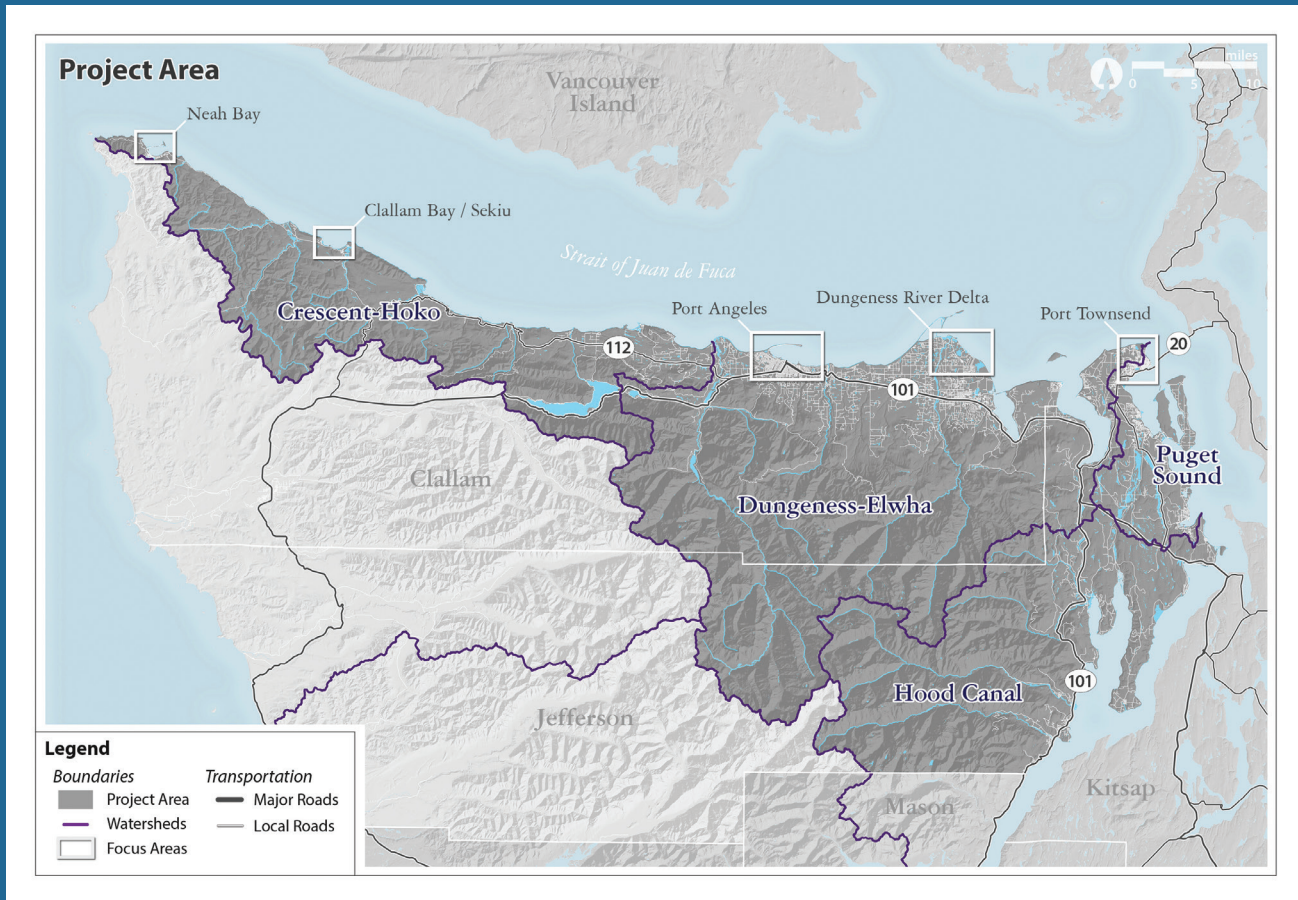


Taking Action on Climate Change on the North Olympic Peninsula

A summary of the 'Preparing for Climate Change on the North Olympic Peninsula' Project.
For the full report and materials: www.adaptationinternational.com



The North Olympic Peninsula of Washington State



For this project, the North Olympic Peninsula is defined as the region whose terrestrial waters flow into the Strait of Juan de Fuca and Puget Sound.

