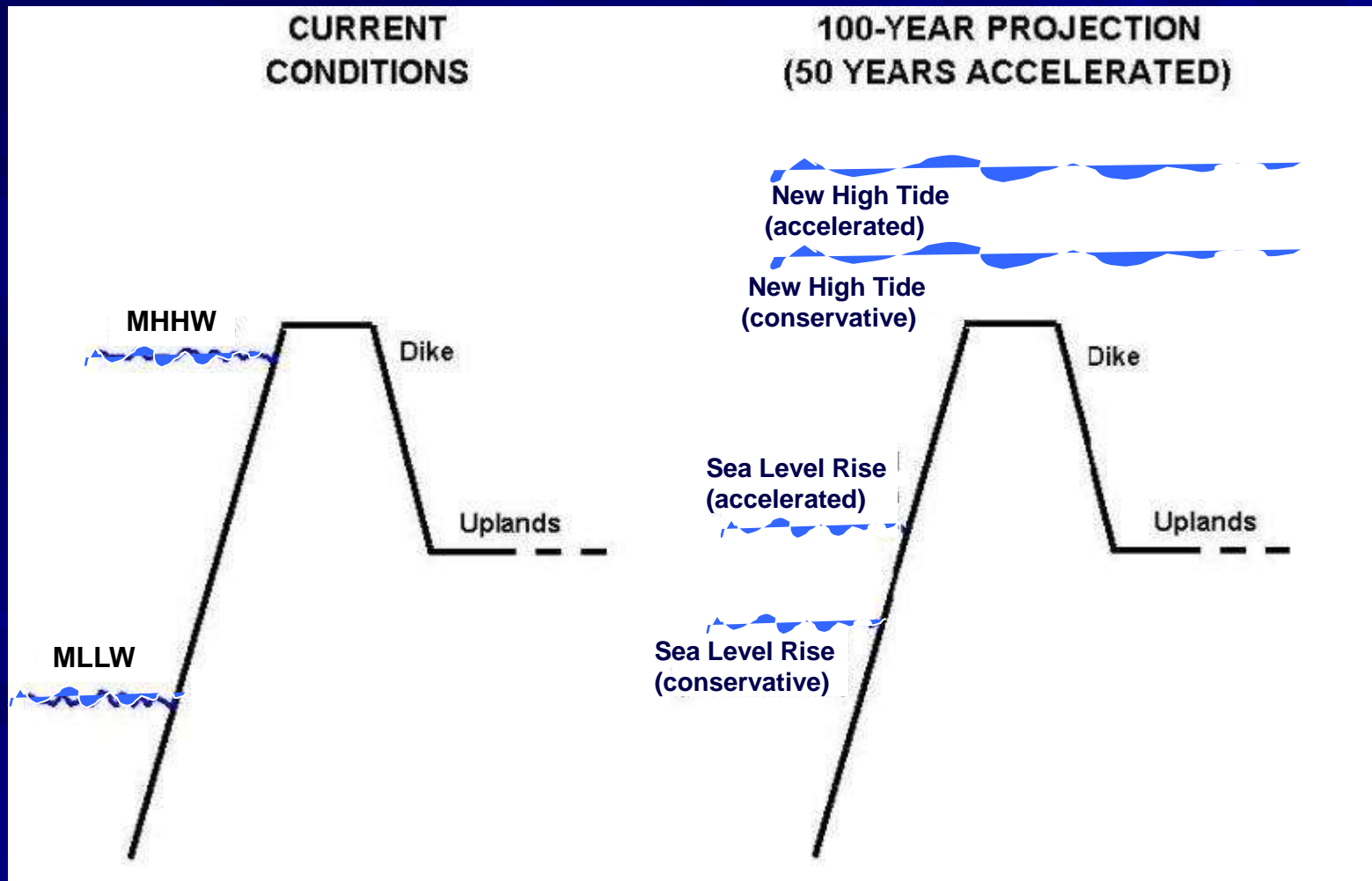
- **Focus is local impacts, adaptation**
- **Two-year, \$400,000 project**
- **80% federal funding, 20% Tribal**
- **First year: Impact assessment, publish technical report (Oct. 2009)**
- **Second year: Develop strategy options, publish Action Plan (Sept. 2010)**

