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*Place of the clear salt water*

# MULTI-HAZARD MITIGATION PLAN 2022

For the Port Madison Indian Reservation

THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

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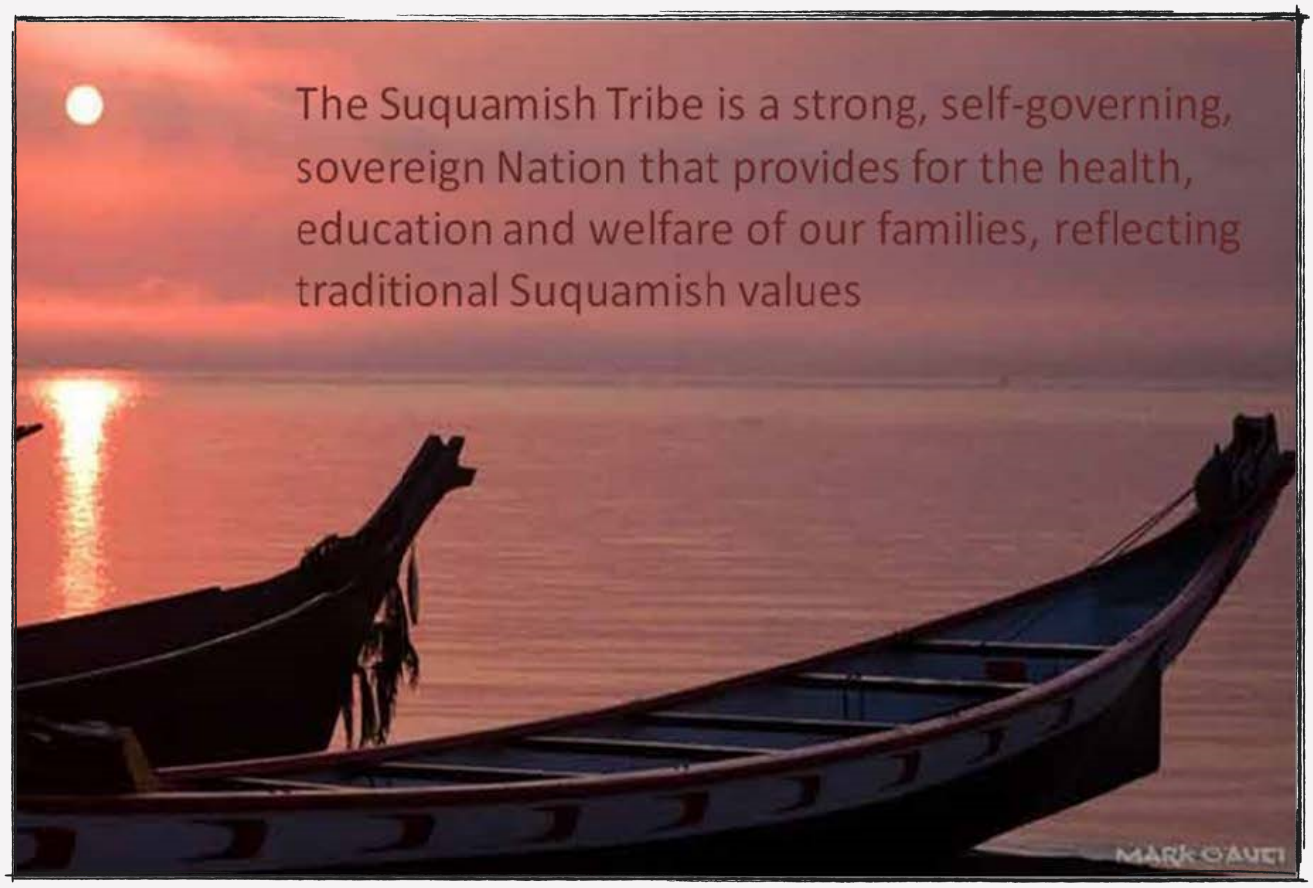


THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

FEMA

www.suquamish.nsn.us

The Suquamish Tribe Multi-Hazard Mitigation Plan, 2022

**Prepared For:**

The Suquamish Tribe, Port Madison Indian Reservation

**Funded By:**

The Suquamish Tribe

**Prepared by:**

The Suquamish Office of Emergency Management

Jennifer Marsland, Emergency Management Planner

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# Executive Summary

Hazard mitigation aims to reduce or eliminate hazards' long-term risk to people and property. The Suquamish Tribe developed this Hazard Mitigation Plan to make the Port Madison Indian Reservation and its residents less vulnerable to future hazard events. This plan was prepared under guidance from the Disaster Mitigation Act of 2000 so that the Tribe would be eligible for the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation and Hazard Mitigation Grant programs.

The Tribe followed a planning process prescribed by FEMA, which began with the formation of a Hazard Mitigation Planning Committee comprised of vital tribal representatives, community members, and other local stakeholders. The Planning Committee conducted a risk assessment that identified and profiled hazards that pose a risk to the Tribe, assessed the Reservation's vulnerability to these hazards, and examined the capabilities currently in place to mitigate them.

The Reservation is vulnerable to several hazards that are identified, profiled, and analyzed within this Plan. Earthquakes, landslides, floods, severe storms, tsunami, drought, and wildfires are among the hazards that can have a significant impact on the Reservation. Based upon the risk assessment review and goal setting process, the Planning Committee developed the following goals for this plan:

**Goal 1: Increase public awareness of vulnerability to hazards.**

**Goal 2: Minimize the risk from hazards to existing and proposed development, tribal assets, culturally sensitive sites, and proactively adapt to a changing climate.**

**Goal 3: Reduce the loss of life and personal injuries from hazard events.**

**Goal 4: Assess needs for multi-program participation.**

The Plan establishes a series of specific mitigation strategies that were developed collaboratively by the Planning Committee with the intent to meet the identified goals. These strategies provide a basis for continued planning to develop specific action plans. These will be implemented over time and can provide a means to measure progress toward hazard reduction. The Plan also lists Plan update and maintenance procedures.

U.S. Department of Homeland Security
FEMA Region 10
130 228th Street, SW
Bothell, WA 98021-8627

FEMA

The Honorable Leonard Forsman
Chairman, Suquamish Tribal Council
P.O. Box 498
Suquamish, Washington 98392

JAN 18 2023

Dear Chair Forsman:

Congratulations, on January 9, 2023, the United States Department of Homeland Security's Federal Emergency Management Agency (FEMA) Region 10 approved the Suquamish Tribal Hazard Mitigation Plan as a Tribal Mitigation Plan, in accordance with Code of Federal Regulations Title 44 Part 201.

An approval provides the Suquamish Tribe eligibility to apply directly with FEMA for Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) programs, for example, Building Resilient Infrastructure and Communities project grants, Public Assistance (PA Categories C-G), and Hazard Mitigation Grant Program projects through January 8, 2028. Recipients are required to develop and maintain hazard mitigation plans compliant with FEMA standards as a condition for receiving funds. To continue eligibility tribes must review, revise as appropriate and re-submit plans for approval within five years of the plan approval date. For further assistance on hazard mitigation planning, please contact our Regional Mitigation Planning Program Manager, Erin Cooper at 202-856-1927.

FEMA evaluates applications for funding according to the specific requirements of the applicable program. A mitigation action identified in the plan may, or may not, meet a program's eligibility requirements. For assistance with Building Resilient Infrastructure and Communities project grants, please contact the Region 10 Mitigation Division's Community Resilience and Infrastructure Grants Branch at FEMA-R10-MIT-CRAIG@fema.dhs.gov and for assistance with Hazard Mitigation Grant Program please contact FEMA-R10-HMGP@fema.dhs.gov.

We look forward to continuing a productive relationship between FEMA Region 10 and the Suquamish Tribe. Our Regional Tribal Liaison, Lanaina Upham, at 202-746-0087, or lanaina.upham@fema.dhs.gov, is available to facilitate this relationship and delivery of our programs. You are also welcome to contact me directly, at 425-487-4604.

Sincerely,

Willie G. Nunn
Regional Administrator

Enclosure

cc: Tim Cook, Washington Emergency Management Division

# Tribal Adoption Resolution

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THE SUQUAMISH TRIBE
PORT MADISON INDIAN RESERVATION
RESOLUTION 2022-178

WHEREAS, the Suquamish Tribal Council is the duly constituted governing body of the Port Madison Indian Reservation by authority of the Constitution and Bylaws for the Suquamish Tribe of the Port Madison Indian Reservation, Washington, as approved on July 2, 1965, by the Under-Secretary of the United States Department of the Interior;

WHEREAS, under the Constitution and Bylaws of the Suquamish Tribe, the Suquamish Tribal Council is charged with the general governance of the Port Madison Indian Reservation and to this end, has the power, right, and authority under the Tribe's Constitution to take all actions necessary to carry such duties into effect, including protecting the health, security, and general welfare of the Suquamish people and other persons within the Tribe's jurisdiction to the fullest extent allowed under applicable law;

WHEREAS, because disasters cause loss of life, damage buildings and infrastructure, and have devastating consequences for a community's economic, social, and environmental well-being, the Tribe seeks to reduce or eliminate the long-term risk to life and property from hazards on the Port Madison Indian Reservation;

WHEREAS, the Tribe, through its Department of Natural Resources Emergency Coordinator Cherrie May, received a grant from the Federal Emergency Management Agency ("FEMA") to develop a Hazard Mitigation Plan ("Plan") in an effort to make the Reservation and its residents less vulnerable to future natural hazard events;

WHEREAS, the Plan was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 so that the Tribe would be eligible for FEMA's Pre-Disaster Mitigation and Hazard Mitigation Grant programs;

WHEREAS, the Reservation is vulnerable to several hazards that are identified, profiled, and analyzed within the Plan, and the Plan establishes a series of specific mitigation strategies that were developed collaboratively by a Planning Committee comprised of tribal representatives, community members, and other local stakeholders to meet identified goals;

WHEREAS, these strategies will be implemented over time and can provide a means to measure progress towards hazard reduction;

WHEREAS, the Plan has been reviewed and commented on by the Suquamish Legal Department and FEMA, with changes incorporated based on those comments; and

WHEREAS, the Tribal Council has had the opportunity to review the Plan in its final form;

Res. 2022-178, Multi Hazard Mitigation Plan
Page 1 of 2

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NOW THEREFORE, BE IT RESOLVED that the Suquamish Tribal Council hereby approves and adopts the Multi Hazard Mitigation Plan as presented today, and authorizes the Tribe's Emergency Coordinator to being implementing the strategies outlined in the Plan.

CERTIFICATION

The foregoing resolution was duly adopted on October 24th, 2022 at a regular meeting of the Suquamish Tribal Council at which a quorum was present, by a vote of 5 for and 0 against, with 0 abstention(s), in accordance and pursuant to the authority vested in it by the Constitution and Bylaws of the Suquamish Tribe.

By:
DocuSigned by:
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Leonard Forsman, Chairman

Attested to by:
DocuSigned by:
Windy Anderson
5E1169175C57429...
Windy Anderson, Secretary

Res. 2022-178, Multi Hazard Mitigation Plan
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# Plan Distribution List

The Suquamish Tribe's Multi-Hazard Mitigation Plan is distributed to:

- Suquamish Tribal Council
- Suquamish Tribe Legal Department
- Suquamish Tribe Department of Natural Resources
- Suquamish Tribe Department of Fisheries
- Suquamish Tribe Department of Community Development
- Suquamish Tribe Department of Maintenance
- Kitsap County Department of Emergency Management
- Washington State Emergency Management Division
- Federal Emergency Management Agency (FEMA)

**Record of Changes**

The following Hazard Mitigation Plan is meant to be a living document, meaning that it is intended to be periodically updated as circumstances change, new data is discovered, hazards are mitigated, etc. This Record of Changes Table is included to summarize and to document pertinent changes to the Planning document as they are made.

| Change # | Description | Date |
|---|---|---|
| 1 | Updated per 5-year requirement – added Cybersecurity Event and Climate Change as specific hazards – updated risks based on new data – updated demographics. | 10/1/2022 |
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# PLANNING PROCESS

Multi-Hazard Mitigation Plan 2022

THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

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## Purpose Statement

The types of hazards that could impact on our community are growing, occurring more frequently, and are increasingly more complicated. They can lead to the loss of life, damage to buildings and infrastructure, and could have devastating consequences for our community's cultural, economic, social, and environmental well-being. The Suquamish Tribe seeks to reduce or eliminate the long-term risks to life, property, economy, and the environment that various hazards pose to our community. The hazard mitigation process strives to reduce community risk and foster long-term sustainability by seeking ways to:

- Protect public safety and prevent loss of life and injury.
- Reduce harm to existing and future development, including climate change adaptations.
- Prevent damage to a community's unique economic, cultural, and environmental assets.
- Minimize operational downtime and accelerate recovery following disasters.
- Reduce the costs of disaster response, recovery, and the exposure of first responders to risk.
- Help accomplish other community objectives, such as leveraging capital improvements, infrastructure protection, open space preservation, and economic resiliency.

## Vision Statements

The following vision statements describe the Tribe's vision of its overarching role and responsibility as a governing body and the Planning Committee's vision of the planning process, purpose, role, responsibility, and intended outcome.

**Tribal Vision Statement:** The Suquamish Tribe is a strong, self-governing, sovereign Nation that provides for the health, education, and welfare of our families, reflecting traditional Suquamish values.

**Project Vision Statement:** Development and adoption of achievable and sustainable hazard mitigation actions that strengthens the Tribe's roles and responsibility in emergency preparedness, prevention, mitigation and, ability to respond, while investing in the Tribe's future.

## Preparation of the Plan

The Emergency Planning Coordinator reviewed the previous Hazard Mitigation Plan from 2017 in addition to mitigation plans from other jurisdictions to determine the most appropriate departments to include in the process and the most effective methods of public involvement. Combined with guidance documents published by FEMA and the selected departments, Jennifer Marsland compiled an initial list of departments and individuals to invite to the "kickoff meeting," held on April 27, 2022. At this short introductory meeting, attendees suggested additional groups to include in the process. The majority of those invited did not attend; however, a core group of interested individuals from relevant departments provided frequent guidance or information to continue with the process. This Mitigation Planning Team met regularly from April 27, 2022, through August 25, 2022, to discuss the progress of the plan update, learn about the findings of the risk assessment, and contribute their knowledge to the decisions made by the Emergency Planning Coordinator and Mitigation Consultants.

## Plan Review

The Suquamish Tribe Mitigation Plan 2017 was developed using existing Tribal plans and studies as well as outside information and research. The following information was especially useful when preparing this document.

- Washington State Hazard Mitigation Plan, prepared by the Washington State Military Department Emergency Management Division.

- Suquamish Tribe Comprehensive Emergency Management Plan 2011, prepared by Suquamish Tribe Emergency Management Coordinator.
- Kitsap County Hazard Mitigation Plan 2012, prepared by Kitsap County Department of Emergency Management.

## Intended Outcome

Given the Suquamish Tribe's responsibility to protect the health, safety, and welfare of its members and citizens, the Suquamish Tribe understands that proactive mitigation policies are proven to reduce risk and create safer, more disaster-resilient communities. Therefore, the Tribe seeks to pursue community risk reduction and sustainability investments that will:

- Prevent hazard-related losses of life and property.
- Reduce the adverse impacts on the economy caused by natural disasters.
- Encourage developing and implementing long-term, cost-effective, and environmentally sound mitigation projects.
- Improve tribal emergency management capability (i.e., prepare, respond, recover, mitigate).
- Promote a disaster-resistant and resilient community.

## Planning Committee Guidelines

To support the collaborative development and effectiveness of a multi-hazard mitigation plan, the Planning Committee is committed to:

- Accounting for the diversity of interests that exist within the Reservation.
- Making the process ours by active and consistent workgroup participation.
- Employing practices that will intentionally incorporate stakeholder and public participation.
- Approaching the project with a willingness to adapt to the agreed upon changes.
- Supporting healthy debate, professional courtesy, and flexibility are needed to foster a collaborative decision-making process.
- Making individual contributions that support the greater good.
- Providing the available resources and staff needed to support the planning process.
- Revising Committee-adopted materials as the need arises.

For community planning to be most effective, supporting the greater good must prevail as the basis for collaborative decision-making.

## Development Process Guidelines

Operating under the direction and authority granted by the Tribe, the Planning Committee shall serve in an advisory capacity. As such, the Committee resolves to oversee the planning process as a work group charged with the responsibility of:

1. Incorporating subject matter expertise along with input from the public, partner agencies, and other relevant stakeholders.
2. Corresponding and/or distributing documents to committee members via email, meetings held in a hybrid virtual-in-person format when possible due to COVID-19 or other constraints.
3. Formally adopting all materials based on committee input.
4. Evaluating and revising planning related metrics as needed.

## Planning Team Members

The planning team was assembled to form a representative group of Tribal staff members with subject matter expertise as well as active community members.

**Community Team Members:**

– Brynn Felix, Suquamish Citizen Advisory Council (SCAC)

– Kathy Cartwright, Indianola Beach Improvement Club (IBIC)

**Staff Team Members:**

Cherrie May – Emergency Management Coordinator

Jennifer Marsland – Emergency Planning Coordinator

Dennis Lewarch – Tribal Historic Preservation

Tina Jackson – Suquamish Cultural CO-OP Committee

Aaron Wheeler – Suquamish IT Director

William (Billy) Lawrence – Tribal Public Utilities

Rich Brooks – Director of Natural Resources

Glen Maxim – Tribal Forestry

Barbara Hoffman – Community Health Nurse

Devon Tiam – Port Madison Enterprises

Tom Curley – GIS (Geographic Information System) Program Manager

Shawn Carper – Tribal Maintenance

Paul Williams – Tribal Shellfish Policy Advisory

Steve Todd – Salmon Recovery Biologist

Vicki Cole – Tribal Finance

**Local Partner Agencies:**

Kitsap County Public Health (KPHD)

North Kitsap Fire & Rescue (NKFR)

Poulsbo Fire Department (PFD)

Kitsap County Sheriff (KCSO)

Washington State Emergency Management Division (WAEMD)

**Planning Process Activities –** The following table summarizes the planning process activities.

| Planning Process Activities | | |
|---|---|---|
| Date | Activity | Participants |
| 03/09/2022 | Meeting with PME | Suquamish OEM/PME Legal |
| 03/29/2022 | Multi-Hazard Mitigation Planning Meeting | Suquamish OEM (Office of Emergency Management) |
| 03/29/2022 | Cultural Co-Op Meeting | Suquamish OEM/Suquamish Cultural CO-OP |
| 04/20/2022 | Port Madison Indian Reservation Forestry | Suquamish OEM/Glen Maxim |
| 04/05/2022 | Community Survey Begins | Suquamish Tribe & Community |
| 04/27/2022 | Multi-Hazard Mitigation Planning Kick-Off Meeting | Suquamish Tribe/ NKFR/PFD/KCSO/IBIC/Community |
| 05/04/2022 | Cybersecurity Meeting | Suquamish OEM/Suquamish IT |
| 05/06/2022 | Climate Change & Impacts on Fisheries Meeting | Suquamish OEM/ Paul Williams/ Steve Todd |
| 05/31/2022 | Tsunami Hazards Meeting & Community Presentation | Suquamish OEM/ WAEMD /Planning Committee/Community |
| 06/01/2022 | MHMP Presentation & Discussion Forum | Suquamish OEM/Community/IBIC |
| 06/29/2022 | Climate Change and Cybersecurity Hazards Planning Committee | Suquamish OEM/ Planning Committee/Community |
| 07/26/2022 | Cascading Events & Impacts | Suquamish OEM/ Planning Committee/Community |
| 08/30/2022 | Risk Assessment Rubric | Suquamish OEM/Planning Committee |
| Sept 2022 | Preparation of MHMP | Suquamish OEM |
| 10/24/2022 | Submit MHMP to Tribal Council | Suquamish OEM/Tribal Council |
| 10/24/2022 | Submit to FEMA for Approval | Suquamish OEM - FEMA |
| | | |
| | | |

## Public Participation Guidelines

The hazard mitigation planning process requires that the public, defined as all Suquamish Tribal Membership, all persons living, working on, or visiting Tribal lands, play an integral role in the planning process. To address this, the Planning Committee's strategies for integrating public input include:

1. Incorporating public stakeholder representatives as part of the Committee.
2. Maintaining an open process intended to welcome public input.
3. Conducting public meetings to review the draft plan.
4. Soliciting input by way of public survey.
5. Providing periodic public information media releases throughout the process.
6. Posting applicable planning documents on the Tribe's website.

## Legal Authority

The planning process derives its legal authority from the following federal laws and local codes, resolutions, and ordinances.

**Federal Laws:**

1. **"The Federal Civil Defense Act of 1950":** Provides general information to mitigation planners on the history of emergency planning response in the United States. Although it does not focus on natural mitigation strategies, it provides a background read on threats and protecting life and property in the U.S.
2. **Public Law 96-342 "The Improved Civil Defense Act of 1980":** Provides general information to mitigation planners on the history of emergency planning response in the United States. Although it does not focus on natural mitigation strategies, it provides relevant background regarding threats and the protection of life and property within the U.S. This bill enhanced the Federal Civil Defense Act of 1950 to improve emergency warning systems, establish better command and control through emergency operations, and to improve the preparations for potential threat (mostly hostile). The document provides background on the history of mitigation measures in the U.S.
3. **Public Law 91-606 "Disaster Relief Act":** Enacted in 1970 as a prelude to the Stafford Act, it provided a provision for public relief after a disaster and provided federal support from agencies to respond during disasters. The document provides background information on disaster relief and assists locals in understanding the history and provision of disaster relief.
4. **Public Law 93-288 "The Robert T. Stafford Disaster Relief Act of 1988":** Amended the Disaster Act of 1974 by providing a provision for disaster relief to include pre-disaster mitigation plans and strategies. This document sets the stage in defining this mitigation plan for local communities and their mitigation strategists.
5. **"Disaster Mitigation Act of 2000":** Amended the Robert T. Stafford Relief Act of 1988 to include, among other revisions; "encouraging hazard mitigation measures to reduce losses from disasters, including development of land use and construction regulations." Along with the Robert T. Stafford Act, these documents are essential to local planners in defining mitigation strategies for their jurisdictions.
6. **FEMA's Multi-Hazard Mitigation Planning Guidance under the Disaster Mitigation Act of 2000-Revision 2007:** The planning guide developed to help interpret the rules in the Disaster Mitigation Act of 2000. It defines requirements of original and updated plans to ensure rules are met. This guidance is essential for mitigation planning and the core document for processing the development and adoption of the plan.
7. **Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, and Related Authorities as of April 2013:** Amended the original version, signed into law on November 23, 1988, to establish the statutory authority for most federal disaster response activities especially as they pertain to the Federal Emergency Management Agency (FEMA) and FEMA programs.

## Local Codes, Resolutions, and Ordinances

1. **The Suquamish Tribe, Port Madison Indian Reservation Resolution #2015-013:** Establishes the consultant agreement needed to initiate the process of developing the Tribe's Hazard Mitigation Plan. The Suquamish Tribe, Port Madison Indian Reservation Resolution #2006-098: Establishes the Tribal Emergency Response Committee and identifies positions within the Suquamish Tribal Government as being the unified response team in emergency management.

2. **Kitsap County Ordinance No. 80 – Flood Damage Prevention Regulations, 1980:** Assists local agencies define flood and storm water mitigation measures. They are used to evaluate flood risk and mitigation strategies to prevent public and private damage during flooding events.
3. **Kitsap County Ordinance No. 109, March 24, 1996:** Provided for the inception of County Emergency Management, including the roles and responsibilities to include hazard mitigation and prevention.

## Existing Policies, Ordinances, and Codes

The following documents have previously been developed and support the spirit and intention of hazard mitigation. The Mitigation plan will integrate with the following strategies for planning purposes, as described below, and new plans below. They are referenced as supplemental supporting material.

1. Forest Management Plan 01/01/12
    a. Mitigation example: steep slopes, wildfire, storm damage, groundwater recharge areas
2. Solid Waste Ordinance 08/06/01
    a. Mitigation example: Groundwater and surface water quality
3. Comprehensive Emergency Management Plan (CEMP) 09/12/11
    a. Mitigation example: update CEMP and training

## Planning Incorporation

Pursuant to 44 CFR 201.7 (c)(4)(iii), the requirements of the mitigation plan must be incorporated into other planning mechanisms, as appropriate. All departments within the Suquamish Tribal Government are required to review and incorporate the requirements of this mitigation plan into their planning documents (examples above). Additionally, the Office of Emergency Management may review proposed plans for compliance with this section as they are developed.

## COVID-19 Pandemic Planning Impacts

Due to the high-risks associated with the COVID-19 pandemic, the Suquamish Tribe had to direct their priorities on reducing the impacts to the community, enhancing programs that provided support to high-risk and vulnerable Tribal members and mission critical staff. This delayed project planning and resiliency expanding projects. Many of the projects and goals within this revised plan are were they are in the previous plan but have been updated to reflect updates to the data and vulnerability assessments.

Identified below are projects that were able to be completed since the last Multi-hazard Mitigation Plan to increase the Tribe's resilience and expanded our ability to prepare for, protect, mitigate, respond, and respond to hazards that are likely to impact the Port Madison Indian Reservation and the Suquamish Tribe.

## Projects completed since the previous Multi-Hazard Mitigation Plan

**Communications Improvements:**
- Enhancements improved the Suquamish Tribe's ability to relay important and emergency information to the Tribal Government staff, specific populations, and all members of the community that have registered with our SUN Alerts program. This investment helped the Tribe relay essential and timely information to the community during the COVID-19 pandemic regarding office closures, updated safety guidance, and COVID-19 testing and vaccination locations.
- Improvements to the Indianola Radio Tower expanded the Tribe's and other local jurisdictions' range and capabilities with HAM/WAN system upgrades, broadening redundant communications.

**Emergency Planning and Response Capabilities:**
- The Suquamish Tribe's Office of Emergency Management was able to acquire a Matrice 300 RTK Drone and establish a training and FAA certification program, which expanded the Tribes' law enforcement capabilities, situational awareness during wide area operations, and hazard and risk Analysis.
- Through grant funding at the beginning of the pandemic, the Suquamish Office of Emergency Management was able to hire an Operations Officer, enabling the Tribe to establish a robust response to the COVID-19 pandemic, establish an EOC, and assist in coordinating logistics for hazardous events.
- Through CARES funding, the Suquamish Office of Emergency Management was able to hire an Emergency Planning Coordinator, allowing the Tribe to further develop Emergency Plans for the Tribal Government and all who live, work, and spend time on the reservation.
- A solar feasibility study was completed for Tribal Government Owned facilities to see where investments in redundant energy sources would be most effective.

**Healthcare:**
- The Tribe built a small health clinic for Tribal Membership, expanding Tribe's ability to provide medical services in the community and support COVID-19 testing and vaccination operations.

**Public Education & Outreach:**
- Hazard-specific education campaigns were promoted during the appropriate seasons or relevant times of the year based on FEMA's and WA EMD Public Outreach Calendars or active hazardous situations. This enabled the Tribe to earn the designation of Weather-Ready Nation Ambassador from the National Weather Service.
- Through CARES funding Suquamish Office of Emergency Management was able to hire a Public Outreach and Volunteer Coordinator (1 position), which has established a volunteer cadre and expanded public outreach opportunities to the public.

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# SUQUAMISH TRIBAL PROFILE

Chief Seattle, cir. 1864

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# The Suquamish Tribe

The Suquamish Tribe is a strong, self-governing, sovereign Nation that provides for our families' health, education, and welfare, reflecting traditional Suquamish values. In the Tribe's Southern Lushootseed language **dxʷsə,q̓ʷəb** (meaning place of clear salt water), has been the primary home of the Suquamish people since time immemorial. It is the ancient place on Agate Passage, the site of Old-Man-House village, the winter home of Chief Seattle, and the heart of the Suquamish people. It is here - past, present, and future - that the Suquamish people live on the land of their ancestors and great-grandchildren.

The Tribe's land base is the Port Madison Indian Reservation, located on the north end of the Kitsap Peninsula, along Agate Passage. Seattle lies directly to the east across Puget Sound while Bremerton is only 25 miles to the south. The Reservation is divided into two portions encompassing 7,657 acres of land. Ownership of the Reservation uplands consists of 46.77% alienated fee land (3,581 acres), 33.97% individual trust land (2,601 acres) and 19.26% tribal trust land (1,475 acres).

The Reservation population is approximately 7,891 (2020 Census), of which approximately 15.75% are enrolled Tribal members or of other Indian nationality. There are 257 Tribal heads of households in the Suquamish housing complexes, with remaining Tribal members living throughout the Reservation. Additional residential areas are clustered in the Suquamish and Indianola communities, with scattered home site, forestry and other low-density land uses throughout the Port Madison Reservation.

The Suquamish Tribe is the successor of responsibility for political interest to tribes, bands, and groups of Indians, including those known as the Suquamish and Duwamish that were signatories to the Treaty of Point Elliot of January 22, 1855, as ratified by Congress on March 8, 1859. The Tribe is federally recognized and operates under the Constitution, and By-laws adopted in 1965, pursuant to the Indian Reorganization Act of 1934. A seven-member Council led by the Tribal Chairman governs the Tribe.

