Samish Indian Nation

Climate Change Vulnerability Assessment

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Lengtíxw tse Schténgexwen Á7leng

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1 ACKNOWLEDGEMENTS

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1.1 Climate Change Working Group

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1.2 Key terms

Annual Chance Exceedance (ACE) flood: A flood that has a (stated percent - %) chance of being exceeded in any given year (i.e. a 1% ACE flood is often referred to as a 100 year flood).

Adaptation (climate change): Actions in response to actual or expected climate change and its effects, that lessen harm or exploit beneficial opportunities. It includes reducing the vulnerability of people, places, and ecosystems to the impacts of climate change.

Adaptive Capacity: describes the ability of built, natural and human systems associated with a given planning area to accommodate changes in climate with minimum disruption or minimum additional cost.

Climate: The "average weather" generally over a period of three decades. Measures of climate include temperature, precipitation, and wind.

Climate Change: Any significant change in measures of climate (such as temperature, precipitation, or wind) lasting for an extended period of time (decades or longer). Climate change may result from natural factors and processes and from human activities that change the atmosphere's composition and land surface.

Exposure: The presence of people, assets, and ecosystems in places where they could be adversely affected by hazards.

Greenhouse Gas (GHG): Any gas that absorbs infrared radiation in the atmosphere; examples include carbon dioxide, methane, nitrous oxide, ozone, and water vapor.

Planning Areas: The areas in which a government or community manages, plans, or makes policy affecting the services and activities associated with built, natural and human systems

Planning Area: An area in which the tribal government manages, plans, or makes policy affecting the services and activities associated with built, human, and natural systems. For example, within the sector Utilities, you might have planning areas of Water and Electricity.

Resilience: Ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to absorb stress and change.

Risk: The actual or potential threat that environmental impacts from climate change have on the natural, social, and built systems that Samish nation members rely on for recreation or livelihood. Determined by considering the consequence of climate impacts along with the probability that such impacts occur.

Sector: General grouping used to describe any resource, ecological system, species, management area, etc. that may be affected by climate change. For example, Transportation, Utilities, Water Resources, Forest Resources, Human Health, or Cultural Resources and Traditions.

Sensitivity: How much a system is directly or indirectly affected by changes in climate conditions (e.g., temperature and precipitation) or specific climate change impacts (e.g., sea level rise, increased water temperature). If a system is likely to be affected as a result of projected climate change, it should be considered sensitive to climate change.

Vulnerability: The susceptibility of a system to harm from climate change impacts. Vulnerability is a function of how sensitive the system is to climate related impacts and the adaptive capacity of the system to respond to such changes. Generally, systems that are sensitive to climate and less able to adapt to changes are vulnerable to climate change impacts.

2 EXECUTIVE SUMMARY

The Samish Indian Nation recognizes that climate change is indeed occurring and that even the most conservative climate projections threaten Samish members, culture, and natural resources. This report is a representation of the Samish Indian Nation's commitment to providing a bright, sustainable future for the Seventh Generation and beyond by developing an institutional understanding of how climate change may impact the Tribe, determining what is most vulnerable to future changes, and creating strategies to mitigate these impacts and protect our resources.

This report is the product of over a year of collaboration between Samish Indian Nation staff and Tribal community members, led by the Samish Climate Change Working Group (hereafter referred to as Working Group). This sharing of knowledge built a list of over 200 planning areas, including infrastructure, human health, and culturally important species, all of which were evaluated in this vulnerability assessment using up to date climate projections, recent reports, and internal expertise.

This vulnerability assessment is the foundation for upcoming climate adaptation planning. It will provide staff with a knowledge base that can be used to develop effective climate adaptation strategies and foster a climate resilient community. This work will help ensure that Samish People can continue utilizing the bountiful natural resources of the Salish Sea that is such an important part of the Samish cultural identity.

Key Concerns:

1. *Children, elders, and those with preexisting chronic health conditions are especially vulnerable to climate change, and are particularly threatened by poor air quality, heat waves, and extreme weather.*
2. *Climate change will increase exposure to wildfire smoke, pollen, & other air pollutants, increasing the risk and severity of asthma attacks and other respiratory issues.*
3. *As the frequency and intensity of extreme weather events increases, so does the likelihood that cultural sites or ancestral remains will be disturbed or uncovered.*
4. *There remains a key information gap regarding climate-related storm surge; that is, how SLR and other changes may affect storm waves, coastal flooding, and erosion.*
5. *Wetland areas are the most climate-vulnerable habitat areas in this region. Species that rely on wetlands in any capacity will be impacted by climate change and will be a management priority in the future.*
6. *Over half of the species evaluated were found to be vulnerable to climate change.*

3 OVERVIEW OF THE SAMISH INDIAN NATION

Since time immemorial, Samish people have lived and prospered on the land and water of the Salish Sea in Washington State. Over time, Samish people have successfully navigated a variety of changes while maintaining a strong connection to the resources, rich lands, and waters of our region. While many of us may have moved away, we are still connected to this place and through it, to each other.

Through our strong connection with the natural world, we are beginning to see changes, such as an increase in extreme weather events and in the number of species struggling to survive and adapt.

Our history instructs us as to proper relationship to the land and its resources by teaching us the lessons left for us by our ancestors about both the natural and spiritual worlds and how those worlds cannot be separated. This teaching helps guide our tribal members in their daily lives and offers a unique and irreplaceable system of beliefs, which takes us through the transitions of life from birth to death and beyond.

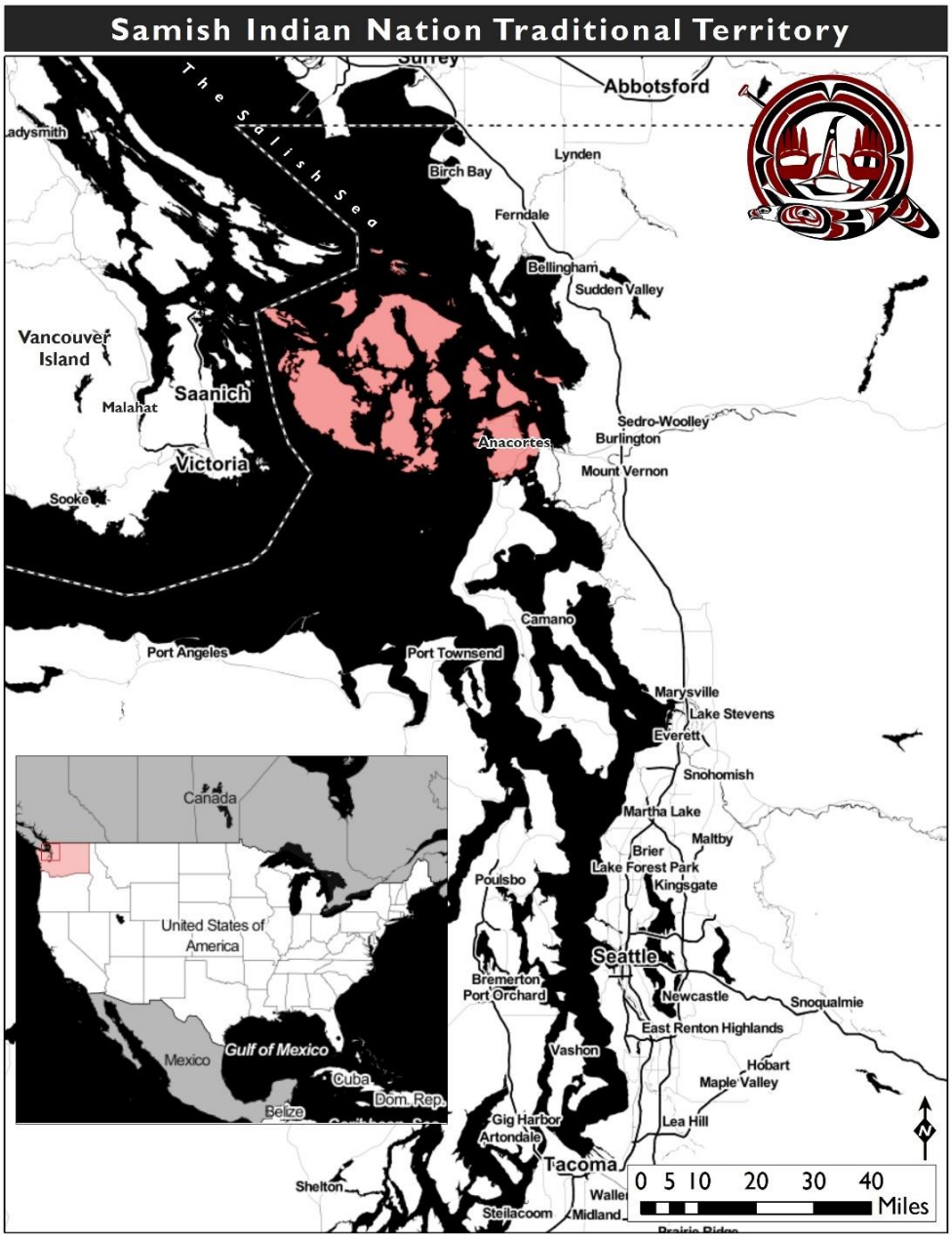
Samish people were respected for their spiritual strength as well as their skillful carving of canoes and construction of longhouses. One of those longhouses on the eastern end of Samish Island measured some 1,250 feet in length. In 1847 the Tribe had over 2,000 members, but raids from Northern Tribes and epidemics of measles, small pox, and the ague (flu), reduced the Tribe's population to approximately 150 by the time of the signing of the Point Elliott Treaty. History also tells us that 113 Samish were present at the Treaty grounds at the time of signing in 1855.

As part of a larger Coast Salish cultural complex the Samish formed a village community, which consisted of several important social groupings. These groupings can be listed as 4 units: the family, the house group, the villages, and the tribe as a whole. Samish tribal members married outside of their groupings, so as to create a network of “kinships”. These kinships regulated both the internal and external relationships between the families, the house groups, the villages, and the tribe as a whole. The Tribe relied on these relationships during bad times in order to access areas of food and shelter that was not currently in their home territory. Linguistically and culturally, the Tribe is grouped as Coast Salish, speaking a dialect of Coast Salish known as “Straits Salish,” rather than Lushootseed dialect as some of our immediate neighbors to the east.

The Tribe's traditional territory historically stretched over a wide area, which ranged from the mountain tops of the Cascades westerly along the hills, woodlands, and river deltas, arriving at the far western shores of the San Juan Islands. Samish Traditional Territory provides a backdrop for our history and cultural traditions that remain strong to this day.

3.1 Samish Traditional Territory

Historically, climate conditions throughout Samish traditional territory are consistent with the climate of the rest of western Washington. Warm, dry, low humidity summers and wet, rainy, mild winters. Present day land use in Samish traditional territory is broad. From tourism, agriculture, and nature conservancy on the San Juan Islands to industry, fuel refining, and agriculture on Fidalgo island and western Skagit county, to natural resource harvest near the cascades; Samish traditional territory land use has changed dramatically.



4 INTRODUCTION

This report summarizes the findings of an extensive climate change vulnerability and risk assessment that evaluated 209 planning areas. The findings are the result of collaboration between Samish departments, Tribal Council, tribal community members, and regional partners.

This vulnerability assessment will provide Samish tribal members and staff with a broad understanding of how climate change will impact a large variety of important resources, and will highlight areas that will need further, more in-depth research. Further, it forms the foundation for all upcoming climate adaptation planning work and will serve as a knowledge base that staff can use to develop effective climate adaptation strategies and foster a climate resilient community.

Preparing and planning for Climate Change ensures that Samish People will be able to continue utilizing the bountiful natural resources of the Salish Sea that is such an important part of their cultural identity.

4.1 Project Overview

Samish Indian Nation was a recipient of the FY16 BIA Tribal Resilience Program capacity building (category 9) grant. This grant laid the groundwork for future adaptation planning work to increase resilience to extreme events and harmful environmental trends. Phase 1 included outreach to Samish Tribal members, inventory of culturally important plant and animal species, and the identification of Tribal concerns related to emerging long-term weather patterns.

Phase 2 of the Samish Adaptation and Resilience Initiative has been funded through a department of Energy Office of Indian Energy grant. The goal of Phase 2 was to build on the foundation of the previous Bureau of Indian Affairs funded capacity building project by hiring a Resiliency Specialist to work alongside the Samish Resiliency Working Group, complete a qualitative vulnerability and risk assessment, and develop a Samish Resiliency Plan based on community values and best available science. Once complete in January of 2019, Phase 2 will help the Samish Indian Nation achieve resilience to extreme events and harmful environmental trends by identifying vulnerabilities, prioritizing resilience goals, and creating the Tribe's first adaptation plan.

Two future phases of this project are planned, both of which involve in-depth quantitative assessments of future impacts to resources that have been identified as vulnerable and "of concern" in Phase 2. Phase 3 will expand on this project by evaluating and prioritizing possible adaptation strategies and mapping a comprehensive path to resiliency for the Samish Indian Nation via a flexible adaptation plan that focuses on key vulnerabilities and ensures cultural

resources are sustained for the next 7 generations. The other upcoming project is similar, but focuses exclusively on coastal resources, specifically identifying coastal climate risks and coastal resource management strategies that prioritize resiliency. This project will also increase Samish resiliency by integrating findings from the vulnerability and risk assessment into the upcoming Samish Comprehensive Plan as well as other appropriate program level management plans.

4.2 Climate Change Projections

We are already witnessing climate change in the Pacific Northwest. According to the US Environmental Protection Agency, annual average temperature has risen by 1.3°F over the past century, and in the past few decades the region has experienced a decrease in precipitation that fell as snow as well as a decrease in total snowfall. More recently, the region has experienced weeks of smoke-filled air in late summer caused by regional and international wildfires.

Throughout this analysis, the Working Group used the most current regional climate projections from groups including US EPA, University of Washington's Climate Impacts Group, Washington Sea Grant, National Oceanic and Atmospheric Administration, and others.

The Working Group decided to conduct this assessment using the IPCC's RCP 8.5 projections which reflect a business as usual (or high emissions scenario) model. Put another way, RCP 8.5 projects climate conditions with the assumption that global emissions continue along their current trend through the end of century. The Working Group deemed it prudent to conduct this analysis using RCP 8.5 projections, as the goal is to protect human health and cultural resources for the Seventh Generation and planning for worst-case-scenario will lead to more robust climate adaptation strategies.

Climate Change Driver (Change relative to 1970-1999 avg.)	Historical (1971-2000)	Mid-century (2040-2069)	End of century (2070-2099)
Annual Average Temperature	46.2°F	51.7°F (+5.5°F)	55.0°F (+8.8°F)
Summer Average Max Daily Temperature	68.6°F	75.6°F (+7.0°F)	79.7°F (+11°F)
Annual High Heat Days (>86°F)	1.1 days	11 days (+9.8)	26.3 days (+25.2)

Table 1 Projected changes in temperature in Samish Traditional Territory based on RCP 8.5. Source: Climate Impacts Group "Tribal Climate Tool" web tool.

Climate Change Driver (Change relative to 1970-1999 avg.)	Historical (1971-2000)	Mid-century (2040-2069)	End of century (2070-2099)
Annual Precipitation	77.1 in	80.9 in (+3.8 in)	83.3 in (+6.2 in)
Summer (Apr-Sept) Precipitation	20.6 in	20 in (-0.6 in)	19.2 in (-1.4 in)
Winter (Oct-Mar) Precipitation	56.5 in	60.8 in (+4.2 in)	64.1 in (+7.6 in)
Heavy Precipitation Events	2 days/year	No data	7 days/year

Table 2 Projected changes in precipitation in Samish Traditional Territory based on RCP 8.5. Source: Climate Impacts Group "Tribal Climate Tool" web tool.

Climate Change Driver (Change relative to 1991-2009 avg.)	Change by 2050s	Change by 2080s	Change by 2100s	Change by 2150s
Sea Level Rise	+1.4 ft	+3.2 ft	+4.9 ft	+10.1 ft

Table 3 Projected sea level rise in Samish Traditional Territory, centered on the coastal area near Anacortes under the RCP 8.5 scenario. Projections include a 19 year period centered on the dates above. Data generated on 07/18/2018, courtesy of the Washington Coastal Resilience Project. (http://www.wacoastalnetwork.com/wcrp-documents.html)

5 VULNERABILITY ASSESSMENT

The Samish Resiliency Working Group was formed in 2017 to oversee this project. It includes diverse membership backgrounds to ensure that input is consistently provided by Samish tribal members, Tribal Council, and each Samish department.

Between 2017 and 2018, a combination of community outreach and thorough climate change research was conducted. These efforts led to a list of 209 planning areas to be evaluated via a vulnerability assessment, using regional climate projections. These planning areas included the various natural, human, and built systems that tribal members rely on for their livelihoods, cultural, social and physical wellbeing, as well as for recreational purposes.

5.1 Adaptation Planning Process

In general, climate adaptation planning processes follow a similar model as other planning processes – that is, beginning by setting goals and building support, transitioning into gathering information and conducting assessments, followed by creating and implementing plans Figure 1). This Vulnerability Assessment evaluated a list of 209 planning areas created via input from tribal members and staff. These planning areas were divided into three main sectors: Natural Environment, Built Environment, and Human Environment (Figure 2).

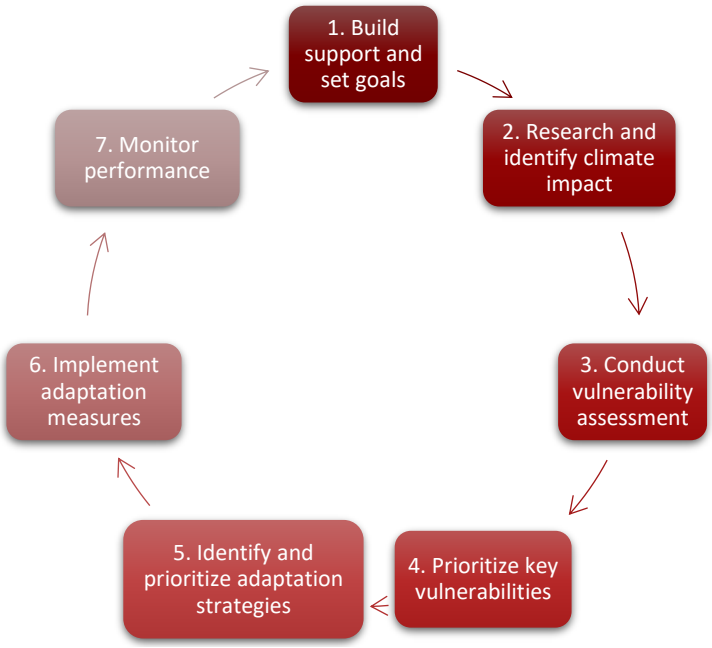


Figure 1 The adaptation planning process.

From the outset, this project had an ambitious timeline and budget, which led the Working Group to opt for a qualitative assessment. This allowed staff to assess a large amount of planning topics in a relatively short timeframe. This method allowed the Working Group to roughly identify the most pressing vulnerabilities and get an idea for future research and planning needs, as opposed to engaging in an in-depth quantitative study for a handful of planning areas which would have provided a deeper understanding but severely limited the scope. The Working Group determined it was more important to gain a broad understanding of vulnerable planning areas, identify key concerns, and begin an adaptation plan with the

understanding that key concern areas will be revisited through a quantitative assessment down the road.

The qualitative assessment framework used in this vulnerability assessment is based on the 2007 publication *Preparing for Climate Change: A Guidebook for Local, Regional, and State Governments* by Snover, et al., in combination with portions of other assessment tools including The Institute for Tribal Environmental Professional's *Climate Change Adaptation Planning Toolkit*. This framework, and the vulnerability matrix in particular, has been used by number of regional Tribes and fit our goal of completing a "rapid" vulnerability assessment.