Impact Assessment Technical Report

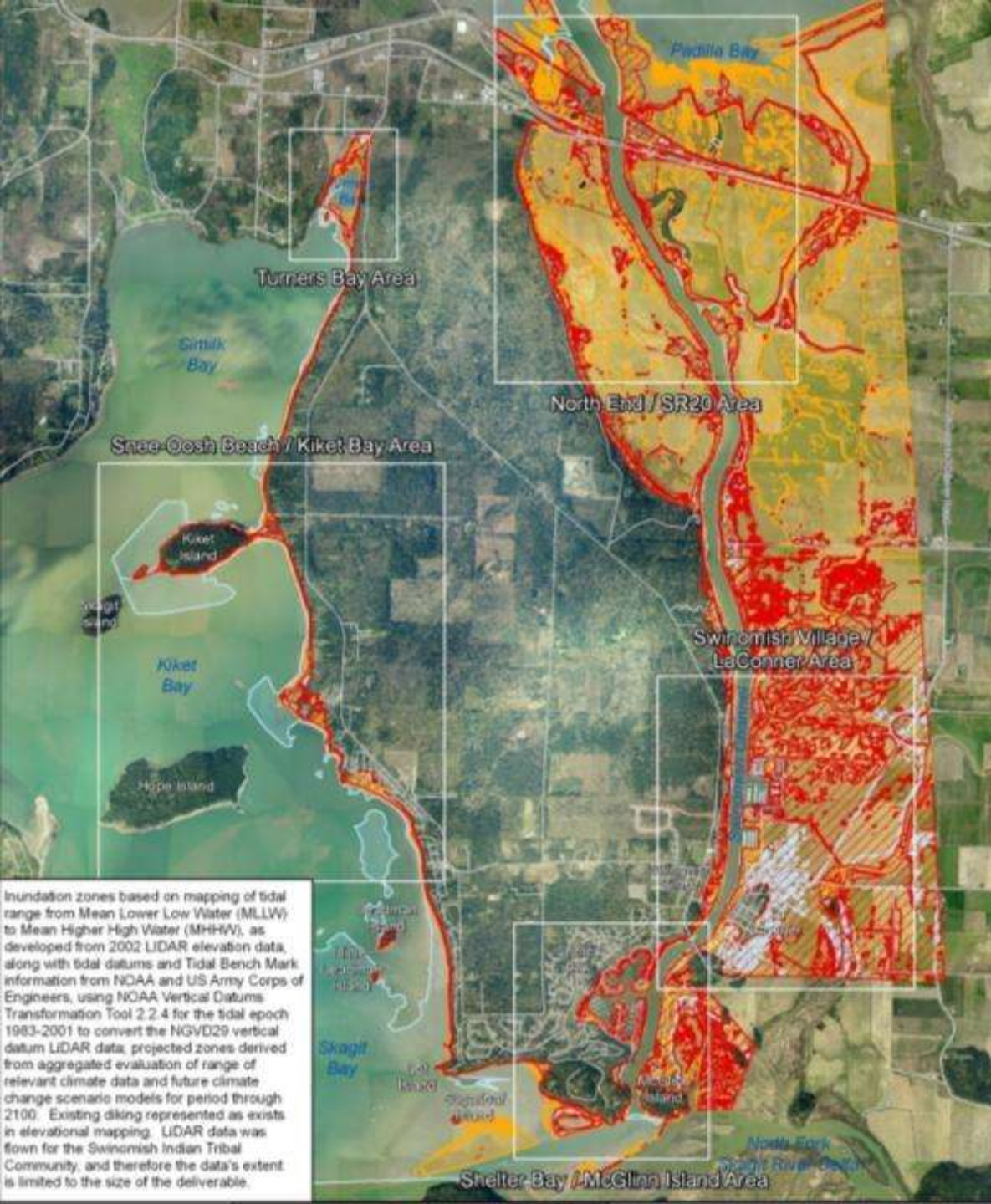


- Review of climate data
- Broad impact analysis
- Many disciplines/sectors
- Risk zone mapping
- Inventory of at-risk assets
- Vulnerability assessment
- Risk analysis
- Basis for Action Plan