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Climate Change on the North Olympic Peninsula

Evidence for climate change abounds, from the top of the atmosphere to the depths of the oceans...Taken together, this evidence tells an unambiguous story: the planet is warming, and over the last half century, this warming has been driven primarily by human activity.*

It is increasingly apparent that the global climate system is rapidly changing. These changes will affect the people, ecosystems, economy, and culture of the North Olympic Peninsula.

The Pacific Northwest is already experiencing drier summers, reductions in snowpack and glacial mass, higher spring and lower summer river flows, and a more acidic ocean. These are not isolated incidents. They are part of a larger regional and global trend of changing climate conditions that is driven primarily by human emission of greenhouse gases like carbon dioxide (CO₂), mainly from the combustion of coal, oil, and natural gas. **There is an urgent need to reduce emission of greenhouse gases at all scales of human society.**

Climate change exerts its influence on our lives both directly (from extreme weather events) and indirectly (through ecosystem shifts and associated impacts to the natural and built environment). This project used a regional planning perspective to better understand and reduce the climate change vulnerabilities of the region's Ecosystems, Water Supplies, and Critical Infrastructure.

*National Climate Assessment, 2014

The most noticeable climate change impacts to the North Olympic Peninsula will likely include:

A diminishing snowpack
lowering the region's summer river flows and extending the summer drought season.

Shifts in the timing and type of precipitation creating rain on snow events and unseasonably high stream flows that scour river bottoms and flood low-land areas.

Extended warm temperatures increasing river water temperatures, decreasing soil moisture, enhancing wildfire risk, and stressing forests through disease and insect outbreaks.

Increasingly corrosive ocean waters
(i.e. ocean acidification) from the ongoing absorption of human emissions of CO₂.

Ongoing sea level rise
enhancing or expanding coastal flooding, saltwater inundation, and shoreline erosion.





A Collaborative Process

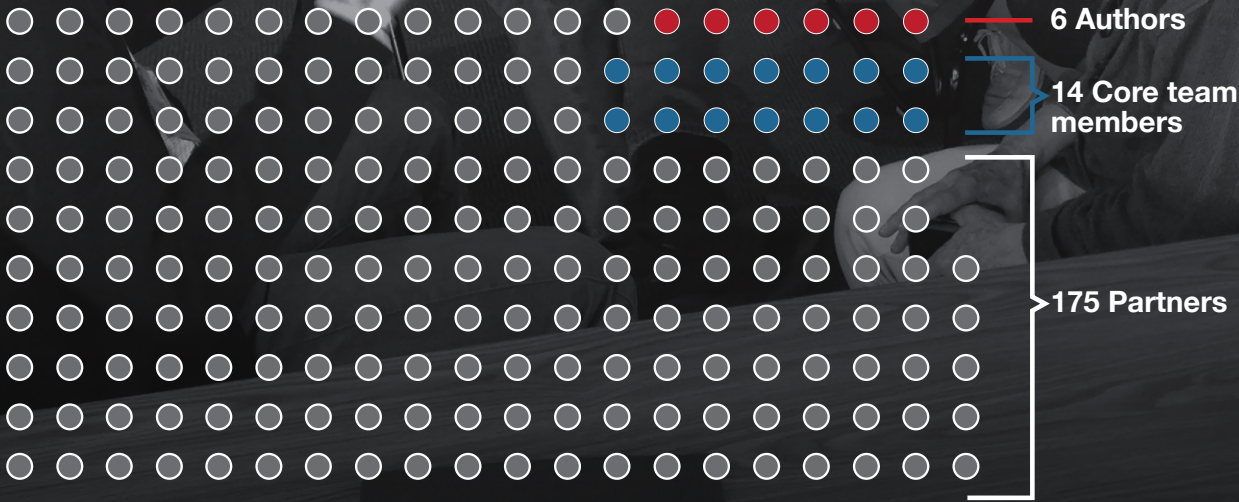
With this project, the region has a unique opportunity for collaboration on climate change adaptation between federal, state, local, and tribal governments, non-profit organizations, academic institutions, and private businesses.