The Tribe's administrative structure includes the following departments: Administration, Community Development, Fisheries, Human Services, Wellness, Tribal Child Welfare, Legal, Natural Resources, Public Safety and Tribal Court, Suquamish Museum, Education, Suquamish Seafood, Maintenance, Human Resources, Sports and Recreation, Grants, Finance, Information Services, and Tribal Council.

## Suquamish Tribal Governance

The Suquamish Tribe had their first recorded contact with non-natives in 1792 with the arrival of British explorer Captain George Vancouver. Settlement intensified in the 1850s after Congress passed the Oregon Donation Land Claim Act that opened Suquamish and other tribal lands to non-native settlement. In 1855, Washington Territorial Governor Isaac Stevens arrived in Puget Sound, intent on clearing the land for more intensive settlement. Four years earlier, the City of Seattle, named for Chief Seattle, had been established by Seattle pioneers, who were indebted to the Suquamish/Duwamish Chief for helping them during their early struggles to survive.

Governor Stevens needed to clear the aboriginal title to the land to claim the property ahead of his plans to bring the transcontinental railroad to Puget Sound. On January 22, 1855, Suquamish leaders, led by Chief Seattle, signed the Treaty of Point Elliott at Mukilteo. The Suquamish Tribe gave up title to their lands, which encompassed most of present-day Kitsap County, in exchange for acknowledgement

and protection of their fishing and hunting rights, health care, education, and a reservation at Port Madison.

In 1994, PL 103-413 was signed into law by President Clinton, which set into place the terms of contracts entered by the United States and tribal organizations under the Indian Self-Determination and Education Assistance Act, to provide for tribal Self-Governance, and other purposes. Tribal governance is based firmly in ton principle of tribal sovereignty and the unique government-to-government relationship between the Federal government and Indian tribes. Self-governance funding is subject to the United States Office of Management and Budget regulations and annual audits and provides support for education, housing, employment assistance, family preservation and support activities, water resource planning, and business development.

The Suquamish Tribe's leadership was a crucial influence in securing similar intergovernmental relationships between the State of Washington and the regional tribes through the 1989 Centennial Accord which recognizes each other's party's sovereignty and tribes' rights to govern their own citizenry. Each state agency is mandated to develop its own Centennial Accord Plan through which they provide services and engage in meaningful consultation with tribes whose interests may be impacted by state programs and activities. In an ever-widening circle, local agencies led by county and city councils are following suit. In addition, the Suquamish Tribe has entered into Memoranda of Agreement with other local tribes to enhance the welfare of their common interests. The Suquamish Tribe now enjoys a prominent position in governmental matters that affect their citizens at every level.

## Tribal History & Culture

Chief Seattle was an ancestral leader of the Suquamish Tribe born in 1786 at the Old-Man-House village in Suquamish. His father was Schweabe, a Suquamish Chief, and his mother was Scholitza, a Duwamish from a village near present-day Kent. Chief Seattle was just six years old when Captain George Vancouver anchored in Suquamish waters in 1792.

Chief Seattle achieved his status as Chief of the Suquamish and a confederation of Duwamish bands after he planned and executed an attack strategy that saved the Central Puget Sound people from a sneak attack from upriver tribal forces from present-day King County. Seattle, who was in his early twenties at the time, devised a plan calling for felling trees across the White (now Green) River above Renton that would capsize and disorient the raiding party allowing for Seattle's forces to attack and capture them. The plan worked, and the people were so impressed that he was promoted to Chief, and the former leaders became his sub-chiefs.

Chief Seattle witnessed the transition of his people from their ancient aboriginal way of life to a new one brought by the arrival of non-natives and imposed upon them by the United States Government. The Suquamish had to adapt their culture based on fishing, hunting, berry, ad root gathering; an, traveling by canoe to accept a new economy and lifestyle forced upon them by religious, social, and political institutions. Missionaries, fur traders, and finally, permanent settlers brought new technology, a currency system, disease, and the concept of private property to the Puget Sound region. This change was destructive and disruptive. The United States had already freed land up for settlers by allowing non-natives to claim Indian lands under the Donation Land Claim Act, angering many of the tribes. The United States wanted to clear the land of Indian title to allow for settlement via a new transcontinental railroad. The Federal government accomplished this by signing treaties with the Indian tribes. Fearing a military conflict that could not be won in the long term, Chief Seattle signed the 1855 Treaty of Point Elliott with the U.S., agreeing to live on the Port Madison Indian Reservation and give up title to the

remainder of Suquamish lands. The U.S., led by Governor Isaac Stevens, agreed to provide health care and education, an recognize fishing and hunting rights.

Some tribes, such as the Puyallup and Muckleshoot who signed the Treaty of Medicine Creek, were angered by their treaties and reservations. They took up arms against the settlers and the military. The Indian forces eventually attacked the settlement on Elliott Bay. Chief Seattle kept his forces out of the battle and remained at Suquamish. For this action, other acts of kindness and long friendships with early Seattle residents, the founders of the city's settlement after Chief Seattle. Chief Seattle remained on the Reservation but continued to travel to the city named for him for intertribal meetings and other business. It was in Seattle that he had his only known picture taken and he gave his, famous speech. Chief Seattle died in 1866 in Suquamish.

Chief Seattle died before the Federal government enacted "Americanization" policies to assimilate the Suquamish into the larger society and eliminate tribal governance, thereby relieving the U.S. of their treaty commitments. These policies included: 1) allotment of Indian reservation lands to individual families to scatter the Tribe away from their concentrated winter villages; 2) forced attendance of Suquamish children at off-reservation boarding schools, where use of tribal language and culture was prohibited and punished; and 3) the federally sponsored sale of reservation lands to non-natives that have resulted in the loss of 14 miles of reservation waterfront and over 5,000 acres of Suquamish landholdings. The assimilation policy failed and Chief Seattle's people, the Suquamish Tribe, continue to persevere by honoring their ancestral ways and preserving their culture.

A group of Seattle pioneers placed a marble headstone on Chief Seattle's grave in 1890 to recognize his legacy. The headstone includes both popular spellings of Chief Seattle's names; Seattle and Sealth, which approximates the native pronunciation of the Chief's name. The Treaty of Point Elliott, recorded 35 years earlier, shows its name as Seattle. The Suquamish Tribe recognizes the use of either name. The original headstone remains, despite being vandalized in 2011. The vandalized headstone has been repaired and is now accompanied by a monument and story boards that were added in 2011. The Suquamish are a Lushootseed (Puget Salish) speaking people who traditionally lived along the Kitsap Peninsula, including Bainbridge and Blake Islands, across Puget Sound from present-day Seattle. Many of the today's Suquamish Tribal members live on the Port Madison Indian Reservation in the towns of Suquamish and Indianola.

The ancestral Suquamish have lived in central Puget Sound for approximately 10,000 years. The major Suquamish winter village was at Old Man House on the shoreline of Agate Passage at **dxʷsəq̓ʷəb,** meaning place of clear salt water. The Suquamish name translates into the people of the clear salt water. The Suquamish depended on salmon, cod and other bottom fish, clams and other shellfish, berries, roots, ducks and other waterfowl, deer, and other land game for food for family use, ceremonial feasts, and for trade. The Suquamish, due to the absence of a major river with large salmon runs in their immediate territory, had to travel to neighboring marine areas and beyond to harvest salmon.

The Suquamish lived in shed-roofed, cedar plank houses during the winter months. The Suquamish had winter villages at Suquamish (Old Man House), Point Bolin, Poulsbo, Silverdale, Chico, Colby, Olalla, Point White, Lynwood Center, Eagle Harbor, Port Madison, and Battle Point. The best-known winter village was at Old Man House, the home of Chief Seattle and Chief Kitsap. The Suquamish periodically left their winter residences in the spring, summer, and early fall in family canoes to travel to temporary camps at fishing, hunting, and berry harvesting grounds. The seasonal camp structures consisted of portable frames made of tree saplings covered with woven cattail mats.

Suquamish Tribal members produced a variety of ingenious tools and other devices to harvest fish and gather other important foods more efficiently. The Suquamish are best known for their traditional basketry. The “hard baskets” made from coiled cedar roots were used for gathering berries but also were watertight, making them ideal for carrying water and cooking. The Suquamish would heat stones in a fire and drop them into water-filled baskets to make soups from smoked salmon and wild potatoes. The Suquamish decorated the berry baskets by imbricating them with colored barks in assorted designs.

The Suquamish mostly traveled by water in dugout cedar canoes. The canoe maker fashioned the canoe from a single cedar log, which after carving, required steaming and spreading to make the canoe wider for buoyancy and greater cargo space. The Suquamish also had an extensive network of trails leading from their winter villages to important camping areas and neighboring tribal villages.

British explorer Captain George Vancouver anchored off the shores of Bainbridge Island in 1792 and traded with the Suquamish, and surveyed Suquamish waters. Over the next fifty years, the Suquamish adapted to changes brought on by the entry of non-natives into the Puget Sound. Fur traders and missionaries were the first and were then followed by permanent settlers traveling over the Oregon Trail. Settlement intensified in the 1850s after Congress passed the Oregon Donation Land Claim Act that opened Suquamish and other tribal lands to non-native settlement. Entrepreneurs also began building sawmills to harvest the vast stands of virgin timber on Suquamish lands, including mills at Port Madison, Port Gamble and Port Blakely. The Suquamish cut and delivered logs to the mills to support themselves.

The Suquamish continue to live on the Port Madison Indian Reservation. The Suquamish Tribe has 1,243 enrolled members of which half live on the Reservation. The Suquamish have persevered despite attempts by the Federal government to assimilate them through land policy; in particular, the allotment of the Reservation into separate parcels assigned to family heads in 1886, the destruction of Old Man House village and scattering of the tribal settlement in 1904, and the mandatory attendance of Suquamish children at Indian Boarding Schools from 1900-1920.

The Suquamish presently are experiencing a cultural resurgence and have constructed a new community house in the tradition of Old Man House as well as a new Tribal Museum. The Tribe continues to actively exercise their treaty rights to gather shellfish and harvest fish.

The Tribe is also committed to exercising its ancient right to self-governance for the betterment of its Tribal members. The Tribe currently has some 382 ±10 employees who serve in the provision of a variety of government programs. Relying on ancestral traditions, the Suquamish look forward to a long and prosperous future.

## Usual & Accustomed Grounds

The 1855 Treaty of Point Elliott at Mukilteo preserves and enhances the Suquamish Tribe’s treaty-reserved grounds. The Treaty assures the Tribe’s right to freely access and harvest resources within the Tribe's designated Usual and Accustomed Grounds for the purpose of providing subsistence, ceremonial, cultural and commercial benefits for the present and future generations of Suquamish Tribal members. These treaty rights were upheld on April 18, 1975, in the US V. WA case.

The Usual and Accustomed Grounds (U & A) incorporate approximately 4,417 square miles of Puget Sound and the Snoqualmie and Snohomish watersheds. They encompass the marine waters of Puget Sound from the northern tip of Vashon Island to the Fraser River including Haro and Rosario Straits, and the streams draining into the western side of this portion of Puget Sound and the Hood Canal.

U & A Vulnerability – Natural hazards can disrupt culturally significant access to essential tribal fisheries and can easily cause secondary hazards with consequences far worse than the natural hazard itself. Because the U & A is part of a delicate ecosystem, an event anywhere within the U & A can produce downstream consequences that can extend many miles away.

For example, wildfires in the Cascade Mountains can increase vulnerability to landslides and mudflows that can disrupt fisheries and salmon spawning. The same can be said for flooding. Earthquakes also can cause landslides that can eventually disrupt fisheries. Flooding typically sends massive jams of logs downstream and eventually to the river deltas and other sensitive shoreline habitats. These logjams then settle on to kelp beds and other salmon food habitats, eventually ruining their food source.

But the main threat to the U & A is human caused. Puget Sound is home to some of the largest ports on the West Coast and to numerous oil refineries. Numerous towns, ports and marinas line the coast. Frequently there are minor oil and other hazardous material spills. The potential for a major spill is high. Whether spills are caused by human error, terrorism, or by earthquakes, tsunamis, or other natural hazard events, the effects are the same: severe pollution that kills plankton and works its way up the whole food chain to eagles, orcas, and even humans. The economic effects to fisheries can be cataclysmic, especially to the Suquamish Tribe, which relies heavily on fishing as a way of life.

Based on its cultural values, economic reliance, and vested treaty rights, the Suquamish Tribe must be viewed as a crucial stakeholder with rightful jurisdictional interests to partner in any efforts to mitigate the effects of disasters within the Puget Sound and in the watersheds defined by the U & A.

## Culturally Sensitive Areas

Founded in its deep cultural values, it must be recognized that the Suquamish People consider all lands and waters on our Reservation and U&A to be sacred and sensitive. Therefore, it is important to note that in accordance with Federal government criteria, the Tribe has identified 20 specifically culturally sensitive areas within the Port Madison Indian Reservation. Sixteen resources are on or directly adjacent to the contemporary marine shoreline and may be affected by wave action during severe storms, by oil spills and other toxic substances that enter marine waters, or by tidal waves caused by earthquakes on the Seattle Fault Zone. Again, based on the Tribe's cultural values, these specific areas only represent a portion of those lands and waters considered culturally sensitive.

Nine sensitive areas are archaeological shell midden sites or petroglyphs on boulders at the contemporary shoreline. The Old Man House archaeological site (45KP2) (Resource 16) extends along the shoreline of Agate Passage and includes pre-contact period archaeological deposits, historic period archaeological materials from the occupation of the Old Man House longhouse, and materials associated with the Suquamish village dating between 1870 and 1905. Cultural materials on the shoreline are subject to wave erosion and may be affected by landslides or toxic spills. Upland resources above the shoreline may be eroded during severe rainfall events or affected by landslides.

The Adams Marsh Complex and its shell midden archaeological site (45KP44) (Resource 8), Doe-Kag-Wats Marsh Complex and archaeological materials (Resource 11), Kiana Lodge Complex and archaeological materials (Resource 13), and Miller Bay Spit Complex (Resource 15) include significant wetland habitats and archaeological materials. Doe-Kag-Wats is a significant traditional cultural property for the Suquamish Tribe and the unique tidal marsh and wetland habitat may be affected by wave action and toxic spills.

Adams Marsh and the Miller Bay Spit Complex also have archaeological materials as well as wetland habitat. These too, may be affected by wave action during storm events or by toxic spills. The Kiana Lodge Complex includes wetlands, archaeological deposits, and significant historic structures. Waves during storms and toxic spills may affect the wetland and archaeological resources. Falling trees during winter storms may damage the historic structures as would fires.

Two sacred places (Resources 17 and 18) on Liberty Bay and Point Bolin have materials that are eroding from bluffs and low banks. These areas would be affected by excessive wave action and landslides.

The Suquamish Tribe House of Awakened Culture Complex (Resource 12) and the St. Peter Mission Church (Resource 19) are culturally significant structures, and may be damaged during storms, earthquakes, or fires. The Suquamish Cemetery (Resource 20) would be damaged during an earthquake.

An inland marsh complex in the western portion of the Reservation (Resource 14) is a traditional cultural property with significant plant resources. The wetland habitat could be affected by fire.

| Culturally Sensitive Sites | |
|---|---|
| **Site ID Number** | **Resource Description** |
| 1 | Archaeological Site 45KP32 - Shell Midden |
| 2 | Archaeological Site 45KP33 - Shell Midden |
| 3 | Archaeological Site 45KP34 - Shell Midden |
| 4 | Archaeological Site 45KP40 - Shell Midden |
| 5 | Archaeological Site 45KP41 - Shell Midden |
| 6 | Archaeological Site 45KP42 - Shell Midden |
| 7 | Archaeological Site 45KP43 - Shell Midden |
| 8 | Archaeological Site 45KP44 - Shell Midden and Adams Marsh Complex |
| 9 | Archaeological Site 45KP45 – Petroglyph |
| 10 | Archaeological Site 45KP48 – Petroglyph |
| 11 | Doe-Kag-Wats Marsh Complex |
| 12 | House of Awakened Culture Complex |
| 13 | Kiana Lodge Complex |
| 14 | Marsh Complex Inland |
| 15 | Miller Bay Spit Complex |
| 16 | Old Man Archaeological Site (45KP2) and Historic Village |
| 17 | Sacred Place |
| 18 | Sacred Place |
| 19 | St. Peter Mission |
| 20 | Suquamish Cemetery |

## Demographic Information

As of 2014, the Port Madison Indian Reservation area consists of 7,602 acres, of which 1,601 acres are owned by the Suquamish Tribe, 2,571 acres are owned by Tribal members, and 3,430 acres are owned by non-Tribal members.

Conventional census tracking details are as follows:

Land area within the existing jurisdiction: 7,602 acres

Land area within urban growth area: 0 acres

Land area of park, forest, and/or open space: 3,276 acres

Current population: 7,891 residents (Based on 2020 Census)

- *The average of 2.4 people per household is used in the hazard assessment sections to forecast the affected population.*

Expected population in 2025: 15,446 residents

- *Kitsap County's anticipated development and population trends project a moderate to quick increase in mixed-use commercial and residential development.*

Number of housing units: 3,847 (Based on 2020 Census)

- *4,650 Structures (Suquamish GIS)*

Predominant Home Construction: Wood Frame

Average value of housing units: Approx. $399,700 (not including land or contents)

Average value of home contents: Approx. $299,775

*The average content value based on insurance industry standard calculation of 75% of housing unit value is used in the hazard assessment sections to forecast the structure contents values.*

## Critical Facilities & Infrastructure

Critical facilities and infrastructure are defined as those structures that are critical to the health and welfare of the population. These become especially important after any hazard event occurs. Critical facilities included examples such as police and fire stations, schools, and tribal buildings including government buildings and housing. Critical facilities include buildings and businesses that are essential to the Reservation's economy and/or safety after an event. These include the Casino and businesses that supply essential goods such as food and equipment. Critical infrastructure includes the roads and bridges that provide ingress and egress and allow emergency vehicles access to those in need and the utilities that provide water, sewage, electricity, and communication services to the Reservation.

| Tribal Owned Critical Facilities & Infrastructure | Insured Values |
|---|---|
| Tribal Government Offices | $20,371,178.00 |
| Chief Sealth Grave | $165,210.00 |
| Communication Tower and Building | $895,987.00 |
| Watercraft & Equipment | $3,418,117.00 |
| Suquamish Seafood | $1,914,803.00 |
| Commercial Offices | $11,186,452.65 |
| Agate Passage Commercial | $11,186,452.65 |

| | |
|---|---|
| Kiana Lodge | $5,725,840.20 |
| Clearwater Casino and Resort | $206,712,427.74 |
| Grover's Creek Hatchery Complex | $1,632,594.00 |
| Community Longhouse | $8,256,593.00 |
| Elders Lodge | $255,175.00 |
| Chief Kitsap School Complex | $5,029,813 |
| Marion Forsman Early Learning Center | $6,990,781.00 |
| Utilities | $284,078.00 |
| Housing Sites | $21,231,943.92 |
| Pier | $2,784,424.00 |
| White Horse Golf Club | $7,865,138.17 |
| Fuel and Retail | $11,524,426.67 |
| Water System | $11,085,507.00 |
| Safe House | $268,067.36 |
| **Total** | $338,785,009.36 |

*Updated numbers for figures highlighted in yellow were not available by the completion of this report.

The Sanitary Sewer, Storm Sewer, Streets and Roads located within the reservation are managed by Kitsap County Departments.

Total estimated value of relevant critical infrastructure (including structures and contents) is **$338,785,009.36**.

| Culturally Significant Sites | Insured Values |
|---|---|
| Veteran's House | $443,188.00 |
| WWII Memorial | $290,045.00 |
| Museum | $5,179,409.00 |
| Totem Pole | $46,407.00 |
| Church & Food Bank | $305,045.00 |
| Youth Center | $2,838,978.00 |
| Fitness Center | $11,327,724.00 |
| Ball Field | $90,023.00 |
| Lake Leland | $450,607.00 |
| **Total** | **$20,971,426.00** |

**Vulnerability Criteria –** The following criteria were used to determine which critical facilities and infrastructure are particularly vulnerable:

**Flooding:** Any critical facility of infrastructure located near the shoreline has been identified as being vulnerable to flooding. The Tribe's salmon hatchery and several residential structures located on the Indianola Spit are particularly vulnerable to flooding.

**Severe Weather:** Since the entire Port Madison Indian Reservation is susceptible to severe weather, all critical facilities and infrastructure are considered exposed to this hazard. Given that electrical utilities and roads are most often affected by severe weather, all critical infrastructure managers and operators should plan for power outages and difficult ingress and egress. Critical

infrastructure, such as above ground power lines, are more likely to be impacted or damaged because of severe weather.

**Landslides:** Critical facilities are considered exposed to landslides if they are on or below historic landslides or potentially unstable slopes.

**Earthquake:** In an earthquake, all the Tribe's critical facilities will experience potentially damaging ground shaking. An earthquake has the potential to cause major structural and/or nonstructural damage to any non-retrofitted facility and hamper its functionality. Older buildings are especially vulnerable.

**Tsunami/Seiche:** Critical facilities and infrastructure are considered exposed if they are located less than 25' above the normal sea level. This has been defined as the 25' inundation zone.

**Wildland Fire:** Any critical facilities or infrastructure near high fuel load areas are exposed to risk from wildfires. The wildfire zones have been defined as forested lands beyond 500 feet of vehicular access.

**Climate Change**: The entire Port Madison Indian Reservation is susceptible to the impacts related to climate change. The scope of climate change is broad and often interconnected to various other hazards that could impact the reservation such as; flooding, severe weather, droughts, wildfire, landslides, epidemics, and other health related impacts. The impacts of climate change are anticipated to have critical impacts on the Usual and Accustomed Fishing grounds and Culturally Significant Archeological sites.

**Cybersecurity Event:** Cybersecurity related events are exponentially increasing throughout the Nation and show no signs of slowing. While the Tribal Government has not experienced a cybersecurity incident, impacts to critical infrastructure our community relies on have. Cybercriminals have increased attacks on Tribal Governments and Tribal Enterprises in the last several years.

## Climate & Weather Conditions

The Port Madison Indian Reservation has the temperate climate typical of the Puget Sound coastal lowlands. Summers are dry with mild temperatures, and winters are rainy with occasional snow. Summer highs can be in the high 90s, while winter lows can reach 0 degrees Fahrenheit. Winds vary in direction but are southerly and westerly. Winter winds average 25 mph with gusts up to 50 mph common. Air inversions and periods of stagnation occur for short periods during the winter, resulting in regional burn bans and other pollution control measures. Fog may occur in low lying areas such as Miller Bay and the Agate Passage. The climate is classified as a moderate climate based on the following averages:

- Annual temperature of 52.2°F (1.7°F above mean temperature for years 1901-2000)
- Average annual rainfall 48.59 inches (+.86-inch increase per decade since 1901)
- The average annual low temperature is 43.5°F (+.2°F increase per decade for years 1901-2021)
- The average annual high temperature is 60.0°F (+.1°F increase per decade for years 1901-2021)

## Local Disaster History

The following information summarizes the recent occurrence of natural disasters that have risen to the level of significance to warrant a Presidential declaration. Presidential declared disasters are events that cause more damage than state and local governments and resources can handle without assistance from the Federal government. Within Kitsap County, communities have been impacted by 19 Presidential Declaration qualifying disasters since 1965. The Tribe has only minimal records that itemize the extent of impact from those declarations, and limited data are available from state resources. However, Tribal members have indicated that many of those 19 events impacted the Suquamish Tribe in some way. The following tables summarize the region's Presidential Declaration history.

| Suquamish Presidential Declarations (2001-present) | | |
|---|---|---|
| **Type of Event** | **Date** | **Total Public Damage** |
| Nisqually Earthquake DR-3161 | February 2001 | $12,392 |
| December Winter Storm DR-1734 | December 9, 2007 | $185,500 |
| COVID-19 Pandemic DR-4481-WA | March 9, 2020 | $ 1,502,124.80 |

The Nisqually Earthquake 2001 caused damage to the Tribal Government Main Building's support beams, which were subsequently retrofitted with iron bands to strengthen the beams.

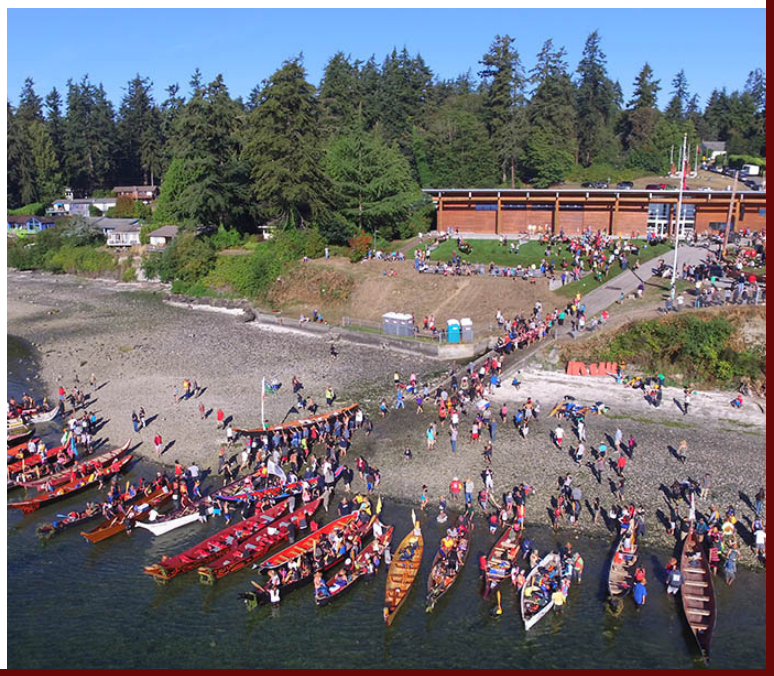
- The December Winter Storm 2007 created significant erosion to a shoreline bluff next to the Tribal Government Main Building placing the structures foundation at risk as well as covering the shellfish beds, which are used for subsistence harvesting. The bluff has since been stabilized.
- The December Winter Storm also created erosion and flooding damage along the shoreline of Kiana Lodge. Shoreline work and removal of structures was needed.
- The Coronavirus Pandemic is ongoing. Significant economic and social impacts underscored many facets of Tribal Government, Tribal Enterprises, and the community at large. Native Americans, as well as other black, indigenous, and people of color experience a greater risk of serious or negative outcomes caused by epidemics/pandemics.

| Kitsap County Presidential Declarations (1965-present) | |
|---|---|
| **Type of Event** | **Date** |
| 1. Earthquake DR-196 | 5/11/65 |
| 2. Severe Winter Storm DR-414 | 1/25/74 |
| 3. Severe Winter Storm DR-612 | 12/31/79 |
| 4. Volcanic Eruption DR-623 | 5/21/80 |
| 5. Severe Winter Storm DR-883 | 11/9/90 – 12/20/90 |
| 6. Severe Winter Storm DR-896 | 12/20/90 – 12/31/90 |
| 7. Severe Winter Storm DR-1100 | 1/26/96 – 2/23/96 |
| 8. Severe Winter Storm DR-1172 | 3/18/97 – 3/28/97 |
| 9. Nisqually Earthquake DR-1361 | 2/28/01 – 3/16/01 |

| | |
|---|---|
| 10. Severe Winter Storm DR-1499 | 10/15/03 – 10/23/03 |
| 11. Severe Winter Storm DR-1641 | 1/27/06 – 02/04/06 |
| 12. Severe Winter Storm DR-1671 | 11/2/06 – 11/11/06 |
| 13. Severe Winter Storm DR-1682 | 12/14/06 – 12/15/06 |
| 14. Severe Winter Storm DR-1734 | 12/1/07 – 12/17/07 |
| 15. Severe Winter Storm DR-1817 | 1/6/09 – 1/16/09 |
| 16. Severe Winter Storm DR-1825 | 12/12/08 – 1/5/09 |
| 17. Severe Winter Storm DR-1963 | 1/11/11 – 1/21/11 |
| 18. Severe Winter Storm DR-4056 | 1/14/12 – 1/23/12 |
| 19. COVID-19 Pandemic DR-4481-WA | 1/20/20 - Continuing |

# Tribal Council 2022

**From left: Vice-Chairman Josh Bagley, Council Member Luther "Jay" Mills, Treasurer Denita Holmes, Chairman Leonard Forsman, Council Member Sammy Mabe, Secretary Windy Anderson, and Council Member Rich Purser**

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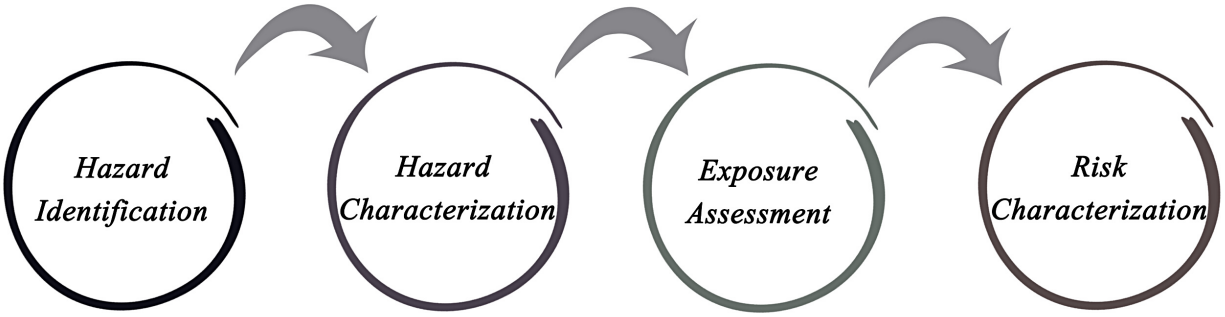
dxʷsəq̓ʷəb

*Place of the clear salt water*

# RISK ASSESSMENT

Multi-Hazard Mitigation Plan 2022

## *4 Steps of Risk Assessment*




THE SUQUAMISH TRIBE
Office of Emergency Management
18490 Suquamish Way, Suquamish WA, 98392
360-598-3311

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# Risk Assessment Rating Criteria

## Overview

Risk can be defined as when hazards and community assets intersect. To identify, plan for, and respond to any potential hazard within the community, a risk assessment provides information on the types of hazards, the location of hazards, and the value of existing land and property in hazard locations. A risk assessment includes an analysis of risk to life, property, and the environment that may result from any hazardous event.