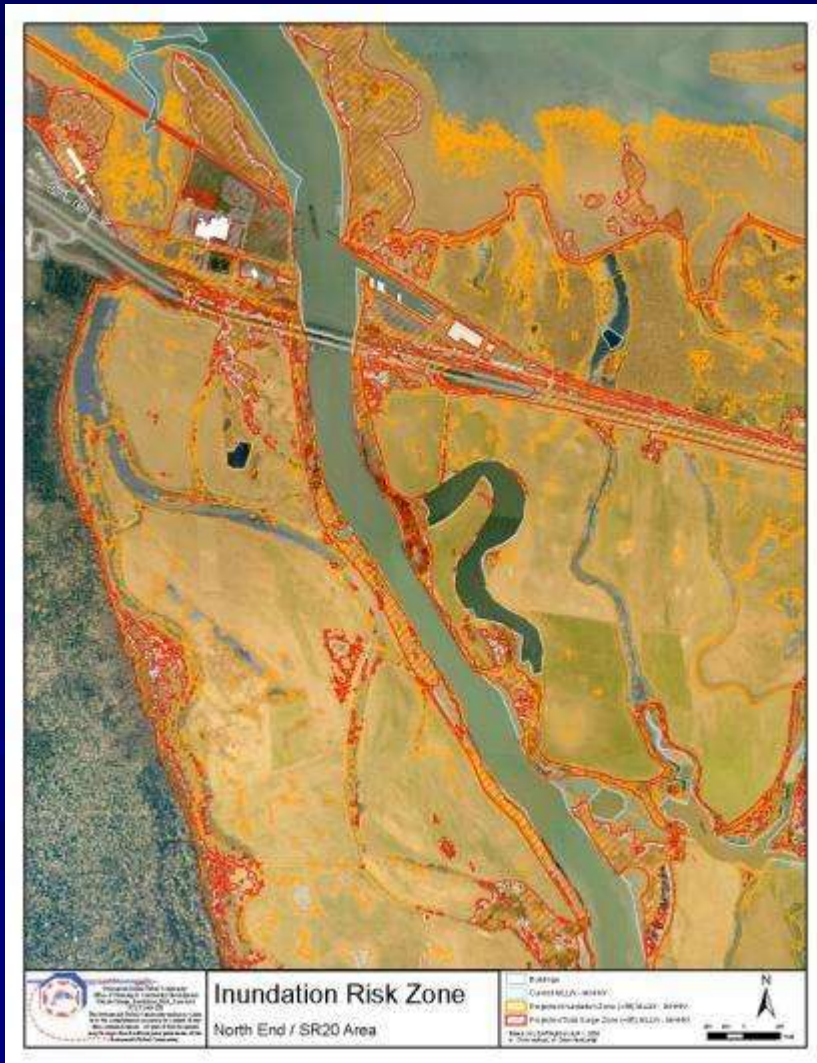
Sea level rise scenarios, low-lying areas