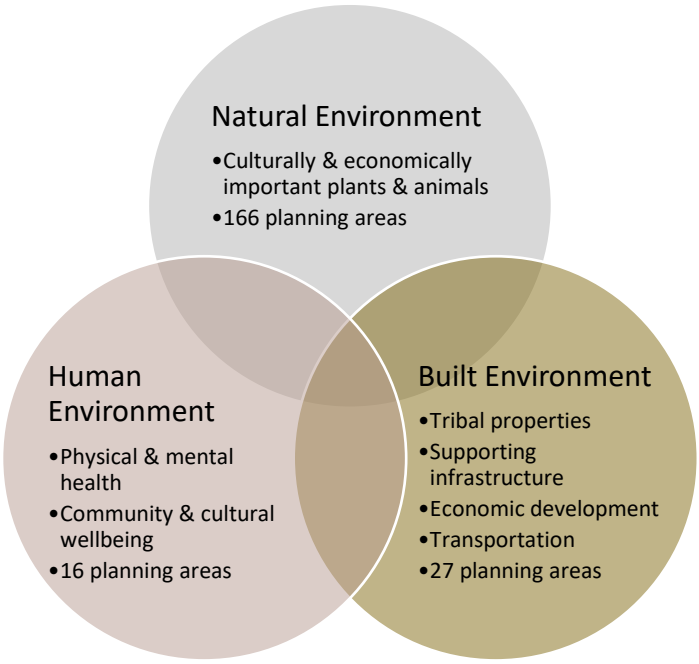


Figure 2 The vulnerability and risk assessment's three sectors.

To evaluate vulnerability, staff studied a variety of potential climate stressors each planning area is likely to face, then determined each planning area's sensitivity and adaptive capacity rating (from low to high) based on these findings. For example, Fidalgo Bay Resort is highly sensitive to climate change impacts like sea level rise and storm surge, and has a low adaptive capacity rating due to the low elevation of the property and prohibitive cost and unwillingness to install shore armoring.

Using the vulnerability matrix shown in Figure 3, the sensitivity and adaptive capacity ratings were combined to output a vulnerability rating. It's important to note that cultural considerations were incorporated into this analysis for many planning areas (where appropriate), though these considerations can't be specifically quantified. A primary goal of this project is protecting cultural resources for future generations, and the vulnerability assessment results presented in this report reflect a combination of traditional knowledge and current climate science.

VULNERABILITY = SENSITIVITY x ADAPTIVE CAPACITY

Sensitivity	Adaptive Capacity		
	High	**Medium**	**Low**
High	Medium Vulnerability	Medium-High Vulnerability	High Vulnerability
Medium	Medium-Low Vulnerability	Medium Vulnerability	Medium-High Vulnerability
Low	Low Vulnerability	Medium-Low Vulnerability	Medium Vulnerability

Figure 3 Vulnerability matrix adapted from Snover, et al. 2007.

The seventh generation is a major theme in Coast Salish culture; this is apparent in the WG's decision to use a precautionary-principle-based planning process. The WG evaluated the extent to which climate change impacts are projected to threaten each planning area by the year 2080, based on the International Panel on Climate Change's (IPCC) RCP 8.5 high emissions scenarios. This long-term planning based on the business-as-usual scenario will help Samish decision makers to understand the full range of impacts and ensure that strategies to protect resources for future generations can be implemented as precautionary measures rather than as a reaction to climate impacts as they occur.

This general format was used to qualitatively assess planning areas in all three categories, though some additional tools, considerations, and evaluation criteria were used, where appropriate. For example, staff used a sensitivity factor matrix adapted from the *Climate Change Vulnerability Assessment for the Treaty of Olympia Tribes* to more accurately evaluate how sensitive each species is to climate change.

5.2 Human Environment

Samish people, like so many other Indigenous peoples, "have a unique and interconnected relationship with the natural environment that is integral to their place-based social, cultural, and spiritual identity; intangible cultural heritage (traditions or living expressions transmitted and inherited through generations); and subsistence practices and livelihoods."[1]

[1] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA. Retrieved from: https://nca2018.globalchange.gov/

Climate change poses a variety of threats to human health – wildfire smoke, extreme weather events, and infectious disease can impact humans regardless of background. Indigenous people, however, are more vulnerable to climate impacts than the general population due to a number of factors known as the social determinants of health. According to the *Fourth National Climate Assessment* (2018), Indigenous peoples experience higher health risks "due in part to historic and contemporary social, political, and economic factors that can affect conditions of daily life and limit resources and opportunities for leading a healthy life. Many Indigenous peoples still experience historical trauma associated with colonization, removal from their homelands, and loss of their traditional ways of life, and this has been identified as a contributor to contemporary physical and mental health impacts."[2]

Key Concerns:

1. *Children, elders, and those with preexisting chronic health conditions are especially vulnerable to climate change, and are particularly threatened by poor air quality, heat waves, and extreme weather.*
2. *Climate change will cause higher exposure to wildfire smoke, pollen, and other air pollutants, increasing the risk and severity of asthma attacks and other respiratory issues.*
3. *As the frequency and intensity of extreme weather events increases, so does the likelihood that cultural sites or human remains will be disturbed or uncovered.*
4. *Safe and secure housing will be a planning priority in the short and long term future due to a number of risks, including flooding, reduced indoor air quality, extreme weather events, and others.*

Nationally, Indigenous people are disproportionately affected by higher rates of asthma, cardiovascular disease, diabetes, and other conditions – all of which will be exacerbated by climate change. In addition to these impacts to physical health, climate change presents a serious threat to Samish members' mental health as well as general tribal community wellbeing. These preexisting stressors and conditions cause communities to be more vulnerable to the potential impacts of climate change.

[2] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA. Retrieved from: https://nca2018.globalchange.gov/

5.2.1 Human Health

According to the U.S. Global Change Research Program's *Fourth National Climate Assessment* (2018), climate change is already causing adverse health effects for Americans – a trend which will be exacerbated with increasing climate change. Climate change affects human health by increasing exposure to extreme weather events (e.g. heat waves, floods, droughts, etc.) and infectious diseases (e.g. vector-borne, food-borne, and water-borne), exacerbating preexisting conditions, reducing the quality of air, food, and water; and causing stress to mental health and general well-being.[3]

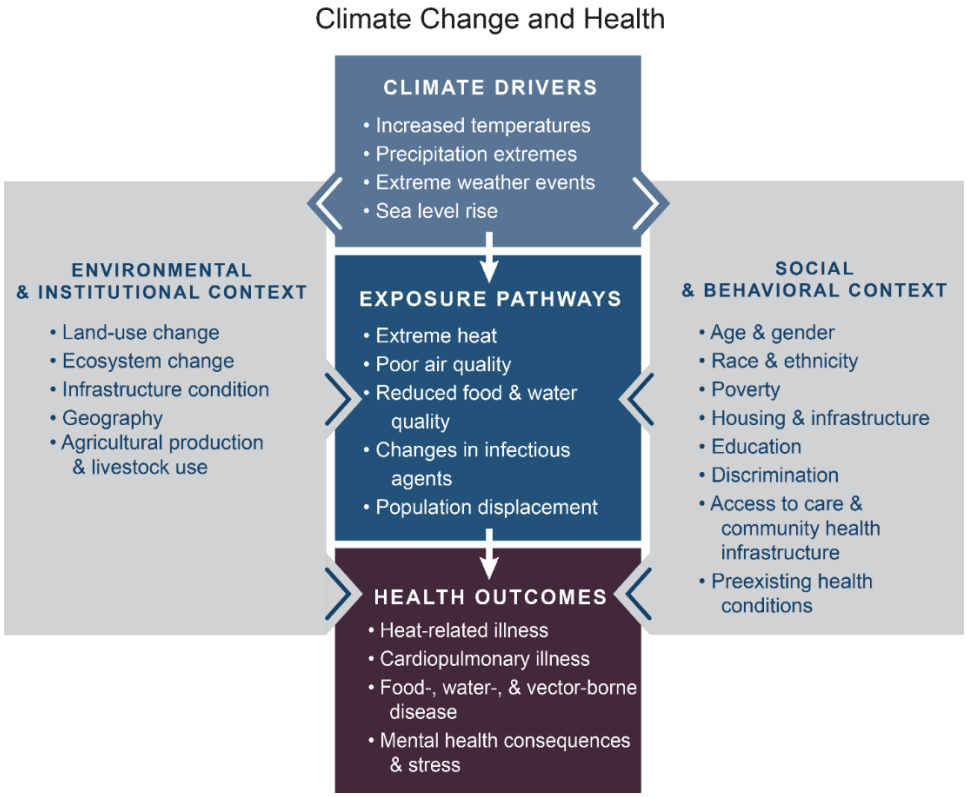


Figure 4 Shows the relationships between climate change and human health. Climate change creates exposure pathways which can be amplified by social and environmental factors. Source: USGRP Fourth National Climate Assessment (2018).

[3] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA. Retrieved from: https://nca2018.globalchange.gov/

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Respiratory Disease	High	Medium	Medium-high
Chronic Disease	High	Medium	Medium-high
Heat-Related Illness	High	Medium	Medium-high
Extreme Weather Events	Medium	Low	Medium-high
Infectious Disease	Medium	Medium	Medium
Mental & Behavioral Health (stress, depression, domestic violence)	High	Low	High

Table 4 Human Health vulnerability assessment results.

5.2.1.1 Respiratory Disease

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Respiratory Disease	High	Medium	Medium-high

Climate change can exacerbate of underlying asthma and respiratory disease issues via increasing allergens and other air pollutants. From 1995-2011, higher temperatures around the US lengthened the pollen season by 11-27 days, depending on location.[4] Climate change will also contribute to high levels of ground-level ozone and particulate matter pollutants (from wildfire, dust, etc.)[5]

Some community members that have chronic health conditions, such as asthma, may not be able to afford medical care. Climate change may cause air quality to worsen and exacerbate these types of medical conditions, and these individuals will be particularly vulnerable to these impacts due to a lack of medical care.

[4] Asthma and Allergy Foundation of America. (2019). *Extreme Allergies and Climate Change*. Retrieved from https://www.aafa.org/extreme-allergies-and-climate-change/

[5] Centers for Disease Control and Prevention. (n.d.). *Climate change decreases the quality of the air we breathe.* Retrieved from https://www.cdc.gov/climateandhealth/pubs/AIR-QUALITY-Final_508.pdf

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Smoke exposure	Immediate	Annually	Smoke from regional wildfires will continue to affect residents in the northwest, especially in summer months. Smoke exposure can cause or exacerbate asthma, bronchitis, and COPD.
Increased allergens	Immediate	Annually	Shorter winters and warmer seasonal temperatures are already causing longer, more potent allergy seasons. This increases the risk and severity of allergies and asthma attacks.
Reduced indoor air quality	Immediate	Ongoing	Increased wildfire smoke and allergens will both contribute to poor indoor air quality, especially in homes with poor filtration and no A/C. Additionally, as the spring and fall seasons lengthen with climate change, wetter and warmer conditions will contribute to increased mold growth in homes.

Potential adaptation strategies:

- Improve outreach and education to prepare tribal members to cope with increasing air quality concerns.
- Provide indoor air quality assessments and programs to improve residential indoor air quality for tribal members.
- Provide emergency shelter with advanced filtration and A/C where tribal members can seek refuge during high smoke or allergen days.

5.2.1.2 Chronic Diseases

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Chronic Diseases	High	Medium	Medium-high

Chronic diseases include diabetes, cardiovascular disease, and substance abuse/addiction. These diseases are often exacerbated heat and air pollution. By creating additional stressors, climate change will have significant future impacts on those with chronic diseases. For example:

- Cardiovascular disease, diabetes, exacerbated by extreme heat and air pollution (smoke, allergens, indoor AQ);

- Addiction and substance abuse may be exacerbated by stress derived from climate change impacts;
- Access to treatment and medication could be disrupted by extreme weather events.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Extreme heat days and air pollution	Mid-century	Annually	Cardiovascular disease and diabetes symptoms can be exacerbated by extreme heat days and air pollutants such as wildfire smoke and allergens, both of which will increase with climate change. People with existing conditions and living in households without proper filtration or access to A/C will be particularly threatened in the future.
Climate stress causing addiction and substance abuse	Immediate	Ongoing	Stress stemming from ongoing and future climate change impacts may cause additional addiction and substance abuse issues.

Potential adaptation strategies:

- Continue to provide home weatherization assistance to eligible tribal members.
- Provide emergency shelter with A/C and advanced filtration where community members can seek refuge during extreme heat events and/or poor air quality days.

5.2.1.3 Heat Related Illness

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Heat Related Illness	High	Medium	Medium-high

High heat days are defined by the Climate Impacts Group as days where temperatures are 86°F or higher. Models for this region project an additional 9.8 high heat days by mid-century, and an additional 25.2 high heat days by the 2080s. Elderly, young, and those with preexisting conditions (i.e. diabetes or cardiovascular disease) are especially vulnerable to high heat days. Additionally, the vast majority of homes in this region are not equipped with A/C, meaning the population is more exposed to this climate impact.

Many Samish Vocational Rehabilitation clients work in industries that demand outdoor physical labor (e.g., landscaping, fisheries, etc.), and therefore may be susceptible to heat stress-related

illness. Many clients already are homeless or living in compromised housing conditions, which may become worse with extreme weather events. For example, some people may be living outside or in tents and may be unable to avoid extreme heat events or worsening air quality. New resources may be needed to address these emerging issues.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Additional high heat days	Mid-century	Annually	By mid-century, the number of high heat days (>86°f) are expected to increase by 9.8 days from the historical average of 1.1 days. Additional hot days will exacerbate many chronic disease symptoms as well as cause heat rash, heat exhaustion, and heat stroke. The elderly, children, and those with preexisting health conditions will be particularly at risk.

Potential adaptation strategies:

- Provide emergency shelter with A/C where community members can seek refuge during extreme heat events.
- Continue to provide A/C and home weatherization assistance to eligible tribal members.

5.2.1.4 Extreme Weather Events

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Extreme Weather Events	High	Medium	Medium-high

Extreme weather events can take many forms. In Skagit and San Juan Counties, these will most likely occur as heavy precipitation events (and resulting riverine flooding and landslides), extreme heat days, extended summer drought. Extreme weather events will increase in frequency and intensity throughout the 21st century. Largely acute and unpredictable in nature, these events have the potential to cause significant property damage and possible loss of life. It's important to begin planning for these events now so that the tribe and members can be prepared in case of emergency.

Extreme weather events can not only affect tribe members ability to get to and from work, but if severe enough can directly impact public health services. Extreme events can disrupt health service delivery and damage critical infrastructure such as hospitals and water treatment facilities. According to our vulnerability assessment, extreme weather events will have a medium to high impact on the tribe's access to safe and secure housing, food security, roadway access, employment, community and emergency service access.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Flooding (coastal, surface, and riverine)	Mid-century	Semi-annually	Incidences of coastal, surface, and riverine flooding will all increase as the century progresses. Surface and riverine flooding will likely pose the greatest direct threat to human health.
Landslide	Mid-century	Rare	As precipitation patterns in the region change (decreasing overall precipitation, but more intense precipitation events), the likelihood of landslides will increase.
Wildfire	Mid-century	Uncommon	The chance of wildfire across the region will continue to increase as average temperatures increase and summer rainfall decreases. While direct exposure to wildfire in western Washington will likely remain low (especially in the lowlands), residents in Samish Traditional Territory should expect regular annual exposure to poor air quality conditions caused by regional wildfire smoke.
Heat waves	Mid-century	Annually	By mid-century, the number of high heat days (>86°f) are expected to increase by 9.8 days from the historical average of 1.1 days. Additional hot days will exacerbate many chronic disease symptoms as well as cause numerous other heat-related illness symptoms.

Potential adaptation strategies:

- Provide emergency shelter with A/C and advanced filtration where community members can seek refuge during extreme weather events.
- Provide an extreme weather hazard map to tribal members to increase awareness of risks.
- Create text alert system to notify tribal members of extreme weather events from floods to high heat days.

5.2.1.5 Infectious Disease

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Infectious Disease	Medium	Medium	Medium

Climate change increases the risk of exposure to infectious disease by creating conditions that are more favorable for vector growth and disease transmission. Warmer overall temperatures and shorter winters have already led to an increase in vector-borne diseases (diseases transmitted to humans via insects) as geographic range and length of season these insects are active has grown. More intense rainfall, floods, and higher humidity creates more favorable breeding conditions for many of these insects. [6]

Likewise, these conditions are also ideal for the growth and spread of water-borne pathogens and harmful algal blooms. Extreme precipitation events and flooding can contaminate potable drinking water and overload sewer systems, increasing exposure to pathogens that cause gastrointestinal illness. High temperatures can increase bacterial and parasitic infection rates, including marine pathogens like Vibrio[7]

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Exposure to water and vector borne diseases and pathogens	Mid-century	Uncommon	Higher temperatures, changing seasonality (especially shorter, warmer winters), and other factors will lead to increased exposure to water and vector borne disease. More mild winters will boost disease carrying insects (mosquitoes, ticks, etc.), and extreme weather events such as flooding could cause sewer backups and increase exposure to water borne disease.
Harmful algal blooms	Mid-century	Semi-annually	Warming sea water temperatures will increase the likelihood of algal blooms such as red tide that can threaten human health. This is especially concerning to Samish members who rely heavily on shellfish.

[6] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II*. [Reidmiller, D.R., C.W. Avery, D.R. Easterling, K.E. Kunkel, K.L.M. Lewis, T.K. Maycock, and B.C. Stewart (eds.)]. U.S. Global Change Research Program, Washington, DC, USA. Retrieved from: https://nca2018.globalchange.gov/

[7] Ibid.

Potential adaptation strategies:

- Create text alert to notify tribal members of any algal blooms or other vector borne disease concerns.
- Provide tribal members with state and local resources that notify community about shellfish harvest closures.

5.2.1.6 Mental and Behavioral Health

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Mental & Behavioral Health	High	Low	High

Climate change is a major concern when considering mental health, as there are multiple direct and indirect pathways for impacts to occur:

- Loss of cultural resources, including access to ceremonies, events, and natural resources may lead to stress and depression;
- Extreme weather events have a direct and immediate impact on mental health (including anxiety, PTSD, etc.) among those with no history of mental illness as well as those already at risk.
- Depression stemming from climate change trends and future economic outlook;
- Many young people harbor a sense of fatalism about their future, and there is a pervasive sense of depression from this;
- Significant stress caused by employment insecurity and living conditions;
- Fear and stress surrounding loss of salmon, orca and other culturally significant plant and animal species. This represents a loss of cultural identity. These species are central to culture, identity, and livelihood.

There are many strong links between climate change and stress and depression. The Centers for Disease Control and Prevention states that there are high levels of anxiety and post-traumatic stress disorder among populations affected by hurricanes, floods, heat waves, and wildfires.[8]

[8] Centers for Disease Control and Prevention. (2014). *Mental Health and Stress-Related Disorders.* Retrieved from: https://www.cdc.gov/climateandhealth/effects/mental_health_disorders.htm

Loss of cultural resources or employment insecurity, lack of safe and secure housing, rising household costs, health threats, etc. will likely result in stress and depression. Impacts may be particularly difficult for those with past drug dependency issues or suffering from PTSD or other mental health issues. This may pose a significant challenge for anyone trying to find new employment. Many Samish Social Service clients are living with mental health issues, and additional impacts related to a changing climate could increase stress and anxiety.

In addition, many community members are not provided sick leave by their employers and may need to choose between their health and income if illness occurs. These individuals may be particularly vulnerable to declining health or employment insecurity.

In order for tribal members to pursue educational opportunities, they need financial and emotional support and time. Tribal members need to feel secure and optimistic about the opportunities that education may bring. Household and individual economic resiliency is a key part of this.

Additionally, climate change may lead to a loss of social/community connections or social instability. Climate change represents a significant threat to the cultural connections of community members who engage in traditional activities, especially those centered around natural resource gathering (berries, cedar, bark, etc.). Any loss of these resources would be a significant impact and could result in loss of social connections and identity.

Potential adaptation strategies:

- Provide information about extreme weather events and emergency management plans to tribal members to help prepare for extreme weather events and reduce stress.