Specifically, there are three important perspectives that a risk assessment must consider:

1. **Hazard Profile -** This considers the causes and characteristics of each hazard, its effect in the past (disaster history), and how the community's population, infrastructure, environment, and culture have been impacted.
2. **Vulnerability –** This considers those factors that make the hazard a threat to the community and what characteristics may increase the threat. It also considers those zones most likely to be susceptible to the threat and the degree to which it would impact the community.
3. **Probability of Occurrence -** This considers the likelihood of occurrence. Since predictions can only be based on historical occurrences, it is an adjective description (High, Medium, or Low) that attempts to consider the probability of a hazardous event occurring within the next 50 years.

## Risk Assessment

Introduction – Risk assessment will look at the hazards that could potentially affect the Port Madison Indian Reservation by determining the vulnerabilities of people, property, and the environment. An assessment of Tribally owned property, critical facilities, and community infrastructure will be made to determine loss estimations. Though the primary geographic focus will center on areas within the Reservation, it also will consider implication to the Tribe's Usual and Accustomed Grounds where doing so is applicable. The format of each hazard assessment will be as follows:

- Overview – An overview to characterize the hazard and to introduce associated key terminology.
- Impacts – An explanatory description of how the hazard would impact the Reservation.
- History – A summary of the known events and their significance on the Reservation.
- Vulnerability – A context explanation of how the hazard places the community at risk.
- Probability of Occurrence – A brief statement describing the likelihood of an event occurring.
- Risk Assessment – The summary of the assessment results based on the risk rating criteria.
- Conclusions – Brief summary statements to characterize the hazard's overall risk rating.
- Problem Statements – A collection of summary statements reflecting specific vulnerabilities.
- Mitigation Strategies – A collection of potential methods for mitigating the identified hazards.

## Hazards Profiled

The first step in conducting a risk assessment is to identify which natural hazards are most likely to negatively affect the community. Numerous documents including the Washington State Hazard

Mitigation Plan and the 2015 Kitsap County Hazard Identification & Vulnerability Analysis (HIVA) were analyzed. Since the Reservation is located within Kitsap County and possesses most all the same hazard profile characteristics, the Kitsap County HIVA was selected as the basis for determining which hazard classifications warrant assessment. Based on this rationale, the Tribe's risk assessment focuses on the following eight natural hazards.

- Floods
- Severe Weather Events
- Landslides
- Earthquakes
- Tsunamis, Tidal Surges, and Seiches
- Droughts
- Wildfires
- Climate Change
- Cybersecurity Events

The Tribe's risk assessment also incorporates an assessment of other potential hazards such as the following:

- Hazardous Materials
- Utilities Failure
- Terrorism & Domestic Terrorism
- Radiological Emergencies
- Mass Casualty Incident (MCI)
- Epidemic Emergencies

## Hazards Not Profiled

The following hazards do exist within the Puget Sound region, but the potential for their direct impact to reach the Port Madison Indian Reservation is extremely remote. This does not dismiss the potential for indirect impacts, which could be experienced in the form of flight restrictions, regional transportation impacts, etc. However, the degree of impact is likely to be minimal.

**Avalanches** - An avalanche occurs when loose snow or ice abruptly descends downhill. Damage extent is related to the type of avalanche, volume of snow and debris, force and velocity of the flow, and the avalanche path. Most commonly, avalanches are characterized as loose snow or slab avalanches. Other types include cornice collapses, ice falls, and slush avalanches. As they descend, avalanches tend to accrue additional material such as mud, rocks, trees, and debris. Avalanches are present in the high alpine areas of the Olympic and Cascade Mountains. But given that the Port Madison Reservation is located within the Puget Sound region, the potential for avalanche associated with steep rugged mountains or excessive buildup of avalanche prone snow cover simply does not exist. Therefore, avalanches are not included as one of the hazards warranting assessment.

**Volcanoes** - Mount Rainier and Mount Saint Helens are the nearest volcanoes that could potentially present a volcanic threat to the Reservation. Mount Rainier is the highest peak in the Cascade Range at 14,410 feet, but according to the USGS, is considered a dormant volcano. It carries more glacial ice on its slopes than any other mountain in the 48 contiguous United States. Theoretically, this could melt and cause flooding in a cataclysmic eruption.

Since 1820, Mount Rainier has experienced 1-2 small eruptions, small debris flows, and debris avalanches. Prehistoric deposits indicate that over the past 10,000 years destructive eruptions of hot lava and rock debris have melted snow and glacier ice, triggering debris flows with the consistency of wet concrete that surged down the mountain's river valleys. No indication exists that these flows have extended beyond the lowlands east of Tacoma and south of Seattle or beyond the present margin of Puget Sound. While devastating, this does not present a direct threat to the Reservation.

Mount Saint Helens erupted on May 18, 1980; at which time its elevation went from 9,677 feet down to 8,364 feet in one cataclysmic event. In the early 1980s, plumes of steam, gas, and ash often occurred on Saint Helens that could be seen from Portland, Oregon, 50 miles to the south. It is estimated that Mount Saint Helens has erupted two to three times in the past 200 years. It is described as having continuous intermittent volcanic activity since 1820. Ash from the 1980 eruption did not reach the Reservation and it is not believed that the volcano poses a direct threat to the Tribe.

## Risk Rating Criteria

An integral part of the risk assessment process is to utilize risk rating criteria that account for the three perspectives described Section 3.1 in an equitable manner that is realistic and reasonably accurate. The assessment needs to produce a hazard profile that provides an objective assessment of both vulnerability and probability. In the absence of any standardized risk rating methodology, the Planning Committee was faced with developing its own risk rating criteria. Tasked with this responsibility, the Planning Committee felt compelled to do so in a manner that most appropriately reflects the community. In the 2022 update, dollar value thresholds were increased in response to increased property values.

The Committee was particularly diligent in its efforts to ensure that the rating criteria were appropriately scaled to match the small size and limited capabilities of the community. The Committee also made a point to account for environmental considerations in a manner that appropriately honors and respects the unique cultural interests of the Suquamish Tribe. To that end, the following risk rating criteria are based on what the Planning Committee felt best reflects the community's interests.

**Planning Committee's Perspective** - Before developing hazard mitigation strategies, the planning process must first assess the community's level of risk in terms of a hazard's probability and degree of impact. To do this most effectively, the assessment must be both valid and credible.

We must bring as much objectivity into the process as possible, recognizing that our ability to predict the scale, type, and timing of future disasters is limited. Disasters may occur with enough frequency to allow us to generate historical averages or discern reliable patterns to provide tangible data sets and one of our most objective sources of information. Unfortunately, over-reliance on the historical record may give us a false sense of likelihood. We will supplement our local historic assessment by considering some of the threats and hazards that concern communities over a broader geographic area. The following risk assessment criteria provide a standardized means to evaluate the threat these hazards pose to our community. The addition of climate change and cybersecurity incidents to the plan this year (2022) requires us to use the best available projections data. This data takes into consideration historical information and current data of events that are already being experienced.

**Risk Assessment** - Risk assessment is based on categorizing the types of hazards; identifying the location of known hazards; estimating the value of existing land and property located within potential hazard locations; and based on these variables, analyzing the risk a hazardous event could pose to life, property, and the environment. Risk assessment is folded into the following criteria:

**Hazard profile**: Examines the nature of the hazard in the context of the Port Madison Indian Reservation. Scale is one aspect that will need thorough consideration, as smaller, localized phenomena may have an atypically high proportional impact.

**Probability of Occurrence**: Considers the likelihood of a hazardous event's occurrence within the next 50 years based on historical information or other probabilistic analysis. This assessment rates the distinction between those events with minimal likelihood of occurrence to those with a high degree of probability.

*Note: The USGS uses 50 years as their standard length of time for developing probabilistic shaking exceedance maps. In addition, Native Americans have codified and commonly follow the 7th Generation principle. This culturally important principle declares that in every decision, be it personal, governmental, or corporate, we must consider how it will affect our descendants seven generations into the future. Honoring this culturally important principle- equates to forecasting with a 175-year perspective. Based on the 7th Generation principle, events that might otherwise be considered unlikely become meaning that many of those hazards classified as medium or high probability are certain to occur.*

**Impact**: Considers, if a hazardous event were to occur, what the significance of its aftermath would be in terms of impact. This assessment rates two important variables, the degree of impact and the type of impact that would result as the consequence of an event's occurrence. Specifically, impact considers both the magnitude and consequential aftermath to life safety, property, economic vitality, and the environment.

**Risk Rating**: Combines Probability, Degree of Impact, and Type of Impact to determine the hazard's impact on the community. This assessment provides a way to compare the effects among more frequent events as well as providing a standard against which the most extreme and unusual events can be better evaluated.

**Probability of Occurrence** – Probability is an estimate of a hazardous event's likelihood of occurrence within the next 50 years and is based on a limited objective appraisal of a hazardous event's frequency using information provided by relevant sources, observations, and trends.

| Probability of Occurrence Rating Criteria | | | |
|---|---|---|---|
| **Probability** | **Rating** | **Description** | |
| >75% Probable | Very High | 5 | Very high probability this type of event will occur within the next 50 years. |
| 50 – 75% Probable | High | 4 | High probability this type of event will occur within the next 50 years. |
| 25 – 50% Probable | Moderate | 3 | Moderate probability this type of event will occur within the next 50 years. The potential for occurrence is ongoing and can be considered a near certainty within the next several centuries. *(Reference the 7th generation principle)* |
| 10 – 25% Probable | Low | 2 | Low probability that this type of event will occur within the next 50 years, though possible. |
| <10% Probable | Very Low | 1 | Very low probability this type of event will occur within the next 50 years. |

Degree of Impact – Classifies hazards to estimate the potential impact on the overall community's population, community infrastructure and physical property assets, economic commerce and services, and the environment. It is primarily based on the characteristics of a hazardous event itself as related to the general makeup of the community.

| Degree of Impact Rating Criteria | | | |
|---|---|---|---|
| **Impact** | **Rating** | **Description** | |
| Catastrophic Event | Very High | 5 | An event with widespread destruction occurs across the entire Reservation causing devastating impact to the total population, property, commerce, infrastructure, and services. |
| Major Event | High | 4 | An event with disproportionate devastation affecting a substantial portion of the Reservation with widespread impact to the total population, property, commerce, infrastructure, and/or services. |
| Moderate Event | Moderate | 3 | An event that damages a substantial portion of the Reservation, while large areas within the total population sustain few if any direct effects; but widespread impact to commerce, infrastructure, and/or services. |
| Localized Event | Low | 2 | An event that only damages and/or directly threatens isolated portions of the Reservation's population and property, but has minor impact to commerce, infrastructure, and /or services. |
| Small Event | Very Low | 1 | An event that only impacts small areas and/or segments of the Reservation's population and property, but with no measurable impact to commerce, infrastructure, and/ or services. |

Each Type of Impact category is weighted based on its given level of priority during an event. This acknowledges that when managing response and recovery efforts with limited resources, it is

understood that not every vulnerability can be afforded top priority. The categories are weighted based on the premise that life loss is permanent, where property can be rebuilt; infrastructure and services can be restored; economies will rebound; and with time and intervention, environmental conditions can recover. Following this premise, it makes sense that life safety should always be afforded the greatest degree of priority.

**Type of Impact** – The following categories were established to further refine the community's vulnerability to each hazard or threat. In any hazardous event, these impacts will have an overall effect on the community's response capacity and resilience for recovery. As such, it is important to ensure these considerations are assessed individually and given a rating that is as objective as possible.

| Type of Impact Rating Criteria | | | | |
|---|---|---|---|---|
| **Impact** | **Weight** | **Rating** | | **Description** |
| **Life Safety** *Event related deaths, PTSD (Post Traumatic Stress Disorder), & mental health issues* | **60%** | Very High | 5 | Loss of life >10; serious injuries >10 |
| | | High | 4 | Loss of life 5 – 10; serious injuries 5 - 10 |
| | | Moderate | 3 | Loss of life <5; serious injuries <5 |
| | | Low | 2 | Minor injuries, with no loss of life |
| | | Very Low | 1 | No injuries of loss of life |
| **Property** *Rebuilding cost for repairing event related property and infrastructure damage* | **10%** | Very High | 5 | Greater than $2 million to rebuild |
| | | High | 4 | Between $1 – 2 million to rebuild |
| | | Moderate | 3 | $50,000 – 1 million to rebuild |
| | | Low | 2 | Less than $50,000 to rebuild |
| | | Very Low | 1 | No measurable rebuilding cost |
| **Economy** *Event related economic losses to businesses resulting in job loss, extended unemployment, & underemployment* | **15%** | Very High | 5 | Loss of businesses >30%; economic recovery requires >5 years |
| | | High | 4 | Loss of business <30%; economic recovery within 2 - 5 years |
| | | Moderate | 3 | Economic recovery within 1 – 2 years |
| | | Low | 2 | Economic recovery within 1 year |
| | | Very Low | 1 | Little to no economic recovery required |
| **Environment** *Effects on the environment include damage to the Tribe's culturally sensitive sites, soils, estuaries, fish, and wildlife* | **15%** | Very High | 5 | Devastating environmental damage; recovery requires >5 years |
| | | High | 4 | Significant environmental damage; recovery requires 2 – 5 years |
| | | Moderate | 3 | Modest environmental damage; recovery requires 1 – 2 years |
| | | Low | 2 | Minimal environmental damage; recovery requires <1 year |
| | | Very Low | 1 | Minor environmental damage; little restoration required |

- *Damages include both public assistance as well as individual assistance.*

**Table 3-4**: Risk Rating Summary – The following is an example of the Overall Risk Rating Table, which combines the individual Probability of Occurrence, Degree of Impact rating, and the Type of Impact ratings into a single table that provides an overall summary of the risk rating.

| Risk Rating Summary (Example) | | | | |
|---|---|---|---|---|
| | **Probability/Impact** | **Rating** | | **Description** |
| P= | 50 – 75% Probable | High | 4 | There is a great likelihood this type of hazardous event will occur within the next 50 years. |
| DI= | Moderate Event | Moderate | 3 | An event that damages a substantial portion of the Reservation, large areas within the total population sustain few if any direct effects; but with widespread impact to commerce, infrastructure, and services. |
| TI= | **Life Safety (Weight 60%)** *Event related deaths, injuries, PTSD, & mental health issues* | High | 4 | Loss of life 5 – 10; Serious injuries 5 – 10 |
| | **Property (Weight 10%)** *Rebuilding cost for repairing event related property and infrastructure damage* | Moderate | 3 | $50,000 – 1 million to rebuild |
| | **Economy (Weight 15%)** *Economic losses to businesses resulting in job loss, extended unemployment, & underemployment* | Moderate | 3 | Economic recovery within 1 – 2 years |
| | **Environment (Weight 15%)** *Effects on the environment include damage to the Tribe's culturally sensitive sites, soils, estuaries, fish, and wildlife* | Low | 2 | Minimal environmental damage; recovery requires <1 year |

**Risk Rating Formula**: In calculating the overall risk rating for each hazard, the following formulas provide a standardized method for quantifiably assessing the community's vulnerability to hazardous events and the impact they may produce.

**P** = Probability of Occurrence (Table 3.1)

**DI** = Degree of Impact (Table 3.2)

**TI** = Type of Impact (Table 3.3) accounts for the hazard's impact consequences by using the formula: TI = (Life rating x .6) + (Property rating x .1) + (Economy rating x .15) + (Environment rating x .15)

**Overall Risk Rating Formula:** Risk Rating = (P (Probability) + DI (Degree of Impact) + TI (Type of Impact)) / 3

**Risk Rating Calculation Example:** A hazard is given a High Probability rating of P = 4, The Degree of Impact is determined to be Moderate, giving it a rating of DI = 3. Next, the Type of Impact rating is determined by, for example; a Life Safety rating of 4, a property rating of 3, an Economy rating of 3, and an Environment rating of 2. These weighted ratings combine to establish a Type of Impact rating of 3.45.

**P = 4 DI= 3** ***TI*** = (Life = 4 x .6) + (Property = 3 x .1) + (Economy = 3 x .15) + (Environment = 2 x .15)

TI = 2.4 + .3 + .45 + .3 **TI = 3.45**

**Risk Rating =** (4 + 3 + 3.45) / 3 **is** 10.45 / 3 = **3.48**

**Risk Rating Classification** – Categorizes each hazard on a priority scale based on the likelihood and overall threat posed by the impact of a hazardous events occurrence within the next 50 years. The Risk Rating is a subjective estimate only, which considers the probability of a hazardous event's occurrence in combination with its consequential impact on the community. In the above example, the Risk Rating Classification would be Moderate to High, based on a Risk Rating of 3.48.

| Risk Rating Classification | | | |
|---|---|---|---|
| **Risk Rating** | | **Classification** | **Description** |
| Very High | 5 | Urgent Priority | Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action |
| High | 4 | High Priority | Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action |
| Moderate | 3 | Modest Priority | Vulnerability is considered as a moderate probability with moderate impact, which warrants moderate priority mitigation action |
| Low | 2 | Low Priority | Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

dxʷsəq̓ʷəb

*Place of the clear salt water*

# FLOODING

Multi-Hazard Mitigation Plan 2022

**Risk Rating**

**3.03**

THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

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## Overview

Flooding is the most common hazard occurring within the region. Heavy, prolonged rain during the fall, winter, or spring months often results in saturated ground and high stream flows. Due to ground saturation, businesses and homes located in low-lying areas may flood during prolonged periods of rain. Wind-driven tidal flooding is also possible along inland waters due to runoff, ground saturation, or tidal flooding. Structures located within floodplain zones also are susceptible to frequent flooding.

The impacts of climate change are currently being observed and projected to become more frequent and severe. As regional and ocean temperatures rise, we can expect greater amounts of precipitation in the form of rain, rising sea-levels, and potential periods of drought that can make the ground less able to absorb water. Furthermore, the projection for more severe and frequent storms could lead to coastal erosion, in turn, increasing the potential for water inundation.

**Key Terminology**

**Floodplain**: The land area along a waterway that becomes inundated with water during a flood.

**100-Year Floodplain**: The area flooded by a flood that has a one percent chance of being equaled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a brief period.

**Flood**: The inundation of normally dry land that often results from rising or overflowing of water.

**Flash Flood** – A sudden and destructive rush of water, typically caused by heavy rainfall.

**Flood Insurance Rate Map (FIRM)**: The official map of a community on which FEMA has delineated both the community's special hazard zones and the risk premium zones.

**Risk Premium Zone**: The zone on the Flood Insurance Rate Map (FIRM) which delineates the Risk Premium Rates that include provisions for operating costs and allowances.

**Special Hazard Zone**: An area having special flood or flood-related erosion hazards as defined on the Flood Insurance Rating Map (FIRM).

**Storm Surge**: A rising of the sea because of atmospheric pressure changes and wind associated with a storm.

## Impacts

Floods may cause loss of life as well as considerable damage to residences, business establishments, public buildings, roads and bridges, utilities, agricultural land, fish and shellfish habitats, culturally sensitive sites, stream banks, and flood control structures.

Flooding is a natural event, and floodplains provide many natural and beneficial functions. Where human development is factored in, flooding can have several negative consequences. Migrating fish can be swept onto roads or into flooded fields, with no possibility of escape. Pollution from roads, such as oil and hazardous materials can wash into streams or onto shorelines. During floods, these can settle onto normally dry soil, polluting them for agricultural uses. Human development can increase stream bank erosion, leading to the unnatural migration of the streams course.

Secondary hazards for flooding include bank erosion, which in some cases, can be more harmful than flooding. Increased risk for hazards such as landslides when waters over-saturate soils on steep slopes,

causing them to fail. Hazardous materials spills are also a secondary hazard of flooding if storage tanks rupture and spill into streams, shorelines, or storm sewers. The public health hazards associated with flooding include but are not limited to hazardous debris movement (such as medical, household, commercial waste), animal carcasses, and dangerous chemicals that can lead to serious burns and infection. Flooding and its interconnected hazards have the potential to impact evacuation and/or response capabilities and reconnection of utilities which could have impacts to the community beyond the flooded areas.

## History

Historically, flooding occurs every year, especially in floodplain zones of streams. In 2007, significant rainfall following a snow event caused creeks to turn into rivers and high tides to create flooding along shorelines. This event washed out and undermined roadways, which caused several important transportation routes to be closed until they could be repaired. Puget Sound beaches and shellfish beds that are critical to the Tribe's economic vitality are often affected by wind driven flood tides that are compounded by periods of heavy rainfall and extreme high tides.

Annual flooding that occurred on Suquamish Way and Augusta Avenue in downtown Suquamish was noted in 1999 during a study conducted by the Suquamish Tribe and Kitsap County to find and address storm water control issues throughout Kitsap County. With funding from the Bureau of Indian Affairs, the Suquamish Tribe, and Kitsap County a major storm water mitigation project was started in September of 2003. The project was temporarily delayed when three abandoned underground tanks were discovered and had to be mitigated. The project resumed in 2008. The original antiquated storm water system was removed and replaced with larger lines, oil-water separators, and flow control for Augusta Avenue, which now drains into Puget Sound. The roadway and sidewalks also were repaved to better control the storm water. The total cost of the project was $561,000.

In 2007 the Suquamish Citizens Advisory Committee and the Suquamish Elementary School received a Safe Routes to School Grant and worked cooperatively with the Kitsap County Public Works Department to create sidewalk improvements. The sidewalk grant was combined with funds from the Surface and Storm Water Management (SSWM), which funds drainage and road improvements. By doing so, three significant improvements were made within Suquamish totaling $2,380,000. The first completed in 2008, was on Augusta Avenue (Center to Geneva); the second completed in 2009, was on Geneva Street (Augusta to Division) and Park Boulevard (Geneva to Prospect); and the third completed in 2011, was on Division Avenue and Suquamish Way.

The improvements along Division Avenue (Columbia Street to Suquamish Way) included two twelve-foot-wide travel lanes, a five-foot concrete sidewalk on the west side of the roadway, landscaped swales, drainage improvements that included a large storm sewer and conveyance, and replacement of the existing water main by Kitsap Public Utility District (PUD). Along Suquamish Way (Division Avenue to Augusta Avenue) improvements were made to the storm water conveyance.

## Vulnerability

The Port Madison Indian Reservation is vulnerable to flooding in both urban and rural areas. In urban areas, flooding is primarily a product of growth and the corresponding impact to watersheds and rural areas. The Reservation has numerous creeks, is prone to significant rainfall that are heavily influenced by the Puget Sound convergence zones. Consequently, the community can experience rapid flooding from creeks and streams into urban areas. There is also the vulnerability of localized flooding due to drainage system overload during especially large or intense storm events. The majority of the 100-year flood plain zone, however, is concentrated around shorelines.

Due to the sequential pattern of meteorological conditions needed to cause serious flooding, it is unusual for a flood to occur without some warning. Warning times for floods can be between 24 and 48 hours. Flash flooding events are less predictable, but those in potential hazard zones can be warned of potential flash flooding conditions.

## Probability of Occurrence

It can be expected that some flooding events will occur annually during extreme storm conditions. Flood planning is based on a 100-Year Flood; meaning the flooding conditions have a one percent chance of being equaled or exceeded each year. This is a statistical average only; a 100-year flood can occur more than once in a brief period. In fact, according to FEMA studies, a 100-year flood has a 26% chance of occurring during a 30-year period, the length of many mortgages.

Statistical techniques, through a process called frequency analysis, are used to estimate the probability of the occurrence of a given precipitation event coupled with stream flow data and tide levels. Rainfall recurrence intervals are based on both the magnitude and the duration of a rainfall event, whereas stream flow recurrence intervals are based solely on the magnitude of the annual peak flow.

## Risk Assessment

The following information summarizes the information gathered during the hazard assessment process.

FEMA Flood maps are one tool that communities use to know which areas have the highest risk of flooding. FEMA maintains and updates data through flood maps and risk assessments.

The SSURGO database contains information about soil as collected by the National Cooperative Soil Survey over the course of a century. Examples of information available from the database include available water capacity, soil reaction, electrical conductivity, *and frequency of flooding*; yields for cropland, woodland, rangeland, and pastureland; and limitations affecting recreational development, building site development, and other engineering uses.

**Structure within the Flood Hazard Zones –** The following table summarizes the estimated number of structures located within the flood hazard zones as defined above.

| Structures Within the Flood Hazard Zones | | | | |
|---|---|---|---|---|
| | | Structure Values | Content Values | Totals |
| Critical Facilities[1] | 4 | $10,588,661 | $5,853,177.75 | $16,441,848.75 |
| Residential[2] | 190 | $75,943,000 | $6,950,285.50 | $82,893,285.50 |
| Non-Residential[3] | 0 | N/A | N/A | |
| | | | | $99,335,134.25 |
| Residential structure values estimated at $399,700 average based on the 2022 housing market. Contents are estimated at 75% of the structure's value. Critical Facilities include the Kiana Lodge, Grovers Creek Hatchery, Suquamish Seafoods, & Suquamish Pier*. (Content value not calculated for Suquamish Pier) | | | | |

[1] As defined in the Tribal Profile.

[2] Any structure, movable or immovable, permanent, or temporary, that is adapted for both human residence and lodging whether occupied or not.

[3] Non-residential buildings consist of buildings other than dwellings, including warehouse and industrial buildings, commercial buildings, buildings for public entertainment, hotels, restaurants, educational, health buildings, etc.

**Affected Hazard Zones –** The following table summarizes the estimated population and culturally sensitive areas located within the flood hazard zones as they are defined above.

| Affected Hazard Zone | | | |
|---|---|---|---|
| Approximate Population[4]: | 456 | Approximate Acreage: | 93.3 |
| Description of Culturally Sensitive Areas: The following is a list of the culturally sensitive areas located within the hazard zone. (Reference Section 2, The Suquamish Tribal Profile for detailed descriptions of these areas.<br>5 – Archaeological Site 45KP41 – Shell Midden<br>6 – Archaeological Site 45KP42 – Shell Midden<br>8 – Archaeological Site 45KP44 – Shell Midden and Adams Marsh Complex<br>11 – Doe-Kag-Wats Marsh Complex<br>15 – Miller Bay Spit Complex<br>16 – Old Man House Archaeological Site (45KP2) and Historic Village<br>18 – Sacred Place | | | |

[4] Approximate population estimation is based on the 2020 Census 2.4 persons per household multiplied by the number of residential structures.

**Overall Risk Rating Formula:** (P (Probability) + DI (Degree of Impact) + TI (Type of Impact)) / 3 = Risk Rating

**Risk Rating Calculation for Flood Events:**

**P = 4**

**DI = 2.5**

TI = (Life = 2 x .6) + (Property = 5 x .1) + (Economy = 2.5 x .15) + (Environment = 3.5 x .15)

TI = 1.2 + 0.5 + 0.375 + 0.525

**TI = 2.6**

(4+2.5+2.6)/3 = 3.03

**Risk Rating Classification for Flood Events:** The following table indicates where the risk rating for Flood events falls within the risk rating classifications. The rating of 2.62 classifies the flood risk as moderately low, meaning it falls between Moderate and Low in terms of the probability of occurrence in combination with its consequential impact to the community.

| Risk Rating Classification for Flooding Events | | | |
|---|---|---|---|
| **Risk Rating** | | **Classification** | **Description** |
| Very High | 5 | Urgent Priority | Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action |
| High | 4 | High Priority | Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action |
| **Moderate** | **3** | **Modest Priority** | **Vulnerability is considered as a moderate probability with moderate-high impact, which warrants moderate priority mitigation action** |

| | | | |
|---|---|---|---|
| Low | 2 | Low Priority | Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

## Conclusions

Although the Overall Risk Rating is moderate (**3.03**), it represents a 15.65% increase in risk from the 2017 MHMP which was calculated as 2.62. The addition of climate change related impacts additional infrastructure and individual residences that could experience damage, which could be significant. Life Safety will be affected as well as the economy, which would likely recover quickly. The results will be dependent on associated hazards such as landslides, hazardous materials events, additional impacts to the environment, and health issues.