Successfully planning for and adapting to the impacts of climate change requires collaboration among a broad range of stakeholders. This project synthesized the best available climate change projections with local stakeholder expertise of vulnerable sectors to develop climate change adaptation strategies. The outputs of this effort are compiled in the final Preparedness Plan and include a Vulnerability Assessment (Section I & II of the full report) and Adaptation Plan (Section II of the full report).

Over the course of a year, this project brought together more than 175 partners through virtual meetings and a series of in-person workshops to: build a climate change stakeholder network, share the best available climate change science, identify and assess potential areas of concern, and select and evaluate adaptation strategies to be used across Jefferson and Clallam Counties. These partners represented cities, counties, tribes, public utility districts, ports, non-profit organizations, advocacy groups, private companies, natural resource managers, and concerned citizens of the region. In-person workshops and meetings took place across the North Olympic Peninsula, from Port Townsend to Neah Bay.



This project is the collaborative effort of:





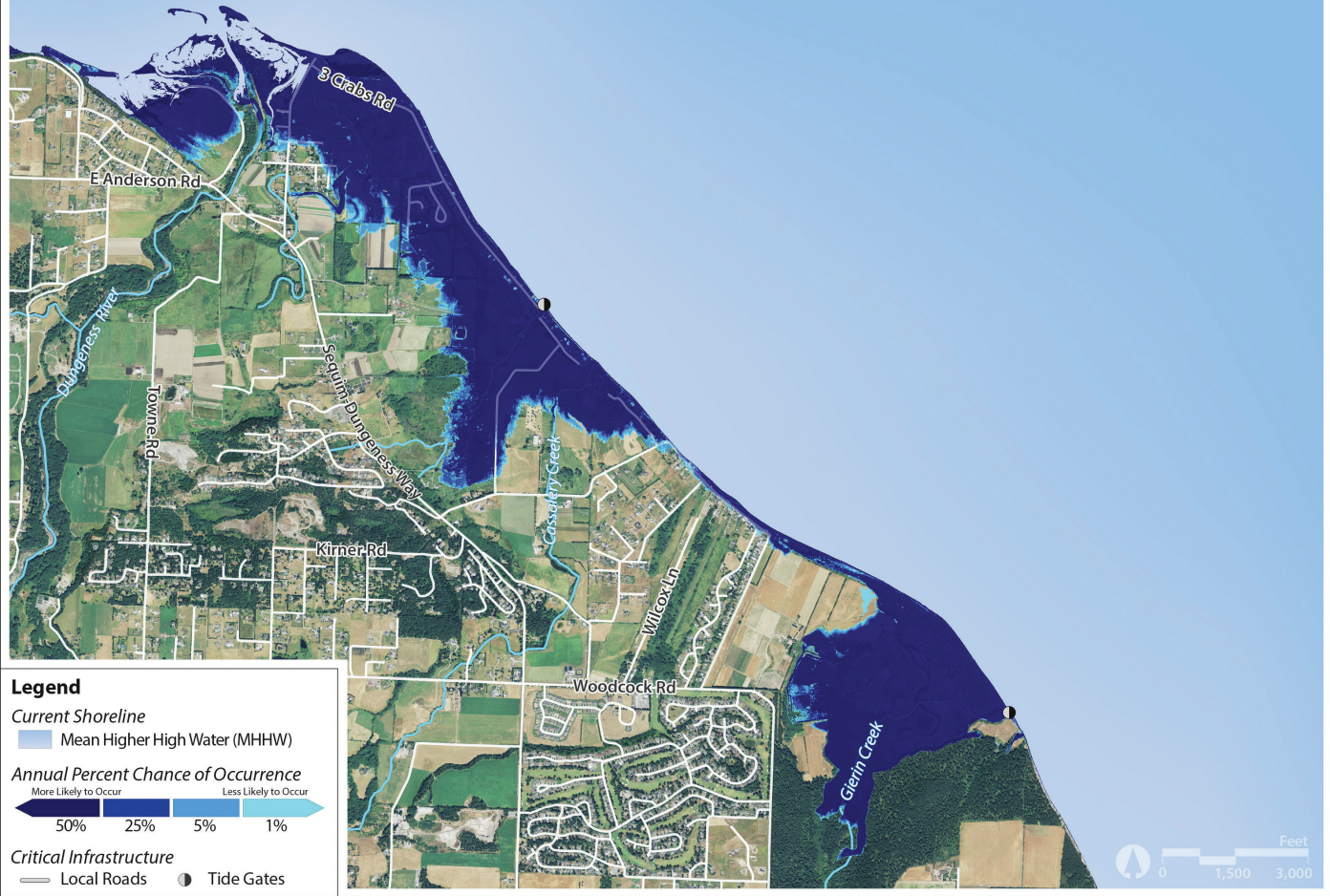
Developing Probabilistic Local Sea Level Rise Projections