5.2.2 Community and Cultural Wellbeing

As climate change alters the world around us, it will also change the way humans interact with their natural surroundings. Climate change can certainly influence how a community interacts, especially among indigenous communities where cultural identity is so closely tied to a sense of place and natural surroundings. Climate change threatens interpersonal relationships and the passage of knowledge and stories between generations when community members “are less able or not able to share traditional knowledges about the natural environment (such as where and when to harvest or hunt), food, and ceremonial or cultural objects, among other things, because

the knowledge is no longer accurate or traditional foodstuffs and species are less available due to climate change."[9]

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Cultural and Historic Sites	High	Low	High
Burial Sites and Ancestral Remains	High	Low	High
Cultural Use Plants	High	Low	High
Household Costs	High	Medium	Medium-high
Safe and Secure Housing	High	Medium	Medium-high
Food Insecurity and Traditional Foods	High	Medium	Medium-high
Employment Security	Medium	Medium	Medium
Access to Community Services	High	Medium	Medium-high
Access to Tribal Events, Ceremonies, and Traditional Activities	High	Medium	Medium-high
Emergency Services	High	Medium	Medium-high

Table 5 Community and Cultural Wellbeing vulnerability assessment results.

5.2.2.1 Cultural and Historic Sites

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Cultural Sites	High	Low	High

Samish Traditional Territory has been occupied since time immemorial. The last ice sheets in this region retreated approximately 10,000 years ago. There is direct archaeological evidence of occupation of Fidalgo Island from 3,000 years ago. There are archaeological sites along many of the shorelines in Samish traditional territory, all of which will be impacted by sea level rise and storm surge. As these sites erode, we will lose irreplaceable information about Samish ancestral

[9] USGCRP, 2018: *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II.* [Jantarasami, L.C., R. Novak, R. Delgado, E. Marino, S. McNeeley, C. Narducci, J. Raymond-Yakoubian, L. Singletary, and K. Powys Whyte.. U.S. Global Change Research Program, Washington, DC, USA. Retrieved from: https://nca2018.globalchange.gov/

lifeways. Ongoing sea level rise thus represents a significant threat to the preservation of Straits Salish history in the area. Samish Island (Figure 5) will certainly be impacted by sea level rise and coastal erosion, and may be cut off from the mainland by the end of this century.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Inundation of coastal sites due to SLR	Mid-century	Annually	By mid-century, coastal flooding will be semi-regular, especially in winter. By 2100, flooding will be near daily during MHHW tide, and severe when combined with winter storms. Access via Fidalgo Bay Rd and Weaverling Rd will be threatened, and lower portions of the property will flood.
Erosion of cultural sites due to SLR, storm surge, and extreme weather events	Immediate	Annually	Coastal erosion is already occurring at cultural sites within Samish Traditional Territory, and this trend is expected to continue and become more severe.

Figure 5 Historically significant sites, including the one on Samish Island are threatened by future sea level rise.

5.2.2.2 Burial Sites and Ancestral Remains

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Burial Sites and Ancestral Remains	High	Low	High

Similar to cultural and historic sites, there are burial sites and ancestral remains located throughout Samish Traditional Territory and the greater western Washington region. While some sites are known, there are undoubtedly many more that are unknown. What is known is that many burial sites are located in coastal areas and will be increasingly threated by erosion and land movement caused by sea level rise and extreme weather events. There are instances of erosion uncovering the remains of Samish ancestors in the past decade.

Samish leadership, the Samish Tribal Historic Preservation Office, and the Washington State Department of Archaeology and Historic Preservation will need to work together to determine the best and most sensitive course of action when remains are inevitably uncovered.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Increasing possibility of disturbance or exposure of remains due to erosion	Immediate	Annually	Sea level rise, storm surge, and extreme weather events will all contribute to erosion in the future, increasing the likelihood that burial sites and ancestral remains will be disturbed.

Potential adaptation strategies:

- Samish leadership, Chelángen, and Washington State Department of Archaeology and Historic Preservation will need to agree on a best course of action on a site-by-site basis, including allowing sites to be disturbed by climate impacts or removing artifacts and/or remains for preservation purposes.

5.2.2.3 Cultural Use Plants and Resources

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Cultural Use Plants and Resources	High	Low	High

Many culturally important natural resources are threatened by climate change in the near and long term. Any loss of these species represents at the very least a loss of stories and cultural history. For more information about these species, please refer to section *5.4 Natural Environment*.

Along with climate change directly impacting the long-term viability of these species, climate change also threatens Samish members' ability to locate and harvest. Extreme weather events may restrict access to gathering areas or destroy these areas altogether. High heat or low rainfall years may cause some species to temporarily disappear, as has happened with Q'exmín (aka Indian celery or biscuitroot) in the past decade. Climate conditions may also affect the window of availability or harvest timing for culturally-critical resources like cedar bark, Labrador tea, salmon, or shellfish.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Reduced access and availability due to extinction or migration of species.	Mid-century	n/a	Refer to section *5.4 Natural Environment*.
Extreme weather events threaten ability to harvest	Mid-century	Semi-annually	Some extreme weather events such as flooding may temporarily restrict access to gathering areas. Others like high heat or poor air quality days will make gathering cultural use plants unsafe for Samish members, especially the young, elderly, or those with pre-existing conditions.

Potential adaptation strategies:

- Identify ecosystems that can facilitate climate migration for culturally important species and negotiate access agreements for tribal members.
- Identify and implement habitat restoration projects to support vulnerable species.
- Establish a community garden featuring culturally important species.

5.2.2.4 Household Costs

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Household Costs	High	Medium	Medium-high

Changes in climate conditions may cause energy, food, and water prices to rise, which may stress families already struggling to meet basic needs and may cause more families to have difficulty meeting rising household costs. This will be huge for our families that are on a fixed income and are currently challenged with meeting their basic needs. Additionally, increasing extreme weather events may damage residences and increase the costs of maintenance and insurance.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Rising household costs	Mid-century	n/a	Adapting to future climate change and repairing damage from climate-related extreme weather events will be expensive. Home insurance, flood insurance, utility rates, and even food costs will likely increase as providers spend more to adapt to climate change.

Potential adaptation strategies:

- Continue to provide home weatherization assistance to eligible tribal members.
- Explore other opportunities to mitigate rising household costs via community assistance programs.

5.2.2.5 Safe and Secure Housing

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Safe and Secure Housing	High	Medium	Medium-high

Ensuring Samish members have access to safe and secure housing in a priority for Samish Health and Human Services. Today, many Vocational Rehab clients already live in compromised housing conditions (e.g., leaking roof, located in floodplain, etc.). This situation will undoubtably become worse with climate change and extreme weather events. Gradually changing climate conditions such as seasonal precipitation and temperature patterns will increase allergens and other air

pollutants and worsen indoor air quality. Warmer wetter winters will cause additional mold and mildew in homes, especially those already in disrepair. Additional high heat days in summer could cause housing without air conditioning to become unsafe for elderly residents or those with pre-existing health conditions that are impacted by heat. Housing will also face direct threats from extreme weather events such as flooding.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Increased chance of riverine and coastal flooding	Mid-century	Semi-annually	Many community members' homes in the area are in current flood zones. Flood risk will only increase in the future.
Declining indoor air quality	Immediate	Ongoing	Poor indoor air quality (from wildfire smoke, winter mold, and allergens) will become a more significant issue in the future, especially for homes with poor ventilation or filtration. See: 5.2.1.1 Respiratory Disease.
More high heat days will threaten health	Mid-century	Annually	Increasing high heat days will threaten community members who live in homes with poor insulation and no A/C. Most homes in the area don't have A/C, and many community members that do have A/C can't afford to run it.
Extreme weather events (Direct impacts)	Mid-century	Semi-annually	More extreme weather events will damage homes, costing homeowners more in unexpected costs and insurance, and will disproportionately impact low income residents and homes already in disrepair.
Extreme weather events (Indirect impacts)	Mid-century	Semi-annually	Extreme weather events that significantly damage homes may cause crowding in households that take in family and neighbors, which may stress sewage/septic systems and increase the spread of infectious disease. This may also lead to stress and other serious mental health impacts.

Potential adaptation strategies:

- Continue to provide home weatherization assistance to eligible tribal members.
- Include climate residency considerations in tribal housing project designs.
- Provide assistance to tribal members to relocate out of flood zones.

5.2.2.6 Food Insecurity and Traditional Foods

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Food Insecurity and Traditional Foods	High	Medium	Medium-high

Food insecurity is already an issue for many Samish Health and Human Services clients, who may rely upon the Food Bank or other services. If access to food is impacted (e.g., rising costs, decreased availability, etc.) these families and individuals would likely be the first to feel the impacts. A wide array of factors could worsen food insecurity. High heat days or days with high air pollution (smoke, pollen) can make it unhealthy or even dangerous to leave home to get food or go outside to tend gardens. Other extreme weather events can prevent community members from reaching stores or other food sources altogether. Additionally, climate change is likely to impact fish, shellfish, bee populations and native plant species that some community members rely on as food sources.

Traditional food sources have value both culturally and economically. Traditional foods, sourced locally, are valuable for reducing waste and lowering energy inputs from transportation, storage and preservation. Local, traditional foods are also generally fresher and healthier because they use less preservatives and are often less processed. Plants grown locally are also more likely to require self-reliance on food production, thus helping to prepare the tribe for food insecurity issues. The practices surrounding the production and preparation of traditional foods could also be valuable resources that help to foster cultural tribal connections.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Reduced access to traditional foods	Immediate	Semi-annually	Climate change, along with other human-caused impacts (pollution, overharvesting), is already reducing access to traditional foods such as fish, shellfish, and plants. See: Natural Environment Page 59.
Restricted access to food during large flood events	Mid-century	~5-10 years	Access to/from Fidalgo Island would be severely restricted during large flood events, reducing access to food. This will disproportionately impact low income households with less stored food.
Increasing food prices	Mid-century	n/a	Food prices may increase due to changing climate conditions and extreme weather events that disrupt agriculture.

Potential adaptation strategies:

- Create community gardens to promote activity and food security.
- Develop traditional food cooking classes to teach community members about incorporating traditional Samish foods into their contemporary diets.
- Support policies and projects that bolster fish and shellfish populations.

5.2.2.7 Employment Security

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Employment Security	Medium	Medium	Medium

Future climate change may negatively impact a number of industries and employers in the pacific northwest, from forestry to fisheries. In particular, fisheries and related services are threatened by a myriad of stressors, from climate change to water pollution. The continued decline of fisheries will threaten many community members' employment or ability to earn a living wage, whether they work directly with fishing or are employed in a related field such as equipment sales, maintenance or tourism. Additionally, many tribal members are either self-employed or work in small businesses, which may not have the capacity/resources to recover from impacts from extreme weather, rising costs, or other impacts that may be associated with climate change. Many may not have the skills needed to readily transition into other employment opportunities. Therefore, the need for retraining and job placement services is likely to increase.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Industries in the area may lay off employees as climate change impacts increase	Mid-century	n/a	Fisheries, and fisheries supporting industries, will continue to be negatively impacted by climate change. Agriculture may face negative impacts as well, though there may also be positive impacts. Refineries may also face direct or indirect impacts from climate change or associated policy.
Working days may decrease	Mid-century	Annually	Climate change may impact working days via environment related illness or exacerbating existing conditions, as well as restricting transportation during extreme weather events.

Potential adaptation strategies:

- Continue to provide employment opportunities for tribal members within Samish departments as they grow.
- Continue to support vocational rehab programs for tribal members.

5.2.2.8 Access to Community Services

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Access to Community Services	High	Medium	Medium-high

Maintaining access to community services is critical, from a preventative health and general wellbeing standpoint. Samish Health and Human Services conducts site visits and provides medicine and household supplies, and often acts as a vital lifeline to community members – especially those with mobility or other serious health issues.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Access disruptions due to extreme weather events, storm surge, and SLR	Mid-century	Semi-annually	Extreme weather events, storm surge, and sea level rise all have the potential to impact Samish members' access to community services. The Tribe provides a variety of services and crucial household items to members (site-visits, insulin, cleaning supplies, food, other medication), some of which can be very time-sensitive.

Potential adaptation strategies:

- Create a Samish transportation service to transport at-risk tribal members that are unable to travel by themselves to an emergency shelter, healthcare services, or a family member's home in the event that their home is damaged.

5.2.2.9 Access to Tribal Events, Ceremonies, and Traditional Activities

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Access to Events, Ceremonies, and Traditional Activities	High	Medium	Medium-high

Strong cultural and community bonds are an important part of climate resilient communities. Further, these connections are important from a mental health standpoint. Maintaining access to these events is an important consideration in the face of climate change so that future generations will have equal or improved cultural opportunities as Samish members do today.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Access disruptions due to extreme weather events, storm surge, and SLR	Mid-century	Semi-annually	Extreme weather events, storm surge, and sea level rise all have the potential to impact Samish members' access to community events, ceremonies, and other traditional activities.
Access disruptions due to climate related air pollution	Immediate	Semi-annually	Climate related air pollution (pollen, wildfire smoke, dust, etc.) will periodically cause conditions that make it unhealthy and even dangerous for Samish community members to attend events or participate in traditional activities, especially members that are elderly or have preexisting conditions that can be affected by air pollutants.

Potential adaptation strategies:

- Create Samish transportation service to help tribal members attend community events.
- Request the Washington Department of Transportation to invest in climate resilient transportation infrastructure.

5.2.2.10 Emergency Services

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Emergency Services	High	Medium	Medium-high

Access to emergency services such as fire and police may face temporary challenges due to climate related extreme weather events. Road closures caused by flooding may make it difficult for emergency responders to reach community members in need. Additionally, as extreme weather events become more common or severe, there will be more demand for emergency services – potentially straining resources.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Service disruptions due to extreme weather events, storm surge, and SLR	Mid-century	Semi-annually	Extreme weather events, storm surge, and sea level rise may all disrupt the ability of emergency services to reach community members or vice versa. Road closures due to extreme weather events may also make it more difficult to transfer emergency patients to larger regional hospitals without an airlift. See Transportation.

Potential adaptation strategies:

- Work with state and local partners to boost investment in climate resilient infrastructure.

5.3 Built Environment

This project evaluated the potential impacts of climate change to Samish owned properties as well as important regional infrastructure. The assessment for Samish owned properties was based on their current and near-future development and use. The vulnerability of the following planning areas to future climate change was evaluated based on RCP 8.5 projects for mid-century (19 year range around 2050), though end of century (2100) projections were also considered.

Key Concerns:

1. *The Fidalgo Bay Resort is a high priority planning area – it's highly vulnerable to sea level rise and coastal flooding, which would cause damage and restrict access.*
2. *All Samish-owned buildings are vulnerable to temporary access restrictions caused by riverine and coastal flooding which could close SR-20 access to Fidalgo Island.*
3. *Increasingly intense floods will put more stress on floodplain infrastructure, resulting in higher upkeep costs and possibility of failure, threatening homes and infrastructure.*
4. *Summer water availability will likely decrease in the future which could restrict residential use, and water quality could be negatively impacted during flood events.*

5.3.1 Samish Owned Properties

5.3.1.1 Fidalgo Bay Resort

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Fidalgo Bay Resort	High	Low	High

Fidalgo Bay Resort is a camping, cabin rental, and event venue owned by the Samish Indian Nation. The resort is located on Weaverling Spit on Fidalgo Bay, just east of the SR-20 Spur W, and is accessed via the low-lying Weaverling Rd. It is one of the Samish Indian Nation's economic development assets.

Sea level in this area is expected to rise by 1.4 feet around 2050 and 5 feet by 2100. At these levels, the resort should expect to experience intermittent coastal flooding in the lower half of the property by mid-century, especially during winter storm events. By the end of the century, the property will likely experience extensive daily flooding during MHHW tide, as well as more extreme coastal flood events during winter storms.

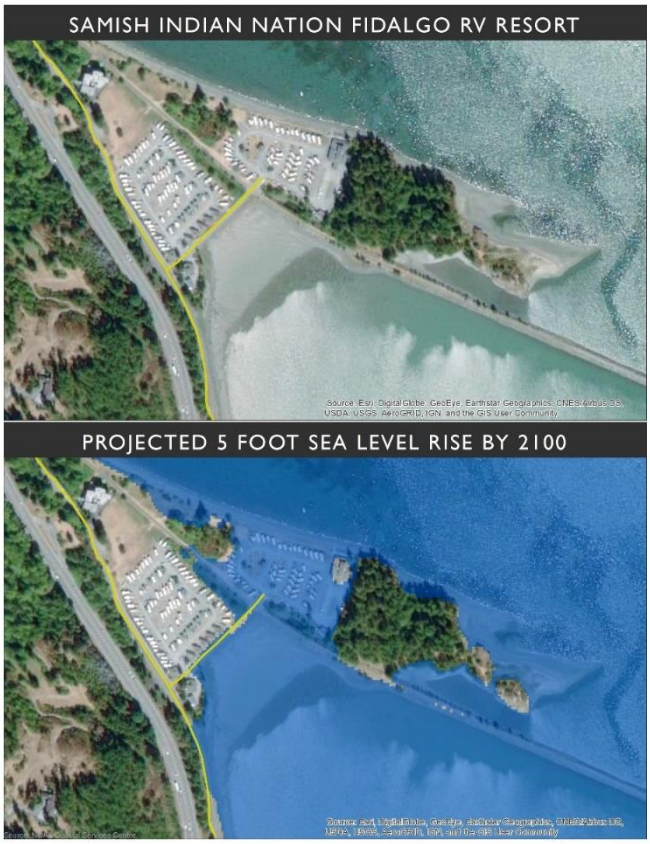


Figure 6 How 5 feet of sea level rise will impact the Fidalgo Bay

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Inundation due to SLR and storm surge. At current trends, 1.4ft SLR by 2050 and 5ft by 2100. (Direct)	Mid-century	Semi-regularly, especially in winter	By mid-century, coastal flooding will be semi-regular, especially in winter. By 2100, flooding will be near daily during MHHW tide, and severe when combined with winter storms. Access via Fidalgo Bay Rd and Weaverling Rd will be threatened, and lower portions of the property will flood.
Increased likelihood of landslide along Fidalgo Bay Rd during extreme precipitation events. (Direct)	Mid-century	Unlikely	Landslide risk along Fidalgo Bay Rd hasn't been evaluated by geologists, but our rough assessment didn't find any major risk of landslide without major structural changes or extreme and prolonged rainfall events.
Potential interruption of utility services. (Indirect)	Mid-century	Unlikely	Increasing temperatures and changing precipitation patterns will put additional stress on utilities in the future. However, utility providers are

			required by law to maintain high levels of service and are working to address climate concerns.
Access disruptions via SR 20 due to 1%, 2%, and 4% ACE flood events. (Indirect)	Mid-century	Semi-annually	Flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods in the near future, leading to temporary road closures and access disruptions.
Access threatened via SR 20 by SLR and storm surge. (Indirect)	Mid-century	Semi-annually	By mid-century, SR 20 will face higher risk of coastal flooding, especially during a combination of high tides and winter storms.

Potential adaptation strategies:

- Planned retreat, removing buildings and infrastructure from lower portion of the property as sea levels rise.
- Install air conditioning in the convention center to the mitigate higher summer temperatures.
- Build sea wall along Weaverling Rd and around the property to prevent inundation and coastal flooding.

5.3.1.2 Summit Park

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Summit Park	Medium	Medium	Medium

The Summit Park campus houses several departments and is often used for community events. This campus serves community members on a daily basis through the elder's lunch program as well as other semi-regular community events. The property is located just south of SR-20, about 0.5 mile east of Sharpe's Corner (SR-20/SR-20 Spur W junction).

The campus sits about 50 feet above sea level on relatively flat and open terrain. As such, it faces little direct threat from changing climate conditions (SLR, flooding, etc.), but could be affected by secondary impacts such as road closures or utility disruptions.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Interruption of utility services. (Indirect)	Mid-century	Unlikely	Increasing temperatures and changing precipitation patterns will put additional stress on utilities in the future. However, utility providers

			are required by law to maintain high levels of service and are working to address climate concerns.
Access disruptions via SR 20 due to 1%, 2%, and 4% ACE flood events. (Indirect)	Mid-century	Semi-annually	Flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods in the near future, leading to temporary road closures and access disruptions.
Access threatened via SR 20 by SLR and storm surge. (Indirect)	Mid-century	Semi-annually	By mid-century, SR 20 will face higher risk of coastal flooding, especially during a combination of high tides and winter storms.