## Problem Statements

The following problem statements reflect specific vulnerabilities identified in the process of conducting the risk assessment. These are included to summarize the community's most significant risks and vulnerabilities related to flooding.

There are several culturally sensitive areas located within the areas identified by the FEMA Flood Insurance Rate Map. These areas would be vulnerable to water damage and erosion caused by flooding and include the following culturally sensitive sites (Reference Section 2, Suquamish Tribal Profile)

5 Archaeological Site 45KP41 – Shell Midden
6 Archaeological Site 45KP42 - Shell Midden
8 Archaeological Site 45KP44 - Shell Midden and Adams Marsh Complex
11 Doe-Kag-Wats Marsh Complex
15 Miller Bay Spit Complex
16 Old Man House Archaeological Site (45KP2) and Historic Village
18 Sacred Place

## Mitigation Strategies

The following mitigation strategies offer a series of sample recommendations. They must be considered, approved, and funded by the authority having authority to be implemented. They are in no way intended to imply a call to action, constitute serving as an action plan, or be binding recommendations.

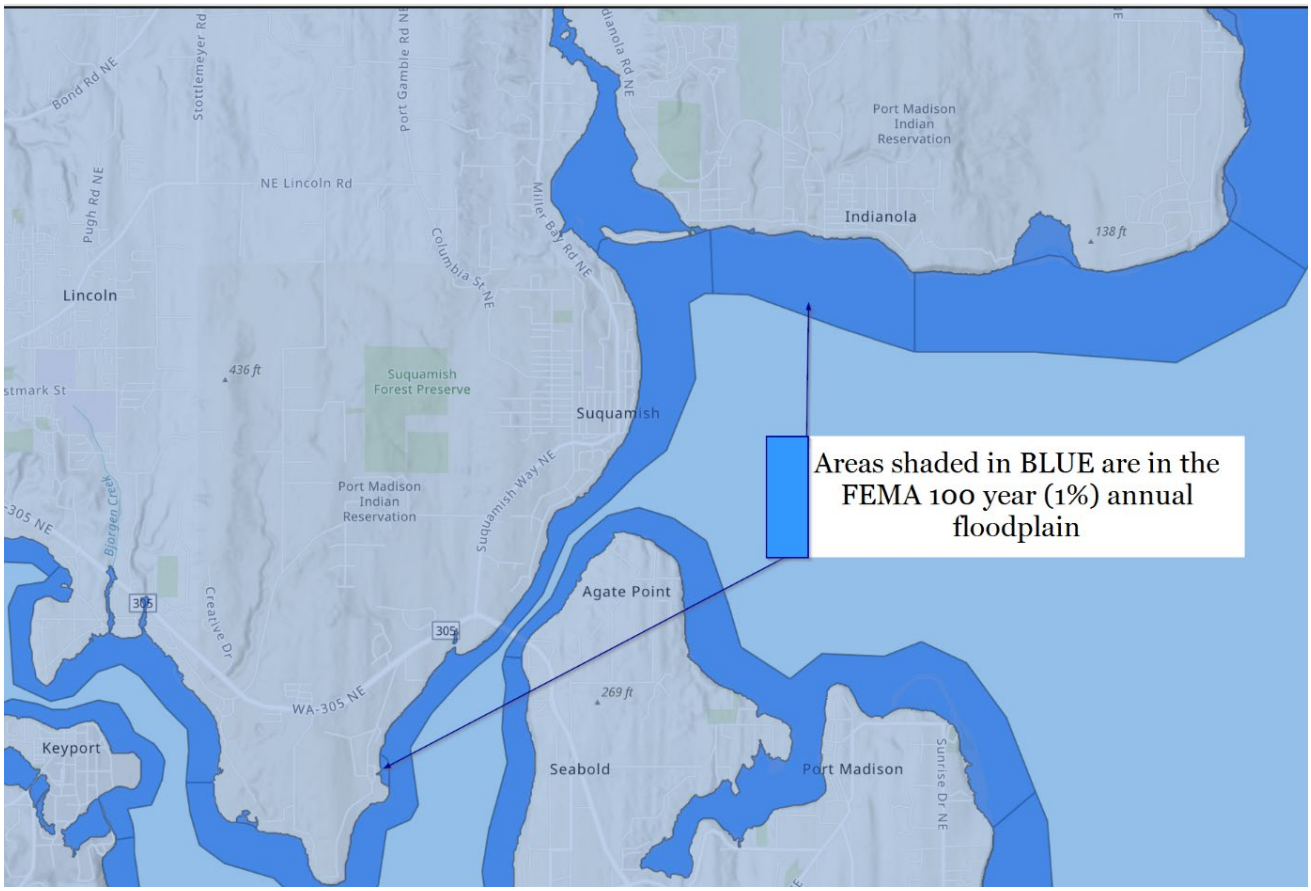
The Suquamish Tribe's treaty-reserved cultural, environmental, and economic interests extend well beyond territory located within the Port Madison Indian Reservation. Therefore, the following mitigation strategies also may have relevant application throughout the region as defined by the Tribe's Usual and Accustomed Grounds. (Reference Chapter 2, Suquamish Tribal Profile)

- PE-1: Deliver public education to engage the community as stewards for maintaining the effectiveness of both domestic and commercial storm water drainage systems located on private property.

- DS-1: Continue active Tribal participation in local community, county, state, and federal growth management planning efforts; the development of land use and zoning standards; the process of conducting environmental impact studies; and permitting processes so that the Tribe's risk management interests are addressed.
- DS-2: Continue to assure that all the Tribe's development projects meet or exceed all applicable best practice standards related to managing landslide, mudslide, and erosion vulnerability to assure wetland preservation, provide shoreline protection, and protect critical areas.
- IE-1: Continue collaborative relationships with the Kitsap County Public Works Department's efforts to mitigate landslide, mudslide, and erosion hazards within the Reservation; provide educational resources; and seek grant opportunities that will support mitigation & nature-based solutions.
- IE-2: Evaluate the Indianola Spit's access/egress vulnerability to potential flooding of NE William Rogers Road; implementing mitigation measures that would prove suitable and cost effective.
- IE-3: Evaluate the Doe-Kag-Wats estuary's access/egress vulnerability to potential flooding and related hazards of the access road; implementing mitigation measures that would prove suitable and cost effective.
- EP-1: Continue active Tribal representation in the relevant forums to assure the Tribe's habitat preservation interests are considered and accounted for within both wetland preservation and shoreline management decisions.

## Culturally Sensitive Sites

FEMA FLOOD MAP 100 Year Flood Zone 2017 (1% Annual Flood)



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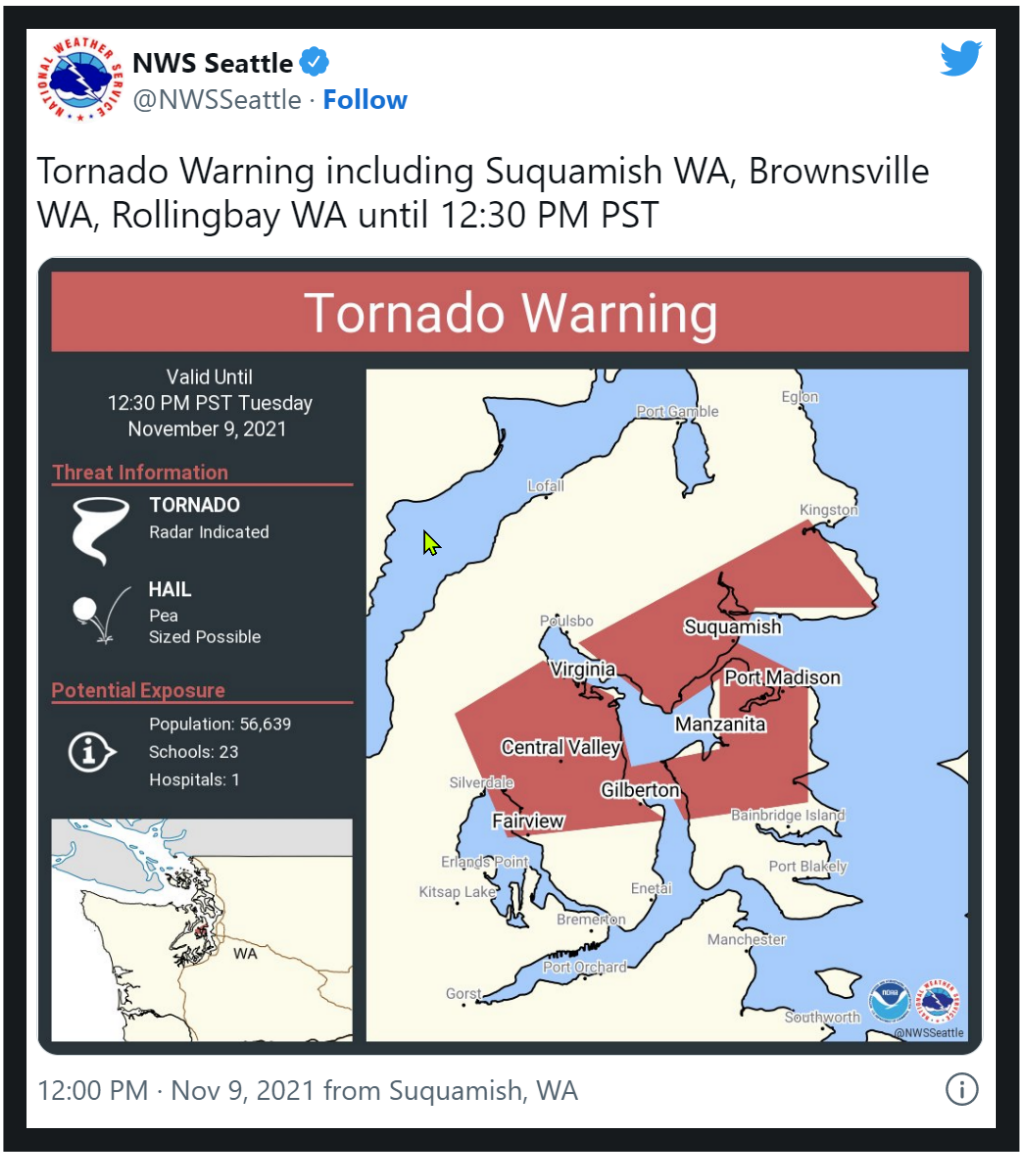
*Place of the clear salt water*

# SEVERE WEATHER EVENTS

Multi-Hazard Mitigation Plan 2022




**Risk Rating**

# 3.74


THE SUQUAMISH TRIBE
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## Overview

The Port Madison Indian Reservation experiences all the types of severe weather common to the Puget Sound region. This includes windstorms, heavy rain, and an occasional snow and ice storm. Though rare, tornados do occur within the region. The Reservation is located within the Puget Sound Convergence Zone where opposing air streams converge to produce precipitation. The Convergence Zone shifts, but encompasses the Reservation.

The region typically experiences multiple storm events each year. Most do not reach the level of becoming a widespread, damaging event. However, they do often generate pockets of significant local impacts or damage, the impacts of climate change are projected to increase the frequency and severity of storms.

**Key Terminology**

**Puget Sound Convergence Zone -** This is a weather phenomenon unique to Puget Sound and NW Washington State. Northwest winds in the upper atmosphere become split by the Olympic Mountains, then re-converge over Puget Sound, causing updrafts and rain.

**Severe Local Storms –** These include what are termed “microscale” atmospheric systems: tornadoes, thunderstorms, windstorms, ice storms, and snowstorms.

**Typical Weather Patterns** – Washington’s location on the windward side of the Pacific coast results in a marine-type climate west of the Cascade Mountains. The Puget Sound region’s climate is impacted by the Olympic Mountains where the first major release of rain occurs along the west slopes of the Olympics, with the second along the west slopes of the Cascade Range. Atmospheric pressures originating in the Pacific Ocean dramatically affect weather patterns. During the summer and fall, high-pressures result in a prevailing westerly and northwesterly flow of comparatively dry, cool, and stable air, resulting in a warmer dry season. In the winter and spring, the high pressure shifts further south, which shifts the prevailing wind southwesterly, bringing in cool moist air from the Pacific. This results in a wet season beginning in late October or November, reaching a peak in winter, and gradually decreasing by late spring.

During the wet season, rainfall is typically light to moderate intensity and continuous over a period, rather than heavy downpours for brief periods. The strongest winds occur during the fall and winter with wind velocities commonly reaching 40 to 50 mph. Winds can reach 75 to 90 mph, and typically do so every few years. During the winter months, freezing drizzle can occur, and is often accompanied with a warm Chinook wind (a Native American word meaning “snow-eater”). These warm winds can cause drastic and rapid temperature increases that can cause rapid snow melting and flooding.

**Puget Sound Convergence Zone** – The Puget Sound is a prime example of how surface-level convergence of air streams in rugged terrain can produce updraft regions, which in turn will generate clouds and convective rain showers. Westerly winds off the Pacific Ocean must cross the high and rugged Olympic Mountain range. One of the easiest paths for the air to follow inland is eastward through the Strait of Juan de Fuca into the Georgian Basin and then southward through the channels of Puget Sound, producing the northern air stream. The opposing air stream results from air flow that traverses the coastal range further south to skirt the high peaks, rolling over low ones and then flowing through fjords to eventually push northward into the Sound. Where these air currents meet is called the Puget Sound Convergence Zone and is where the moist marine air rises to produce convective rain showers that help to reinforce Seattle's wet reputation.

The Convergence Zone shifts north or south, depending on the strength of each air stream. If the southern air stream becomes stronger, it will push the Zone further north, and vice versa. Warm and cold fronts are prime areas for updraft formation, combining the force of convergence with that of buoyancy. Along the warm front, the warm air converges on the colder air and, because it is less dense, slides upward over the cold air. Within the cold frontal zone where cold air converges on the warm, the heavier cold air pushes under the warm, and lifts the warm air aloft. Lifts at the cold front are more explosive, and the resulting updrafts more rapid, causing convective clouds to grow into thundershowers or thunderstorms.

**Hazard Profile** – As it is with the entire Puget Sound region, the Port Madison Indian Reservation experiences a range of severe weather event types. This includes heavy rains, windstorms, occasionally snow and ice storms, and on rare occasions, even a tornado is possible. The Puget Sound Convergence Zone produces unique weather patterns as the jet stream splits to get around the Olympic Mountains and then converges again. When this occurs, the air rises and temperatures shift, often causing extreme weather conditions. The following further describes the characteristics of these event types.

**Blizzard**: Though rare for the inner Puget Sound area, a blizzard like storm is possible. Blizzards consist of considerable falling and/or blowing snow combined with sustained winds or frequent gusts of 35 mph or greater that frequently reduce visibility to less than one-quarter mile.

**Snowstorms**: Heavy snow in Western Washington is confined to the mountains with heavy accumulation in the lowlands uncommon. Snowfall within the Reservation does occur, typically a couple of times each winter, but is with minor accumulation that is short lived.

**Freezing Rain**: When rainfall occurs when the ambient temperature is below the freezing point, the rain will freeze on impact, producing a layer of glazed ice over everything it touches. Though the layer of glaze is typically quite thin, it can build up to one inch in depth. In severe ice storms, perfectly healthy trees can become burdened with tons of ice, creating a serious threat to power and telephone lines and transportation routes.

**Severe Local Storms**: These include what are termed “microscale” atmospheric systems such as tornadoes, thunderstorms, windstorms, ice storms, and snowstorms. Typically, major impacts from a severe storm are transportation and loss of utilities. The major characteristic all these events have in common is that though they may cause a great deal of destruction and even death, their impact is confined to a small area.

**Thunderstorms**: Though the most common of severe weather systems, they are normally localized events that can become large scale events reaching 20 miles or so in diameter, lasting 30 minutes from birth to growth through maturity to decay. Thunderstorms are underrated hazards; producing lightning that can be a serious threat to human life. Thunderstorms are often accompanied by localized rain showers and/or hail, commonly referred to as thundershowers. It is also common for heavy rain to be dumped in a small area over a brief time, which can lead to flash flooding. Intense winds, hail, and tornadoes also can be associated dangers.

**Tornado**: Sudden windstorms formed by the turbulent mixing of layers of air with contrasting temperature, moisture, density, and wind flow is the least yet potentially the most dangerous of severe storms. This mixing accounts for most of the tornadoes occurring in April, May, and June when cold, dry air moving into the Puget Sound region from the north or northwest meets warm, moister air moving up from the south.

**Windstorms**: Storms consisting of violent winds. There are several sources of windstorms. Southwesterly winds are associated with strong storms moving onto the coast from the Pacific Ocean. Winds running parallel to the Cascade Mountains can be among the strongest and most destructive winds. Windstorms tend to damage ridgelines that face into the winds.

Often a storm will have a period of heavy rain followed by high winds. The effects of the heavy rain can saturate root mass that weakens a tree's ability to withstand high winds.

**Extreme Heat Events**: Characterized by weather conditions that are hotter and/or more humid than typical for a given location at that time of year*. The average number of Extreme Heat Events (Temperatures sustained above 90° F for Kitsap between the years 1976-2005 was 2. Projected for 2050 is 11 days above 90° F annually).*

## Impacts

The effects of a strong thunderstorm, tornado, windstorm, or ice storm are likely to be similar; fallen trees, downed power lines and interruption of transportation lifelines, and damaged homes and public buildings. Fatalities are uncommon in Western Washington, but they can occur. If a major tornado struck a populated area within the Reservation, damage could be widespread. Businesses could be forced to close for an extended period or permanently, fatalities could be high, many people could be homeless for an extended period, and routine services such as telephone or power could be disrupted. In the case of extremely high winds some buildings may be damaged or destroyed. Due to the (often) short warning period, livestock are commonly the victims of a tornado or windstorm.

The effects of an ice storm or snowstorm also can cause downed power lines and trees and a significant increase in traffic accidents. These storms can cause death by exposure, heart failure due to shoveling or other strenuous activity, traffic accidents (over 85% of ice storm deaths are caused by traffic accidents), and carbon monoxide poisoning. They also have the potential to cause large losses among livestock, caused primarily by dehydration rather than cold or suffocation. Other concerns include frozen pipes and roof collapses due to heavy snow loads.

Although windstorms are not an excessively frequent problem within the Reservation, they have been known to cause substantial damage. The predicted wind speed given in wind warnings issued by the National Weather Service is for a one-minute average; gusts may be 25% - 30% higher. Under most conditions the county's highest winds come from the southwest, although they have been known to blow from the south or east. The highest recorded wind gust in the vicinity was more than 81 miles per hour.

The impacts of climate change are projected to increase the severity and frequency of hazardous weather events. As local, national, and global temperatures rise this will create a greater demand for resources both locally and regionally. Additional severe and extreme weather events jeopardize lives, property, the economy, and environment, while the higher frequency of these events create additional challenges responding to and recovering from disasters.

**Warning Time** – Meteorologists are often able to predict the likelihood of an incoming severe storm. However, the unique characteristics of the Puget Sound Convergence Zone make it exceedingly difficult for meteorologists to accurately predict the exact time of onset or the severity of the storm. Some storms may come on more quickly and have only a few hours of warning time.

**Secondary Hazards** – The most significant secondary hazards associated with severe storms within the Puget Sound region are floods, landslides, and electrical hazards (fires) from downed powerlines. Rapidly melting snow combined with heavy rain can quickly overwhelm both natural and manufactured

drainage systems, causing overflow and property destruction. Landslides occur when the soil on slopes becomes oversaturated and prone to failure.

## History

Periodic wind and snowstorms are the most frequent form of severe storms to impact the Reservation area. Wind and/or snow events can be difficult to predict, but they are clearly the most routine of all storm events within the region. Fortunately, most of them produce only minor damage. However, that is not always the case. The following provides a summary of the most noteworthy recent storm events.

**Windstorms**

- October 12, 1962 – The Columbus Day Windstorm: According to the National Weather Service, this was the State's top weather event during the 20th Century. Called the "mother of all windstorms," this was the most powerful windstorm to hit the Northwest since weather record keeping began in the 19th Century. This was the strongest widespread, non-tropical windstorm to strike the continental U.S. during the 20th century, affecting an area from northern California to British Columbia. The storm claimed 7 lives in Washington State; 46 died throughout the impacted region. One million homes lost power. More than 50,000 homes were damaged. Total property damage in the region was estimated at $235 million (1962 dollars). The storm blew down 15 billion board feet of timber worth $750 million (1962 dollars); this is more than three times the timber blown down by the May 1980 eruption of Mount St. Helens, and enough wood to replace every home in the state.
- February 13, 1979 – The Hood Canal Floating Bridge suffered a catastrophic failure. Having withstood sustained winds of up to 85 mph and gusts estimated at 120 mph throughout the night, the bridge finally succumbed at about 7:00 a.m. when the western draw span and pontoons broke loose and sank. At the time of the failure, the bridge had been closed to traffic, the draw span was open to relieve lateral pressure, and the tower crew had evacuated. It is believed that the intense winds blew pontoon hatches open, allowing the pontoons to flood and sink. It took three years to rebuild the bridge and a cost of $143 million.
- November 1981 – Record high winds.
- January 20, 1993 – The Inauguration Day Windstorm: Hurricane force winds swept through the region, claiming 5 lives. More than 870 million homes and businesses lost power. Fifty-two single-family homes, mobile homes, and apartment units were destroyed, and 249 incurred major damage, many from falling trees and limbs. More than 580 businesses were damaged. Total damage in Western Washington is estimated at $130 million. Winds in the Puget Sound area gusted to 70 mph. A gust at Cape Disappointment on the Washington Coast reached 98 mph with damage estimated at $250 million. The Interstate 90 – Lake Washington floating bridge between Seattle and Mercer Island sank during this storm event.
- December 1995 – California Express Windstorm.
- January through March 1999 – A series of La Niña winter windstorms impacted the entire Puget Sound region.
- December 2006 – (Federal Disaster #1682). This storm brought 90 mph winds to Washington's coastline and wind gusts of up to 70 mph in the Puget Sound region. The storm also knocked out power to 1.5 million Washington residents with some not seeing electricity restored for 11 days. A federal disaster was declared for all 39 of Washington's counties and estimated damages exceeded $50 million dollars.

**Snowstorms**

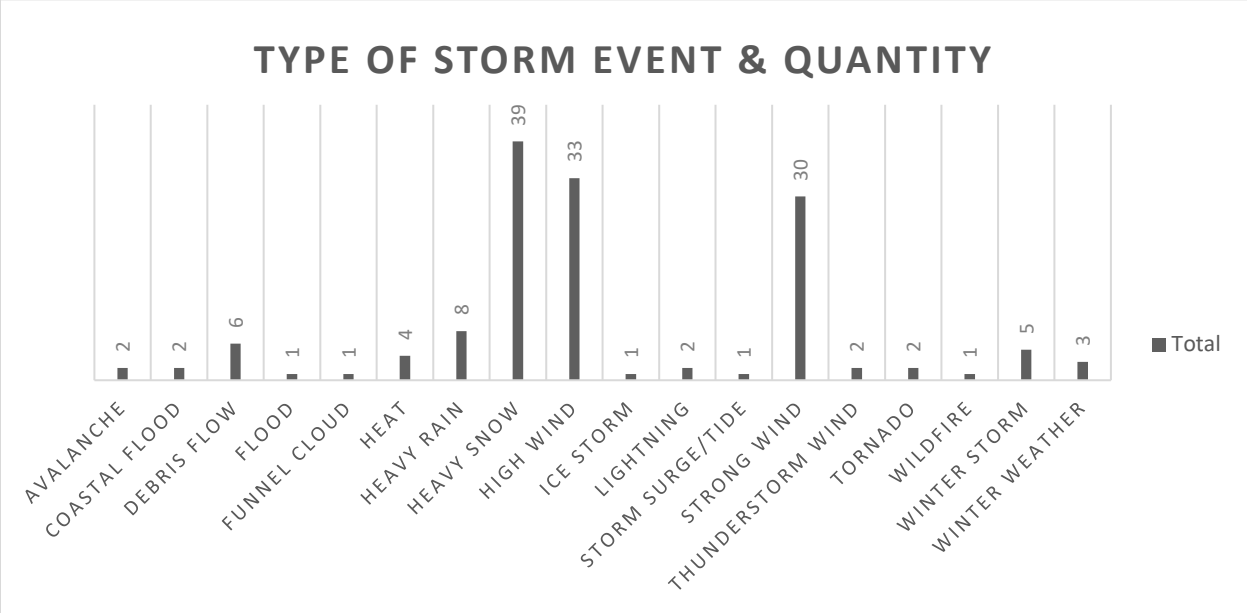
- January/February 1916 – Seattle's Greatest Snowstorm: According to the National Weather Service, this was one of the State's top 10 weather events during the 20th Century. Seattle's snowfall in January was 23 inches, and February snowfall was 35 inches, for a two-month total of 58 inches. Seattle recorded its maximum snowfall ever in a 24-hour period, with 21.5 inches on February 1. Other parts of Western Washington received between 2 to 4 feet of snow. Winds created snowdrifts as high as 5 feet. The region was crippled, with transportation halted.
- January 13, 1950 – The January 1950 Blizzard: According to the National Weather Service, one of the State's top 10 weather events during the 20th Century. On this date, 21.4 inches of snow fell in Seattle, the second greatest 24-hour snowfall recorded. The snowfall was accompanied by 25-40 mph winds. The storm claimed 13 lives in the Puget Sound area. January had 18 days with high temperatures of 32 degrees or lower. The winter of 1949-50 was the coldest winter on record in Seattle, with an average temperature of 34.4 degrees.
- November 1961 – Severe Storm: Heavy snow and high winds affected the region.
- January 1969 – Severe Storm: Heavy snow and high winds affected the region.
- January 1971 – Severe Storm: Heavy snow and high winds affected the region.
- January 1980 – Severe Storm: Heavy snow and high winds affected the region.
- December 1990 – Severe Storm: Floods, snow, and high winds affected the region.
- December 1996 – January 1997 "Holiday Blast" Storm: Saturated ground combined with snow, freezing rain, rain and rapid warming and high winds within a 5-day period produced flooding and landslides, impacting the entire state. Twenty-four deaths; an estimated $140 million in insured losses; 250,000 people lost power.
- Winter 2000 – In addition to the events reported above, North Kitsap experienced a serious snow/ice storm that knocked down numerous power lines and coated the roads with black ice. It was reported that as many as 100 car accidents occurred due to the icy conditions this storm brought.

**Rainfall**

- December 2007 – The most significant recent rainstorm arrived bringing record high temperatures (59°F for Seattle) and moist tropical air and led to record rainfall and flooding around Western Washington. Reports indicated that 6-hour and 24-hour precipitation was at or near 100-year levels. This became the wettest day on record for Bremerton which received 7.50 inches of rain. Several sites reached record high river flows and high flood stage levels. The Coast Guard rescued more than 300 people from the flood areas, and the flooding and mudslides resulted in at least 5 deaths.
- January 2009 – Severe Winter Storms, Landslides, Mudslides, and Flooding (Federal Disaster No 181725): A strong, warm, and very wet Pacific weather system brought copious amounts of rainfall, with subsequent major flooding, as well as minor flooding that continued through most of January. The storm involved a strong westerly flow aloft with embedded sub-tropical moisture, known as an atmospheric river of moisture. Snow levels rose from near sea level to between 6,000 and 8,000 feet, with strong westerly winds enhancing precipitation amounts in the mountains. This event caused an estimated 1,500 land/mudslides across the state and resulted in structural damage to buildings from added snow load, compounded by heavy rains. All Western Washington's lowlands received 3-8 inches of rain. The National Weather Service issued flood warnings for 49 flood warning points across the state. On January 7th, Olympia received a record breaking 4.82 inches of rain.

**Frequency -** History demonstrates that, in addition to annual snowfall, the Reservation will encounter an average of one major snowstorm every ten years. The frequency of a major snowstorm is variable and is not predictable on a seasonal basis. 2019 was the most recent major snowstorm. Ice storms also occur infrequently but are estimated to have a higher degree of probability. Windstorms occur infrequently but can usually be predicted more accurately than other local storms. The Reservation can expect to experience at least one windstorm each year. The National Climatic Data Center has collected information about past severe weather events in Kitsap County since 1950. There has been a total of 143 events recorded.

**Severe Storm History within Kitsap County –** The following graph summarizes the type and quantity of Kitsap County severe storms. It should be noted that the flood event in the graph below is from data collected by the National Climatic Data Center and is linked to a heavy rain event that led to riverine flooding. And it is not inclusive of all flooding events within the county.




## Vulnerability

The entire Port Madison Indian Reservation is exposed to various forms of severe weather events. Certain areas are more exposed than others due to their geographic location and local weather patterns. Populations living at higher elevations with large stands of trees or power lines may be more susceptible to wind damage and black out, while populations in low-lying areas and shorelines are at risk for flooding, storm surge, and erosion. Vulnerable populations include the elderly and people with life-threatening illnesses, and residents living in areas that are isolated from major roads. Power outages can be life threatening to those dependent on electricity for life support, such as breathing machines; or for heat during periods of low temperatures. Isolation of these populations is a significant concern, as is the potential exposure to the elements during severe weather events.