Inundation Risk Zones – Sea Level Rise & Tidal Surge



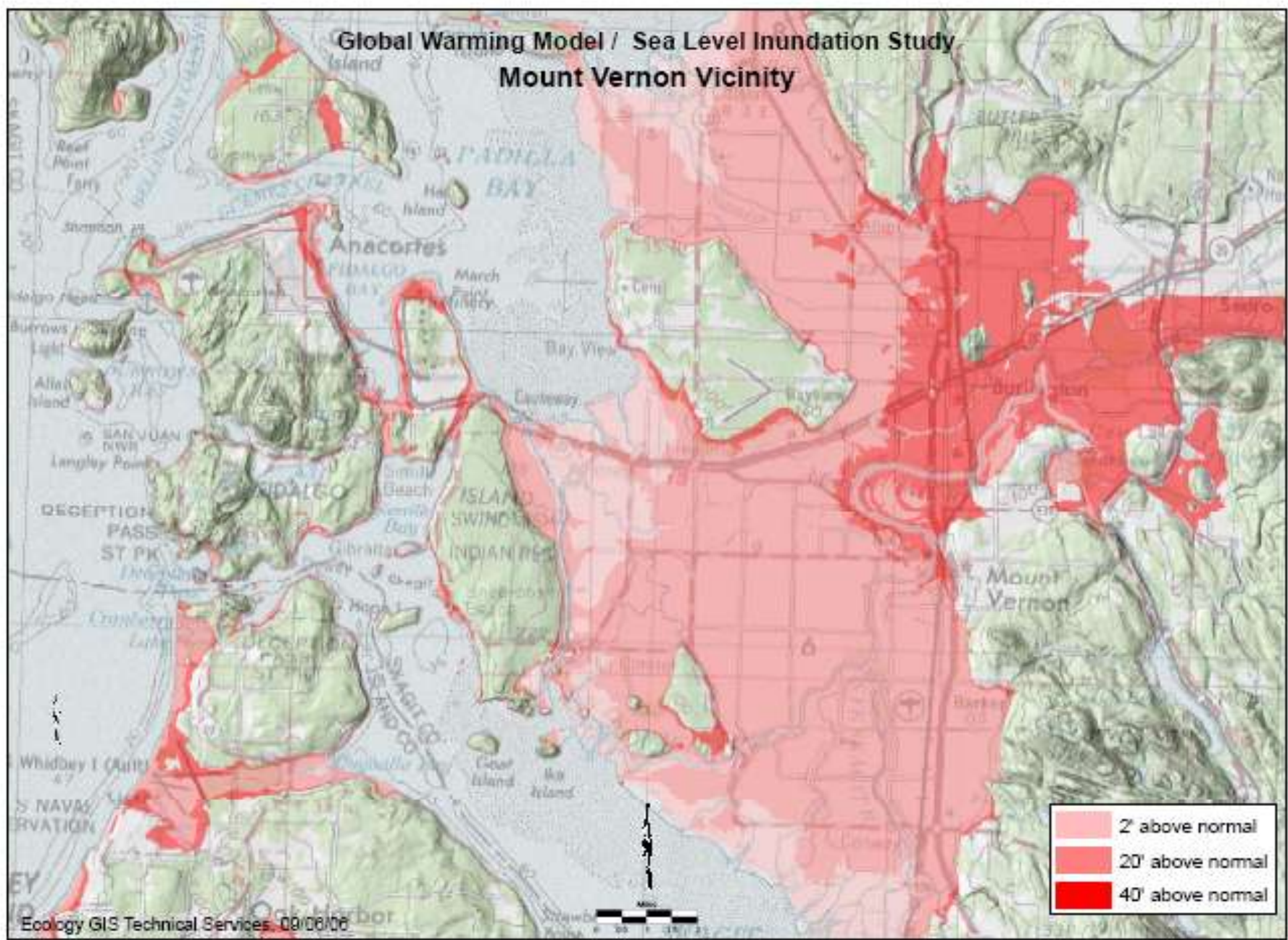
Inundation Risk Zones – detail



Potential sea level rise impacts – built environment (Swinomish)

- **~1,100 low-lying acres at risk**
- **180 structures, over \$100 million value**
- **Access/transportation links at risk**
- **Economic development land at risk**
- **Impaired marine/port facilities**
- **Erosion, flood damage from storm surges**

Global Warming Model / Sea Level Inundation Study Mount Vernon Vicinity



Access routes to Fidalgo Island and Swinomish Reservation



Significant Regional Issues

- **Short-term risk: storm surge to homes and infrastructure**
- **Long-term risk: access to/from mainland (sea level rise)**
- **Impacted communities – Swinomish, LaConner, Anacortes, Oak Harbor, Coupeville, etc.**
- **Impacted facilities – ferry terminals, services, refineries, Whidbey NAS**
- **Collective population of \sim 45,000 potentially affected**

Other projected impacts – natural environment, human health

- **Reduced freshwater flow/availability**
- **Increased coastal salt water intrusion**
- **Forest Conversion and wildfire risk**
- **Stressed/relocated fish & wildlife species**
- **Increase in pests, disease vectors**
- **Public/human health (heat, diseases)**

Threats to Shoreline and Near Shore Habitat

- **Loss of shoreline/shellfish habitat**
- **Stressed fish / shellfish populations**
- **Permanent species relocation/migration**
- **Threats from invasive species**
- **Loss of forage fish spawning beaches**
- **Loss of eel grass beds**
- **Hardened shorelines with resulting impacts.**

Counter-Productive Response

- To protect at risk homes, roads and pipelines – first response may be to build bulkheads to hold back the sea.
- This will block any upward migration of shoreline habitats.
- Eventually squeezing out shorelines/beaches as permanent inundation meets vertical walls.

Evolution of a Marsh as Sea Level Rises

5,000 Years Ago



Today



Future

Substantial Wetland Loss Where House is Moved or Upland is Vacant



Complete Wetland Loss Where House is Protected with Bulkhead in Response to Rise in Sea Level



LEGEND



Sedimentation and Peat Formation



Marsh

Coastal marshes have kept pace with the slow rate of sea level rise that has characterized the last several thousand years. Thus, the area of marsh has expanded over time as new lands have been inundated. If in the future, sea level rises faster than the ability of the marsh to keep pace, the marsh area will contract. Construction of bulkheads to protect economic development may prevent new marsh from forming and result in a total loss of marsh in some areas.

Source: Titus, J.G. 1991. Greenhouse Effect and Coastal Wetland Policy, *Environmental Management*, 15(1):39-58.

Allow for Habitat Migration

- To retain tideland and shoreline habitats relocate homes and infrastructure away from shoreline and not harden banks.
- Id critical areas to retreat and allow / encourage shoreline habitat migration and adaptation.
- Plan long-term in actions taken now.

Sources

- **Impacts of Climate Change on Washington's Economy: A Preliminary Assessment of Risks and Opportunities**
Publication No. 07-01-010, November, 2006. Washington Department of Ecology and Department of Community, Trade, and Economic Development.
- **Climate Change 2007: The Physical Science Basis, Summary for Policymakers**, February 2007. Produced and approved by the Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland.
- **Swinomish Climate Change Initiative: Impact Assessment Technical Report**. October 2009. Swinomish Indian Tribal Community.
- **Swinomish Climate Change Initiative: Adaptation Plan**. September 2010. Swinomish Indian Tribal Community.