Potential adaptation strategies:

- Work with state agencies to advocate for climate resilient infrastructure upgrades where appropriate in order to maintain year-round access.

5.3.1.3 Thompson Rd Property/March's Point

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Thompson Rd Property	Medium	Medium	Medium

This undeveloped property is located adjected to SR-20, near to the Summit Park campus. It faces the same future threats as the Summit Park Property, though these will carry less consequence while the property remains undeveloped.

5.3.1.4 Administration Complex

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Administration Complex	Medium	Medium	Medium

The Administration Complex is located on Commercial Ave in Anacortes and includes offices as well as space for community gatherings. The property does not face any significant direct impacts from future climate change, though it will likely face indirect impacts such as temporary access limitations due to road closure or utility disruptions in the future.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Interruption of utility services. (Indirect)	Mid-century	Uncommon	Increasing temperatures and changing precipitation patterns will put additional stress on utilities in the future. However, utility providers are required by law to maintain high levels of service and are working to address climate concerns.
Access disruptions via SR 20 due to 1%, 2%, and 4% ACE flood events. (Indirect)	Mid-century	Semi-annually	Flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods in the near future, leading to temporary road closures and access disruptions.
Access threatened via SR 20 by SLR and storm surge. (Indirect)	Mid-century	Semi-annually	By mid-century, SR 20 will face higher risk of coastal flooding, especially during a combination of high tides and winter storms.

Potential adaptation strategies:

- Work with state agencies to advocate for climate resilient infrastructure upgrades where appropriate in order to maintain year-round access.
- Install air conditioning to mitigate higher summer temperatures.

5.3.1.5 Longhouse

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Longhouse	Medium	Medium	Medium

Located on D Ave in Anacortes, the Samish Longhouse houses the Early Learning Center and Head Start Preschools, serving Tribal and local community members. It faces little to no risk from future sea level rise or other major climate impacts. If flooding or other extreme weather events restrict access or cause utility interruptions on Fidalgo Island, the longhouse is likely to be affected. Aside from extreme weather events, future impacts should be minimal.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Interruption of utility services. (Indirect)	Mid-century		Increasing temperatures and changing precipitation patterns will put additional stress on utilities in the future. However, utility providers are required by law to maintain high levels of service and are working to address climate concerns.
Access disruptions via SR 20 due to 1%, 2%, and 4% ACE flood events. (Indirect)	Mid-century	Semi-annually	Flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods in the near future, leading to temporary road closures and access disruptions.
Access threatened via SR 20 by SLR and storm surge. (Indirect)	Mid-century	Semi-annually	By mid-century, SR 20 will face higher risk of coastal flooding, especially during a combination of high tides and winter storms.

Potential adaptation strategies:

- Work with state agencies to advocate for climate resilient infrastructure upgrades where appropriate in order to maintain year-round access.

5.3.1.6 The Cannery Building

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Cannery Building	Medium	Medium	Medium

The Cannery Building is an office building located next to the Cap Sante Marina in Anacortes. Samish Indian Nation's Department of Health and Human Services relocated to office space in the building in 2019, and the Tribe leases the remaining space to other tenants. The building sits about 11 feet above sea level and will not face direct threat from SLR this century. It's also largely protected from storm surge impacts thanks to the Marina's capped breakwater over the old Scott Paper Mill pollution site.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Interruption of utility services. (Indirect)	Mid-century	Uncommon	Increasing temperatures and changing precipitation patterns will put additional stress on utilities in the future. However, utility providers are required by law to maintain high levels of service and are working to address climate concerns.
Access disruptions via SR 20 due to 1%, 2%, and 4% ACE flood events. (Indirect)	Mid-century	Semi-annually	Flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods in the near future, leading to temporary road closures and access disruptions.
Access threatened via SR 20 by SLR and storm surge. (Indirect)	Mid-century	Semi-annually	By mid-century, SR 20 will face higher risk of coastal flooding, especially during a combination of high tides and winter storms.

Potential adaptation strategies:

- Work with state agencies to advocate for climate resilient infrastructure upgrades where appropriate in order to maintain year-round access.

5.3.1.7 34th Street Housing Project

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
34th Street Housing Project	Medium	Medium	Medium

This project is planned for future development, and will be located near the Administration Complex in Anacortes. It lies well above sea level and faces no major direct threat from climate change. Like other buildings in Anacortes, extreme weather events such as flooding could result in access or utility disruptions.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Interruption of utility services. (Indirect)	Mid-century	Uncommon	Increasing temperatures and changing precipitation patterns will put additional stress on utilities in the future. However, utility providers are required by law to maintain high levels of

			service and are working to address climate concerns.
Access disruptions via SR 20 due to 1%, 2%, and 4% ACE flood events. (Indirect)	Mid-century	Semi-annually	Flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods in the near future, leading to temporary road closures and access disruptions.
Access threatened via SR 20 by SLR and storm surge. (Indirect)	Mid-century	Semi-annually	By mid-century, SR 20 will face higher risk of coastal flooding, especially during a combination of high tides and winter storms.

Potential adaptation strategies:

- Work with state agencies to advocate for climate resilient infrastructure upgrades where appropriate in order to maintain year-round access.
- Include air conditioning and advanced filtration in the project design to mitigate higher future temperatures and improve indoor air quality.

5.3.1.8 Campbell Lake/The People's House

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Campbell Lake/The People's House	Medium	Medium	Medium

The Campbell Lake property is comprised of 11 contiguous parcels just east of Lake Campbell, four of these parcels are held in trust. Construction is underway on an access road in preparation for construction of the People's House, which is slated to begin in 2019. The upper portion of the property is largely secondary growth forest estimated to be 60-80 years old.

As climate change progresses, the Lake Campbell property will become increasingly susceptible to wildfire, especially on the forested upper portions of the property.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Increased landslide potential. (Direct)	End of century	Unlikely	The risk of landslide at the Campbell Lake property is believed to be low. A rough assessment didn't find any major risk without major structural changes or extreme and prolonged rainfall events.

Increased wildfire potential. (Direct)	End of century	Unlikely	As temperature increases and summer precipitation decreases around the region, wildfires will increase in frequency and intensity.
Interruption of utility services. (Indirect)	Mid-century	Uncommon	Increasing temperatures and changing precipitation patterns will put additional stress on utilities in the future. However, utility providers are required by law to maintain high levels of service and are working to address climate concerns.
Access disruptions via SR 20 due to 1%, 2%, and 4% ACE flood events. (Indirect)	Mid-century	Semi-annually	Flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods in the near future, leading to temporary road closures and access disruptions.
Access threatened via SR 20 by SLR and storm surge. (Indirect)	Mid-century	Semi-annually	By mid-century, SR 20 will face higher risk of coastal flooding, especially during a combination of high tides and winter storms.

Potential adaptation strategies:

- Maintain safe fire fuel buffer around development on the property.
- Work with state agencies to advocate for climate resilient infrastructure upgrades where appropriate in order to maintain year-round access.

5.3.1.9 Thomas Creek

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Thomas Creek	Medium	Medium	Medium

Thomas Creek is an agricultural property located at the junction of Kelleher Rd and District Line Rd in Skagit County. Based on models, the property is unlikely to be affected by riverine flooding from the Skagit river (see **Error! Reference source not found.**). However, the property is bordered on the north by Thomas Creek, which has flooded the property numerous times due to the Samish river backing up into it.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Potential inundation during riverine flood events. (Direct)	Mid-century	1-5 years	Although some flood projection maps show flood extent nearly reaching the property (though not quite), we believe the property is more at risk than these projections show. The creek that boarders the property has flooded the field in the past, and this threat will grow and precipitation events become more intense.
Increased wildfire potential. (Direct)	Mid-century	Unlikely	Though climate change will increase the overall threat of wildfire in western Washington, we don't believe much of the Skagit lowlands to be at high risk.
Interruption of utility services. (Indirect)	Mid-century	Uncommon	Increasing temperatures and changing precipitation patterns will put additional stress on utilities in the future. However, utility providers are required by law to maintain high levels of service and are working to address climate concerns.
Access disruptions via SR 20 due to 1%, 2%, and 4% ACE flood events. (Indirect)	Mid-century	Semi-annually	Flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods in the near future, leading to temporary road closures and access disruptions.
Access threatened via SR 20 by SLR and storm surge. (Indirect)	Mid-century	Semi-annually	By mid-century, SR 20 will face higher risk of coastal flooding, especially during a combination of high tides and winter storms.

Potential adaptation strategies:

- Mitigate potential flood impacts, including floodproofing the buildings.
- Work with regional partners to expand wetland restoration projects in the area to mitigate flood impacts.

5.3.1.10 Lopez Island (Upland)

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Lopez Island (Upland)	Low	Medium	Medium-low

This property on Lopez Island is owned by the tribe but is vacant. It faces no serious threat from climate change from a land use management standpoint.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Increased risk of wildfire. (Direct).	Mid-century	Very unlikely	Though climate change will increase the overall threat of wildfire in western Washington, the risk of wildfire in the San Juan Islands will likely remain very low thanks to generally cool temperatures, regular precipitation, and other factors.

5.3.1.11 Huckleberry Island

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Huckleberry Island	High	Low	High

Just east of Guemes Island, Huckleberry is a small (~10 acres) uninhabited island that has been owned and managed by the Samish Indian Nation since 2010 when the Washington State Parks and Recreation Commission transferred ownership to the Tribe. The island features a small SW-facing rocky beach but is largely surrounded by steep cliffs. Erosion, especially during winter storms, is already a problem for the island and is the primary concern in the future. Rising sea level and changing storm surge patterns are expected to exacerbate erosion on Huckleberry, a concern for the cultural department as well as general land management.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Erosion from SLR and storm surge. (Direct)	Immediate	Annually	Huckleberry Island currently suffers from erosion during winter storms. This trend will certainly continue throughout the century as sea level rises and winter storms and storm surge increase in intensity.
Increased landslide risk. (Direct).	Mid-century	Uncommon	Landslide risk will increase along with more intense storm surge and winter storms that bring heavy precipitation. However, the overall risk of landslide will remain small, largely due to the rocky substrate that makes up Huckleberry Island.
Increased wildfire risk. (Direct)	Mid-century	Very unlikely	Though climate change will increase the overall threat of wildfire in western Washington, the risk of wildfire in the San Juan Islands will likely remain

			very low thanks to generally cool temperatures, regular precipitation. Additionally, overnight camping is not allowed on Huckleberry Island, reducing the risk of human caused fire.

Potential adaptation strategies:

- Monitor erosion and take preservation steps when necessary.
- Consider closing the island to public access if safety becomes a concern due to erosion of the access trail.

5.3.2 Transportation

Though roadway and transportation system management responsibility lie primarily with Washington State and Skagit County, it's important to consider how these routes may be impacted by climate change. Maintaining transportation access to and from Fidalgo Island is critically important to Samish Indian Nation daily operations. Any access interruptions would disrupt the Tribe's ability to provide a number of key services to members, prevent staff and tribal members from commuting to and from work, and could result in lost wages for some members.

The Washington State Department of Transportation completed a statewide climate vulnerability assessment for transportation assets in 2011 (results shown in Figure 9) and published a follow up report in 2015 that evaluated adaptation strategies for Skagit County transportation. These reports were used to guide our assessment of transportation infrastructure.

The single largest climate threat to transportation in Skagit County is flooding caused by heavy rainfall, rapid snow melt, storm surge, and a combination of other factors. According to WSDOT's 2015 findings, some stretches of highways in low-lying areas, such as SR 20 between Burlington and Fidalgo Island, would be impacted by as little as 2 feet of sea level rise. Our own analysis using NOAA digital elevation model (DEM) and sea level rise (SLR) data shows that parts of SR 20 would be inundated and impassable during MHHW (Mean Higher High Water) with just 1 ft of sea level rise. According to RCP 8.5 scenario projections, this will likely occur before mid-century. Even at the low end of projections, climate change is sure to increase the frequency and intensity of coastal and riverine flooding in the area in the future. Major infrastructure improvements will be necessary to avoid road closures.

In addition to the immediate impacts of coastal and riverine flooding, transportation infrastructure will also likely face long-term damage from erosion, weathering, and heat stress,

requiring more frequent maintenance. Our evaluation assumes that floodplain infrastructure will be upgraded as climate change impacts occur.

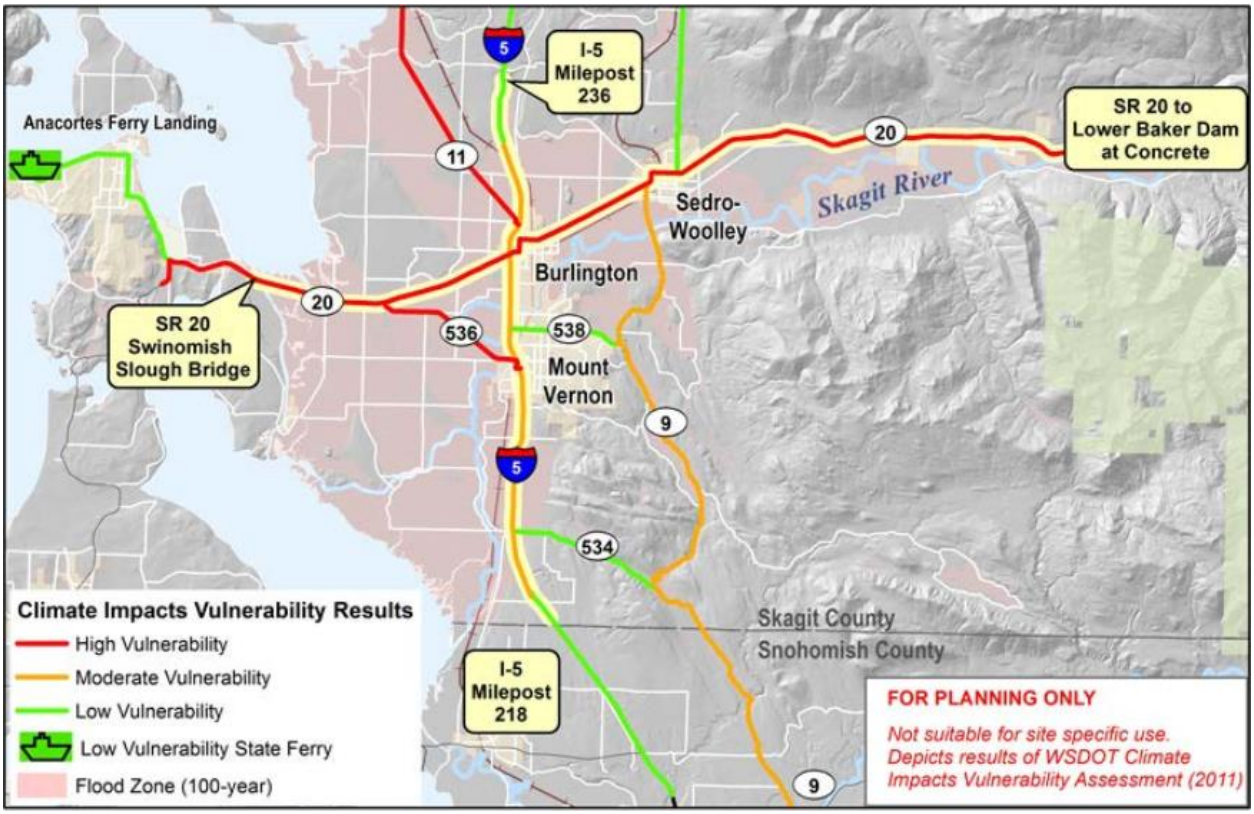


Figure 7 Map showing stretches of state and federal highways that are vulnerable to climate change assuming 2 ft of sea level rise based on GIS flood analysis. (WSDOT, 2011).

Potential adaptation strategies:

- Work with local, state, and federal partners to advocate for climate resilient infrastructure upgrades.

5.3.2.1 Roads: State Highways and Interstate 5

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Roads: State Highways and Interstate 5	Medium	Low	Medium-high

The roadway of highest concern in Skagit County is SR 20, which functions as the main transportation artery between Fidalgo Island and the mainland. However, closures to Interstate 5, SR 11, and SR 536 would also impact Samish Tribal operations; even independent closures of these major transportation routes would cause heavy traffic issues on SR 20. Figure 8 highlights the potential impacts sea level rise may cause to SR 20.

WSDOT's 2015 report, *Creating a Resilient Transportation Network in Skagit,* identified portions of I-5 (MP), SR 20 (MP), SR 11 (MP), and SR 536 (MP) that will face increased threats from flooding as climate change continues (see Figure 9-Figure 14). The vast majority of these sections of highway will face increased threat from riverine flooding. In their 2015 report, WSDOT estimated that "about 90% of I-5 in Skagit County, as well as the rest of the highway system, is at risk of flooding." The Climate Impacts Group predicts that by 2080, climate change will cause 1% Annual Chance Exceedance (ACE) floods to become 4% ACE floods, and 0.4% ACE floods to become 1% ACE floods. In other words, 100-year floods will occur at a 25-year flood rate.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Temporary inundation of roadways due to coastal or riverine flooding. (Direct)	Mid-century	Semi-annually	By mid-century, coastal flooding will be semi-regular, especially in winter. Some portions of SR 20 may be threatened by coastal flooding when winter storms and high tides combine. Similarly, riverine flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods, leading to temporary road closures and access disruptions.
Increased incidence of wildfire that could cause temporary road closures. (Direct)	Mid-century	Uncommon	As temperature increases and summer precipitation decreases around the region, the likelihood of wildfire will increase. However, the likelihood of wildfire impacting transportation will remain low.
Accelerated damage to roads from extreme heat events or flooding. (Direct)	Mid-century		Climate change will increasingly stress road infrastructure as the century progresses.

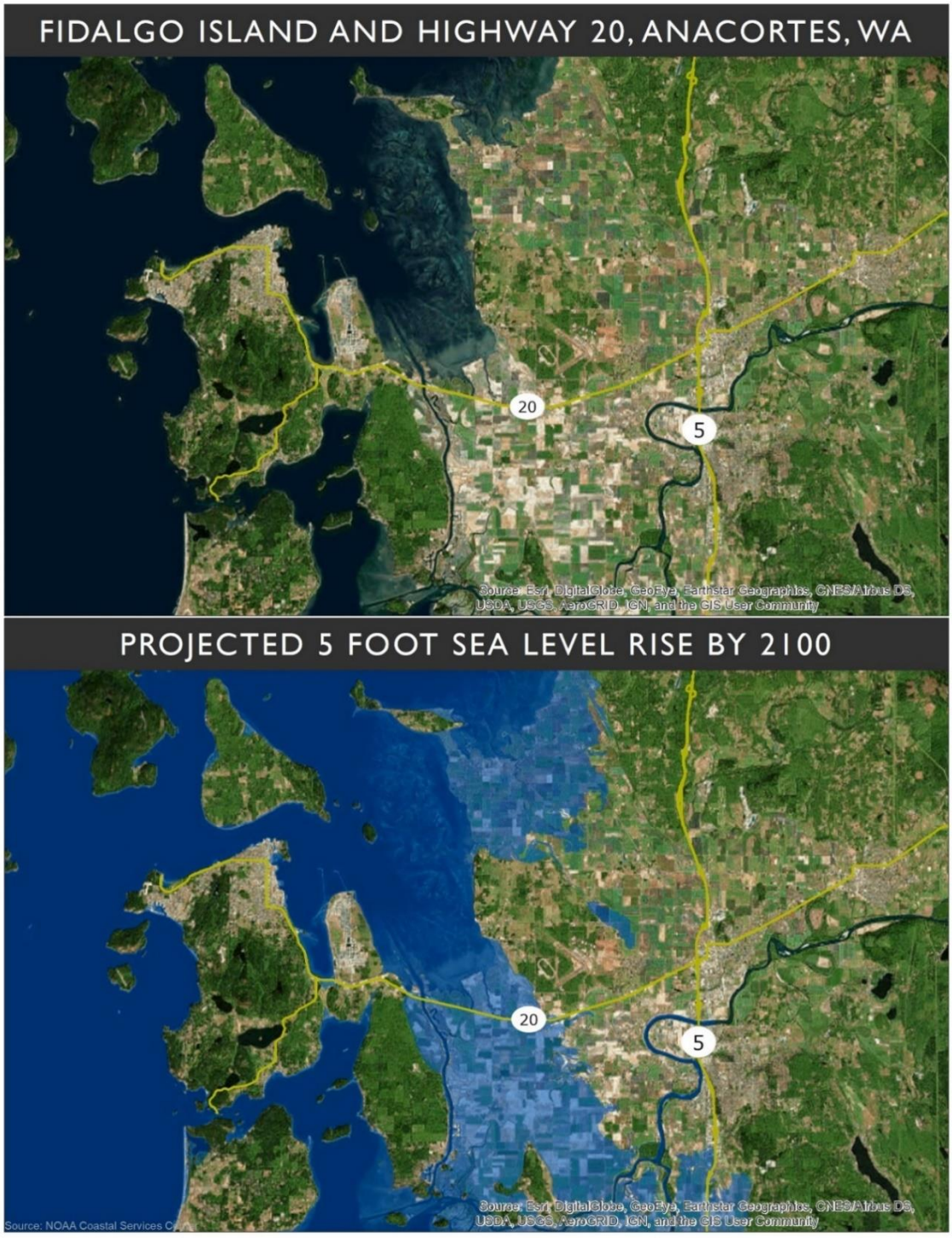


Figure 8 Results from our SLR analysis showing significant inundation in Skagit County with projected 5 feet of SLR by 2100.