There are several governmental, commercial, and residential structures within the Reservation that would be at risk in the event of severe weather hazards. The frequency and degree of damage is dependent on their specific location and the specific event scenario. All property is vulnerable during

severe weather events, but properties in poor condition or in particularly vulnerable locations may be most vulnerable to damage.

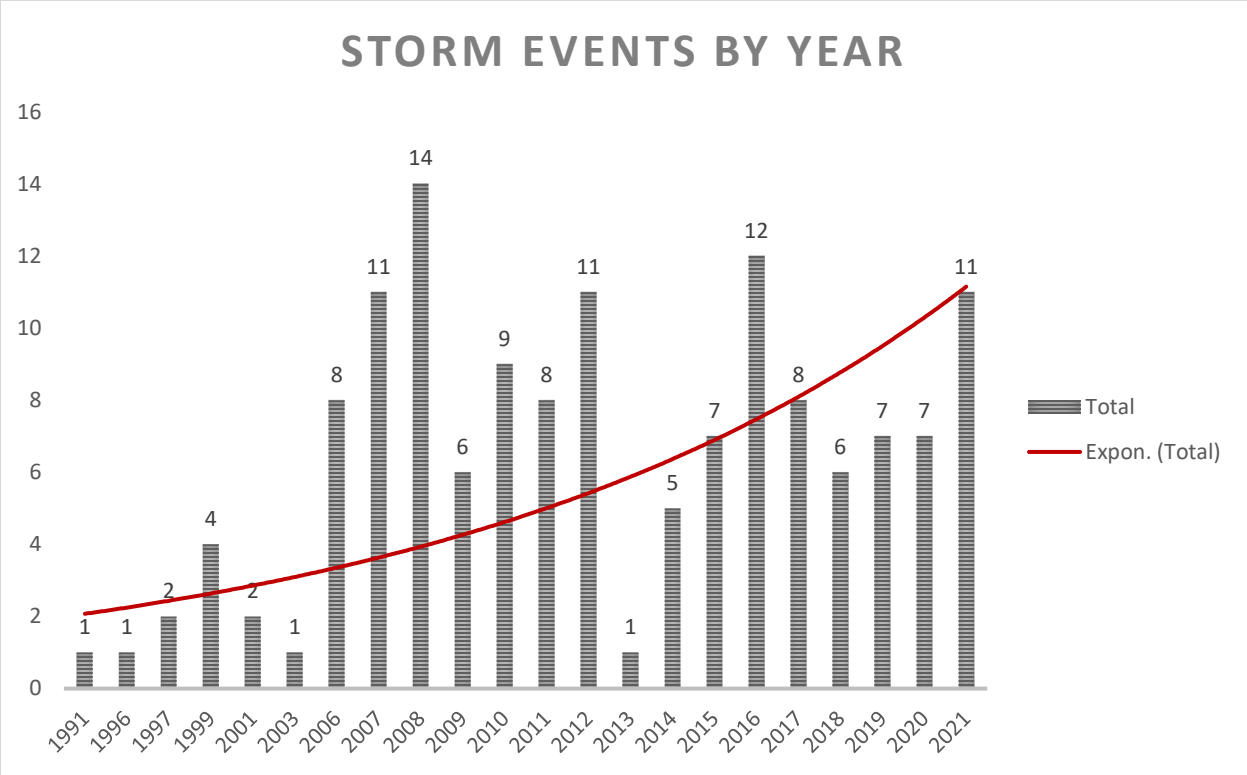
Those in higher elevations or on ridges may be more prone to wind damage. Those under or near overhead lines or near large trees may be vulnerable to falling ice, wildfires caused by damaged powerlines, or may be damaged in the event of a collapse. The most frequent problem associated with severe weather is loss of utilities. Downed power lines can leave large areas isolated and without heat or cooling sources in addition to critical life-sustaining medical equipment for some residents. Phone, water, and sewer systems may not function. Public services, such as power and utility restoration, assistance from law enforcement, public works, fire, and emergency medical response are all likely to be delayed due to the demands of multiple calls for services, restrictions caused by road closures, etc.

Roads may become impassable from secondary hazards such as landslides caused by heavy prolonged rains or runoff from melting snow. High winds can cause considerable damage to trees and power lines, blocking roads with debris, incapacitating transportation, isolating communities, and disrupting ingress and egress. Snowstorms in higher elevations can significantly impact transportation and the availability of public safety services. Of particular concern are roads providing access to isolated areas and to the elderly. Prolonged obstruction of major routes due to landslides, snow, debris, or floodwaters can disrupt the shipment of goods and other commerce. Large, prolonged storms can have negative economic impacts for an entire region. Severe windstorms, downed trees, and ice can create serious impacts on power and above-ground communication lines. The buildup of freezing rain and snow can cause them to break or become damaged, disrupting electricity and communication. Loss of electrical, phone, and cellphone service would leave populations isolated because residents would be unable to call for assistance.

The environment is highly exposed to severe weather events. Natural habitats such as streams and trees are exposed to the elements during a severe storm and risk major damage and destruction. Prolonged rains can saturate soil and lead to slope failure. Flooding events caused by severe weather or snowmelt can produce channel migration and/or damage to delicate wildlife habitat. Storm surges can erode beachfront and redistribute sediment loads.

## Probability of Occurrence

Utilizing historical data for types of events and frequency, combined with climate change projections, the rate of severe weather events is becoming more frequent and severe. According to NASA research, every 1.8 degrees Fahrenheit that Sea-Surface Temperatures increased, the number of extreme storms went up by about 21 percent. Based on their climate model projections, the researchers concluded that extreme storms may increase 60 percent by the year 2100. With 143 events to date from 1991-2022, by 2100 the projected number of storms is approximately 228.8.




## Risk Assessment

**Loss Estimation** – There are no recognized standards in place to quantifiably estimate damage from severe storm events. This is largely because the broad scope, nature, and type of damage can vary considerably. Furthermore, storm history demonstrates that a severe storm's impact is widespread throughout the entire community, rather than isolated to specific geological hazard zones. A severe storm has the potential to affect all people, all property, as well as essential community infrastructure. But in most cases, it is this infrastructure, such as roadways and power lines that suffer the most damage from severe storm events.

Losses to the Reservation also would be experienced in the form of economic and social effects. Storms that damage fishing and essential harvesting grounds would impact essential resources Tribal members rely on for their basic sustenance and economic security. Therefore, except for the collateral damage from floods and storm surge, which are estimated in the Flood section of this plan, the risk assessment for severe storms is based on the experiences and lessons learned from previous severe storms. The increase of Extreme Heat Events

**Risk Rating Summary for Severe Storm Events –** Based on the data obtained, the following table summarizes the Probability of Occurrence (P), Degree of Impact (DI), and Type of Impact (TI) ratings assigned to potential severe storm events on the Port Madison Indian Reservation. (*Reference Section 3, Risk Assessment Rating Criteria)*

**Overall Risk Rating Formula:**

Risk Rating = (P (Probability) + DI (Degree of Impact) + TI (Type of Impact)) / 3

**Risk Rating Calculation for Severe Weather Events:**

**P = 5**

**DI= 3**

TI = (Life = 3.5 x .6) + (Property = 3 x .1) + (Economy = 2 x .15) + (Environment = 3.5 x .15)

TI = 2.1 + 0.3 + 0.3 + 0.525

**TI = 3.225**

**Risk Rating = (**5 + 3 + 3.225) / 3 is 11.225 / 3 = **3.74**

**Risk Rating Classification for Severe Weather Events:** The following table indicates where the risk rating for severe weather events falls within the risk rating classifications. The rating of 3.74, a 3.31% increase from the 2017 MHMP rating of 3.62, classifies severe weather events as moderate to high in terms of the probability of occurrence in combination with its consequential impact to the community.

| Risk Rating Classification | | | |
|---|---|---|---|
| **Risk Rating** | | **Classification** | **Description** |
| Very High | 5 | Urgent Priority | Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action |
| **High** | **4** | **High Priority** | **Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action** |
| **Moderate** | **3** | **Modest Priority** | **Vulnerability is considered as a low probability with moderate impact, which warrants moderate priority mitigation action** |
| Low | 2 | Low Priority | Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

## Conclusions

The Overall Risk Rating for severe storms is moderate to high (3.74). Given that winter storms are a routine occurrence within the community; this rating may seem higher than it should be. However, there is a distinction between routine storms that cause only minor damage and those that rise to the level of severe. The rating is not intended to reflect routine storms. Rather, it is intended to reflect severe storm events and to account for the fact that they occur with a high degree of frequency. Severe

storms differ from those considered routine because their severity is such that they produce widespread damage throughout the community.

The biggest impact is often on utility infrastructure where large segments of the community are affected, many for extended periods of time. Conversely, the potential for life loss is moderate and economic impacts are typically low, meaning they will recover quickly. The increasing frequency and severity in addition to more extreme heat events could lead to more severe economic consequences due to climate change. The rating also accounts for the likelihood of an extreme heat event, severe rain, ice, or snowstorm causing collateral damage in the form of flooding, landslides, and electrical hazards. This simply compounds the community's vulnerability during a severe storm.

## Problem Statements

The following problem statements reflect specific vulnerabilities identified in the process of conducting the risk assessment. These are included to summarize the community's most significant risks and vulnerabilities related to severe storms.

- Throughout the community there are homes and businesses that are vulnerable to structural damage as the result of a severe windstorm due to the proximity of large trees.
- Given the popularity of rural development, there are several residences located within areas where they could become isolated during a severe storm.
- There are essential elements of community infrastructure such as roadways and power and phone lines located within areas where they are subject to damage from falling trees during severe wind and/or ice and snowstorms.
- History has shown that significant severe storms have a cascading effect, often triggering collateral damage such as landslides and electrical hazards. This compounds the Reservation's vulnerability during a severe storm.
- Currently, homes in western Washington are built in a such a way that helps trap heat inside and few have access to air conditioning. With heat-related events becoming more intense and frequent this poses significant problems for human health, especially for children and the elderly.
- There are several culturally sensitive areas located within the Reservation that would be vulnerable to collateral water damage and erosion caused by severe storm-induced flooding. These include the following culturally sensitive sites: (Reference Section 2, Suquamish Tribal Profile)

    1 Archaeological Site 45KP32 - Shell Midden

    2 Archaeological Site 45KP33 - Shell Midden

    3 Archaeological Site 45KP34 - Shell Midden

    4 Archaeological Site 45KP40 - Shell Midden

    5 Archaeological Site 45KP41 - Shell Midden

    6 Archaeological Site 45KP42 - Shell Midden

    8 Archaeological Site 45KP44 - Shell Midden and Adams Marsh Complex

    9 Archaeological Site 45KP45 - Petroglyph

11 Doe-Kag-Wats Marsh Complex

13 Kiana Lodge Complex

15 Miller Bay Spit Complex

16 Old Man House Archaeological Site (45KP2) and Historic Village

18 Sacred Place

## Mitigation Strategies

The following mitigation strategies offer a series of sample recommendations. They must be considered, approved, and funded by the authority having authority to be implemented. They are in no way intended to imply a call to action, constitute serving as an action plan, or be binding recommendations.

The Suquamish Tribe's treaty-reserved cultural, environmental, and economic interests extend well beyond territory located within the Port Madison Indian Reservation. Therefore, the following mitigation strategies also may have relevant application throughout the region as defined by the Tribe's Usual and Accustomed Grounds. (Reference Chapter 2, Suquamish Tribal Profile)

- PE-1: Promote public education efforts to engage the community as stewards for maintaining the effectiveness of both domestic and commercial storm water drainage systems located on private property.
- PE-2: Deliver public education to develop a culture of disaster preparedness based on the need for citizens to be self-reliant and prepared to care for themselves for at least two weeks.
- PE-3: Promote public education opportunities that inform residents on energy efficient mitigation options that reduce indoor heat accumulation for extreme heat.
- DS-1: Continue active Tribal participation in local community, county, state, and federal growth management planning efforts; the development of land use and zoning standards; the process of conducting environmental impact studies; and permitting processes so that the Tribe's risk management interests are addressed.
- DS-2: Continue to assure that all the Tribe's development projects meet or exceed all applicable best practice standards related to managing landslide, mudslide, and erosion vulnerability to assure wetland preservation, provide shoreline protection, and protect critical areas.
- DS-3: Support and/or encourage electrical utilities to use underground construction methods where possible to reduce power hazards and outages from windstorms.
- IE-1: Continue collaborative relationships with the Kitsap County Public Works Department's efforts to mitigate landslide, mudslide, and erosion hazards within the Reservation; provide educational resources; and seek grant opportunities that will support mitigation efforts.
- IE-4: Continue to develop and implement prevention programs designed to keep vulnerable trees from threatening lives, property, and public infrastructure during windstorm events.

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*Place of the clear salt water*

# LANDSLIDES

Multi-Hazard Mitigation Plan
2022

**Risk Rating**

**3.02**

THE SUQUAMISH TRIBE
Office of Emergency Management
18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

## Overview

The term landslide refers to the down-slope movement of masses of rock and soil. Slides range in size from thin masses of soil a few yards wide to deep-seated movement of many acres to depths of hundreds of feet. Slides are commonly categorized by the form of initial failure, but they may travel in a variety of forms along their paths. This travel rate may range in velocity from a few inches per month to many feet per second, depending on slope, material, and water content. The recognition of ancient, dormant slide masses is important as they can be reactivated by earthquakes or unusually wet winters. Also, because they consist of broken materials and have disrupted ground water flow paths, they are more susceptible to construction-triggered sliding than adjacent undisturbed material.

Mudslides and debris flows are rivers of rock, earth, organic matter, and other soil materials saturated with water. Where mudslides consist primarily of saturated soil materials; debris flows consist of saturated soil materials mixed with debris such as vegetation and trees that is carried with and/or picked up by the mudslide as it travels. This debris can compound a mudslide's impact by damming, redirecting, or otherwise obstructing mud flow. Mudslides develop in the soil on sloping surfaces when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt. Water pressure in the pore spaces of the material increases to the point that the internal strength of the soil is drastically weakened. The soil's reduced resistance can then easily be overcome by gravity, changing the earth into a flowing river of mud or "slurry."

Erosion refers to the gradual removal of soil through wind or water action. Erosion may be induced or increased by failure to use ground covers to protect soil from wind or drainage systems that allow effective management of storm water to avert mudslides and excessive debris flows. Also, slopes on waterfront can be severely undercut by normal wave action or large waves produced by storms. The following factors contribute to landslides and earth movements:

- Erosion caused by rivers, glaciers, or ocean/sound waves.
- Earthquakes shake the ground and create stress and instability within vulnerable soils.
- Increased loads from manufactured structures like roads and the weight of rain/snow and/or vegetation.
- Hydrologic issues caused by high water tables, freezing, and thawing of ground, or weak soils.
- Development of land, grading of roads, and the removal of vegetation.

**Key Terminology**

**Debris Flow** – A fast moving mass of loose mud, sand, soil, rock, water, and vegetation that travels down a slope under the influence of gravity.

**Erosion** – Refers to the gradual removal of soil through wind or water action.

**Hillslope** – A steep (commonly 20-35 degrees) surface.

**Landslide** – The down-slope movement of masses of rock and soil.

**LIDAR** – Light, Detection, and Ranging (LIDAR) technology used for mapping the shape and elevation of the earth's surface using a laser beam emitted and read from an aircraft.

**Mudslide** – A flow of rock, earth, organic matter, and other materials saturated with water.

**Scarp** – A steep slope or long cliff where landslides originated. Sometimes scarps may be found within landslide deposits or as surface features resulting from seismic activity.

## Impacts

The most significant effects of landslides are severe injury or death, disruption of transportation, and the destruction of property. Landslides typically and primarily cause damage to roads, railroads, sewers, water lines, homes, and commercial buildings. Severe slides may affect shipping and travel routes to the extent that economic loss results.

Uncontrolled water flow frequently causes erosion, which in turn can cause mudslides and excessive debris flows. Erosion also can move soil, causing gullies, which ruin land and deltas by covering the more valuable land. The effects of erosion are usually much less dramatic than landslides, but the results may be significantly costlier. Landslides, mudslides, and debris flows also can occur because of flooding areas and/or can cause localized ground saturation and/or flooding if they impact the drainage system within the slope or bluff. Excessive infiltration of water can result in ground saturation, which also can lead to layers of saturated soils becoming unstable and sliding as water saturation separates them from impervious soil layers.

## History

Numerous landslides have impacted the region throughout history. Landslides can cause deaths, considerable damage to properties, and in some cases, loss of the use of land for many years due to the extensive cost of restoration. The Oso Landslide in 2014 left 42 people dead and many injured and devastated the town of Oso, the Stillaguamish River, and surrounding infrastructure. This tragedy reminds us of the unpredictability of these events and the devastating impact they can have on a community.

The geological conditions of western Washington are primarily a legacy of repeated glacial episodes of advance and retreat during the past two million years. The cool, rainy Pacific Northwest climate ensures that soil moisture levels remain high throughout most of the year, and in fact are often at or near saturation during the wetter winter months. The region's topography reflects glacial carving, as well as the differential erosion of weaker sediments in the 13,000 years since the last ice disappeared. Consequently, our region is subject to landslides and soil erosion due to wind, water, and flooding at all times of the year. In Kitsap County's more recent history, the winter storm of 1996, caused the death of a family of four on Bainbridge Island and destroyed millions of dollars in both public and private property. A report by the USGS provided a summary of the area from a geological perspective and the long-term issues affecting the area. The report stated:

*"Although slow-moving slides were less common than debris flows, they caused significant property damage. Slow, deep-seated slides severely damaged several homes, roads, and utilities on the rim, bench, or sloping face of bluffs. Many of the deep slides appeared to result from reactivation of preexisting landslide deposits. Detailed engineering-geologic mapping to identify existing landslides before development and establishing minimum setback distances for structures at the rim of bluffs could help reduce damage caused by deep slides.*

*The distribution and likelihood of debris flows and shallow landslides occurring in any given area are crudely predictable. In general, such landslides occurred in the same areas and relative abundance as they have previously. Analyzing the spatial and temporal distributions of historic landslides and debris flows could aid in delineating areas of significant landslide hazard for parts of the Puget Lowland.*

*Though debris-flows were abundant and widespread on lake and coastal bluffs, debris flows were particularly hazardous in certain settings and any attempt to delineate debris-flow hazard zones should include the potential paths (run-out zones) as well as the source zones. Several homes on beaches or benches that were directly down slope from steep bluffs were struck and destroyed or damaged by*

*debris flows. One such debris flow killed a family of four people sleeping in the lower level of their home, which was built directly down slope from a steep bluff." (USGS Landslides Triggered by the Winter 1996-97 Storms in the Puget Lowland, Washington)*

## Vulnerability

The State of Washington rates landslide losses second to flood losses for the state, with the Puget Sound basin having the greatest vulnerability. This is because of increased population density and development on or within the collapse zone of bluffs and slopes. As referenced in a series of sensitive area maps, the region has several landslide-prone hazard areas ranging from low to very high hazard ratings. Areas with the largest landslide risk are often at some distance from development, although an event would impact roads and transportation lifelines. The two most common types of landslides within the Puget Sound region are Deep Seated and Shallow landslides.

Within the Puget Sound region, the most common type of landslide tends to be the Shallow Slides, which occur in response to intense, short-duration storms. Deep-Seated Slides are less common for the region than other types, but they tend to be the largest and most destructive. Many landslides occur in January after the water level has risen during the wetter months of November and December.

In addition to the shoreline bluffs, land sliding is most prevalent around the slopes of Puget Sound's steep, linear hills. According to the USGS, water is involved in all cases; and, consistent with other studies in the region, human influence was identified in more than 80% of the reported slides.

The recognition of ancient, dormant mass movement sites is important in the identification of those areas most susceptible to flows and slides because they can be reactivated by earthquakes or by exceptionally wet weather. Also, because they consist of broken materials and frequently involve disruption of ground water flow, these dormant sites are more vulnerable to construction-triggered sliding than adjacent undisturbed material.

Mass movements can occur either very suddenly or slowly. There are methods used to monitor mass movements that can provide an idea of the type of movement and amount of time prior to failure. It also is possible to determine what areas are at risk during general time periods. Assessing the geology, vegetation, and amount of predicted precipitation for a given area can help in these predictions.

Landslides also can cause several different types of secondary effects such as by blocking roadway egress and ingress, causing isolation of residents and businesses. These blockages can impede public and commercial transportation, resulting in economic losses for businesses. Other secondary effects can impact power and communication systems resulting from downed trees taking out power and communication lines. This, in turn, creates communication and power isolation. Landslides also can destabilize structural foundations requiring extensive and costly repairs. Landslides can damage rivers or streams, potentially harming water quality, and destroying delicate fisheries and spawning habitat.

## Probability of Occurrence

Slope failures that result in landslides occur when forces allow gravity to overcome the inertia and structural integrity of the soil and rock in a slope. The Reservation continues to be impacted by landslides and erosion issues with each new winter storm. Soil erosion and minor slides continue to occur, especially at steep slopes and construction sites during wind and rainstorms. It is difficult to predict precisely if, when, where, and to what extent a landslide will occur. There are, however, seasonal predictions that can be made in locations that have historically experienced heavy rains affecting shorelines. In some cases, the rate of precipitation over a period can serve to predict the vulnerability of a slope.

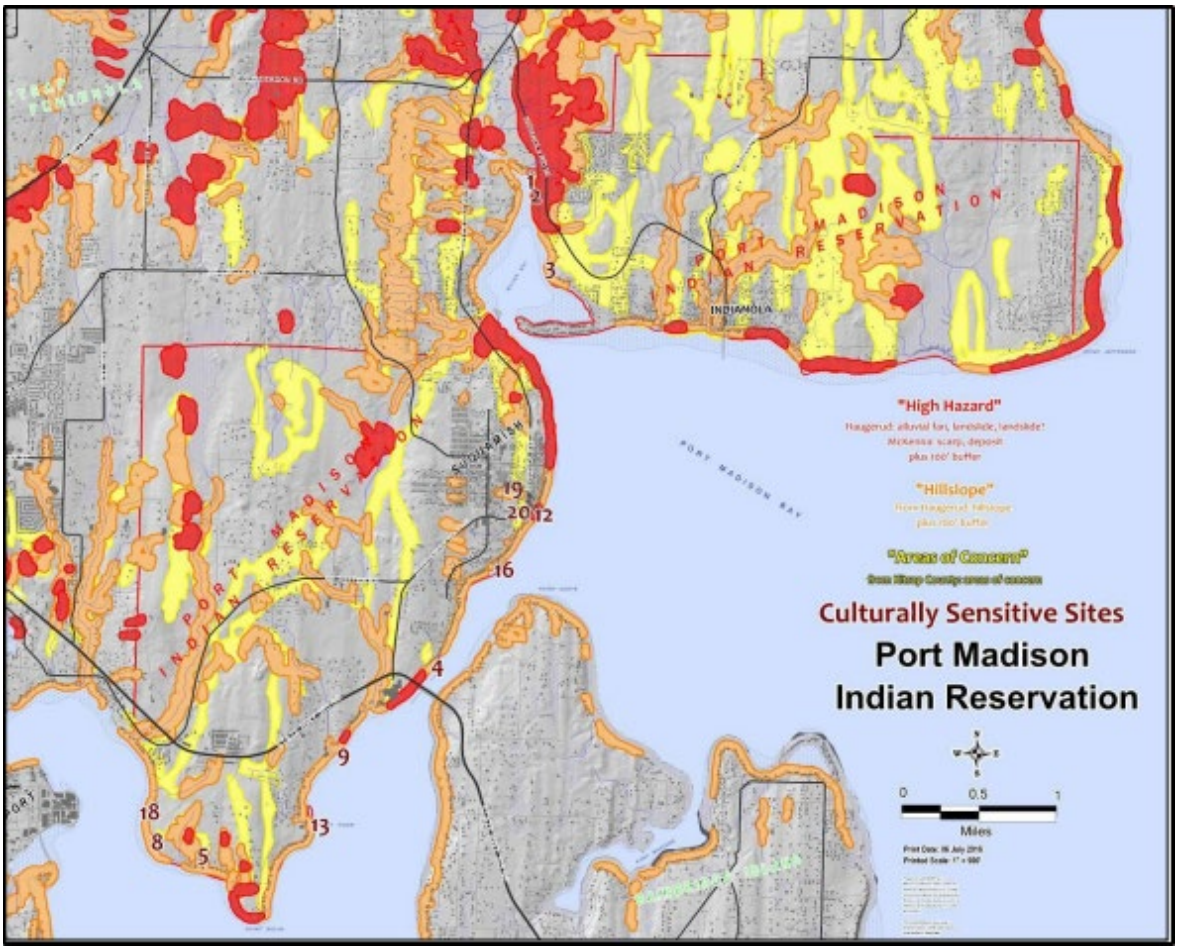
Despite the difficulty in predicting landslides, previous research conducted by the USGS in Kitsap County has been instrumental in mapping landslide areas. Light, Detection, and Ranging (LIDAR) mapping provides essential information about the land and geological history of the land's surface. LIDAR is a remote-sensing technology typically used in this context to measure the shape and elevation of the earth's surface using a laser beam emitted and read from aircraft. In 2008 the USGS completed two relevant studies using LIDAR that provided useful information about landslides in Kitsap County that far surpasses what was previously available.

## Risk Assessment

The following is a summary of the information gathered during the hazard assessment process. The data sets used to estimate relative landslide risk include the two USGS studies as well as the geologically hazardous areas designated by Kitsap County. Kitsap County's High Hazard/ Geologically Hazardous Areas dataset is primarily derived from digitized areas of steep, unstable slopes from the 1979 Slope Stability Map of Kitsap County and the Coastal Zone Atlas. "Areas of [Geologic] Concern" include slopes that do not meet steepness or instability criteria of the prior classification along with certain soil types as classified by the Natural Resources Conservation Service. Both classifications may include areas that geologists in the field determined met the County's criteria. As of 2022, regular monitoring of potential landslide areas has not been feasible, though information about this hazard is widely shared during extreme weather events that could increase the risks of landslide, erosion, and debris flows. The increasing severity and frequency of severe weather events due to climate change will increase the likelihood of landslide, erosion, and debris flows.

Geologic data from the USGS's Jonathan P. McKenna, et.al. (2008); Landslides mapped from LIDAR imagery, Kitsap County and Ralph Haugerud, (2009); and preliminary geomorphic map of the Kitsap Peninsula have all been used to assess landslide risk. McKenna's work was focused specifically on landslides, and those areas have been included in the following risk assessments. Haugerud was mapping a much wider variety of features and in the process, classified four types that also are included.

Landslide Susceptibility Map– The following map provides a local representation of the USGS mapping completed for Kitsap County in 2008 and is based on the use of LIDAR imagery. The map combines the McKenna and Haugerud data sets to generate three ranked categories; the highest ranked are High Hazard Areas.




The three categories, designated by color on the map, are:

**High Hazard Areas (Red)** – The areas color coded in red reflect a combination of the:

- Geologically Hazardous Areas (USGS, 2008) – with no buffers added;
- McKenna's mapped scarps & deposits – with addition 100 ft. buffers;
- Areas mapped by Haugerud as having a high probability for landslides, a vulnerability to landslides, and areas vulnerable to alluvial fans where debris and sediment is deposited after being transported by excessive mud flow – with 100 ft. buffers added.

Buffers are added to account for mapping inaccuracies that occur when mapping lines dissect through a portion of an area that would be affected. The buffer expands the mapping lines, so these areas are included and appropriately accounted for.

**Hillslope Areas (Orange)** – The areas color coded orange reflects the hillslopes as mapped by Haugerud – with 100 ft. buffers.