Mean sea level is rising globally due primarily to two mechanisms: ocean warming, and the melting of land-grounded ice. Global sea level rise projections are important, but they don't fully explain observed and projected changes to ocean levels along the North Olympic Peninsula. This project developed an innovative approach to local sea level rise modeling for communities on the Strait of Juan de Fuca.

This approach combines probabilistic sea level rise projects for the region with high-resolution estimates of vertical land movement and observed patterns of coastal flooding. Instead of predicting a specific water level at a given date, this work displays a range of probabilities for both sea level rise and storm surge elevations, allowing users to choose which level they want to plan for given their risk tolerance. The maps show the probability that mean sea levels or annual peak water levels will be a certain elevation above the contemporary shoreline (mean higher high water) in future decades (2030, 2050, or 2100).

Annual Extreme Storm Flooded Areas in 2050 with Sea Level Rise, DUNGENESS RIVER DELTA

Combined Probabilistic Sea Level Rise Projections and Annual Extreme Coastal Flooding Probabilities



Overview of Prioritized Vulnerabilities

This project used a regional planning perspective to better understand and prepare for climate change impacts on the region's Ecosystems, Water Supplies, and Critical Infrastructure.



Ecosystems

Nearshore Environment & Watersheds are most vulnerable to sea level rise and storm surge, changes to the amount and timing of freshwater inputs, shifting erosion patterns, changing sediment delivery and transportation patterns, and increasing opportunities for invasive plants and animals.

Agriculture & Forestry are most vulnerable to increases in mean summer temperatures, increases in mean cool-season temperatures, increases in length of growing season, increases in atmospheric CO₂ levels, increases in mean evapotranspiration, decreases in summer soil moisture, decreases in mean summer precipitation, reductions in summer/fall water availability due to decreases in snowpack, and increases in mean winter precipitation.

Emerging Risks for ecosystems could include: low average river flows, higher water temperatures, more intense flooding events, lower water quality, more acidic ocean waters, and shifting species and habitats.

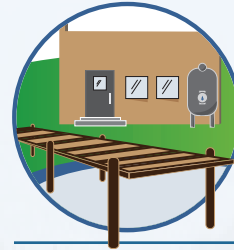


Water Supplies

Water Supplies are most vulnerable to seasonal changes to river flows, extended periods of lower stream flows during the summer and fall, more intense and frequent extreme precipitation events (increasing turbidity and hampering water treatment).

Groundwater Supplies are most vulnerable to changes in precipitation intensity and timing, decreases in snow pack that may reduce seasonal recharge, and sea level rise that could increase salinization of coastal groundwater tables.

Water Quality and Availability could be affected by diminishing snowpack, more frequent droughts, and lower summer precipitation, all of which may decrease seasonal water availability and increase competition for water supplies.



Critical Infrastructure

Downtowns, Ports, and Coastlines are most vulnerable to sea level rise, storm surge, and coastal flooding.

Floodplains and Stormwater could be affected by more intense and frequent extreme precipitation events: bringing increases in erosion, scouring, and entrainment of more rocks and sediments; expanding flood zones; and changing side channel habitats.

Sewer and Septic Systems are most vulnerable to sea level rise, storm surge, riverine flooding, groundwater table alterations, shifting precipitation patterns, and changes in evaporation rates (for mound septic systems).