Figure 9 WSDOT study area with flood hazard locations for 1%, 2%, 4% and 10% ACE floods. (WSDOT, 2015).

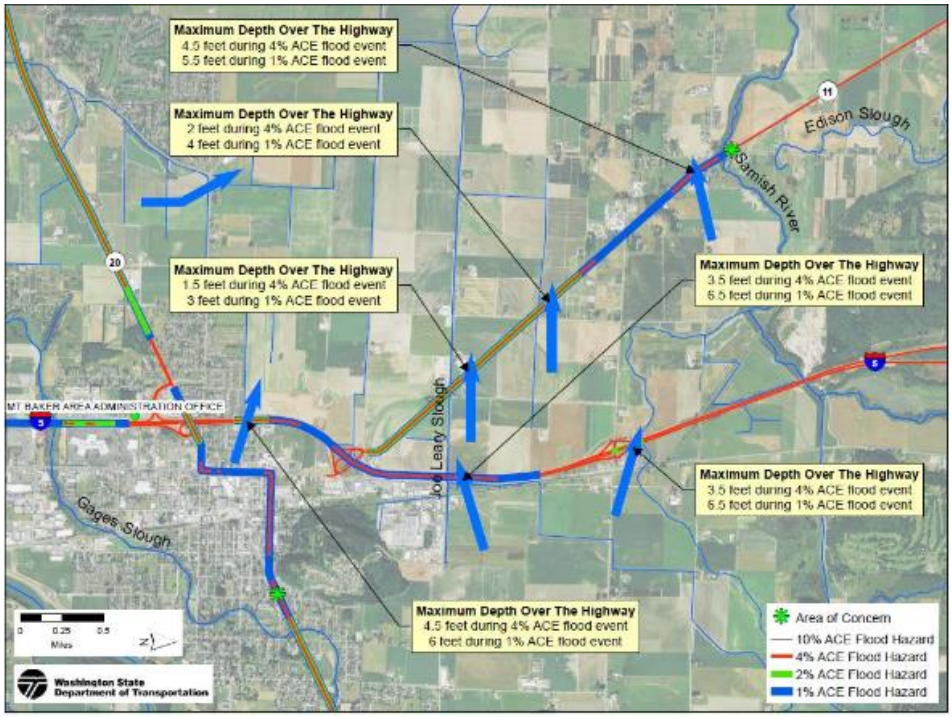


Figure 10 Northern section of WSDOT flood hazard study area showing I-5, SR 20, and SR 11. Arrows indicate flow of water. Note: top of map is west. (WSDOT, 2015).

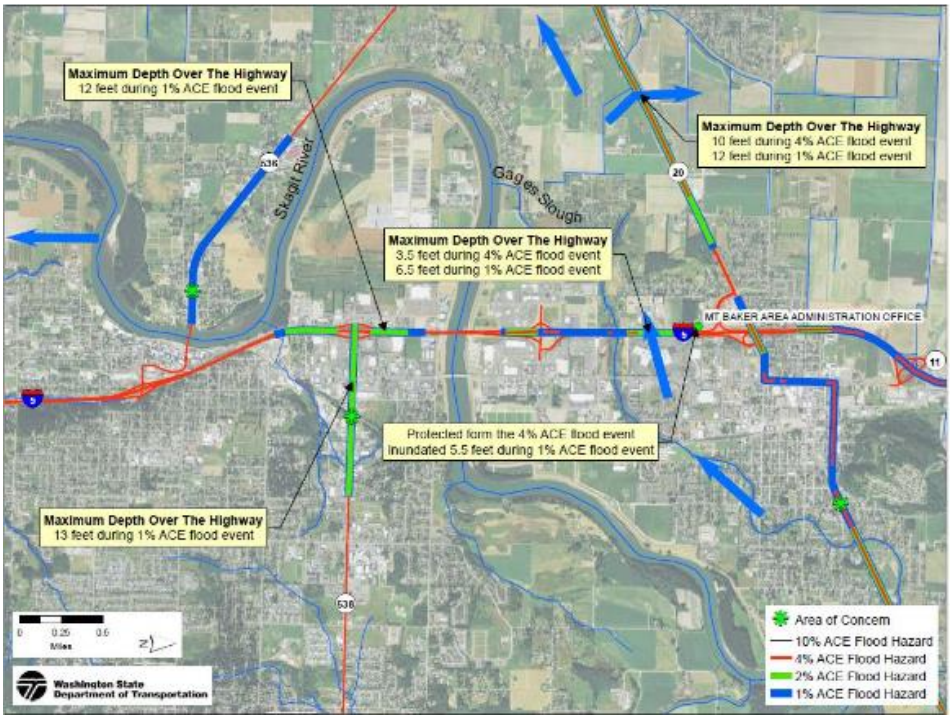


Figure 11 Northern section of WSDOT flood hazard study area just south of previous figure, showing I-5, SR 20, and SR 538. Arrows indicate flow of water. Note: top of map is west. (WSDOT, 2015).

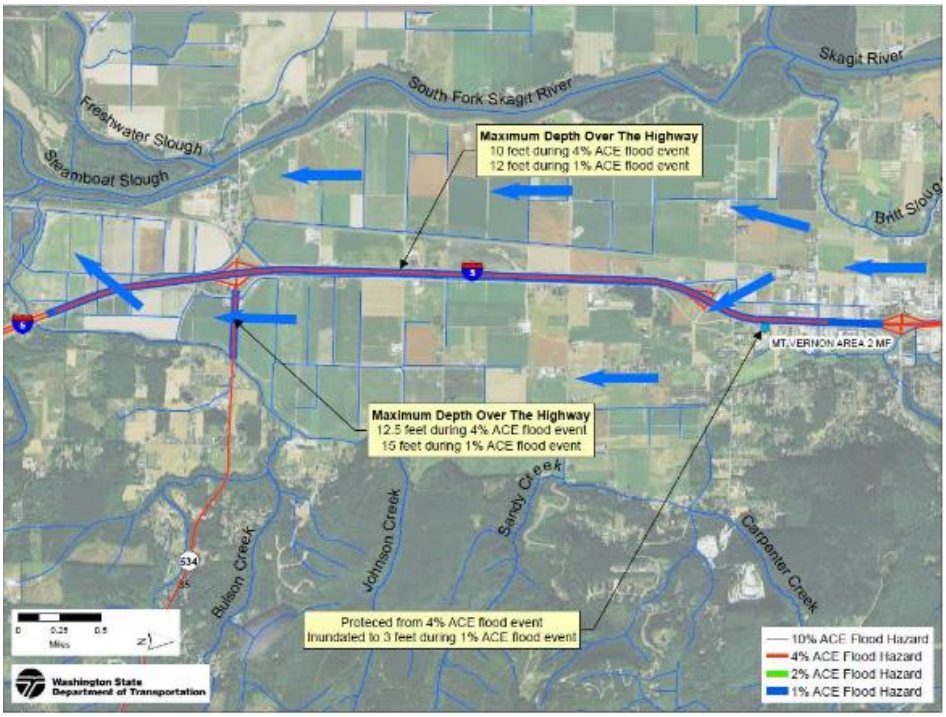


Figure 12 Southern section of WSDOT flood hazard study area, south of Mount Vernon, showing I-5 and SR 534. Arrows indicate flow of water. Note: top of map is west. (WSDOT, 2015).

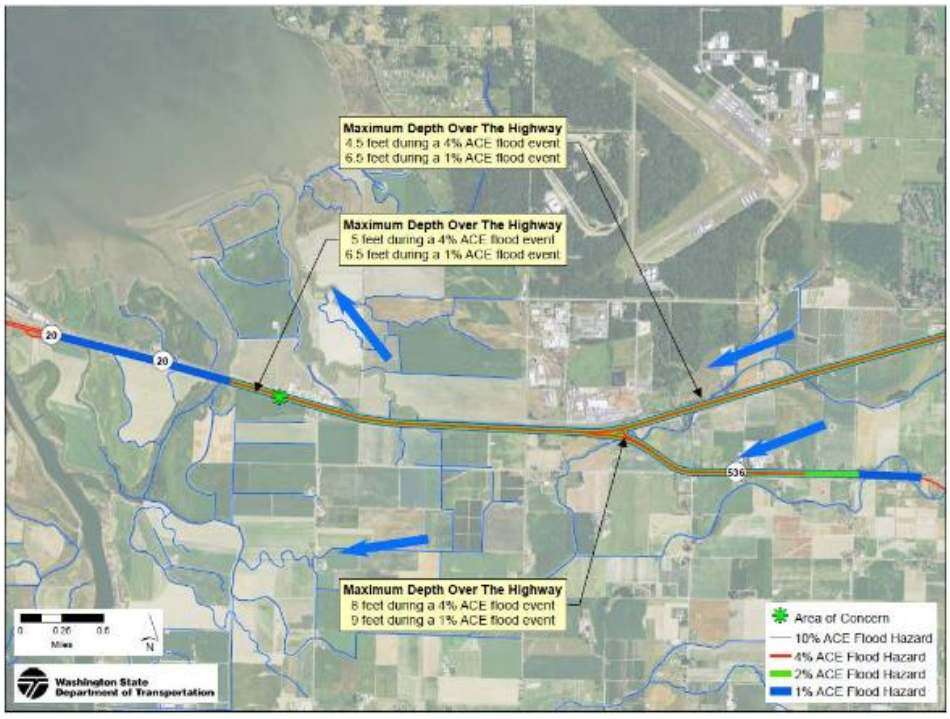


Figure 13 West section of WSDOT flood hazard study area, west of I-5, showing SR 20 and SR 536. Note: Arrows indicate flow of water. (WSDOT, 2015).

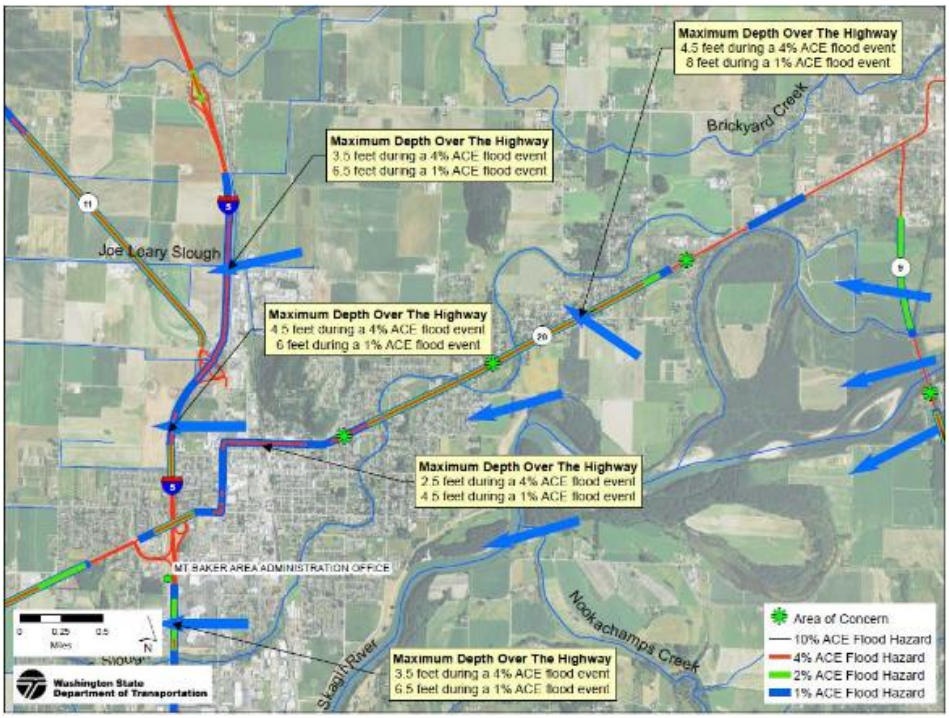


Figure 14 East section of WSDOT flood hazard study area, east of Burlington, including SR 538, SR 9, SR 20, and I-5. Note: Arrows indicate flow of water. (WSDOT, 2015).

5.3.2.2 Roads: Local

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Roads: Local	Medium	Low	Medium-high

Local roads in Skagit County will face similar threats from climate change as highways. Riverine flooding will be a major threat in the future with the potential to close or restrict access to significant portions of Skagit County roadways during a single extreme precipitation event. Additionally, as sea levels continue to rise, many low-lying local roads will be periodically inaccessible during MHHW.

Further, many local roads are some combination of lower elevation and less protected by dikes than their highway counterparts, meaning less severe storm events will have a greater impact on these infrastructure assets. Because of this, some local roads will be subjected to higher levels of weathering and weather-related damage including erosion and heat related buckling.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Inundation of roadways due to coastal or riverine flooding. (Direct)	Mid-century	Semi-annually	By mid-century, coastal flooding will be semi-regular, especially in winter, and many low-lying coastal roads in Skagit County will experience temporary inundation. By 2100, flooding will be near daily during MHHW tide, and severe when combined with winter storms. Similarly, riverine flood events will become increasingly frequent and severe. 10-year floods of today will become 1-year floods, leading to temporary road closures and access disruptions.
Increased incidence of wildfire that could cause temporary road closures. (Direct)	Mid-century	Uncommon	As temperature increases and summer precipitation decreases around the region, the likelihood of wildfire will increase. However, the likelihood of wildfire impacting transportation will remain low.
Erosion of bridge footings from high tides or storm surge. (Direct)	Mid-century	Increasing as century progresses	Climate change related storm surge and flooding will likely cause a small amount of additional erosion of bridge footings by mid-century, but the more severe impacts will likely occur closer to the end of century.
Accelerated damage to roads from extreme heat events and flooding. (Direct)	Mid-century	Increasing as century progresses	Temperature and flooding will put additional stress on roadways, leading to premature failure and increased maintenance costs.

5.3.2.3 Public Transportation

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Public Transportation	High	Medium	Medium-high

Public transportation in Skagit County relies on open and hazard free roadways. Any climate change related events that impact roadways will reduce public transportation operational ability.

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Service disruption due to floods, extreme weather, etc.	Mid-century	Semi-annually	Roadway closures will certainly impact public transportation, either causing temporary route closures or alternate route use. This will affect dikes, pumping stations and other transportation infrastructure. For more information refer to sections 5.3.2.1 Roads: State Highways and Interstate 5 and 5.3.2.2 Roads: Local.

5.3.2.4 Marine Transportation

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Marine Transportation	High	Medium	Medium-high

Samish Traditional Territory includes a number of islands in the Salish Sea. Samish members live throughout the San Juan Islands and on Vancouver Island. Samish members rely on the Washington State Ferries, Skagit County Ferry, and BC Ferries and personal watercraft to travel to and from home and to access important sites and traditional use resources.

According to Washington State Department of Transportation, the State managed northern ferry terminals are threatened by future climate change via sea level rise and storm surge. However, they do not expect these terminals to be vulnerable to less than 2 feet of SLR.[10]

Boat launches in the area will be impacted by climate change. In particular, the small boat launch at Fidalgo Bay Resort is routinely covered by sediment and debris during winter storms and king tides. As SLR increases, this and other boat launches will face additional challenges and damage from sediment deposited during these king tides and storm surge.

[10] Washington State Department of Transportation. 2015. Creating a Resilient Transportation Network in Skagit County: Using Flood Studies to Inform Transportation Asset Management. Retrieved from: http://www.wsdot.wa.gov/publications/fulltext/design/Skagit_County_Report_Appendices.pdf

Potential Impacts/Hazards	Estimated Time Frame	Estimated Occurrence Interval	Description
Service disruption or damage from extreme weather events	Mid-century	5-10 years	Storm surge, SLR, and other extreme weather events could damage terminal facilities, causing temporary service disruptions.
Access limitations due to regional flooding and road closures	Mid-century	Semi-annually	As with other public transit, road closures in Skagit County will impact ferry operations, and riders' ability to access terminals. For more information refer to sections 5.3.2.1 Roads: State Highways and Interstate 5 and 5.3.2.2 Roads: Local.

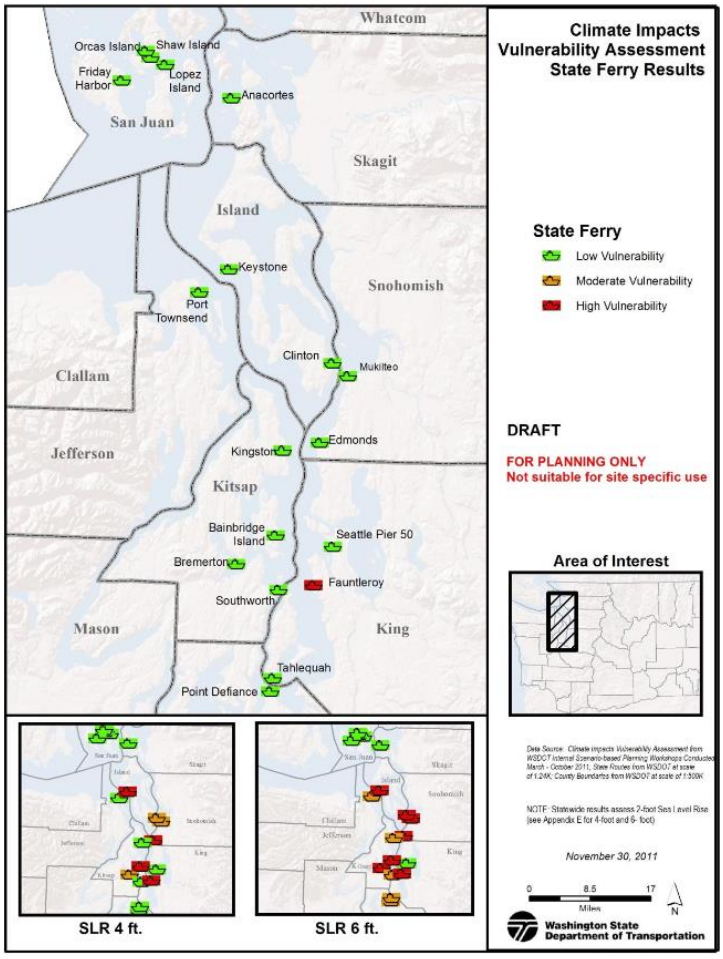


Figure 15 Climate vulnerability of ferry facilities. (WSDOT, 2011).

5.3.3 Community Planning and Utilities

5.3.3.1 Floodplain Infrastructure

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Floodplain Infrastructure	High	Low	High

Floodplain infrastructure in Skagit County is managed by a number of dike districts, all of which are likely to face more challenges and stress in the future. More intense precipitation events will cause more frequent floods, especially river floods. From the coast, sea level rise will lead to higher tides that will push up the Skagit River, as well as additional storm surge and coastal flooding. Additionally, sea level rise will raise the Skagit valley water table leading to groundwater seepage and flooding. This issue will require more thorough study to determine the necessary floodplain infrastructure installation.