**Areas of Concern (Yellow)** – The areas color coded yellow reflects the areas of Geologic Concern – with no buffers.

**Potential Landslide Affected Hazard Zones** – The following table summarizes the estimated population and approximate acreage as well as culturally sensitive areas located within the landslide hazard areas as they are defined in Map 6.1 above.

| Landslide Hazard Zones | | |
|---|---|---|
| **High Hazard Areas:** | Approximate Acreage: | 280 |
| **Hillslope Areas:** | Approximate Acreage: | 1,314 |
| **Areas of Concern:** | Approximate Acreage: | 2,194 |
| | Total: | 3,788 |
| Description of Culturally Sensitive Areas: The following is a list of the culturally sensitive areas located within the High Hazard and Hillslope areas. The list does not include any Culturally Sensitive areas within the Areas of Concern. *(Reference Map 6.1 and Section 2, The Suquamish Tribal Profile for detailed descriptions of these areas.)*<br>1 - Archaeological Site 45KP32 - Shell Midden<br>2 - Archaeological Site 45KP33 - Shell Midden<br>3 - Archaeological Site 45KP34 - Shell Midden<br>4 - Archaeological Site 45KP40 - Shell Midden<br>5 - Archaeological Site 45KP41 - Shell Midden<br>8 - Archaeological Site 45KP44 - Shell Midden and Adams Marsh Complex<br>9 - Archaeological Site 45KP45 – Petroglyph<br>12 - House of Awakened Culture Complex<br>13 - Kiana Lodge Complex<br>16 - Old Man House Archaeological Site (45KP2) and Historic Village<br>18 - Sacred Place<br>19 - St. Peter Mission<br>20 - Suquamish Cemetery | | |

**Structures within the Landslide Hazard Zones** – The following table summarizes the type and estimated number of structures located within each of the landslide hazard areas as defined in the Landslide Vulnerability Map above.

| Structures Within Hazard Areas | | | | |
|---|---|---|---|---|
| High Hazard Areas | | Structure Values | Content Values | Totals |
| Critical Infrastructure | 1 | $2,449,000 | N/A | $2,449,000 |
| Critical Facilities[2] | 6 | $17,737,684 | $13,303,263 | $31,040,947 |
| Residential[3] | 204 | $81,538,800 | $61,154,100 | $142,692,900 |
| Non-Residential[4] | 2 | $2,130,760 | $1,598,070 | $3,728,830 |
| | | | Sub Total: | $121,542,177 |
| **Hillslope Areas** | | | | |
| Residential | 570 | $227,829,000 | $170,871,750 | $398,700,750 |
| **Areas of Concern** | | | | |
| Residential | 669 | $267,399,300 | $200,549,475 | $467,948,775 |
| | | | | |
| | | | Combined Total: | $633,382,827 |
| Residential structure values estimated using a $399,700 average. Contents are estimated at 75% of the structure's value. Critical Infrastructure includes the Suquamish Dock. Critical Facilities include the Kiana Lodge | | | | |

| |
|---|
| complex, Chief Kitsap School, Suquamish Seafood, Agate Pass Commercial, Elder's Lodge, and the Whitehorse Clubhouse. Non-residential facilities include Bella Luna Pizza and Camp Indianola church camp. |
| [2] As defined in the Tribal Profile<br>[3] Any structure, movable or immovable, permanent, or temporary, that is adapted for both human residence and lodging whether occupied or not.<br>[4] Non-residential buildings consist of buildings other than dwellings, including warehouse and industrial buildings, commercial buildings, buildings for public entertainment, hotels, restaurants, educational, health buildings, etc. |

**Risk Rating Summary for Landslide Events –** Based on the data obtained, the following table summarizes the Probability of Occurrence (P), Degree of Impact (DI), and Type of Impact (TI) ratings assigned to potential landslide events on the Port Madison Indian Reservation. (*Reference Section 3,* Risk Assessment Rating Criteria*)*

| Risk Rating Summary for Landslide Events | | | | |
|---|---|---|---|---|
| | **Probability/Impact** | **Rating** | | **Description** |
| P= | 50 - 75% Probable | High | 4 | There is a very highly probable likelihood this type of hazardous event will occur within the next 50 years. |
| DI= | Localized Event | Low | 2 | An event that damages a substantial portion of the community, while large areas within the total population sustain few if any direct effects; yet with widespread impact to commerce, infrastructure, and services. |
| TI= | **Life Safety (Weight 60%)** *Event related deaths, injuries, PTSD, & mental health issues* | Moderate | 3 | Loss of life <5; Serious injuries <5 |
| | **Property (Weight 10%)** *Rebuilding cost for repairing event related property and infrastructure damage* | Very High | 5 | Greater than $2 million to rebuild |
| | **Economy (Weight 15%)** *Economic losses to businesses resulting in job loss, extended unemployment, & underemployment* | Low | 2 | Economic recovery within 1 year |
| | **Environment (Weight 15%)** *Effects on the environment to include damage to the Tribe's culturally sensitive sites, soils, estuaries, fish, and wildlife* | Moderate | 3 | Modest environmental damage; recovery requires 1 – 2 years |

**Overall Risk Rating Formula:**

Risk Rating = (P (Probability) + DI (Degree of Impact) + TI (Type of Impact)) / 3

**Risk Rating Calculation for Flood Events:**

**P = 4**

**DI= 2**

TI = (Life = 3 x .6) + (Property = 5 x .1) + (Economy = 2 x .15) + (Environment = 3 x .15)

TI = 1.80 + 0.5 + 0.3 + 0.45

**TI = 3.05**

**Risk Rating =** (4 + 2 + 3.05) / 3 is 9.05 / 3 = **3.02**

**Risk Rating Classification for Landslide Events:** The following table indicates where the risk rating for Landslide events falls within the risk rating classifications. The rating of 3.02 classifies the landslide risk as moderate in terms of the probability of occurrence in combination with its consequential impact to the community.

| Risk Rating Classification | | | |
|---|---|---|---|
| **Risk Rating** | | **Classification** | **Description** |
| Very High | 5 | Urgent Priority | Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action |
| High | 4 | High Priority | Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action |
| **Moderate** | **3** | **Modest Priority** | **Vulnerability is considered as a low probability with moderate impact, which warrants moderate priority mitigation action** |
| Low | 2 | Low Priority | Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

## Conclusions

Although the Overall Risk Rating is moderate (3.02), the threat of landslides, mudslides, and excessive erosion within the Reservation are very real. As history within the region has shown, the impacts of a major landslide could be devastating in many respects. Local history and local geology support the predictability of this potential and its possibility for devastation. Though these conditions exist throughout most of the Reservation, the degree of impact from a landslide is likely to be isolated and therefore minimal. But the potential for a devastating landslide remains.

## Problem Statements

The following problem statements reflect specific vulnerabilities identified in the process of conducting the risk assessment. These are included to summarize the community's most significant risks and vulnerabilities related to flooding.

- Given the popularity of waterfront development, there are several residential structures located within landslide prone areas.
- Regular monitoring of the identified historical landslide & erosion sites has not been feasible.
- There are several culturally sensitive areas located within both the High Hazard and Hillslope areas (Landslide Susceptibility Map). These areas would be vulnerable to the damage caused by landslide, mudslide, or erosion and include the following culturally sensitive sites: (Reference Section 2, Suquamish Tribal Profile)

| | |
|---|---|
| 1 | Archaeological Site 45KP32 - Shell Midden |
| 2 | Archaeological Site 45KP33 - Shell Midden |
| 3 | Archaeological Site 45KP34 - Shell Midden |
| 4 | Archaeological Site 45KP40 - Shell Midden |
| 5 | Archaeological Site 45KP41 - Shell Midden |
| 8 | Archaeological Site 45KP44 - Shell Midden and Adams Marsh Complex |
| 9 | Archaeological Site 45KP45 - Petroglyph |
| 12 | House of Awakened Culture Complex |
| 13 | Kiana Lodge Complex |
| 16 | Old Man House Archaeological Site (45KP2) and Historic Village |
| 18 | Sacred Place |
| 19 | St. Peter Mission |
| 20 | Suquamish Cemetery |

## Mitigation Strategies

The following mitigation strategies offer a series of sample recommendations. They must be considered, approved, and funded by the authority having authority to be implemented. They are in no way intended to imply a call to action, constitute serving as an action plan, or be binding recommendations.

The Suquamish Tribe's treaty-reserved cultural, environmental, and economic interests extend well beyond territory located within the Port Madison Indian Reservation. Therefore, the following mitigation strategies also may have relevant application throughout the region as defined by the Tribe's Usual and Accustomed Grounds. (Reference Chapter 2, Suquamish Tribal Profile)

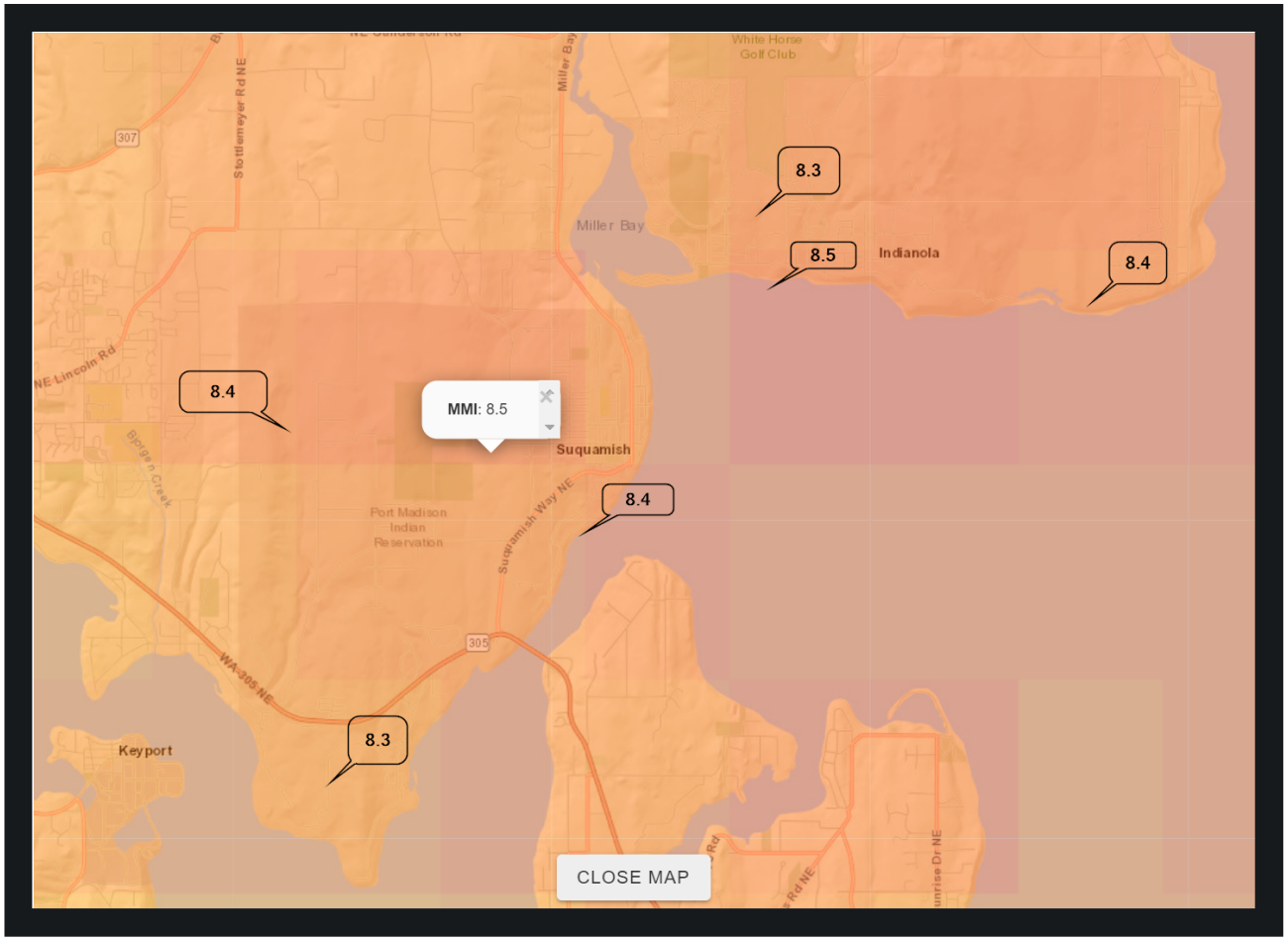
- PE-1: Deliver public education to engage the community as stewards for maintaining the effectiveness of storm water drainage systems located on private property.
- DS-1: Continue active Tribal participation in local community, county, state, and federal growth management planning efforts; the development of land use and zoning standards; the process of conducting environmental impact studies; and permitting processes so that the Tribe's storm water management and landslide prevention interests are addressed.
- DS-2: Continue to assure that all the Tribe's development projects meet or exceed all applicable best practice standards related to managing landslide, mudslide, and erosion vulnerability to assure wetland preservation, provide shoreline protection, and protect critical areas.
- DS-4: Continue to ensure the enforcement of impervious surface limitations by way of local building and development standards, promoting the use of pervious surfaces were advantageous in landslide vulnerable areas.
- IE-1: Continue collaborative relationships with the Kitsap County Public Works Department's efforts to mitigate landslide, mudslide, and erosion hazards within the Reservation; provide educational resources; and seek grant opportunities that will support mitigation efforts.
- EP-1: Continue active Tribal representation in the relevant forums to assure the Tribe's habitat preservation interests are considered and accounted for within both wetland preservation and shoreline management decisions.
- EP-2: Continue to actively promote reforestation practices following logging and land clearing to minimize landslides, mudslides, and erosion vulnerability.
- EP-3: Continue to actively promote the preservation of natural vegetation to maintain soil stability and to minimize landslides, mudslides, and erosion vulnerability.

dxʷsəq̓ʷəb

*Place of the clear salt water*

# EARTHQUAKES

Multi-Hazard Mitigation Plan 2022




## Risk Rating

# 4.51

THE SUQUAMISH TRIBE
Office of Emergency Management
18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

| Significant Earthquakes within the Puget Sound Region | | | | |
|---|---|---|---|---|
| **Date** | **Type** | **Epicenter from Suquamish** | **Mag** | **Location** |
| 2019 | Shallow | 26 miles NE | 4.6 | Roosevelt |
| 2017 | Shallow | 35 miles SW | 4.1 | Hoodsport |
| 2015 | Crustal | 30 miles NE | 3.7 | Near Lake Cavanaugh |
| 2013 | Crustal | 50 miles N | 3.4 | Near La Conner |
| 2012 | Crustal | 60 miles NW | 4.0 | Northwest of San Juan Island |
| 2012 | Crustal | 57 miles NW | 3.0 | Northern San Juan Island |
| 2012 | Crustal | 40 miles NNE | 3.6 | South of Mount Vernon |
| 2011 | Crustal | 55 miles NW | 3.6 | Northern San Juan Island |
| 2010 | Crustal | 21 miles NNW | 3.1 | West of Whidbey Island |
| 2009 | Crustal | 18 miles N | 4.0 | Whidbey Island |
| 2009 | Crustal | 73 miles NNE | 2.4 | Near Deming |
| 2009 | Crustal | 78 miles N | 2.6 | Near Ferndale |
| 2008 | Crustal | 27 miles NW | 3.6 | Near Port Townsend |
| 2007 | Crustal | 57 miles NW | 3.0 | Near Friday Harbor |
| 2007 | Crustal | 63 miles N | 3.0 | Five miles south of Bellingham – Three miles deep |
| 2005 | Crustal | 82 miles NNE | 4.1 | Four miles south of Kendall - < one half mile deep |
| 2002 | Crustal | 45 miles NW | 4.1 | South of San Juan Island |
| 2001 | Intraplate | 34 miles SSW | 6.8 | **Nisqually Quake:** Approximately 11 miles NE of Olympia, Strong shaking for 40 seconds, over 700 injuries, 1 death - $2.0 – 3.5 billion in damages |
| 1999 | Crustal | 61 miles SW | 5.1 | 8.2 km N of Satsop |
| 1997 | Crustal | 9 miles SW | 4.9 | 5.5 km NEW of Bremerton |
| 1996 | Crustal | 23 miles E | 5.4 | Near Duvall |
| 1995 | | 27 miles SSE | 5.3 | 17.6 km (about 10.94 mi) NNE of Tacoma |
| 1990 | Crustal | 74 miles NNE | 5.0 | Near Deming |
| 1981 | Crustal | 70 miles SW | 5.5 | South Cascades |
| 1976 | Crustal | 74 miles NNE | 5.1 | West of North Pender Island |
| 1967 | Crustal | 60 miles NNW | 4.1 | Near Orcas Island |
| 1965 | Intraplate | 16 miles SSE | 6.5 | Near SeaTac Airport – 7 deaths – Approximately $12.5 million total damage – Landslides, liquefaction, and other ground failures |
| 1964 | Crustal | 80 miles NE | 5.0 | Between Ferndale and Lynden |
| 1959 | Crustal | 80 miles NE | 7.0 | Northwest Cascades |
| 1949 | Intraplate | 43 miles SSW | 7.1 | Near Olympia – Strong shaking for 20 seconds Approximately $25 million total damage – Trigger of landslide that caused 8-foot tsunami, other ground failures also reported |
| 1946 | Crustal | 193 miles NNW | 7.3 | Central Vancouver Island – 2 deaths – Chimneys toppled; buildings damaged – strong shaking throughout region |
| 1945 | Crustal | 58 miles NE | 5.2 | Central Cascades |
| 1920 | Crustal | 58 miles NNW | 5.5 | NW corner of Shaw Island – Slight damage in Bellingham, Anacortes, and British Columbia |
| 1909 | Intraplate | 62 miles NNW | 6.0 | Near the NE Orcas Island – 19 miles deep – Slight damage in Blaine, Bellingham, and Anacortes |

## Overview

Earthquake is a term used to describe ground shaking and radiated seismic energy caused by sudden movement (or slip) along a fault line, by volcanic or magmatic activity, or by other sudden stress changes in the earth. The Puget Sound Region is vulnerable to three different earthquake types with three vastly different consequences.

1. **Crustal or Shallow Quakes** occur in the North American plate at 0-30 km (about 18.64 mi) near the surface along faults. Intense shaking occurs near the epicenter but usually diminishes quickly with distance relative to the other earthquake types. Shallow quakes are the type expected in the Seattle Fault zone, which is the primary but not the only source for shallow quakes in the region.
2. **Intraplate or Deep Quakes** occur at depths of 30-70 km (about 43.5 mi) in oceanic crust as it dives under lighter continental crust. Deep quakes are the most common large earthquakes known to occur within the Puget Sound region.
3. **Subduction Zone or Megathrust Quakes** occur on the interface between the North American plate and the San Juan de Fuca plate, a small plate extending from northern California to British Columbia. These are the largest type of earthquakes in the world. Megathrust earthquakes are what pose the greatest risk to the region. A megathrust earthquake could reach magnitude 9.0+ and affect an area from Canada to northern California. Shaking would be violent and prolonged, but not as intense as a Seattle Fault quake. This area has a megathrust earthquake about every 500 years.

**Earthquake Hazards** – Secondary impacts from landslides, tsunami, fires, flooding, and hazardous materials releases are compounding disasters. More people die from the collateral damage of fire than from building collapse. Earthquakes can trigger soil and other geologic failures that can easily trigger additional hazards such as ground shaking, landslides, liquefaction, and amplification. These hazards are further described below:

- **Ground Shaking**: The motion caused by seismic waves generated by an earthquake. It is the primary cause of earthquake damage. The strength of ground shaking depends on the magnitude of the earthquake, the type of fault, and the distance from the epicenter. Buildings on poorly consolidated and thick soils will typically have more damage than buildings on consolidated soils and bedrock.
- **Earthquake-Induced Landslides**: Landslides can be secondary earthquake hazards that result from ground shaking. They can destroy homes and the roads, buildings, utilities, and other critical facilities necessary to respond and recover from an earthquake. Most vulnerable are developed areas with steep slopes.
- **Liquefaction**: Occurs when ground shaking causes wet granular soils to change from a solid state to a liquid state. Liquefaction results in the loss of soil strength and the ability of the soil to support weight. Buildings and their occupants are at risk when the ground can no longer support these buildings and structures. Areas vulnerable to liquefaction are illustrated on Map 7.5: Earthquake Soil Liquefaction Susceptibility.
- **Amplification**: Soils and soft sedimentary rocks near the earth's surface can modify ground shaking caused by earthquakes. One of these modifications is amplification. Amplification increases the magnitude of the seismic waves generated by the earthquake. The amount of amplification is influenced by geologic material thickness and their physical properties. Buildings and structures built on soft and unconsolidated soils can face greater risk. Amplification also can occur in areas with deep, sediment-filled basins and on ridge tops.

**Key Terminology**

- **Amplification** – Shaking levels at a site may be increased, or amplified, by focusing of seismic energy caused by the geometry of the sediment velocity structure, such as basin subsurface topography, or by surface topography.
- **Earthquake** – Shaking of the ground caused by an abrupt shift of rock along a fracture in the earth or a contact zone between tectonic plates.
- **Epicenter** – Point on the earth's surface directly above the hypocenter of an earthquake. The location of an earthquake is commonly described by the position of its epicenter and its depth.
- **Fault** – A fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other.
- **Focal Depth** – The depth from the earth's surface to the hypocenter.
- **Hypocenter** – The region underground where an earthquake's energy originates.
- **Liquefaction** – Loosely packed, waterlogged sediments losing their strength in response to strong shaking, causing major damage during earthquakes.

## Impacts

Effects of a major earthquake could prove catastrophic, providing the worst-case disaster short of drought-induced wildfire sweeping through a suburban area. Hundreds of residents could be killed, and a multitude of others left homeless. Depending on the time of day and time of year, a catastrophic earthquake could easily cause hundreds of injuries, deaths, and millions of dollars in damage to critical community infrastructure and private property. A severe earthquake could level or severely damage older buildings, especially those constructed of non-reinforced masonry. Newer structures, built under contemporary building codes, would sustain less damage, but are still vulnerable to the soil conditions of the building site.

Emergency services (i.e., fire, medical, search and rescue) would be instantly overwhelmed by the amount of damage and injury throughout the region. Public works departments would be extremely hard pressed to establish a working road network for essential services, especially if bridges become damaged. At a minimum, bridges in an affected area would have to be inspected and confirmed safe prior to use. Emergency food and shelter would be needed for thousands of persons forced from their homes or isolated by damaged roads and bridges.

A severe earthquake also would do major damage to utilities. Depending on the earthquake epicenter and duration of the earthquake, major damage to water systems such as ruptured mains and failure of local water reservoirs could occur. Sanitary sewer and storm water piping and associated spills are probable and electrical and natural gas utilities would also suffer major damage. Failed transformers and downed electrical lines also would create massive power failures. Ruptured gas lines would create conditions for large fires and explosions. Public communication facilities (i.e., radio, television, and telephone systems) would be damaged. Surviving telephone systems would be overloaded instantly. Radio and television services may take days or weeks to recover.

Since a catastrophic earthquake would affect communities on a wide scale, the likelihood of immediate assistance from outside sources would be remote. Depending on the extent of damage and severity of injuries caused by an earthquake, businesses may close, unemployment may rise, and economic loss might occur.

**Earthquake Frequency –** The following table, developed by the USGS, provides an important perspective regarding how frequently earthquakes occur throughout the world. As the table illustrates, minor earthquakes occur routinely (approximately five earthquakes per minute), where the more extreme earthquakes occur much less frequently.

| Earthquake Frequency in Washington State | | | |
|---|---|---|---|
| **Descriptor** | **Occurrence** | **Frequency** | |
| Micro - very minor | About 1,000 | Annually | |
| MMI 3.0+ (or can be felt) | About 12+ | Annually | |
| | | | |
| Type | Avg. Magnitude | Last Occurrence | Probability |
| Cascadia Subduction Zone | M 8.0-9.0+ | January 26, 1700 | 15-25% chance within next 50 years |
| Deep Crustal (Nisqually 2001) | M 7.0+ | February 28, 2001 | 85% chance within next 50 years |
| Shallow Fault (Seattle Fault) | M 7.0 – 7.5 | About 1,100 years ago | 15% chance within the next 50 years |

## History

**Tribal History** – The following creation story comes from Suquamish Tribal oral traditions passed on by the elders from generation to generation.

*Long ago, when this land was new, the area we know as Agate Pass was much smaller than today. The people of this land could cross from one side to the other by stepping over a small body of water that it flowed into.*

*There lived in this larger body of water a guardian spirit, who was to protect the people and watch over them forever. This Guardian Spirit was a Giant Serpent. One day some of the women from the village were going to step across the pass to what we now call Bainbridge Island to dig clams, and the Giant Serpent was angry and very mean. He came out of the water and began biting at the women. They dropped their baskets and ran back to the village, telling the people that the Great Spirit was angry and mean. Many went to see what was wrong. A serpent came and attacked the people. The people ran back to the village and prayed to the Great Spirit for help.*

*Chief Kitsap went to the pass, sang his spirit song, and called his Spirit Power to help the people of the village. His spirit power was the Double Headed Eagle, and it came from the mountains. The Chief told the Spirit to stop the Serpent and its evil actions.*

*The Double Headed Eagle flew over the pass and the Giant Serpent came up very angry. The two began to fight, then the earth shook, and the water boiled. The Chief was singing his power song the entire time the battle was going on. After a long, long time the two vanished under the water, and the people were very frightened, believing that it was the end of Double Headed Eagle. Some of the people began to scream and cry until it was as loud as thunder.*

*Then, as if the earth were going to be swallowed by the waters, they began to boil and churn. Then a Double Headed eagle exploded out of the water and up into the sky with the body of Giant Serpent in its*

*claws. The Double Headed Eagle flew back into the mountain and behind him was left the wide pass in which the waters flow so swift at the change of tides, they boil to this day.*

The Puget Sound region has an extensive history of earthquake activity. Most are crustal earthquakes, which are less damaging than Intraplate Earthquakes. Large crustal earthquakes include a magnitude 7.0 or greater earthquake along the Seattle Fault zone about 1,100 years ago. Evidence of this earthquake includes large landslides and tsunami deposits (Atwater and Moore 1992). Another large crustal earthquake was a magnitude 7.3 North Cascades earthquake in 1872. During the 1872 earthquake, the shaking was felt from central British Columbia to central Oregon and east into the present-day Alberta and Montana.

The magnitude 6.8 Nisqually earthquake on February 28, 2001 (Pictured) was the region's most recent intraplate earthquake. The epicenter was located 35 miles southwest of Seattle (or about 35 miles south of Suquamish) at a depth of approximately 30 miles underground. The Nisqually earthquake caused one death, hundreds of mostly minor injuries, and estimated total damages of $2.0-3.5 billion. President Bush granted federal disaster assistance on March 1, 2001 (FEMA 2001b).

Other intraplate earthquakes occurred on April 13, 1949, near Olympia (magnitude 7.1) and on April 29, 1965, between Seattle and Tacoma (magnitude 6.5). These intraplate earthquakes caused landslides, liquefaction, and other ground failures in the Puget Sound region. The 1949 earthquake is believed to have triggered the landslide that occurred three days later at the Tacoma Narrows and produced an eight-foot-high tsunami in Puget Sound. The tsunami reflected off the undeveloped opposite shoreline and caused minor flood damage to homes adjacent to the landslide. The landslide itself destroyed the homes in its path (Noson et al. 1988, Walsh 2003). In addition, a substantial portion of a sandy spit jutting into Puget Sound north of Olympia disappeared during the earthquake (USGS 2001a).

## Vulnerability

According to the USGS, there are multiple fault lines in and around the Puget Sound region with catastrophic earthquake potential. The following maps show the numerous seismic faults within the Puget Sound Region. Past HAZUS modeling, a FEMA product used to develop potential scenarios and to predict the effects from earthquakes, has been essential in defining damage estimates and outcomes. It is obvious that a significant earthquake can have cascading impacts to infrastructure and the community and is not limited to the hazards presented in this mitigation plan; particularly landslides, tsunamis and seiches, and flooding. Other consequences resulting from significant earthquakes could include structure fires, environmental impacts from debris flows or hazardous waste and chemical spills, impassable roadways, and extended utility outages. Especially, for large earthquakes that can have anywhere from a few to hundreds of aftershocks. Therefore, any effort to mitigate those hazards can in turn lessen the vulnerability and impact potential of an earthquake.

The region also is vulnerable to potential liquefaction damage because of a catastrophic earthquake. Liquefaction is a phenomenon in which strong earthquake shaking causes soil to rapidly lose its strength and behave like quicksand. Liquefaction typically occurs within artificial fills and in areas of loose sandy soils that are saturated with water, such as coastal areas, lakeshores, and river valleys. During an earthquake, liquefaction is a occurrence and can be catastrophic.

The Seattle Fault Zone presents the most serious earthquake threat to the region. Geologists are studying the dynamics of the Seattle Fault and its relationship to similar shallow faults nearby. There is evidence that vertical uplift of more than 15 feet occurred in a portion of the Seattle Fault during the

A.D. 900-930 earthquake. Some geologists hypothesize that significant movement of the Seattle Fault may be associated with numerous shallow quakes.

At least four deep earthquakes have occurred in the past 3,000 years on the west end of the fault. USGS calculations estimate that the Seattle Fault can easily generate a very damaging magnitude 7.0 earthquake that would result in extensive damage to unreinforced structures and structures built on fill. In addition to the impact caused from intense shaking there is considerable evidence that shaking will be almost immediately followed by a tsunami, giving mere minutes to seek higher ground for those near the shoreline. Projections based on the most up-to-date research suggest there is a 15% chance of a magnitude 7.0 earthquake happening on the Seattle Fault within the next 50 years.

Just off the coast of Washington state lies the Cascadia Subduction Zone, a 1,300 km (about 807.78 mi)-long tectonic boundary between the Juan de Fuca and Gorda oceanic plates to the west and the North America continental plate to the east. Over time, frictional stresses accumulate along these faults, building slowly until they exceed the fault's strength, resulting in an earthquake. Subduction zone earthquakes are the largest on Earth, reaching magnitudes more than magnitude M9, and are known to generate large tsunamis ("Cascadia Subduction Zone Marine Geohazards - USGS.gov", 2021). Projections based on the most up-to-date research suggest there is between a 15 – 25% chance of a magnitude 9.0 earthquake (violent ground shaking could last from 3-6 minutes) happening within the next 50 years.

**Types of Faults** – Earthquakes are caused by the fracture and sliding of rock within the earth's crust. However, not all fractures are equal in their destructive potential. The type of fracture (normal dip slip, reverse dip slip, left-lateral strike slip, or right-lateral strike slip) will determine the extent of damage that can be expected from an earthquake. The reverse dip slip is the most common in Puget Sound shallow fault zones and far more damaging than, for example, strike-slip faults.