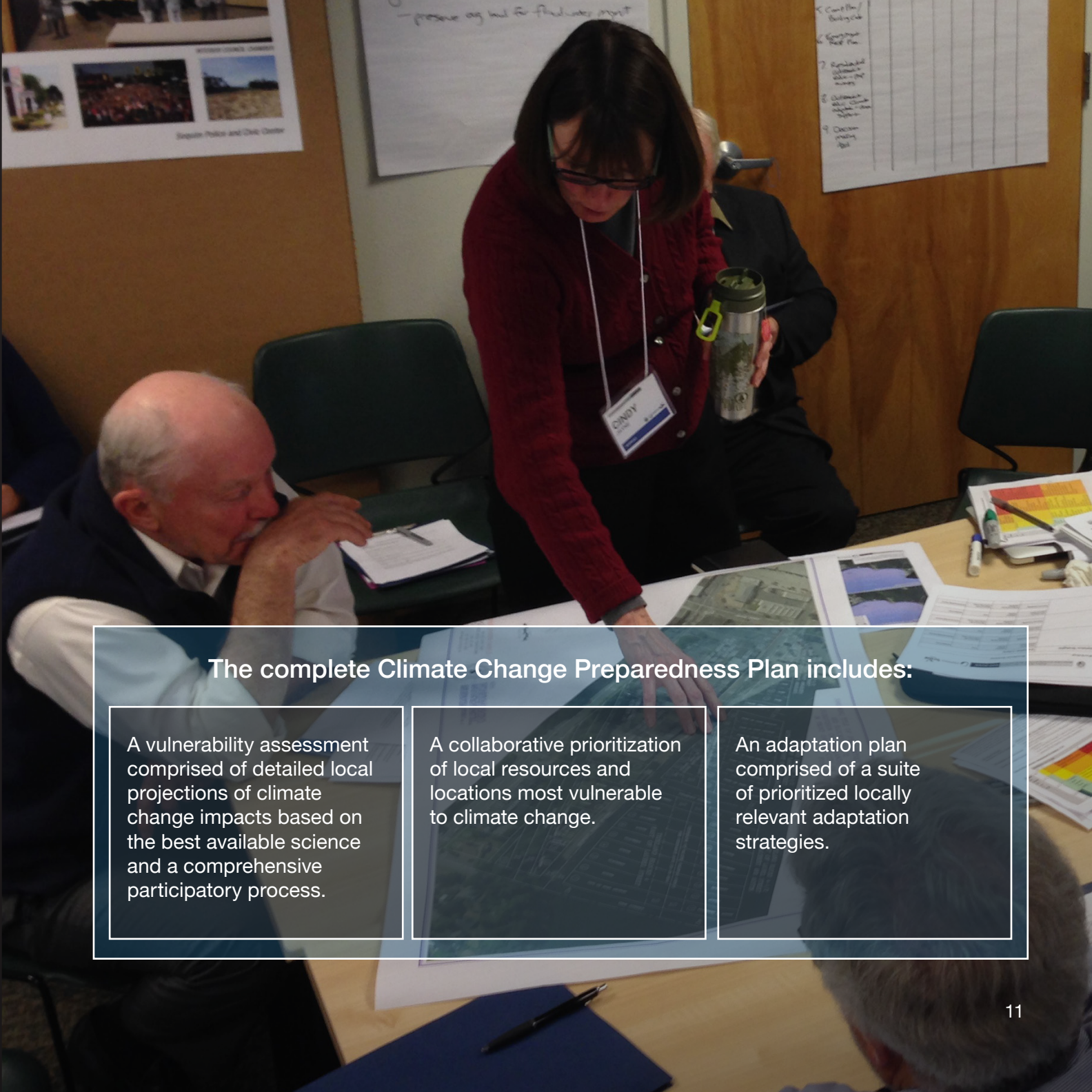


Climate Change Adaptation

There is no “one size fits all” approach to preparing for climate change. Climate change impacts are distinct to place and thus require targeted adaptation efforts to truly benefit the people who reside there.

Climate change preparation can take many forms, from developing educational materials to implementing policies and updating ordinances and regulations. The adaptation strategies were developed collaboratively during this project and represent some of the most targeted and effective actions the region can use to prepare for the impacts of climate change. Each strategy was selected to be useful across the entire region and will likely need to be tailored to specific local community contexts.

The adaptation strategies of this project focus on three areas of vulnerability: Ecosystems, Water Supplies, and Critical Infrastructure. In addition to the 30 strategies shown on subsequent pages, there are many other relevant strategies that were discussed during this project and are included in Section II and appendices of the complete Preparedness Plan. These materials also include more in-depth information on each strategy, such as opportunities or concerns and key action steps for successful implementation.