Potential adaptation strategies:

- Work with Skagit County to advocate for dike maintenance and improvement where appropriate.

5.3.3.2 Freshwater

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Freshwater – Skagit County	High	Low	High
Freshwater – San Juan County	High	Low	High

The majority of freshwater resources in Skagit County come from the Skagit River. This critical water source will face a variety of challenges as climate change progresses. Reduced snowpack and earlier melt will stress water availability, especially in late summer. Extreme precipitation events will increasingly wash surface contaminants into the Skagit and other bodies of freshwater, potentially contaminating these sources. Further, extreme weather events may stress or damage water treatment plants or contaminate potable water. For community members that rely on groundwater for their freshwater supply, the biggest future threat involved is sea level rise which may contaminate groundwater sources and affect salmon migration

patterns as the state's population, and need for water sources, grows and freshwater sources become scarcer.

In the San Juan Islands, users rely on wells to supply groundwater, overseen by San Juan County. Like Skagit groundwater users, wells in San Juan County are susceptible to salt water intrusion which will increasingly contaminant groundwater sources as sea level continues to rise.

Potential adaptation strategies:

- Work with regional water management agencies to convey climate concerns and advocate for climate resiliency upgrades.

5.3.3.3 Wastewater and Sanitary Sewer System

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Wastewater and Sanitary Sewer System – Skagit County	High	Low	High
Wastewater and Sanitary Sewer System – San Juan County	Medium	Low	Medium-high

The wastewater and sanitary sewer system serving the areas surrounding Samish Indian Nation administration buildings are managed by Skagit County, and the Cities of Anacortes, Burlington, and Mount Vernon. Wastewater and sewage in the nearby San Juan Islands are regulated by San Juan County.

A combination of wastewater treatment plant facilities and on-site septic systems are used in both Skagit and San Juan Counties. Our analysis concluded that treatment plant facilities in San Juan County are not likely vulnerable to impacts from future climate change, while some facilities in Skagit County are vulnerable to climate impacts, including;

- Inundation/backup of treatment systems from higher tides and/or storm surge;
- Increasing inflow and infiltration into the sanitary sewer collection system from increasing groundwater table, caused by SLR in areas that are tidally influenced;
- Rainwater inflow and infiltration entering and overloading the system during heavy rain events;
- Damage caused by flood events;

Septic systems in both counties will also face several challenges and threats from climate change.

- Sea level rise and extreme rain events may lead to septic system overload and failures.
- Current septic system designs are vulnerable to saltwater intrusion.

Potential adaptation strategies:

- Work with regional wastewater management agencies to advocate for climate resiliency upgrades.

5.3.3.4 Electricity

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Electricity	Medium	Low	Medium-high

The Climate Impacts Group 2009 report *Washington Climate Change Impacts Assessment* found that by 2080, Washington's demand for cooling energy alone may be 11 to 20 times higher than demand in the 1980s, depending on the emissions scenario, population growth, and air conditioning market penetration rates (CIG 2009). The assessment also found that, while heating energy demand would likely fall significantly under a warming climate, population growth could more than offset this effect, leading to increased energy demand for both heating and cooling (CIG 2009). Further, changing temperature and precipitation regimes will alter hydropower production patterns and availability, as well as increase wildfire risk which has the potential to damage electricity transmission infrastructure.

Potential adaptation strategies:

- Install systems that allow buildings to operate off-grid in case of power outages, such as microgrids, generator or battery storage, or renewable energy.

5.4 Natural Environment

Samish people have been stewards of the environment in the San Juan Archipelago for hundreds of generations. As ocean people, Samish culture and traditions are intimately tied to resources and places in the Salish Sea. There is a common phrase said among Samish and other Coast Salish People: "When the tide is out, the table is set!"

There is not a single beach in Samish Traditional Territory that has not seen the footprints of the ancestors. Honoring traditional ways while preserving cultural use materials and foods for future generations is a cornerstone that guides the work of Samish DNR.

Key Concerns:

1. *Wetland areas are perhaps the most climate-vulnerable habitat areas in this region. Species that rely on wetlands in any capacity will be impacted by climate change and will be a management priority in the future.*
2. *Over half of the species evaluated in this project were found to be vulnerable to future climate change.*
3. *Species with smaller range extents were generally found to be more vulnerable than others.*

5.4.1 Natural Environment Methods

The Climate Resiliency Working Group worked with the Samish Chelángen Department, the Samish Department of Natural Resources, and Samish Tribe members to identify plant and animal species of significant cultural, historical, or ecological importance. Through this collaboration, 166 plant and animal species were identified and assessed, including 3 amphibians, 34 birds, 26 fishes, 2 fungi, 4 terrestrial invertebrates, 18 aquatic invertebrates, 19 mammals, and 60 plants.

The Natural Environment assessment methods differed slightly from the Human and Built Environment assessments. For this section, staff followed the same general formula of determining sensitivity and adaptive capacity, then using the matrix to calculate vulnerability. However, to get a more thorough understanding of species' sensitivity, staff used a process adapted from the *Climate Change Vulnerability Assessment for the Treaty of Olympia Tribes* (2016) prepared by The Oregon Climate Change Research Institute. Each species was ranked from

1-7 for eight sensitivity factors (below).[11] The sum of these scores were correlated to a low-med-high ranking and inputted into the matrix to determine vulnerability.

1) **Generalist or specialist** – Rank the degree to which a species is a generalist (low sensitivity) or a specialist (high sensitivity), and identify which of the following factors make the species more of a specialist: predator-prey relationships, foraging dependencies, seed-dispersal dependencies, host plant dependencies, phenological dependencies, pollinator dependencies, or others.
2) **Aspects of physiology** – CC can affect the chemical/physical function of species, and some can tolerate less change than others. If applicable, rank species from low to high on how physiologically sensitive they are to climate and climate-change related factors and identify which factors contribute to this sensitivity: temp, precipitation, salinity, pH, CO2, dissolved oxygen, etc.
3) **Life-history characteristics** – The timing and magnitude of growth, reproduction, and mortality of a species influences its sensitivity to climate change. Rank species on a scale of being more r-selected (low sensitivity), meaning species with many offspring and a short generation time, to more k-selected (high sensitivity), meaning species with few offspring, high parental investment, and potentially longer generation time.
4) **Depends on sensitive habitats** – Sensitive habitats include coastal lowlands, some marshes, estuaries, beaches, seasonal streams, wetlands and vernal pools, seeps and springs, alpine and subalpine areas, grasslands and balds, rocky intertidal zones, ecotones, or others deemed to be sensitive.
5) **Dispersal distances and the presence of barriers** – The capability of a species to move across the landscape will likely affect its ability to respond to climate change and thus contribute to its overall sensitivity.
6) **Dependence on disturbance regimes** – Changes in intensity and frequency of disturbances will likely affect some species more than other. Rank species on how sensitive they are to one or more disturbance regimes, from not sensitive to the nature of any disturbance regime (1) to highly sensitive to the nature of one or more disturbance regimes (7).
7) **Climate-dependent ecological relationships** – Species that have ecological relationships that may be altered in the face of climate change will likely be more sensitive than those species that do not. If applicable, identify relationships such as forage, predator-prey, habitat, hydrological, competition, or others and identify what

[11] Dalton, M. (2016). *Climate Change Vulnerability Assessment for the Treaty of Olympia Tribes.* Retrieved from: https://quileutenation.org/wp-content/uploads/2017/02/Climate_Change_Vulnerablity_Assessment_for_the_Treaty_of_Olympia_Tribes.pdf

climate and climate-driven changes in the environment affect these, such as temp, precipitation, salinity, pH, CO2, etc. Then rank the species' ecological relationships on how sensitive they are to the effects of climate change.

8) **Interacting non-climatic stressors** – A species' sensitivity can be affected by pre-existing stressors or threats, (i.e. habitat loss). Identify non-climate threats, such as habitat loss or degradation, invasive species, direct human conflict (i.e. overharvest), pollution, etc.

During this portion of the assessment, Samish DNR staff defined 18 habitat types; 7 terrestrial habitats, 5 marine habitats, and 6 freshwater habitats. While assessing each species' vulnerability, DNR staff listed the habitat types used by that species. This was used to determine the number of species included in our assessment that are served by each of these 18 habitat types, with an end-goal to identify what habitat types serve the greatest number of vulnerable species.

The Working Group and Samish DNR agreed that with limited funds, the best approach to climate change resiliency planning for the natural environment is a "bang for our buck" method which will focus on habitat-based resiliency projects which will serve the highest number of medium-vulnerability to high-vulnerability species.

5.4.2 Natural Environment Results

This assessment found 29 of 166 species to be highly vulnerable to the impacts of climate change by the end of the century, highlighted by Figure 16. 105 species, or nearly two thirds of those evaluated, were determined to be between medium to highly vulnerable to current and future climate change impacts.

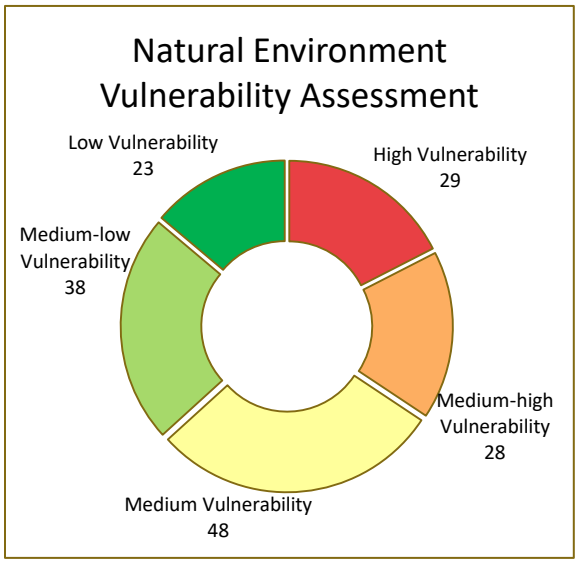


Figure 16 Natural Environment Vulnerability Assessment results: Number of species by vulnerability level.

To assist with future prioritization of natural resource climate adaptation projects, staff listed what habitat areas each of the assessed species commonly utilize, then determined the number of vulnerable species served by each of these key habitat areas (Figure 17). This will help inform future climate adaptation and habitat management project design to achieve

the best value for money results by targeting habitat areas that serve the largest number of vulnerable species.

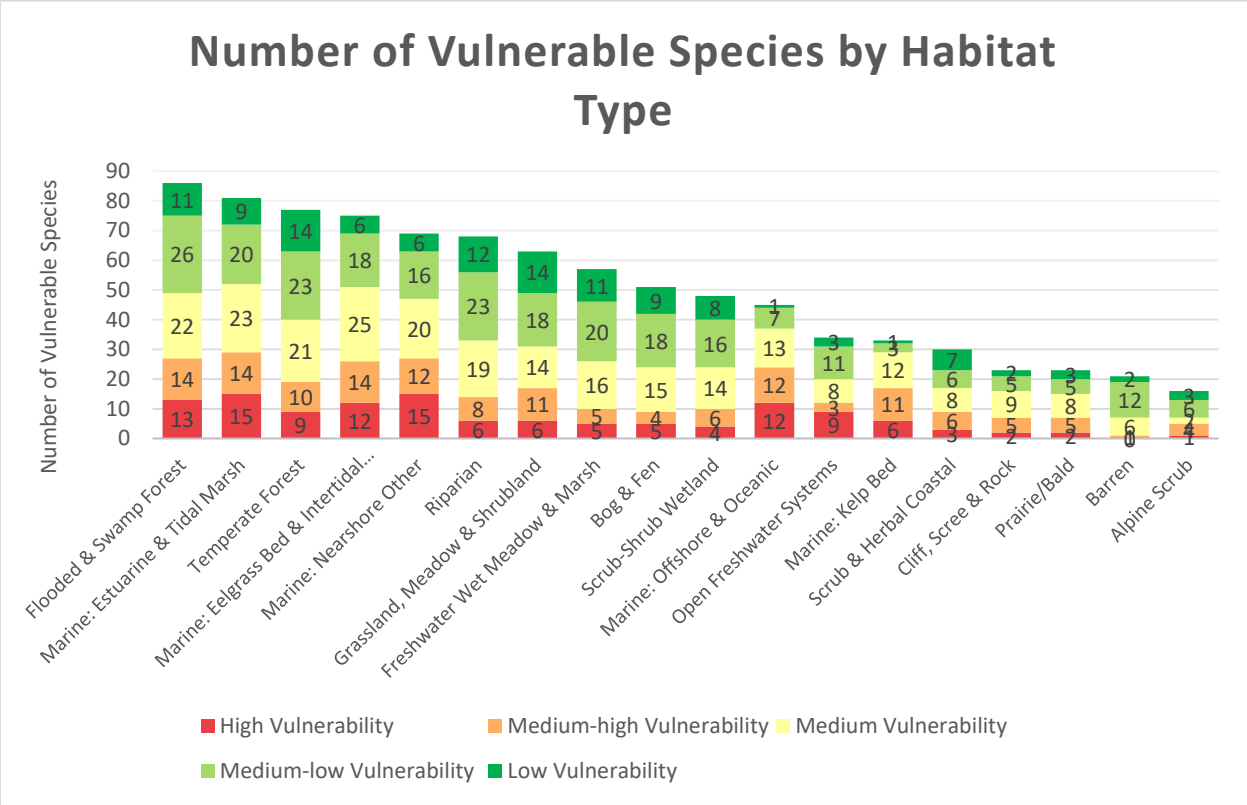


Figure 17 Number of vulnerable species served by each major local habitat area. Note: many species use multiple habitat areas and are therefore listed under multiple habitats in this chart.

5.4.3 Amphibians and Snakes

Three species of amphibians and one Snake were included in the vulnerability assessment, all of which were found to be highly vulnerable to impacts generated by a changing climate due to their low adaptive capacity, the consequence of impacts to their populations, and the probability that these impacts will occur in upcoming decades.

Impacts that will drastically affect the populations of these three species include habitat changes brought upon by rising sea levels, lake and wetland temperature rise that will affect the spawning viability of these shallow bodies of water. Changes in the insects, disease patterns and invasive species populations within the habitat will also have a negative effect on the populations. Drier summers will also reduce air quality and increase wildfire and drought risks throughout the region. All these impacts represent an increase in the vulnerability of these species. The species,

named below, were given their high sensitivity and vulnerability ranking due to their inability to adapt to a changing climate.

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Oregon spotted frog	High (51)	Low	High
Salamander	High (49)	Low	High
Rough-Skinned Newt	High (48)	Low	High
Garter snake	High (43)	Low	High

Potential Impact/Hazard	Estimated Time Frame	Description
Weakened viability due to habitat changes shallows, estuaries	Mid-century	Increasing temperatures and changing precipitation patterns will put additional stress on amphibian habitat, including vegetation and streamflow patterns.
Increasing inundation of wetlands, low elevation riparian habitat, and estuaries	Mid- century	Rising sea levels will inundate previously shallow regions around Samish historical territory.
Lake and wetland temperature rise	Ongoing & Continuous	Rising average global temperatures are causing lake and wetland temperatures to rise, and consequently causing changes in habitat that negatively impact spawning habitat for the three amphibian species included in the VA. Temperature rise could also affect larvae hatching due to lower DO content in spawning habitats.
Seasonality shifts		Seasonality shifts will cause earlier spawning for the species in our VA as earlier annual warming in the region becomes more frequent.
Insect, disease and invasive species	Unknown	Increasing temperatures and precipitation will cause seasonality shifts that affect amphibian spawning profiles. This issue can lead to exposure to new insects, diseases and invasive species issues as climate patterns shift and regional ecosystem profiles change.
Wildfire Risk	Mid- century	Changing precipitation patterns and rising temperatures will lead to drier, hotter summers. The consequent wildfire risk increase could majorly impact species living in forested habitat.

Drought Risk	Mid-century	Changing precipitation patterns and rising temperatures will lead to drier hotter summers. Combine this with less glacial accumulation during the winter, and it will lead to an increase in late summer drought risks.

Potential adaptation strategies:

- Continue partnering with regional groups on population monitoring projects to understand needs going forward.
- Habitat restoration or creation projects.

5.4.4 Birds

34 species of birds were evaluated, including raptors, waterfowl, and others. Of those 34, we identified a variety of climate change impacts that will negatively affect the bird populations throughout their habitat within Samish traditional territory. While none of the bird species identified were placed into the high vulnerability category, there are still 8 species that, due to a combination of their low adaptive capacity and high consequence and probability of impact, were placed into the high planning priority category.

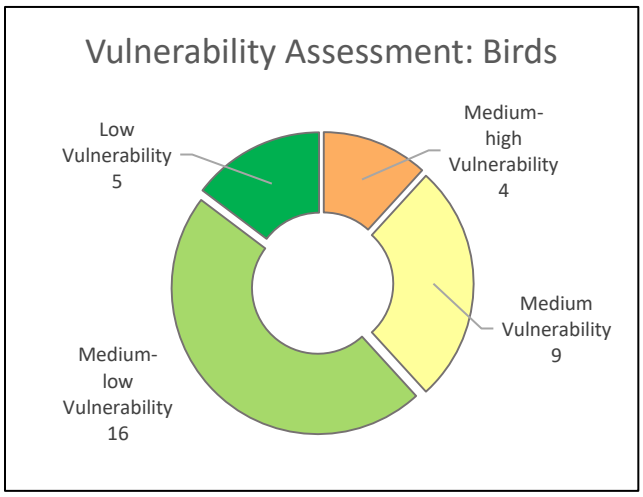


Figure 18 Vulnerability Assessment results: birds

Potential impacts include changing migration patterns due to an increase in surface air temperatures. Warming temperatures and changes in seasonality will cause birds to change the latitude at which they winter, as well as the temperature cues that birds use to time their migration patterns. As climate change impacts become more dramatic, Washington state will experience a longer spring and summer, while simultaneously experiencing shorter winters. This has the effect of pushing non-indigenous insects, diseases and birds into local habitats; as well as causing an increase in wildfire and drought risk throughout the region due to less snowfall accumulation during the winter. All these impacts have the effect of stressing the existing, indigenous bird populations. For bird species reliant on marine food sources, climate change represents an immediate threat to their survival due to ocean acidification, temperature rise,

and- in the case of birds who feed in estuaries and shallows- sea level rise and inundation of shallow areas throughout the region.