**Normal (Dip Slip) Faults**: The movement is up or down parallel to the dip of inclined fault surfaces. In the central Puget Sound area, dip slip faults tend to be deep zone quakes. However, in the Olympics, reverse dip slip faults can be quite shallow.

**Strike Slip Fault**: A fault is where movement (or slip) is horizontal and therefore parallel to the strike of the fault. Strike slip faults are common in the North Cascades and most often found in the shallow crust.

**Oblique (Thrust) Slip Fault** – A fault that moves with characteristics of both strike-slip and dip-slip. Oblique faults also can refer to "Thrust Fault," which has a shallow angle fault plane. Thrust faults are more common in the Puget Sound area than the higher angle reverse or normal faults shown above.

**Distance from Epicenter** – The extent of damage from an earthquake is a function of a site's distance from the earthquake's epicenter. The closer a site is to the epicenter, the more damage it can expect.

**Local Site Conditions** – Generally, earthquakes are most damaging to those buildings that are built on wet or soft soils ("unconsolidated" soils). Buildings constructed on hard rock and stiff (consolidated) soils often fare better in an earthquake.

**Structural Damage during an Earthquake** – An extensive investigation by HUD (Housing and Urban Development) following the 1994 Northridge, California earthquake found that the extent of structural damage that occurs during an earthquake varies based on the building's design and the type of construction. The following provides a comparison of how, based on the Northridge study, the three types of structures most common to the Reservation can be expected to perform during an earthquake.

1. Manufactured (Mobile) Homes – Manufactured mobile homes resisted structural collapse due to their light weight. However, many of them slipped off their foundation supports, toppling

appliances and damaging power lines. Though structural damage was isolated, the lateral movement and shifting damaged gas and electrical utility connections, in some cases causing devastating fires. Homes that were not properly tied down were more severely damaged than those that were properly tied down.

2. Conventional Wood Frame Homes – A very high percentage of conventional wood frame houses performed well. Most of the damage to these homes was non-structural in nature and easily repairable. The more severe damage included houses sliding from foundations (like manufactured homes), collapse of "cripple walls" in crawl spaces, and collapse of porches and masonry chimneys. Modular homes built using conventional wood frame home building materials and techniques were included in this category.
3. Commercial and Government Buildings – Metal and concrete commercial structures (strip malls, office buildings, hotels, etc.) performed poorly wood framed commercial buildings performed best. Again, this is due to the light weight and inherent energy-absorbing characteristics of wood frame buildings, a characteristic that makes them less prone to collapse when compared to rigid metal or concrete structures.

**Severity** – Earthquakes can last from a few seconds to over five minutes; they also may occur as a series of tremors over several days. The actual movement of the ground in an earthquake is seldom the direct cause of injury or death. Casualties result from falling objects and debris because the shocks shake, damage, or demolish buildings and other structures. Disruption of communications, electrical power supplies, and gas, sewer, and water lines should be expected. Earthquakes may trigger fires, dam failures, landslides, or release of hazardous material, which can significantly compound their disastrous effects.

Small, local faults produce lower magnitude quakes, but ground shaking can be strong, and damage can be significant in areas close to the fault. In contrast, large regional faults can generate earthquakes of great magnitudes, but because of their distance and depth, they may result in only moderate shaking in the immediate area.

Past events suggest that earthquakes typical for the Puget Sound region caused light to moderate damage. However, severity can increase based on soil type and proximity to the hypocenter of the event. There is soft soil in the area that has a high degree of vulnerability to earthquakes.

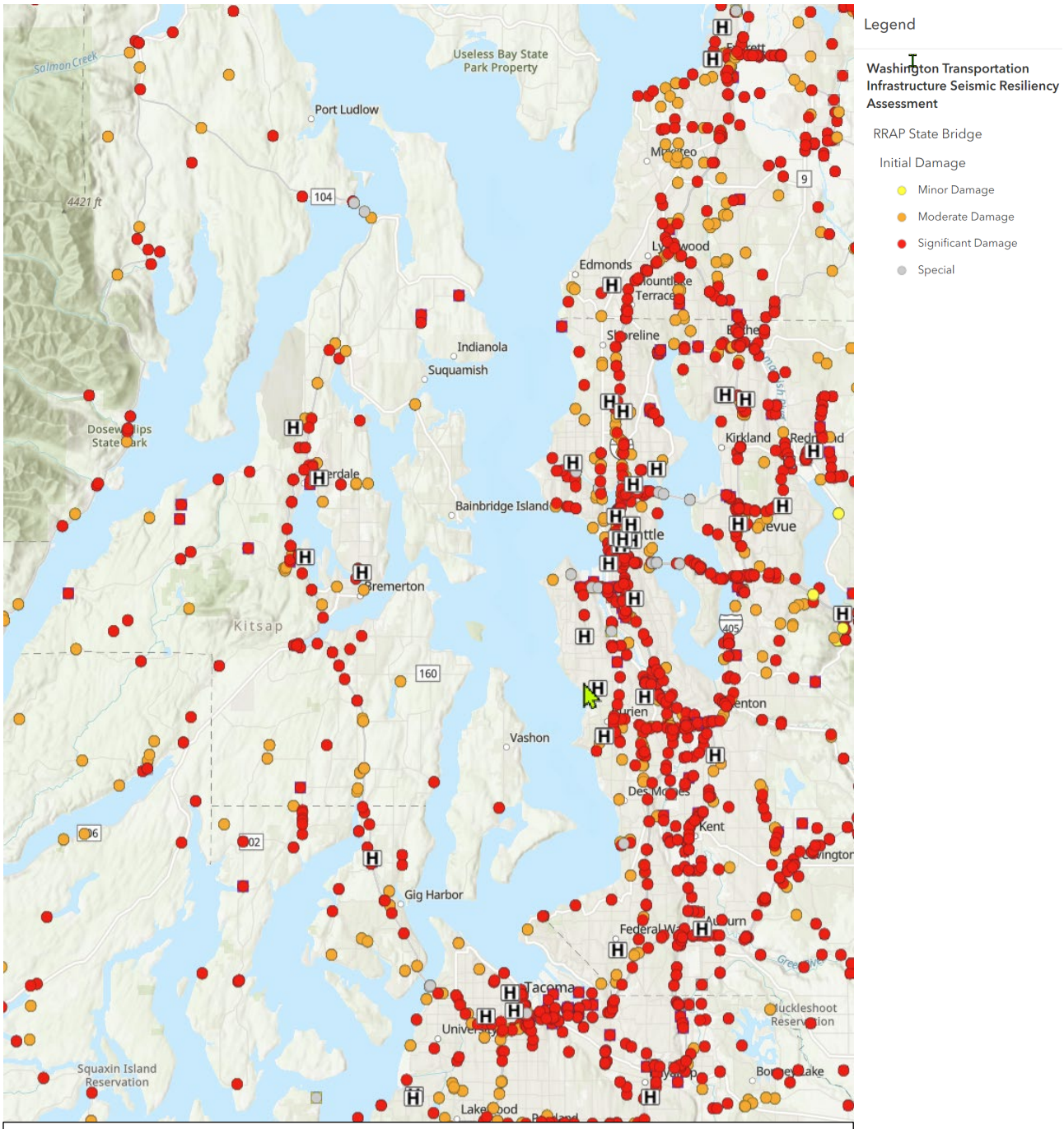
**Warning Time** – There is currently no reliable way to predict the day or month that an earthquake will occur at any given location. ShakeAlert®, a recently implemented warning system that uses the low energy waves that precede major earthquakes, can give vital seconds of warning before the ground starts shaking. The warning time is noticeably short, but it could allow someone to get under a desk, step away from a hazardous material they are working with, or not step into an elevator. The length of time before the arrival of an earthquake is felt depends on how far away from the epicenter a person is. If close to the epicenter, the ground could begin shaking before a warning is issued. Earthquake early warning (EEW) systems can detect and measure an earthquake fast enough that warning can be given before the strongest shaking arrives, providing seconds to minutes to prepare. The system's effectiveness was demonstrated during the 2011 Tohoku Earthquake, where the EEW system detected the offshore earthquake, recognizing it as serious within 30 seconds of its initiation. The system provided Tokyo residents with 30 seconds of warning. Following the quake, cellphone alarms warned millions of people of large aftershocks.

**Earthquake Magnitude and Intensity –** Earthquakes are typically classified in one of two ways: By the amount of energy released, measured as magnitude; or by the impact on people and structures, measured as intensity. The following table developed by the USGS provides a descriptive coloration

between magnitudes, commonly referred to as the Richter scale; intensity using the modified Mercalli intensity scale; and a corresponding description of the impact.

| Earthquake Magnitude and Intensity | | |
|---|---|---|
| Magnitude | *Intensity | Description |
| 1.0 – 2.9 | I | **I**: Not felt except by a very few under especially favorable conditions. |
| 3.0 – 3.9 | II – III | **II:** Felt only by a few persons at rest, especially on upper floors of buildings.<br>**III:** Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it is an earthquake. Standing cars may rock slightly. Vibrations like the passing of a truck. Duration estimated. |
| 4.0 – 4.9 | IV - V | **IV:** Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like a heavy truck striking building. Standing cars rocked noticeably.<br>**V:** Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop. |
| 5.0 – 5.9 | VI - VII | **VI:** Felt by all; many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.<br>**VII**: Damage negligible in buildings of good design and construction; slight in well-built ordinary structure; considerable in poorly built or badly designed structures. |
| 6.0 – 6.9 | VIII - IX | **VIII:** Damage slight in specially designed structures; considerable damage in ordinary buildings with partial collapse. Damage is great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.<br>**IX:** Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage is great in substantial buildings, with partial collapse. Buildings shifted off foundations. |
| 7.0 & higher | X & higher | **X:** Some well-built wooden structures were destroyed; most masonry and frame structures were destroyed with foundations. Rails bent.<br>**XI:** Few, if any (masonry) structures remain standing. Bridges destroyed. The rails bent greatly.<br>**XII:** Damage total. Lines of sight and level are distorted. Objects thrown into the air. |

- Modified Mercalli Scale




https://data.wsdot.wa.gov/arcgis/rest/services/Shared/EOC/MapServer

*Transportation Resiliency Map Cascadia Subduction Zone M 9.0:* Focused on assessing the impacts of a Cascadia Subduction Zone (CSZ) earthquake on state transportation systems and how those impacts may affect the ability of emergency response efforts to move supplies into the region.

## Probability of Occurrence

The USGS estimated that a Cascadia subduction zone earthquake has a 15 - 25% probability of occurrence in 50 years, and a crustal zone earthquake has a recurrence interval of about 500 to 600 years. Earthquakes on the South Whidbey Island and Seattle faults have a 15% probability of occurrence

in 50 years. A deep zone earthquake has an 85% probability of occurrence in 50 years, making it the most likely of the three types.

Historically, the following scales of earthquakes have occurred within the Puget Sound region:

- Intraplate or Deep: Five magnitude 6 earthquakes; one magnitude 7 since 1900.
- Shallow or Crustal: Four magnitude 7 or greater earthquakes are known to have occurred within the last 1,100 years; including two quakes since 1918 on Vancouver Island.
- Subduction Zone or Megathrust: Every 400-600 years; intervals between events are irregular. The most recent was in 1700.

## Risk Assessment

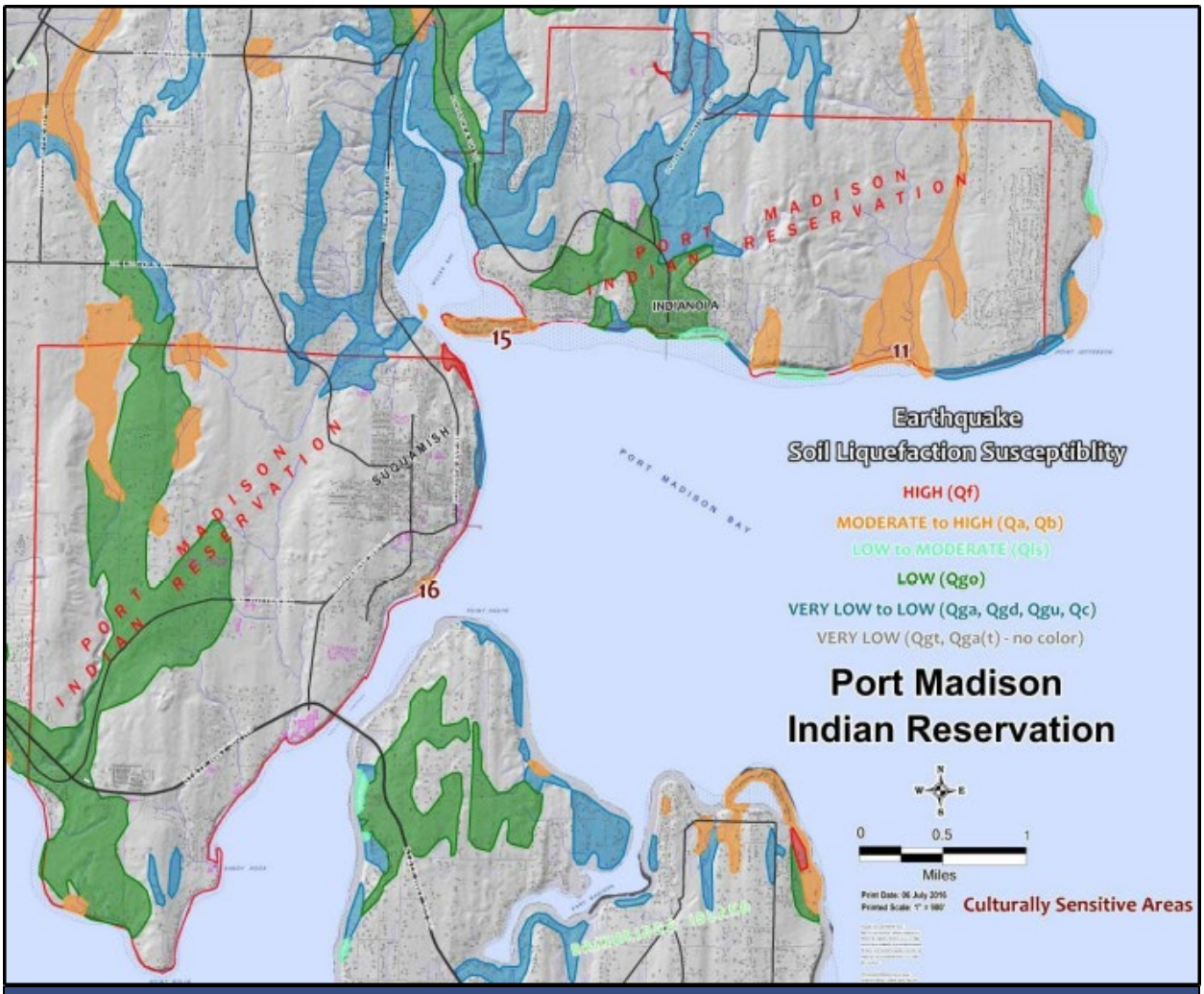
The following information summarizes the information gathered during the hazard assessment process.

**Level of Damage** - HAZUS-MH classifies the vulnerability of buildings to earthquake damage in five categories: no damage, slight damage, moderate damage, extensive damage, or complete damage. The model assigns each facility a vulnerability category based on what is typical for communities comparable to the Reservation. The analysis was performed for the 100-year and 500-year probabilistic, and the Cascadia earthquake events.

| Level of Damage: Earthquakes | | | | | |
|---|---|---|---|---|---|
| **(100 & 500-Year Probabilistic Earthquakes)** | | | | | |
| **Category** | **None** | **Slight** | **Moderate** | **Extensive** | **Complete** |
| Critical Facilities | 33.8% | 32.6% | 26.3% | 5.9% | 1.4% |
| Commercial | 34.4% | 32.9% | 25.8% | 5.7% | 1.3% |
| Industrial | 43.3% | 35.0% | 18.4% | 3.1% | 0.3% |
| Residential | 4.7% | 34.9% | 18.2% | 3.0% | 0.2% |
| **Average:** | **40.9%** | **34.3%** | **20.4%** | **3.8%** | **0.5%** |
| **Cascadia 9.0 M Earthquake** | | | | | |
| **Category** | **None** | **Slight** | **Moderate** | **Extensive** | **Complete** |
| Critical Facilities | 4.9% | 35.2% | 50.0% | 9.2% | 0.6% |
| Commercial | 4.2% | 34.3% | 51.8% | 9.1% | 0.6% |
| Industrial | 6.5% | 45.5% | 44.8% | 3.1% | 0.1% |
| Residential | 7.5% | 47.5% | 42.3% | 2.6% | 0.0% |
| **Average:** | **6.6%** | **43.7%** | **45.0%** | **4.5%** | **0.2%** |

*Map of Earthquake Soil Liquefaction Susceptibility* - The potential for soil liquefaction exists in saturated soils when the space between individual particles is filled with water. This water exerts a pressure on the soil particles that influences how tightly the particles are pressed together. Prior to the earthquake, the water pressure was low. Liquefaction occurs when the strength and stiffness of this saturated soil is reduced by earthquake shaking or rapid loading. The earthquake's shaking causes the water pressure to increase to the point where the soil particles can readily move with respect to each other, turning the soil to a liquid consistency. Liquefaction can cause tremendous amounts of damage. The following map illustrates areas that are prone to soil liquefaction during a major earthquake.

Residential Structures within Liquefaction Zones – The following table summarizes the estimated number of structures located within the earthquake hazard zones that would be susceptible to liquefaction as defined in the map above.




| Residential Structures within Liquefaction Zones | | | |
|---|---|---|---|
| | Structure Values | Content Values | Totals |
| **High Liquefaction Areas**<br>Residential[1]: 11 | $ 4,396,700 | $3,297,525 | $7,694,225 |
| **Mod/High Liquefaction Areas**<br>Residential: 92 | $36,772,400 | $27,579,300 | $64,351,700 |
| **Low/Mod Liquefaction Areas**<br>Residential: 2 | $799,400 | $599,550 | 1,398,950 |
| **Low Liquefaction Areas**<br>Residential: 511 | $204,246,700 | $153,185,025 | $357,431,725 |

| | | | |
|---|---|---|---|
| **Very Low / Low Liquefaction Areas**<br>Residential: 264 | $105,520,800 | $79,140,600 | $184,661,400 |
| **Very Low Liquefaction Areas**<br>Residential: 2582 | $1,032,025,400 | $774,019,050 | $1,806,044,450 |
| | | **Total:** | $2,364,924,975 |
| Residential structure values estimated using a $399,700 average. Contents are estimated at 75% of the structure's value. | | | |

[1] Any structure, movable or immovable, permanent, or temporary, that is adapted for both human residence and lodging whether occupied or not.

**Affected Liquefaction Hazard Zones –** The following table summarizes the estimated population and culturally sensitive areas located within the earthquake hazard zones that would be susceptible to liquefaction as they are defined in Landslide Susceptibility Map above.

| Liquefaction Susceptibility Zones | | |
|---|---|---|
| **Degree of Susceptibility** | **Estimated Population[4]** | **Approximate Acreage** |
| High | 27 | 9 |
| Moderate/High | 226 | 376 |
| Moderate | - | - |
| Low/Moderate | 5 | 17 |
| Low | 1,257 | 1,191 |
| Very Low/Low | 649 | 494 |
| Very Low | 6,352 | 5,566 |
| **Totals:** | **8,516** | **7,653** |
| Description of Culturally Sensitive Areas: The following is a list of the culturally sensitive areas located within the Liquefaction Susceptibility Zones. (Reference Section 2, The Suquamish Tribal Profile for detailed descriptions of these areas)<br>11 - Doe Kag Wats Marsh Complex<br>15 - Miller Bay Spit Complex<br>16 - Old Man House Archaeological Site (45KP2) and Historic Village | | |

[4] Estimated population estimation is based on the 2020 Census 2.4 persons per household multiplied by the number of residential structures.

**Risk Rating Summary for Earthquake Events –** Based on the data obtained, the following table summarizes the Probability of Occurrence (P), Degree of Impact (DI), and Type of Impact (TI) ratings assigned to potential earthquake events on the Port Madison Indian Reservation. (*Reference Section 3, Risk Assessment Rating Criteria)*

| Risk Rating Summary for Earthquake Events | | | | |
|---|---|---|---|---|
| | **Probability/Impact** | **Rating** | | **Description** |
| P= | >75% Probable | Very High | 5 | There is a very high probability this type of hazardous event will occur within the next 50 years. |
| DI= | Major Event | High | 4 | An event with disproportionate devastation affecting a large |

| | | | | |
|---|---|---|---|---|
| | | | | portion of the Reservation with widespread impact to the total population, property, commerce, infrastructure, and services. |
| TI= | **Life Safety (Weight 60%)** *Event related deaths, injuries, PTSD, & mental health issues* | High - Very High | 4.5 | Loss of life more than 5 - 10; Serious injuries more than 5 – 10 |
| | **Property (Weight 10%)** *Rebuilding cost for repairing event related property and infrastructure damage* | Very High | 5 | Greater than $2 million to rebuild |
| | **Economy (Weight 15%)** *Economic losses to businesses resulting in job loss, extended unemployment, & underemployment* | Moderate-High | 3.5 | Potential for business losses, economic recovery within 1 - 5 years |
| | **Environment (Weight 15%)** *Effects on the environment to include damage to the Tribe's culturally sensitive sites, soils, estuaries, fish, and wildlife* | Moderate-High | 3.5 | Modest- significant environmental damage; recovery requires 1 – 5 years |

**Risk Rating Calculation for Flood Events:**

**P = 5; DI= 4**

TI = (Life = 5 x .6) + (Property = 5 x .1) + (Economy = 3.5 x .15) + (Environment = 3.5 x .15)

TI = 3 + 0.5 + 0.525 + 0.525 **TI = 4.55**

**Risk Rating = (**5 + 4 + 4.55) / 3 **is** 13.55 / 3 = **4.51**

**Risk Rating Classification for Earthquake Events:** The following table indicates where the risk rating for Landslide events falls within the risk rating classifications. The rating of 4.51 classifies the earthquake risk as high to very high in terms of the probability of occurrence in combination with its consequential impact to the community.

| Risk Rating Classification for Earthquake Events | | | |
|---|---|---|---|
| **Risk Rating** | | **Classification** | **Description** |
| **Very High** | **5** | **Urgent Priority** | **Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action** |

| | | | |
|---|---|---|---|
| **High** | **4** | **High Priority** | **Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action** |
| Moderate | 3 | Modest Priority | Vulnerability is considered as a low probability with moderate impact, which warrants moderate priority mitigation action |
| Low | 2 | Low Priority | Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

## Conclusions

The Overall Risk Rating is high to very high (4.51), which is a 14.76% increase from the (3.93) rating from the 2017 MHMP. This means the threat of a significant earthquake with the region that would impact the Reservation is very real. It is not a question of if; it is a matter of when. The increase in rating is due to latest information based on the most up-to-date research regarding earthquake hazards and probability of occurrence. Additionally, the added risks associated with climate change in the form of erosion and additional precipitation are likely to contribute to soil instability and more frequent disaster events, which could strain the region's capabilities to respond and recover from significant earthquakes. As history within the region demonstrates, the likelihood of a significant earthquake causing devastating damage is highly probable. Local history and local geology support the probabilities these events could occur and the potential for localized to catastrophic devastation.

Though these conditions exist throughout the Puget Sound region and the degree of impact from an earthquake is difficult to predict, the potential for a devastating earthquake remains. Strong earthquakes are infrequent, but a large-magnitude earthquake involving either the Cascadia Subduction Zone or the Seattle Fault line has the potential to cause catastrophic damage, especially in areas with soils subject to liquefaction. Additionally, history demonstrates that a significant earthquake could generate a tsunami that would inundate the Reservation's extensive shoreline, causing severe damage to residences and other structures along the coastline. This devastation, along with the cascading impacts caused by the earthquake on the community, properties, and the environment would result in significant economic hardship to tribal members.

## Problem Statements

The following problem statements reflect specific vulnerabilities identified in the process of conducting the risk assessment. These are included to summarize the community's most significant risks and vulnerabilities related to earthquakes.

- Throughout the Reservation there are hundreds of homes and businesses that are vulnerable to significant structural damage due to their inadequate seismic resilience.
- Given the popularity of waterfront development, there are several residential structures located within the high and moderate liquefaction and tsunami susceptibility zones.
- History has shown that during a significant earthquake the damage is not limited to that caused by the earthquake. Earthquakes often trigger collateral damage such as fire, sewage leaks,

landslide, flooding, extended utility outages, and pose risks to public health, etc. This compounds the community's vulnerability during an earthquake.

- There are essential elements of community infrastructure such as roadways, waterlines, and gas lines that are located within the liquefaction susceptibility zones that are vulnerable to damage. Major arterials are projected to be impassable for an extended period following a Cascadia Subduction Zone Earthquake.
- Several culturally sensitive areas located within the liquefaction susceptibility zones (Map 7.5). These areas would be vulnerable to the damage and erosion caused by liquefaction and includes the following culturally sensitive sites: *(Reference Section 2, Suquamish Tribal Profile)*
  - 11 Doe Keg Wats Marsh Complex
  - 15 Miller Bay Spit Complex
  - 16 Old Man House Archaeological Site (45KP2) and Historic Village

## Mitigation Strategies

The following mitigation strategies offer a series of sample recommendations. They must be considered, approved, and funded by the authority having authority to be implemented. They are in no way intended to imply a call to action, constitute serving as an action plan, or be binding recommendations.

The Suquamish Tribe's treaty-reserved cultural, environmental, and economic interests extend well beyond territory located within the Port Madison Indian Reservation. Therefore, the following mitigation strategies also may have relevant application throughout the region as defined by the Tribe's Usual and Accustomed Grounds. (*Reference Chapter 2, Suquamish Tribal Profile*)

- PE-2: Deliver public education to develop a culture of disaster preparedness based on the need for citizens to be self-reliant and prepared to care for themselves for a minimum of two weeks.
- PE-4: Deliver earthquake safety and survival public education such as the "Drop Cover and Hold", "The Great Washington Shake-Out" programs and other relevant earthquake safety programs.
- PE-5: Encourage residents to secure their structures by promoting programs such as the "Bolt It, Brace It – Do it" program for the purpose of teaching local citizens and builders how to effectively assess buildings for earthquake retrofitting and conduct the required modifications. (Potential partnership opportunities may be available with the Homebuilders Association, Olympic Peninsula Chapter of International Code Council, and Simpson Strong-Tie)
- PE-6: Encourage residents to secure their household and workplace objects using resources such as: Is Your Home Protected from Earthquake Disaster, A Homeowner's Guide to Earthquake Retrofit (IBHS 1999) for economic and efficient mitigation techniques.
- PE-7: Create, test, and evaluate Evacuation Plans for the Reservation, deliver public information and education on all aspects of the plans, and establish communication and coordination procedures with local jurisdictions.
- PE-8: Coordinate areas with members of the community areas that will serve as communication and information hubs following a disaster to allow information to be exchanged between residents in the community and the emergency operations center.
- DS-5: Continue to ensure the enforcement of seismic building standards by way of local building and development standards.

- DS-6: Continue to ensure that all the Tribe's development projects meet or exceed all applicable best practice and building standards so that buildings are constructed with adequate seismic resilience and stability.
- DS-7: Consider developing and implementing local building regulations that would require major building renovations to include structural and nonstructural retrofitting of any structures identified as seismically vulnerable.
- IE-5: Encourage seismic strength evaluations of the Tribe's critical facilities to identify vulnerabilities and where feasible, implement retroactive mitigation measures based on current seismic standards to reduce their vulnerability.
- IE-6: Seek opportunities to reinforce resilience to Tribal-owned critical infrastructure to support Continuity of Operations and Continuity of Government for Tribal Government.