The complete Climate Change Preparedness Plan includes:

A vulnerability assessment comprised of detailed local projections of climate change impacts based on the best available science and a comprehensive participatory process.

A collaborative prioritization of local resources and locations most vulnerable to climate change.

An adaptation plan comprised of a suite of prioritized locally relevant adaptation strategies.

Prioritized Adaptation Strategies

Ecosystem



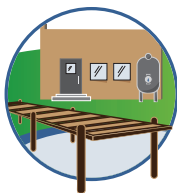
- **Enhance promotion of agricultural best management practices to include future climate conditions.**
- Enhance efforts to encourage breeding and planting of drought tolerant, resilient plant species.
- Utilize low cost citizen science monitoring and analysis approaches and technologies.
- Enhance efforts to incentivize use of native plants landscaping in residential, commercial, industrial settings.

Water Supplies



- **Enhance education on drought and water supplies issues for the peninsula.**
- **Enhance efforts to educate home and business owners on the value of on-site water conservation, retention, and catchment.**
- Identify monitoring needs and enhance water supply monitoring.
- Promote and incentivize smart irrigation technologies for agriculture.
- Encourage forestry practices promoting water retention within the watershed.

Critical Infrastructure



- **Perform outreach and education on climate adaptation to build community support.**

Planning Horizon for Adaptation Strategy

- **Immediate**
- Near-term (0–3 years)
- Medium-term (3–10 years)
- Long-term (>10 years)

Planning Strategies

- Develop a graphic tool to illustrate climate impacts.
- Incorporate climate change more explicitly into comprehensive plans and Shoreline Master Programs.
- Increase regional capacity for water storage (preferably with natural systems).
- Encourage the Federal Emergency Management Agency (FEMA) to incorporate climate change in rate maps and guidance.

- Map water retention values for ecosystems.
- Continue to study ways to enhance water storage and groundwater recharge.
- Improve forecasting for future water supply and demand.
- Research or develop a model to assess sea level rise and saltwater intrusion to groundwater.

- Create critical area flood maps that use future projections and go beyond FEMA's historical flood data.
- Update planning documents for sea level rise and flooding where needed.
- Update emergency management and response planning to include climate change where needed.
- Develop and utilize decision making tools related to climate change risks.
- Participate in FEMA's Community Rating System.

Policy Strategies

- Update municipal codes to account for enhanced fire risk at forest/residential interface where needed.
- Update financing policies to reduce development in high risk areas.

- Adopt new regulations requiring water-efficient appliances.

- **Reduce inflow and infiltration to wastewater systems.**
- Improve on-site stormwater management practices.
- Encourage soft defenses for shoreline infrastructure.
- Enhance stormwater retention in upstream areas.



Concluding Remarks

Preparing for the impacts of a changing climate and building resilience is a process and not an outcome. By participating in the development of this project's preparedness plan, appendices, and supplementary information, all of the partners involved have initiated this process. This project has already borne rich cross-sectoral discussions and enhanced and strengthened professional networks and social connections around the common cause of climate change preparedness. With continued collaboration, the recommended adaptation strategies of this project have the potential to build overall climate resilience on the North Olympic Peninsula and promote the best possible future outcomes for the region's residents, ecosystems, and economy.



“There is no other cause more worthy than this.”

- Project Core Team Member, and Senior Planner in the Region

List of Appendices & Supplementary Information

For more detailed information on this project please download the complete “**Climate Change Preparedness Plan for the North Olympic Peninsula**”, available at: www.adaptationinternational.com

Additional project materials available for download:

Appendices

- A: Comprehensive List of Adaptation Strategies
- B: Adaptation Strategy Matrix
- C: Sea Level Rise Probability Maps
- D: Sea Level Rise Analysis Details
- E: Monitoring Plan
- F: Focus Area Overview Maps

Supplementary Information

- A: List of Project Partners
- B: Climate Preparedness Outreach PowerPoint
- C: Planning Language Examples for Climate Resiliency
- D: Workshop 1 Results
- E: Workshop 2 Results
- F: GIS Map Development

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A diminishing snowpack in the Olympic Mountains is the expected 'new normal' under the current best available climate change projections.

Photo comparison of the snowpack on the same June day on Bogachiel Peak in the Olympic Mountains between 2014 (L) and 2015 (R).



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