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
American crow	Low (22)	High	Low
Bald Eagle	High (41.5)	Medium	Medium-high
Red-Tailed Hawk	Medium (36.5)	Medium	Medium
Cooper's Hawk	Medium (38.5)	Medium	Medium
Rufous Hummingbird	Low (23)	Medium	Medium-low
Common Loon	Medium (29)	Medium	Medium
Northern harrier	Medium (36.5)	Medium	Medium
Western Screech-Owl	Medium (39.5)	Medium	Medium
Barn Owl	Medium (29)	High	Medium-low
Snowy Owl	Medium (40)	Medium	Medium
Northern Saw-whet Owl	Medium (29)	High	Medium-low
Peregrine falcon	Medium (36.5)	Medium	Medium
Band-tailed Pigeon	Medium (25)	High	Medium-low
California Quail	Medium (35)	Low	Medium-high
Common Raven	Medium (25)	High	Medium-low
Red-winged blackbird	Low (23)	High	Low
Swainson thrush	Low (23)	High	Low
Swallow	Low (23)	High	Low
Turkey vulture	Medium (25)	High	Medium-low
Western Grebe	Medium (29)	Medium	Medium
Mallard	Medium (29)	High	Medium-low
American Wigeon	Medium (29)	High	Medium-low
Western gull	Medium (36.5)	Low	Medium-high
Blue-winged Teal	Medium (29)	High	Medium-low
Cinnamon Teal	Medium (29)	High	Medium-low
Green-winged Teal	Medium (29)	High	Medium-low
Northern Pintail	Medium (29)	High	Medium-low
Ruffed Grouse	Medium (35)	Low	Medium-high
Horned Grebe	Medium (37)	Medium	Medium
Ruddy Duck	Medium (35)	High	Medium-low
Greater Scaup	Medium (29)	High	Medium-low
Trumpeter Swan	Medium (37)	High	Medium-low
Canada Goose	Low (23)	High	Low
Great Blue Heron	Medium (29)	High	Medium-low

Potential Impacts/Hazards	Estimated Time Frame	Description
Air quality	Ongoing	Air quality reductions will have a direct impact on the general health of bird species throughout the region.
Insect, Disease, and Invasive Species	Mid-Century	Increasing temperatures and precipitation will lead to more insect, disease and invasive species issues as climate patterns shift. Non-indigenous species that previously didn't inhabit the region will soon become more common.
Drought Risk	Mid Century	Changing precipitation patterns and rising temperatures will lead to drier, hotter summers. Combine this with less snowfall accumulation during the winter, and it will lead to an increase in late summer drought risks throughout the region.
Wildfire risk	Mid-Century	Rising average global temperatures is causing lake and wetland temperatures to rise, and negatively impact important habitat areas.
Seasonality shifts	Mid-century	Changes in seasonality will affect migration patterns of many bird species. Earlier springs and later winters will change the migration timing.
Surface air temperature rise	Ongoing	Increasing temperatures and changing precipitation patterns will put additional stress on highly sensitive habitat.
Ocean Acidification	Ongoing	Ocean acidification will affect bird species that rely on marine food sources. Food scarcity due to the effects of ocean acidification will be an added stressor to current bird populations in the region.
Sea Temperature Rise	Mid-century	Changing precipitation patterns and rising temperatures will lead to drier, hotter summers. The consequent wildfire risk increase could majorly impact bird living in heavily forested habitat.
Sea Level Rise	Mid-century	Sea level rise will impact coastal resources that birds rely on for food and nesting habitat, as well as inundate previously shallow estuaries where some bird species would feed.

Potential adaptation strategies:

- Explore habitat restoration projects aimed at nesting areas or boosting populations of prey species.

5.4.5 Fishes

26 fish species were included in this assessment, including freshwater and marine species. Of the 26 species that were evaluated, 19 were ranked between medium and high vulnerability.

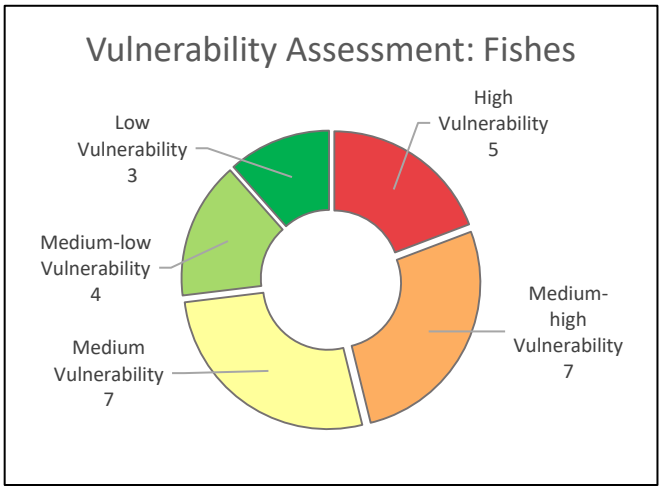


Figure 19 Vulnerability Assessment results: fishes

Most of the fish species staff analyzed will face an array of threats from climate change in the near to distant future.

Hydrologic changes include higher average air temperatures, higher summer water temperatures as well as more frequent harmful algal blooms. As a consequence of these environmental changes, rivers will experience lower dissolved oxygen levels, reduced streamflow in mid-late summer due to reductions in winter snowpack, increased streamflow in winter that can wash out salmon redds or flush returning salmon back to sea, ocean acidification from increasing CO2 concentrations in the atmosphere, and finally sea level rise that will change the environmental profile of coastal habitat across the region.

Salmon species are the most highly threatened of all fish included in this assessment. Because they are a freshwater/saltwater species, they will experience all the above climate impacts at different stages of their life cycles.

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Bay pipefish	Medium (38)	Medium	Medium
Broadnose Seven-gill shark	Low (12)	High	Low
Bull trout	High (53)	Medium	Medium-high
Chinook (king)	High (54)	Low	High
Chum (dog)	High (45)	Medium	Medium-high
Cod	Medium (25)	Low	Medium-high
Coho (silver)	High (50)	Low	High
Cutthroat trout	High (50)	Low	High
Flounder	Medium (26)	Medium	Medium
Halibut	Low (22)	Medium	Medium-low
North Pacific Spiny Dogfish	Low (19)	High	Low
Pacific hake	Low (23)	Medium	Medium-low
Pacific herring	High (47)	Medium	Medium-high
Pacific sand lance	High (48)	Medium	Medium-high

Pacific sardine	Medium (29	Medium	Medium
Pink (humpback)	High (47)	Low	High
Sablefish	Low (22)	Medium	Medium-low
Sculpin/bullhead	Medium (25)	High	Medium-low
Shiner perch	Medium (33)	Medium	Medium
Snapper/rockfish	Medium (35)	Low	Medium-high
Sockeye (red)	High (51)	Low	High
Sole	Medium (27)	Medium	Medium
Steelhead	High (53)	Medium	Medium-high
Sturgeon	Medium (36)	Medium	Medium
Surf smelt	High (49)	High	Medium
Three-spine stickleback	Low (20)	High	Low

Potential Impacts/Hazards	Estimated Time Frame	Description
Increased ocean and stream temperatures	Mid-century	Increasing water temperature throughout the region is stressing current fish populations by reducing the amount of DO in the water, thus negatively impacting fish respiration and stressing salmon fry.
Seasonality shifts	Mid-century	Changing seasonal climate patterns are changing stream flow patterns, snowfall accumulation, and spring snowmelt patterns. This has the effect of causing less streamflow late in the summer which negatively affects returning salmon migration patterns.
Less winter snowfall and reduced snowpack/glacial melt	Mid-century	Warming temperatures are causing less snow accumulation during winter, and in an area that is so reliant on glacial snowmelt, lessening late summer streamflow will increase drought risks.
Earlier spring run off	Mid-century	Warmer temperatures will cause spring to come earlier in the year, and less precipitation falling as snow can cause flooding issues. For fish populations, the earlier spring runoff has the effect of changing how fish spawning and migration occurs throughout heavily affected streams.
Lower summer stream flows	Mid-century	Less snow accumulation during the winter means that snow fed rivers throughout the region will experience low flow during the mid to late summer. Fish populations will experience changes in streamflow patterns that could impact the spawning habits of fish species
Bank erosion into spawning stream habitat	Ongoing	Higher, faster streamflow during wetter months will lead to sedimentation in critical spawning habitat. This fine sediment fills

		spaces between gravel and reduces oxygen access for fish eggs that may get stuck under the sediments.
Ocean Acidification	Ongoing	Our current energy models, the use of fossil fuels and the land use models in place, are causing the ocean to absorb more co2 from the atmosphere. This increase in co2 levels is leading to changes in fish ability to detect threats. Studies show salmon sense of smell is harmed due to changes in the acidity of the ocean.
Sea level rise, extreme flooding, estuary erosion	Late century	Sea level rise is affecting spawning habitat for fish species. Coastal erosion and changing habitats will put stress on at-risk fish populations throughout the region.

Potential adaptation strategies:

- Explore opportunities to develop habitat restoration projects.
- Continue monitoring important habitat areas, including eelgrass and kelp beds.
- Lobby for policy that would benefit fish species.

5.4.6 Fungi

There are several fungi and lichen species that are historically important to Samish culture. Primary concerns about fungi, and how they'll fare as the climate changes, are related to changes in seasonality, precipitation changes and changes in temperature, as well as the human caused stressors that will exacerbate climate change conditions such as agricultural runoff.

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Fungi	High (45)	Medium	Medium-high
Lichen	Medium (39)	High	Medium-low

Potential Impacts/Hazards	Estimated Time Frame	Description
Seasonality shifts	Mid-Century	Changes in seasonality, due to changing temperatures, will affect the growth and reproduction patterns of fungi.

Lower summer stream flows	Mid-Century	As winter snowpack and steady stream flows decrease, fungi that rely on consistent moisture will be stressed by changing water quantities.
Changing precipitation patterns	Ongoing	Fungi that rely on specific precipitation patterns to survive will be put under stress as rain and snowfall patterns change.
Increasing temperatures	Ongoing	Fungal species that rely on specific temperature and humidity will be stressed as temperatures increase over the course of the next century.
Agricultural runoff	Ongoing	Nitrogen pollution from agricultural runoff represents an anthropogenic stressor to fungi throughout the region. Climate change will exacerbate the impacts that existing stressors already have on these natural systems.

Potential adaptation strategies:

- Monitor changes in species populations over time.
- Protect and restore habitat areas.

5.4.7 Terrestrial Invertebrates

Our vulnerability assessment analyzed the effects that climate change will have on terrestrial invertebrates. Staff assessed three bee species. The impacts staff identified in the vulnerability assessment were focused primarily on changes in precipitation, seasonality and temperature.

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Honey bee	Medium (38)	Medium	Medium
Mason bee	Medium (40)	Medium	Medium
Bumble bee	Medium (39)	Medium	Medium

Potential Impacts/Hazards	Estimated Time Frame	Description
Seasonality shifts	Mid-Century	Changes in seasonality will cause bee species to mistime the coming of spring. This can lead to a longer flowering season that ultimately leads to more days with poor flower availability, thus causing food shortages for bees.

Lower summer stream flows	Mid-Century	Drier summers means fewer flowering plants, thus food sources will be negatively impacted as water scarcity become more common in the region.
Changing precipitation patterns	Ongoing	The region will experience larger fluctuations in weather as climate change continues. Winters will become warmer and wetter, while summers will get drier and hotter. A side effect of this change will be that bees, which rely on certain annual precipitation pattern to determine when to hibernate for winter and when to become active again in the spring, will be put under greater stress.
Increasing temperatures	Ongoing	Increasing temperatures will cause problems at the extremes for the region. Higher temperatures mean that foraging capabilities during hot months will be stressed due to issues related to the heating and cooling capability of terrestrial invertebrates.
Drought risk	Mid-Century	Drought during late summer would have the effect of limiting plant growth, and thus limit the amount of pollen that the bee species have access to for food.
Flood Risk	Mid-Century	Increasing precipitation will lead to more flooding in the region. This could put stress on already heavily impacted bee populations.
Wildfire Risk	Mid-Century	Drier summers will lead to higher wildfire risk, with invertebrates being heavily impacted in areas that are most at risk to wildfire.
Air quality	Ongoing	Air quality issues will affect bees' ability to forage for food. Studies show that, as air quality decreases, bees' ability to forage for food goes down due to an inability to detect food sources at previously functional ranges. (Penn State, 2016)
Insect, disease and invasive species	Unknown	Changes in climate will lead to increased exposure to insects, diseases and invasive species that aren't indigenous to western Washington.
Agricultural runoff/Pollution	Ongoing	Agricultural runoff is often full of pesticides used for productive farming practices and, when consumed by bees, will cause large bee populations to die off.

Potential adaptation strategies:

- Explore habitat restoration opportunities.
- Fund apiaries to boost bee populations as well as environmental services associated with pollination.

5.4.8 Aquatic Invertebrates

This vulnerability assessment included 18 different culturally important aquatic invertebrate species. Over half of these aquatic invertebrates will be significantly vulnerable to future climate change, based on staff findings. The primary concerns for these species include changes to precipitation, storm frequency and intensity, sea level rise, increasing temperature, flooding and increased disease and invasive species issues due to the temperature changes that are going to become more impactful as climate change continues. The common denominator for the highest vulnerability species in this category is their physiology. Of the 5 high vulnerability species, all 5 of them are shelled invertebrates with little adaptation or migration capability.

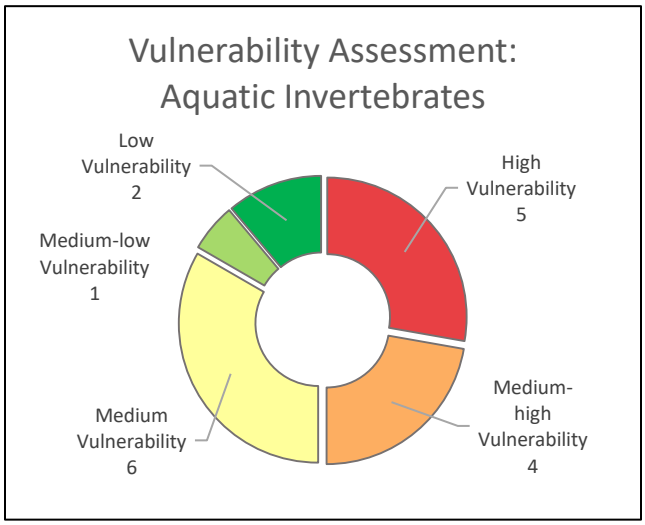


Figure 20 Vulnerability Assessment results: aquatic invertebrates

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Abalone	High (48)	Low	High
Chiton/Chinese slipper	Low (21)	High	Low
Clams	High (41)	Low	High
Cockle	High (41)	Low	High
Crab	Medium (36)	Medium	Medium
Crawfish	Low (17)	High	Low
Dentalium	Medium (30)	Low	Medium-high
Mussel	Medium (39)	Low	Medium-high
Mussel (freshwater)	High (42)	Low	High
Octopus	Medium (33)	Medium	Medium
Oyster	High (41)	Low	High
Prawn	Medium (30)	Medium	Medium
Scallop	Medium (37)	Low	Medium-high
Sea anemone	Medium (34)	Medium	Medium
Sea cucumber	Medium (28)	Medium	Medium
Shrimp	Medium (30)	Medium	Medium
Squid	Low (23)	Medium	Medium-low
Urchin	High (43)	Medium	Medium-high

Potential Impacts/Hazards	Estimated Time Frame	Description
Ocean acidification	Mid-Century	Increasing CO2 emissions is causing an increase in the acidity of the ocean, which means a reduction in shelled invertebrate's ability to form their calcium carbonate shells.
Storm frequency and strength	Mid-Century	Increasing precipitation and frequency of extreme weather events means that marine invertebrates, whose habitat is often in high risk near shore or intertidal zones that may be easily scoured by high wind and wave effects.
Changing precipitation patterns	Ongoing	Precipitation can affect the salinity of some of these intertidal areas and estuaries, thus any change in precipitation represents a risk to changing the characteristics and qualities of habitats that are crucial to the species we studied in our vulnerability assessment.
Increasing sea temperatures	Ongoing	Increasing sea temperatures in the region will put stress on local marine invertebrate species that are unable to adapt to dramatic changes in sea temperatures. Consequences of warmer sea temperatures include introduction of invasive species, new diseases, and increased growth of plant and algae which can change the food web for the region.
Runoff/Pollution/water quality	Ongoing	Agricultural and city source runoff represents large stressors to marine invertebrates. Increases in nitrogen or potassium quantities flowing into the sea has a variety of negative consequences, most notably this issue causes "dead zones" to form (dead zones are areas where large algal blooms effectively starve the area of oxygen, thus killing marine invertebrates. This issue, while not specific to climate change, is a consequence of increasing population density near coastal regions.
Flood Risk	Mid-Century	Sea level rise can cause previously low-lying regions to become more flood prone. Marine or intertidal invertebrates that thrive in current habitats, may face stressors related to increased flood events.
Insect, disease and invasive species	Ongoing	Warmer temperatures are associated with increased disease and invasive species issues. The impacts of this could put additional stress on marine invertebrates throughout the region.
Increased surface air temperature	Mid-Century	Increasing surface air temperatures means that species that spend some amount of time out of the water- such as intertidal species are going to be stressed by hotter, drier temperatures than they have historically been faced with.

Potential adaptation strategies:

- Implement nearshore habitat restoration projects.
- Identify beaches where shellfish habitat can migrate up-beach with sea level rise and protect those areas for future habitat migration.
- Recreate Coast Salish clam gardens to maintain shellfish populations.

5.4.9 Mammals

19 mammals, both terrestrial and aquatic, of cultural significance were included in this vulnerability assessment. A primary concern for these species is future change in water regimes that affect flood and drought patterns throughout the region. This change will affect habitat and water availability for mammals that rely on regular seasonal changes in precipitation and ecosystem services. These shifts will affect the feeding and migration habits of many mammals in the region. Increasing temperatures and shifting seasons are leading to shorter hibernation periods for bears; while deer and elk are experiencing expansion of winter habitat due to less snowfall during wet seasons as well as easier survival of young due to warmer summers and longer growing seasons. Reduced snowfall and changing precipitation patterns will allow terrestrial mammals to feed and migrate to higher elevations earlier in the year.

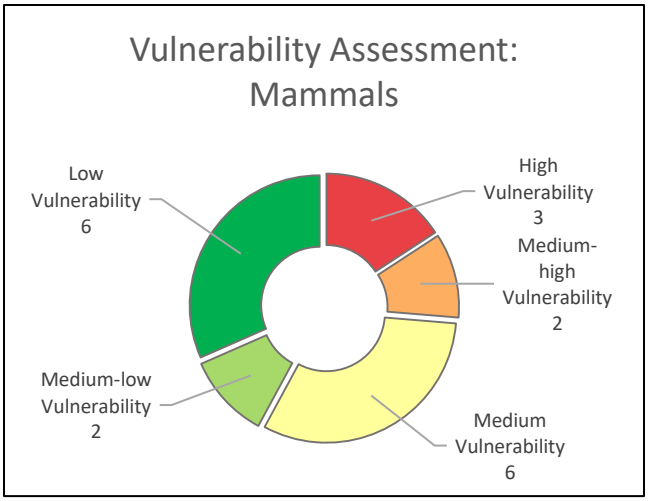


Figure 21 Vulnerability Assessment results: mammals

For aquatic mammals, climate change and direct man-made impacts will have a variety of effects that will cause dramatic changes in feeding and migration patterns. Increasing ocean temperature, acidity, overfishing, disease and invasive species migration will put stress on high risk aquatic and semi-aquatic mammals, such as the orcas, sea otters, and beavers.

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
American beaver	Medium (32)	Medium	Medium
American black bear	Low (19)	high	Low
American mink	Medium (24)	Medium	Medium

Bat	Low (23)	Medium	Medium-low
Black-tailed deer	Low (8)	high	Low
Chipmunk	Low (19)	high	Low
Coyote	Low (12)	High	Low
Elk	Low (12)	high	Low
Gray Wolf	Low (23)	Medium	Medium-low
Grizzly bear	Medium (28)	Low	Medium-high
Long/short-tailed weasel	Low (19)	High	Low
Mountain goat	High (42)	Low	High
North American porcupine	Medium (35)	Medium	Medium
Orca (killer) whale	High (49)	Low	High
River otter	Medium (34)	Medium	Medium
Sea otter	Medium (38)	Low	Medium-high
Seal (harbor)	Medium (37)	Medium	Medium
Snowshoe hare	Medium (27)	Medium	Medium
Squirrel (Douglas)	High (42)	Low	High

Potential Impacts/Hazards	Estimated Time Frame	Description
Ocean acidification	Mid-Century	Increasing CO2 emissions is causing an increase in the acidity of the ocean, which means a reduction in aquatic mammals' ability to feed. Terrestrial mammal species that feed on marine species may also face increased food scarcity as marine animal species struggle to adapt.
Changing precipitation patterns	Ongoing	Shifting precipitation patterns will change where species feed and migrate. Wetter, warmer winters and drier, hotter summers will change how and where mammal species feed and migrate. This will put added stress on already stressed mammal populations.
Flood Risk	Mid-Century	Sea level rise can cause previously low-lying regions to become more flood prone. Mammals whose primary habitat is low elevation will be forced to migrate to higher ground as sea levels rise and flooding occurs with more frequency.
Increasing sea temperatures	Ongoing	Increasing sea temperatures in the region will put stress on local aquatic mammal species that are unable to adapt to dramatic changes in sea temperatures. Consequences of warmer sea temperatures include invasive species, new diseases, and increased growth of plants and algae which can change the food web for the region.

Runoff/Pollution/water quality	Ongoing	Agricultural and city source runoff represents a large stressor to aquatic mammals. Increases in nitrogen or potassium quantities flowing into the sea has a variety of negative consequences, most notably this issue causes "dead zones" to form (dead zones are areas where large algal blooms effectively starve the area of oxygen, thus killing marine species in the area. This issue, while not specific to climate change, is a consequence of increasing population density near coastal regions.
Insect, disease and invasive species	Ongoing	Warmer temperatures are associated with increased disease and invasive species issues. The impacts of this could put additional stress on mammals throughout the region. Previously non-threatening insects or species can, as climate changes, move into new habitats and displace previously thriving mammal species.
Increased surface air temperature	Mid-Century	Increasing surface air temperatures means that extreme summer heat waves will have a much more dramatic impact on mammal species who've historically thrived in current regional temperature conditions.
Drought Risk	Mid-Century	Snowpack reductions during winter will lead to drier summer streams. Water scarcity during dry summer months will put stress on terrestrial mammal populations throughout the region.
Fire Risk	Mid-Century	Increasing fire risk, due to drier summers, will become a threat to terrestrial mammal species throughout the region as climate change impacts continue to increase. Wildfires will force the migration of species who otherwise wouldn't have been forced to move habitats.

Potential adaptation strategies:

- Explore habitat restoration opportunities.
- Advocate for climate-resilient habitat management plans with state partners.

5.4.10 Plants

This vulnerability assessment included 59 plant species of cultural significance to the Samish nation. Staff identified a variety of impacts that will be detrimental to local plant species as climate change continues to occur. Climate change concerns for terrestrial plants in the region include changing precipitation patterns which have the effect of increasing late summer fire and drought risk and bringing new insects, diseases and invasive species to the region. Increasing air

and water temperatures are causing reductions in snowpack, and consequently drier summers as winter snowpack shrinks.

Climate change impacts to aquatic plant species were also identified in our vulnerability assessment. These species are also threatened by non-climate stressors such as urban and agricultural runoff.

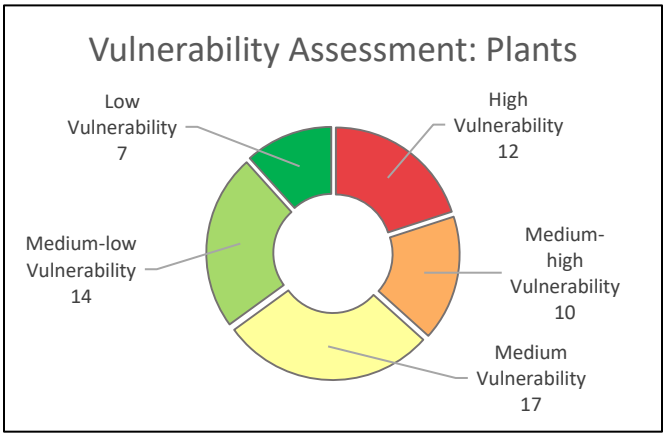


Figure 22 Vulnerability Assessment results: Plants

Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Alaska blueberry	Medium (35)	Medium	Medium
Alder	Low (17)	Medium	Low
American three-square	High (41)	Medium	Medium
Baltic rush	Medium (30)	Medium	Medium
Barestem biscuitroot	High (41)	Low	Medium-high
Bear grass	High (42)	Low	Medium-high
Bearberry	Medium (25)	High	Medium-low
Bent grass	Low (22)	Medium	Medium-low
Black cap	Medium (25)	Medium	Medium
Black Cottonwood	Low (19)	Medium	Medium-low
Blackberry	Low (23)	Medium	Medium-low
Bunchberry	Medium (29)	Medium	Medium
Camas	High (44)	Low	High
Cascara	Medium (27)	Medium	Medium
Cattail	Medium (27)	Medium	Medium
Pineapple weed	Low (9)	High	Low
Cherry	Low (16)	Medium	Medium-low
Chocolate lily	High (42)	Medium	Medium-high
Crab apple	Low (20)	Medium	Medium-low
Currant	Medium (28)	Medium	Medium
Devil's club	High (44)	Low	High
Dogwood	Low (17)	High	Low
Douglas fir	Medium (29)	Medium	Medium
Eelgrass (Wide-blade eelgrass)	High (47)	Low	High
Hazelnut	Low (22)	High	Low
Hemlock	Medium (41)	Medium	Medium-high

Horsetail	Low (10)	High	Low
Huckleberry, thinleaf/mountain/big	Low (23)	Medium	Medium-low
Huckleberry, evergreen	Medium (27)	Medium	Medium
Juniper	Medium (27)	Medium	Medium
Kelp	High (52)	Low	High
Labrador tea	High (43)	Low	Medium-high
Madrona (Pacific Madrone)	High (41)	Low	High
Maple	Medium (29)	Medium	Medium-low
Ocean spray (ironwood)	Low (20)	High	Low
Pickleweed	Medium (35)	Low	Medium-low
Red elderberry	Low (19)	Medium	Medium-low
Rose	Low (19)	High	Low
Salal	Medium (32)	Low	Medium
Salmonberry	Medium (26)	Medium	Medium
Seabeach sandwort	High (51)	Low	High
Seashore saltgrass	Medium (28)	High	Medium-low
Seaweed	High (51)	Low	High
Serviceberry	Medium (40)	Low	Medium-high
Silverweed	High (41)	Low	High
Skunk cabbage	Medium (40)	Low	Medium-high
Soapberry (Buffalo berry)	High (47)	Low	High
Spruce	Medium (39)	Low	Medium-high
Stinging nettle	Medium (27)	High	Medium-low
Sweet grass	Medium (39)	Low	Medium-high
Thimbleberry	Medium (34)	Medium	Medium
Tree lupine	High (47)	Low	High
Tule	Medium (29)	Medium	Medium
Western red cedar	Medium (38)	Medium	Medium
Wild onion	High (52)	Low	High
Willow	Medium (26)	High	Medium-low
Red Osier Dogwood	Medium (38)	Medium	Medium
Yarrow	Low (20)	Medium	Medium-low
Yellow cedar	High (48)	Low	High
Yew	High (43)	Medium	Medium-high

Potential Impacts/Hazards	Estimated Time Frame	Description
Fire Risk	Mid-Century	Increasing fire risk, due to drier summers, will become a threat to plant species throughout the region as climate change impacts continue to increase. Wildfires will change plant growing patterns and plant populations throughout the region.
Drought Risk	Mid-Century	Snowpack reductions during winter will lead to drier summer streams. Water scarcity during dry summer months will put stress on terrestrial plant populations throughout the region.
Changing precipitation patterns	Ongoing	Increasing precipitation patterns will change the composition of forests, and other heavily planted areas in the region. Wetter, warmer winters will change how and where certain species establish, grow and distribute themselves. This change will have the effect of changing the distribution and productivity of forests throughout the region. This plant distribution and productivity change may put more stress on already stressed populations.
Increasing sea temperatures	Ongoing	Increasing sea temperatures in the region will put stress on marine plant species that may be unable to adapt to dramatic changes in sea temperatures. Consequences of warmer sea temperatures include invasive species, new diseases, and changed growth and distribution of plants and algae which can change the food web and regional composition of plants in the region.
Ocean acidification	Mid-Century	Ocean acidification is expected to cause changes in marine plant growth and distribution in the Salish sea. Some species of algae and sea grass will benefit from an increase in CO2 quantities throughout the region and allow them to increase their growth and photosynthesis rates.
Runoff/Pollution/water quality	Ongoing	City sourced and agricultural runoff represents a large stressor to aquatic plant species. Increases in nitrogen or potassium quantities flowing into the sea has a variety of negative consequences, most notably this issue causes “dead zones” to form (dead zones are areas where large algal blooms effectively starve the area of oxygen and sunlight, thus killing marine species in the area. This issue, while not specific to climate change, is a consequence of increasing population density near coastal regions.
Flood Risk	Mid-Century	Sea level rise can cause previously low-lying regions to become more flood prone. Marine or intertidal plants that thrive in current habitats, may face stressors related to increased flood events.

Insect, disease and invasive species	Ongoing	Warmer temperatures are associated with increased disease and invasive species issues. The impacts of this could put additional stress on local plant species throughout the region.
Increased surface air temperature	Mid-Century	Increasing surface air temperatures means that extreme summer heat waves will have a much more dramatic impact on terrestrial plant species that have historically thrived in current regional temperature conditions.

Potential adaptation strategies:

- Explore habitat restoration and invasive species removal opportunities.
- Create community garden for important cultural species.
- Develop a Samish nursery to grow native species and encourage their use in landscaping projects in the region.

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7 APPENDIX A: NATURAL ENVIRONMENT

Taxon	Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Amphibians	Oregon spotted frog	High (51)	Low	High
	Salamander	High (49)	Low	High
	Rough-Skinned Newt	High (48)	Low	High
Birds	American crow	Low (22)	High	Low
	Bald Eagle	High (41.5)	Medium	Medium-high
	Red-Tailed Hawk	Medium (36.5)	Medium	Medium
	Cooper's Hawk	Medium (38.5)	Medium	Medium
	Rufous Hummingbird	Low (23)	Medium	Medium-low
	Common Loon	Medium (29)	Medium	Medium
	Northern harrier	Medium (36.5)	Medium	Medium
	Western Screech-Owl	Medium (39.5)	Medium	Medium
	Barn Owl	Medium (29)	High	Medium-low
	Snowy Owl	Medium (40)	Medium	Medium
	Northern Saw-whet Owl	Medium (29)	High	Medium-low
	Peregrine falcon	Medium (36.5)	Medium	Medium
	Band-tailed Pigeon	Medium (25)	High	Medium-low
	California Quail	Medium (35)	Low	Medium-high
	Common Raven	Medium (25)	High	Medium-low
	Red-winged blackbird	Low (23)	High	Low
	Swainson thrush	Low (23)	High	Low
	Swallow	Low (23)	High	Low
	Turkey vulture	Medium (25)	High	Medium-low

	Western Grebe	Medium (29)	Medium	Medium
Birds	Mallard	Medium (29)	High	Medium-low
	American Wigeon	Medium (29)	High	Medium-low
	Western gull	Medium (36.5)	Low	Medium-high
	Blue-winged Teal	Medium (29)	High	Medium-low
	Cinnamon Teal	Medium (29)	High	Medium-low
	Green-winged Teal	Medium (29)	High	Medium-low
	Northern Pintail	Medium (29)	High	Medium-low
	Ruffed Grouse	Medium (35)	Low	Medium-high
	Horned Grebe	Medium (37)	Medium	Medium
	Ruddy Duck	Medium (35)	High	Medium-low
	Greater Scaup	Medium (29)	High	Medium-low
	Trumpeter Swan	Medium (37)	High	Medium-low
	Canada Goose	Low (23)	High	Low
	Great Blue Heron	Medium (29)	High	Medium-low
Fishes	Bay pipefish	Medium (38)	Medium	Medium
	Broadnose Seven-gill shark	Low (12)	High	Low
	Bull trout	High (53)	Medium	Medium-high
	Chinook (king)	High (54)	Low	High
	Chum (dog)	High (45)	Medium	Medium-high
	Cod	Medium (25)	Low	Medium-high
	Coho (silver)	High (50)	Low	High
	Cutthroat trout	High (50)	Low	High
	Flounder	Medium (26)	Medium	Medium

	Halibut	Low (22)	Medium	Medium-low
	North Pacific Spiny Dogfish	Low (19)	High	Low
Fishes	Pacific hake	Low (23)	Medium	Medium-low
	Pacific herring	High (47)	Medium	Medium-high
	Pacific sand lance	High (48)	Medium	Medium-high
	Pacific sardine	Medium (29	Medium	Medium
	Pink (humpback)	High (47)	Low	High
	Sablefish	Low (22)	Medium	Medium-low
	Sculpin/bullhead	Medium (25)	High	Medium-low
	Shiner perch	Medium (33)	Medium	Medium
	Snapper/rockfish	Medium (35)	Low	Medium-high
	Sockeye (red)	High (51)	Low	High
	Sole	Medium (27)	Medium	Medium
	Steelhead	High (53)	Medium	Medium-high
	Sturgeon	Medium (36)	Medium	Medium
	Surf smelt	High (49)	High	Medium
	Three-spine stickleback	Low (20)	High	Low
Fungi	Fungi	High (45)	Medium	Medium-high
	Lichen	Medium (39)	High	Medium-low
Invertebrates	Garter snake	High (43)	Low	High
	Honey bee	Medium (38)	Medium	Medium
	Mason bee	Medium (40)	Medium	Medium
	Bumble bee	Medium (39)	Medium	Medium
Invertebrates - Aquatic	Abalone	High (48)	Low	High

	Chiton/Chinese slipper	Low (21)	High	Low
	Clams	High (41)	Low	High
	Cockle	High (41)	Low	High
Invertebrates - Aquatic	Crab	Medium (36)	Medium	Medium
	Crawfish	Low (17)	High	Low
	Dentalium	Medium (30)	Low	Medium-high
	Mussel	Medium (39)	Low	Medium-high
	Mussel (freshwater)	High (42)	Low	High
	Octopus	Medium (33)	Medium	Medium
	Oyster	High (41)	Low	High
	Prawn	Medium (30)	Medium	Medium
	Scallop	Medium (37)	Low	Medium-high
	Sea anemone	Medium (34)	Medium	Medium
	Sea cucumber	Medium (28)	Medium	Medium
	Shrimp	Medium (30)	Medium	Medium
	Squid	Low (23)	Medium	Medium-low
	Urchin	High (43)	Medium	Medium-high
Mammals	American beaver	Medium (32)	Medium	Medium
	American black bear	Low (19)	high	Low
	American mink	Medium (24)	Medium	Medium
	Bat	Low (23)	Medium	Medium-low
	Black-tailed deer	Low (8)	high	Low
	Chipmunk	Low (19)	high	Low
	Coyote	Low (12)	High	Low

	Elk	Low (12)	high	Low
	Gray Wolf	Low (23)	Medium	Medium-low
	Grizzly bear	Medium (28)	Low	Medium-high
	Long/short-tailed weasel	Low (19)	High	Low
Mammals	Mountain goat	High (42)	Low	High
	North American porcupine	Medium (35)	Medium	Medium
	Orca (killer) whale	High (49)	Low	High
	River otter	Medium (34)	Medium	Medium
	Sea otter	Medium (38)	Low	Medium-high
	Seal (harbor)	Medium (37)	Medium	Medium
	Snowshoe hare	Medium (27)	Medium	Medium
	Squirrel(douglas)	High (42)	Low	High
Plants	Alaska blueberry	Medium (35)	Medium	Medium
	Alder	Low (17)	Medium	Low
	American three-square	High (41)	Medium	Medium
	Baltic rush	Medium (30)	Medium	Medium
	Barestem biscuitroot	High (41)	Low	Medium-high
	Bear grass	High (42)	Low	Medium-high
	Bearberry	Medium (25)	High	Medium-low
	Bent grass	Low (22)	Medium	Medium-low
	Black cap	Medium (25)	Medium	Medium
	Black Cottonwood	Low (19)	Medium	Medium-low
	Blackberry	Low (23)	Medium	Medium-low
	Bunchberry	Medium (29)	Medium	Medium

	Camas	High (44)	Low	High
	Cascara	Medium (27)	Medium	Medium
	Cattail	Medium (27)	Medium	Medium
	Pineapple weed	Low (9)	High	Low
	Cherry	Low (16)	Medium	Medium-low
Plants	Chocolate lily	High (42)	Medium	Medium-high
	Crab apple	Low (20)	Medium	Medium-low
	Currant	Medium (28)	Medium	Medium
	Devil's club	High (44)	Low	High
	Dogwood	Low (17)	High	Low
	Douglas fir	Medium (29)	Medium	Medium
	Eelgrass (Wide-blade eelgrass)	High (47)	low	High
	Hazelnut	Low (22)	High	Low
	Hemlock	High (41)	Medium	Medium-high
	Horsetail	Low (10)	High	Low
	Huckleberry, thinleaf/mountain/big	Low (23)	Medium	Medium-low
	Huckleberry, evergreen	Medium (27)	Medium	Medium
	Juniper	Medium (27)	Medium	Medium
	Kelp	High (52)	Low	High
	Labrador tea	High (43)	Low	Medium-high
	Madrona (Pacific Madrone)	High (41)	Low	High
	Maple	Low (29)	Medium	Medium-low
	Ocean spray (ironwood)	Low (20)	High	Low
	Pickleweed	Medium (35)	Low	Medium-low

	Red elderberry	Low (19)	Medium	Medium-low
	Rose	Low (19)	High	Low
	Salal	Med (32)	Low	Medium
	Salmonberry	Med (26)	Medium	Medium
	Seabeach sandwort	High (51)	Low	High
	Seashore saltgrass	Medium (28)	High	Medium-low
Plants	Seaweed	High (51)	Low	High
	Serviceberry	Medium (40)	Low	Medium-high
	Silverweed	High (41)	Low	High
	Skunk cabbage	Medium (40)	Low	Medium-high
	Soapberry (Buffalo berry)	High (47)	Low	High
	Spruce	Medium (39)	Low	Medium-high
	Stinging nettle	Medium (27)	High	Medium-low
	Sweet grass	Medium (39)	Low	Medium-high
	Thimbleberry	Medium (34)	Medium	Medium
	Tree lupine	High (47)	Low	High
	Tule	Medium (29)	Medium	Medium
	Western red cedar	Medium (38)	Medium	Medium
	Wild onion	High (52)	Low	High
	Willow	Medium (26)	High	Medium-low
	Red Osier Dogwood	Medium (38)	Medium	Medium
	Yarrow	Low (20)	Medium	Medium-low
	Yellow cedar	High (48)	Low	High
	Yew	High (43)	Medium	Medium-high

8 APPENDIX B: BUILT ENVIRONMENT

Sector	Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Samish Owned Property	Fidalgo Bay Resort	High	Low	High
	Summit Park	Medium	Medium	Medium
	Administration Complex	Medium	Medium	Medium
	Longhouse	Medium	Medium	Medium
	The Cannery Building	Medium	Medium	Medium
	34th Street Housing Project	Medium	Medium	Medium
	Campbell Lake/The People's House	Medium	Medium	Medium
	Thomas Creek	Medium	Medium	Medium
	Lopez Island (Upland)	Low	Medium	Medium-low
	Thompson Rd Property/March's Point	Medium	Medium	Medium
	Huckleberry Island	High	Low	High
Transportation	Roads: I-5 (MP 219-234), SR 20 (MP 47-60), SR 536 (MP .14-5.38), SR 11 (MP 0-9)	Medium	Low	Medium-high
	Roads: Local	Medium	Low	Medium-high
	Public Transportation	High	Medium	Medium-high
	Marine	Medium	Low	Medium-high
Community Planning and Utilities	Floodplain Infrastructure	High	Low	High
	Freshwater - Skagit County	High	Low	High
	Freshwater - San Juan County	High	Low	High
	Wastewater and Sanitary Sewer System - Skagit County	High	Low	High
	Wastewater and Sanitary Sewer System - San Juan Islands	Medium	Low	Medium-high
	Electricity	Medium	Low	Medium-high

9 APPENDIX C: HUMAN ENVIRONMENT

Sector	Planning Area	Sensitivity	Adaptive Capacity	Vulnerability
Community and Cultural Wellbeing	Cultural and Historic Sites	High	Low	High
	Burial Sites and Ancestral Remains	High	Low	High
	Cultural Use Plants and Resources	High	Low	High
	Household Costs	High	Medium	Medium-high
	Safe and Secure Housing	High	Medium	Medium-high
	Food Insecurity and Traditional Foods	High	Medium	Medium-high
	Employment Security	Medium	Medium	Medium
	Access to Community Services	High	Medium	Medium-high
	Access to Tribal Events, Ceremonies, and Traditional Activities	High	Medium	Medium-high
	Emergency Services	High	Medium	Medium-high
Human Health	Respiratory Disease	High	Medium	Medium-high
	Chronic Disease	High	Medium	Medium-high
	Heat-Related Illness	High	Medium	Medium-high
	Extreme Weather Events	Medium	Low	Medium-high
	Infectious Disease	Medium	Medium	Medium
	Mental & Behavioral Health	High	Low	High