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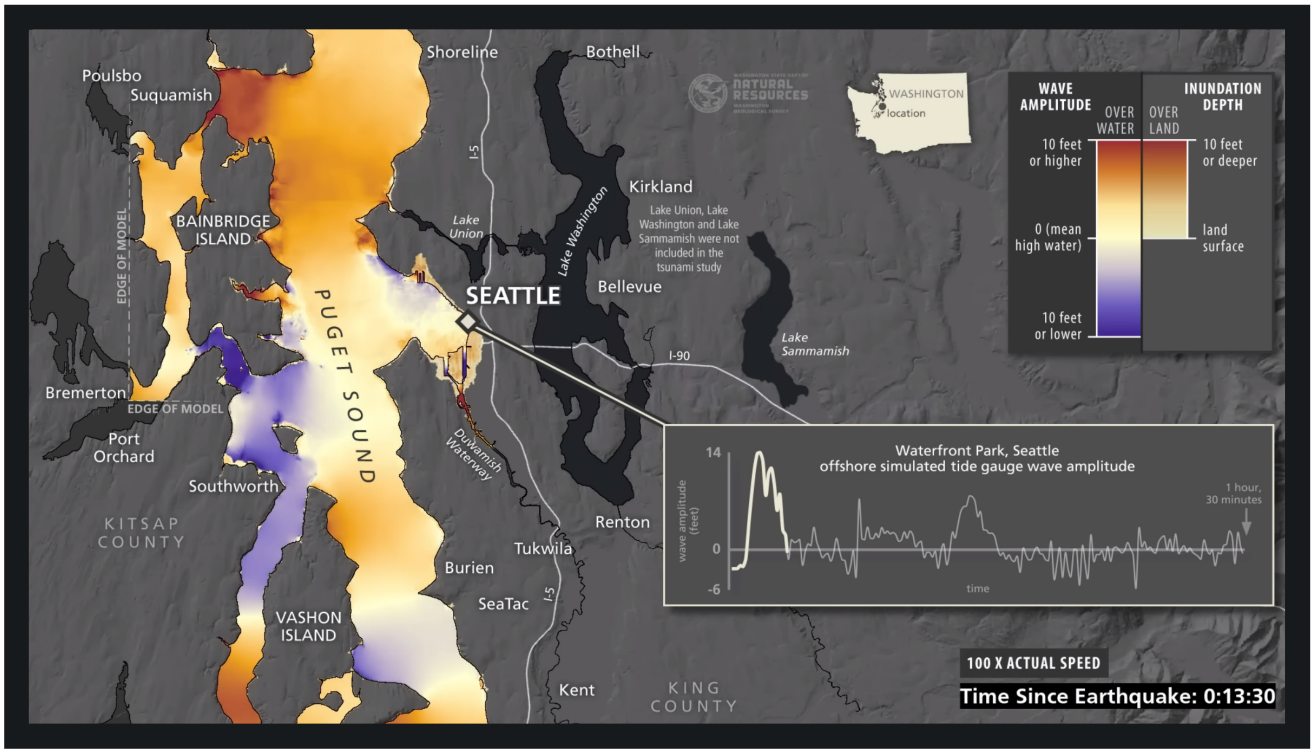
*Place of the clear salt water*

# TSUNAMIS & SEICHES

Multi-Hazard Mitigation Plan 2022




**Risk Rating**

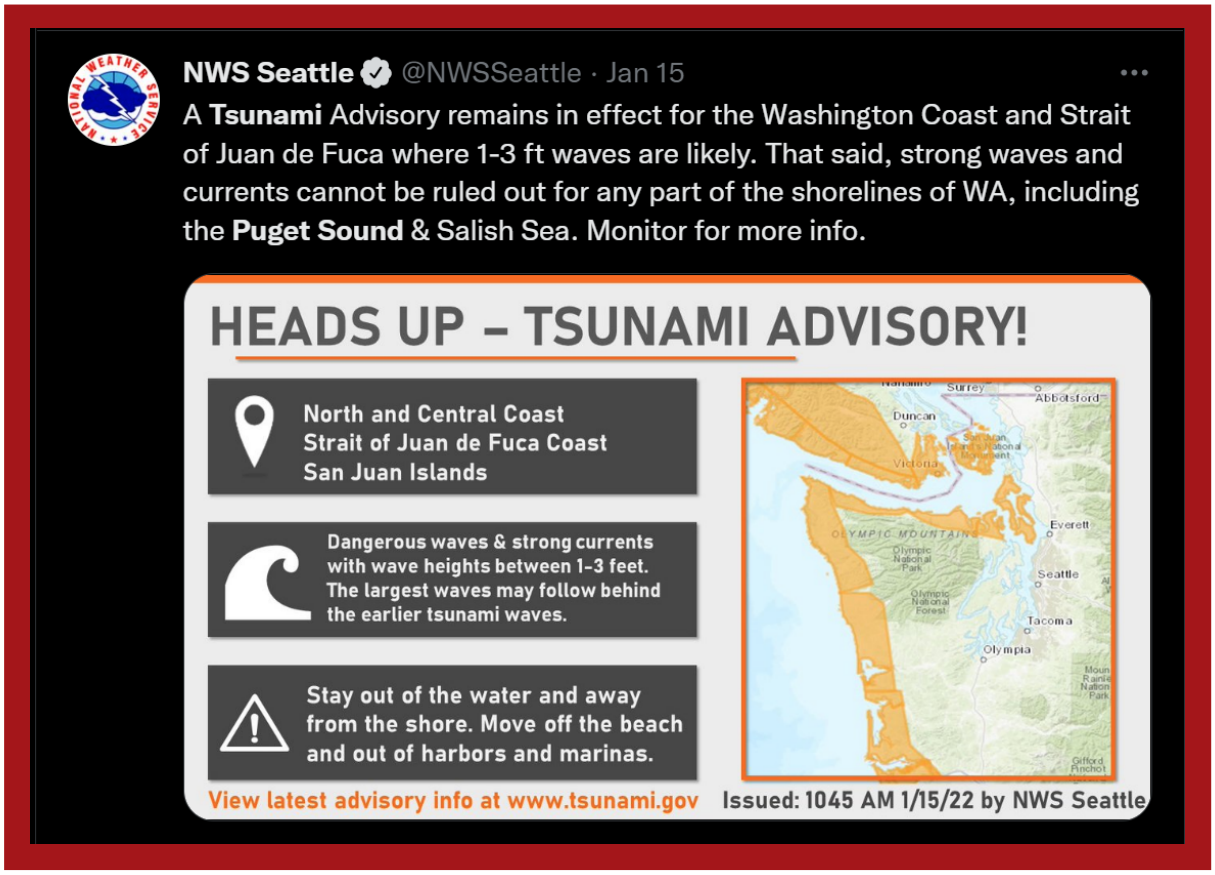
# 3.08


THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

# TSUNAMIS & SEICHES



## Overview

A tsunami consists of a series of high-energy waves that radiate outward like pond ripples from the area in which the generating event occurred. Typically, they are triggered by earthquakes, volcanic activity, and submarine landslides, or in the case of the Puget Sound region, most often by local landslides from surrounding bluffs.

Seiches are a series of standing waves in an enclosed or partly enclosed body of water. Seiches are normally caused by earthquake activity, and can affect harbors, bays, lakes, rivers, and canals.

**Key Terminology**

**Tsunami -** A series of high-energy waves that radiate outward like pond ripples from the area in which the generating event occurred.

**Seiche -** A series of standing waves in an enclosed or partly enclosed body of water where the characteristics form a rolling wave, typically triggered by earthquake activity. They usually do not occur at the quake's epicenter. Seiches occur in enclosed bodies of waters such as lakes, bays, harbors, reservoirs, swimming pools, and seas. The key requirement for formation of a seiche is that the body of water be at least partially bounded, allowing the formation of the standing wave.

## Impacts

Much of the Port Madison Indian Reservation consists of Puget Sound shoreline. With so much shoreline, a tsunami, high waves, or a seiche could have devastating effects. Flooding could cause excessive property damage and result in residents being displaced. The resulting damage and the effects on the environment would include damage to fisheries, estuaries, and other sensitive environments along the coastline. Damage from a tsunami or a seiche ranges from insignificant to catastrophic.

Tsunamis can travel across entire oceans and can be a few feet to 150 feet tall when they reach shore. They are caused when a large amount of water is displaced either by earthquakes or landslides, moving up to 500 mph in open ocean to 20-30 mph in shallow water and can continue for upwards of 24 hours. Where normal ocean waves are generated by the friction of wind acting on the ocean's surface, tsunami waves encompass the whole water column from seabed to surface.

Aside from the tremendous hydraulic force of the tsunami waves themselves, floating debris carried by a tsunami can endanger human lives, batter inland structures, and destroy habitats. Ships moored at piers and in harbors often are swamped and sunk or are left battered and stranded high on the shore. Breakwaters and piers collapse, sometimes because of scouring actions that sweep away their foundation material, and sometimes because of the sheer impact of the waves. Secondary problems, including landslides, erosion, and floods are related to accelerated water movements and elevated water levels.

The impacts of rising sea-levels could exaggerate the impacts of a tsunami.

## History

Though no written records exist of damaging waves within Puget Sound, damaging tsunamis are known to have hit the Washington coast and are recorded in both oral Native American history and in geologic records. For example, verbal accounts among Snohomish Tribal members as reported by Colin Tweddell in 1953 describe a great landslide induced wave caused by a landslide at the south end of Camano Island around the 1820's-1830's. Located only a few miles north of Suquamish, the slide is said to have buried a small village, and the resulting tsunami is reported to have drowned men, women, and children who were clam digging on Hat (Gedney) Island, two miles to the south. Tribes throughout the Puget Sound

region consider this event a very tragic moment in their history and accordingly consider tsunami a major hazard.

On January 26, 1700, an earthquake occurred along the Cascadia subduction zone with an estimated magnitude of 8.7 – 9.2. The megathrust earthquake involved the Juan de Fuca Plate that underlies the Pacific Ocean, from mid-Vancouver Island in British Columbia, Canada, south along the Pacific Northwest coast as far as northern California. The length of the fault rupture was about 620 miles with an average slip of 66 feet. Local Native American and First Nations groups provide numerous oral descriptions of a great earthquake and tsunami-like flooding. These do not specify an exact date, and not all earthquake stories in the region can be definitively isolated as referring to the 1700 quake; however, virtually all the native peoples in the region have at least one traditional story of an event much stronger and more destructive than any other that their community had ever experienced. These verbal accounts are supported by Japanese records, which do precisely document the significant destruction along the coast of Japan caused by this tsunami.

Geologic evidence of tsunamis has been found at Cultus Bay on Whidbey Island and at West Point in Seattle. There also was a past event on Possession Beach on Whidbey Island that caused sloughing and a tsunami. Researchers believe these tsunami deposits are evidence of earthquake activity along the Seattle Fault or other shallow crustal Puget Sound faults. Furthermore, research indicates that a tsunami affected the Snohomish River delta, associated with a Seattle fault earthquake before 800 AD. The Puget Sound region is also known to have experienced seiches in historical times. In 1891, an earthquake near Port Angeles is believed to have caused an eight-foot seiche in Lake Washington. Seiches generated by the 1949 Queen Charlotte Islands earthquake were reported on Lake Union and Lake Washington. The 1964 Alaska earthquake created seiches on 14 inland bodies of water in Washington, including Lake Union where several pleasure craft, houseboats, and floats sustained minor damage.

The recent Hunga Tonga-Hunga Ha'apai volcano eruption sent shockwaves and a tsunami around the globe. This tsunami generated warnings for Washington State's outer coast with the National Weather Service encouraging those on the inland waters of the Puget Sound to heed this information. Currently, Puget Sound does not have Tsunami DART buoys which place limitations on the generation of tsunami warnings for the inland waters. As a protective measure, notifications were sent to fishers and field workers to be aware of potentially hazardous water and shore conditions.

## Vulnerability

The Port Madison Indian Reservation is bordered by several miles of shoreline that is vulnerable to tsunamis, high waves, tidal waves, tidal surges, and seiches due to the potential of powerful storms, major landslides, and earthquakes. The most vulnerable elements of the community are marine enterprises, fisheries, public facilities, and private residences lining the shoreline. Locations on filled ground, over-water, or at the foot of steep shoreline bluffs are in harm's way for tsunami inundation and strong currents, landslides, and soil failure during and after strong ground shaking.

Vulnerability issues include:

- Loss of life
- Debris
- Natural resources damage
- Infrastructure
- Utilities

- Property Damage
- Damage to Culturally Sensitive Sites
- Shoreline development

If warning is received early enough (2 to 5 hours), which is possible for tsunamis generated at a distance, hasty preventive action can be taken: people can be evacuated; ships can clear harbors or seek safer anchorage; and buildings can be closed, shuttered, and sandbagged. For tsunamis generated by local earthquake or landslide events, however, the time from initiation of a tsunami to its arrival at shore can be less than a minute.

**Warning Time** – Tsunamis generated near Japan, Chile, or Alaska may take hours to reach the shores of Washington, but those generated off the Oregon/Washington coast may reach shore within 3 to 30 minutes. People in the way of a tsunami or seiche generated within Puget Sound would only have a few seconds to evacuate.

**Secondary Hazards** – Aside from the tremendous hydraulic force that the wave movement generated by a tsunami or seiche can cause, the secondary hazard of floating debris is well known to endanger human lives and batter inland structures. Boats moored along the shoreline or in normally well protected harbors often are swamped and sunk or are left battered and stranded high on the shore. Breakwaters and piers collapse, sometimes because of scouring actions that sweep away their foundation material and sometimes because of the sheer impact of the waves. Seiches create a “sloshing” effect on bodies of water and liquids in containers. This primary effect can cause damage to moored boats, piers, and facilities close to the water. Secondary problems, including landslides and floods, are related to accelerated water movements and elevated water levels. Electric vehicle batteries if submerged by seawater can spontaneously ignite. Damage to delicate fisheries habitat could significantly impact the Tribe’s economic stability.

## Probability of Occurrence

Earthquakes will occur and when they do, could cause a corresponding tsunami. Other underwater disturbances and landslides also could occur and cause general or localized damage from a tsunami or a seiche. Great earthquakes in the North Pacific or along the Pacific coast of South America historically generate tsunamis that sweep through the entire Pacific basin and occur at a rate of about six every 100 years. Local earthquakes and landslides that generate tsunamis occur more frequently, although a specific rate of occurrence has not been calculated by scientists.

The probability of a significant earthquake generating a tsunami within the Pacific region does exist. However, by the time such a tsunami reaches the inner Puget Sound the probable impact would be in the form of a tidal surge that would cause minimal flooding. Conversely, a significant earthquake that was to originate from within the Puget Sound region, such as one associated with the Seattle fault line, is in close enough proximity that there would be no warning time. Consequently, the impact would result in a much more significant degree of injury and loss of lives.

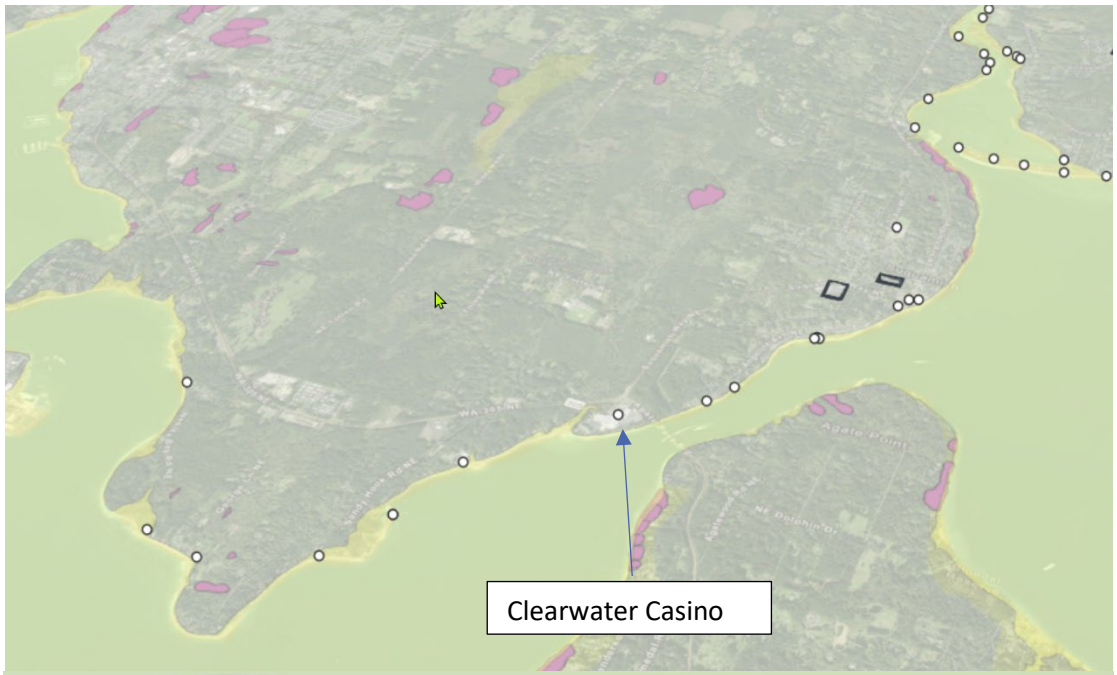
## Risk Assessment

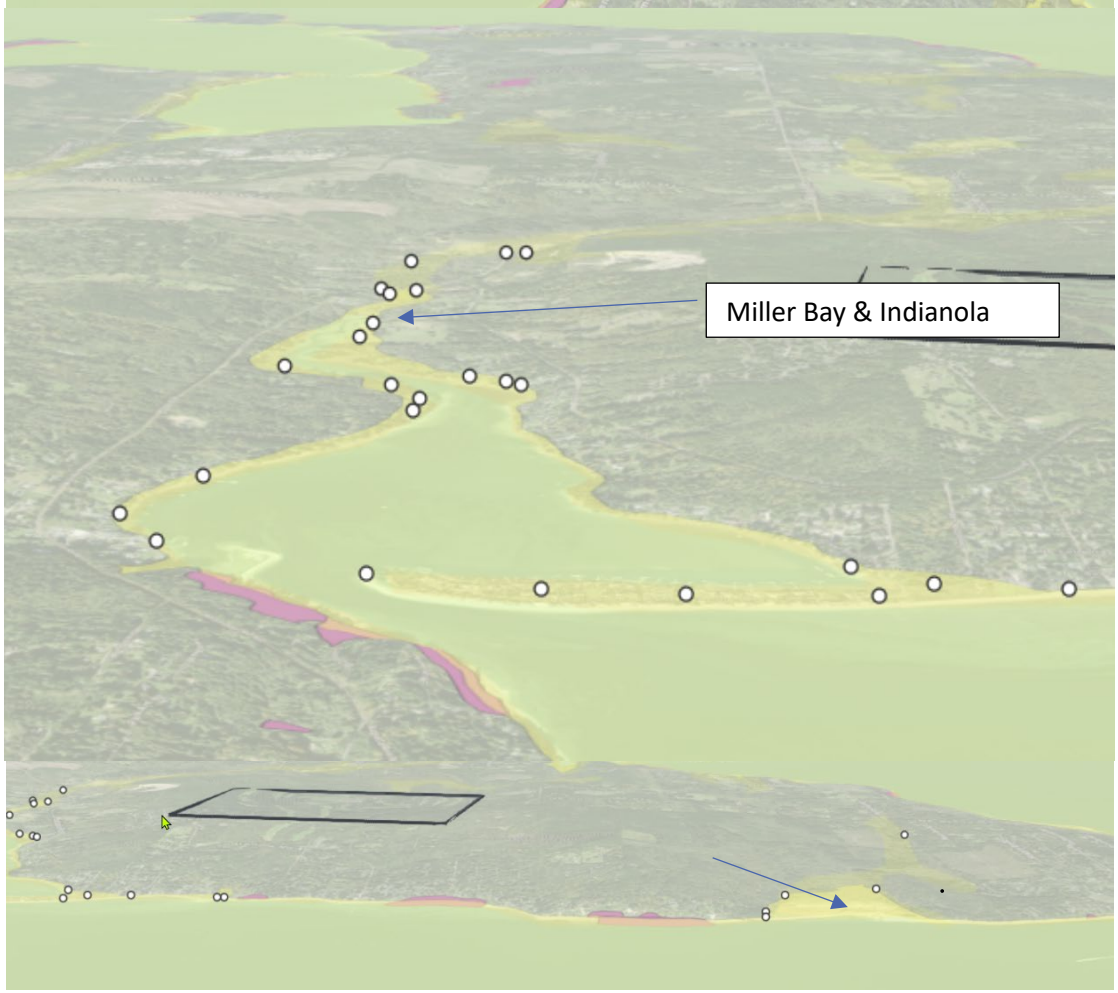
The following information summarizes the information gathered during the hazard assessment process.

Map of Tsunami Inundation Zones The following map illustrates the areas considered vulnerable to a large tsunami occurring at high tide. Areas within these zones are expected to experience severe damage from the sudden inundation of flood water and damaging debris.

## Projected Tsunami Inundation from a M 7.0+ Seattle Fault Earthquake

## Projected Tsunami Inundation from a M 9.0+ Cascadia Subduction Zone Earthquake



Structures within the Tsunami Hazard Zones – The following table summarizes the estimated number of structures located within the tsunami hazard zones as they are defined in Tsunami Inundation Maps above.

| Structures Within the Tsunami Hazard Zone | | | | |
|---|---|---|---|---|
| | | Approximate Values | | |
| | | Structure | Contents | Totals |
| Community Infrastructure | 2 | $2,649,000 | N/A | $2,649,000 |
| Critical Facilities[1] | 1 | $5,650,626 | $4,237,970 | $9,888,596 |
| Residential[2] | 204 | $81,538,800 | $61,154,100 | $142,692,900 |
| Non-Residential[3] | 1 | $1,830,760 | $1,373,070 | $3,203,830 |
| | | | | **$158,434,236** |
| Residential structure values estimated using a $399,700 average. Contents are estimated at 75% of the structure's value. Community Infrastructure includes the Suquamish and Indianola Docks. Critical Facilities include the Kiana Lodge. Non-Residential includes the Camp Indianola church camp. | | | | |

[1] As defined in the Tribal Profile

[2] Any structure, movable or immovable, permanent, or temporary, that is adapted for both human residence and lodging whether occupied or not.

[3] Non-residential buildings consist of buildings other than dwellings, including warehouse and industrial buildings, commercial buildings, buildings for public entertainment, hotels, restaurants, educational, health buildings, etc.

**Affected Tsunami Hazard Zone** – The following table summarizes the estimated population and culturally sensitive areas located within the tsunami hazard zones as they are defined in Map 8.1 above.

| Affected Hazard Zone: Tsunami | | | |
|---|---|---|---|
| Approximate Population: | 802 | Approximate Acreage: | 306 |
| Description of Culturally Sensitive Areas: The following is a list of the culturally sensitive areas located within the hazard zone. (Reference Section 2, The Suquamish Tribal Profile for detailed descriptions of these areas)<br>4 - Archaeological Site 45KP40 - Shell Midden<br>5 - Archaeological Site 45KP41 - Shell Midden<br>6 - Archaeological Site 45KP42 - Shell Midden<br>8 - Archaeological Site 45KP44 - Shell Midden and Adams Marsh Complex<br>9 - Archaeological Site 45KP45 - Petroglyph<br>11 - Doe-Kag-Wats Marsh Complex<br>12 - House of Awakened Culture Complex<br>13 - Kiana Lodge Complex<br>15 - Miller Bay Spit Complex<br>16 - Old Man House Archaeological Site (45KP2) and Historic Village<br>18 - Sacred Place | | | |

Approximate population estimation is based on the 2020 Census 2.4 persons per household multiplied by the number of residential structures.

**Risk Rating Summary for Tsunami Events** – Based on the data obtained, the following table summarizes the Probability of Occurrence (P), Degree of Impact (DI), and Type of Impact (TI) ratings assigned to

potential tsunami events on the Port Madison Indian Reservation. (Reference Section 3, Risk Assessment Rating Criteria)

| Risk Rating Summary for Tsunami Events | | | | |
|---|---|---|---|---|
| | **Probability/Impact** | **Rating** | | **Description** |
| P= | 10 - 25% Probable | Low | 2 | Though possible, there is little likelihood this type of hazardous event will occur within the next 50 years. |
| DI= | Moderate Event | Moderate | 3 | An event that damages a substantial portion of the Reservation, while large areas within the total population sustain few if any direct effects; yet with widespread impact to commerce, infrastructure, and services. |
| TI= | **Life Safety (Weight 60%)** *Event related deaths, injuries, PTSD, & mental health issues* | High | 4 | Loss of life 5 - 10; Serious injuries 5 – 10 |
| | **Property (Weight 10%)** *Rebuilding cost for repairing event related property and infrastructure damage* | Very High | 5 | Greater than $2 million to rebuild |
| | **Economy (Weight 15%)** *Economic losses to businesses resulting in job loss, extended unemployment, & underemployment* | High | 4 | Loss of business <30%; economic recovery within 2 – 5 years |
| | **Environment (Weight 15%)** *Effects on the environment to include damage to the Tribe's culturally sensitive sites, soils, estuaries, fish, and wildlife* | Very High | 5 | Devastating environmental damage; recovery requires >5 years |

**Overall Risk Rating Formula:**

Risk Rating = (P (Probability) + DI (Degree of Impact) + TI (Type of Impact)) / 3

**Risk Rating Calculation for Flood Events:**

**P = 2**

**DI= 3**

TI = (Life = 4 x .6) + (Property = 5 x .1) + (Economy = 4 x .15) + (Environment = 5 x .15)

TI = 2.40 + 0.5 + 0.60 + 0.75

**TI = 4.25**

**Risk Rating =** (2 + 3 + 4.25) / 3 **is** 9.25 / 3 = **3.08**

**Risk Rating Classification for Tsunami Events:** The following table indicates where the risk rating for tsunami events falls within the risk rating classifications. The rating of 3.08 classifies the tsunami risk as moderate in terms of the probability of occurrence in combination with its consequential impact to the community.

| Risk Rating Classification for Tsunami Events | | | |
|---|---|---|---|
| **Risk Rating** | | **Classification** | **Description** |
| Very High | 5 | Urgent Priority | Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action |
| High | 4 | High Priority | Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action |
| **Moderate** | **3** | **Modest Priority** | **Vulnerability is considered as a moderate probability with moderate impact, which warrants moderate priority mitigation action** |
| Low | 2 | Low Priority | Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

## Conclusions

The likelihood of a full-scale tsunami reaching the inner Puget Sound is low, but the corresponding tidal surge would impact the entire inner Puget Sound, including the Reservation's shoreline. Although the Overall Risk Rating is moderate (3.08), the potential for seiches and major tidal movement within the region are very real. No question, as history within the region has shown, the impacts of a major tsunami or seiche triggered tidal movement could be devastating in many respects. Local history and geologic evidence support the predictability of this to occur and validate its potential for devastation. Though the vulnerability is primarily exclusive to the shoreline, the probability of there being no warning time means that the devastating potential for significant loss of life remains.

## Problem Statements

The following problem statements reflect specific vulnerabilities identified in the process of conducting the risk assessment. These are included to summarize the community's most significant risks and vulnerabilities related to flooding.

- There are an estimated 204 residential structures located within the 25-foot inundation zone that, depending on the time of day, would be occupied. In addition, there are critical

infrastructure, critical facilities, and non-residential structures within the inundation zone. Specifically, these include:

1. Suquamish Dock
2. Indianola Dock
3. Kiana Lodge
4. Camp Indianola church camp.

- Depending on the time of day, many of the estimated 208 structures located within the 25-foot inundation zone could be occupied with 800 or more occupants. They would be at significant risk if an earthquake or major landslide event occurring within the Puget Sound region were to trigger a significant tsunami or seiche induced tidal movement with little warning time.
- There are several culturally sensitive areas located within the 25' inundation zone identified by Map 8.1. The following culturally sensitive sites would be vulnerable to the damaged caused by sudden tidal forces, water damage, and erosion: (Reference Section 2, Suquamish Tribal Profile.)

| | |
|---|---|
| 4 | Archaeological Site 45KP40 - Shell Midden |
| 5 | Archaeological Site 45KP41 - Shell Midden |
| 6 | Archaeological Site 45KP42 - Shell Midden |
| 8 | Archaeological Site 45KP44 - Shell Midden and Adams Marsh Complex |
| 9 | Archaeological Site 45KP45 - Petroglyph |
| 11 | Doe-Kag-Wats Marsh Complex |
| 12 | House of Awakened Culture Complex |
| 13 | Kiana Lodge Complex |
| 15 | Miller Bay Spit Complex |
| 16 | Old Man House Archaeological Site (45KP2) and Historic Village |
| 18 | Sacred Place |

## Mitigation Strategies

The following mitigation strategies offer a series of sample recommendations. They must be considered, approved, and funded by the authority having authority to be implemented. They are in no way intended to imply a call to action, constitute serving as an action plan, or be binding recommendations.

The Suquamish Tribe's treaty-reserved cultural, environmental, and economic interests extend well beyond territory located within the Port Madison Indian Reservation. Therefore, the following mitigation strategies also may have relevant application throughout the region as defined by the Tribe's Usual and Accustomed Grounds. (Reference Chapter 2, Suquamish Tribal Profile)

- PE-9: Deliver public education to inform the community of the risks associated with residing in and developing private properties within the 25-foot inundation zone.
- PE-10: Deliver public education to inform the community of the steps they can take to prepare for a tsunami.
- DS-1: Continue active Tribal participation in local community, county, state, and federal growth management planning efforts; the development of land use and zoning standards; the process of conducting environmental impact studies; and permitting processes so that the Tribe's risk management interests are addressed.

- IE-2: Evaluate the Indianola Spit's access/egress vulnerability to potential flooding of NE William Rogers Road; implementing mitigation measures that would prove suitable and cost effective.
- IE-3: Evaluate the Doe-Kag-Wats estuary's access/egress vulnerability to potential flooding of the access road; implementing mitigation measures that would prove suitable and cost effective.
- IE-7: Evaluate the effectiveness and feasibility of a tsunami early warning system for communities located within the 25-foot inundation zone; implementing those measures that would prove suitable and cost effective.
- IE-8: Develop and establish evacuation routes for communities located within the 25-foot inundation zone.
- IE-9: Evaluate the cost/benefit value of potential relocation of structures located within the 25-foot inundation zone; implementing those measures that would prove suitable and cost effective.

dxʷsəq̓ʷəb

*Place of the clear salt water*

# DROUGHTS

Multi-Hazard Mitigation Plan 2022

**Risk Rating**

**2.97**

THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

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## Overview

Historically, drought has not commonly been considered a problem west of the Cascade Mountain Range. However, the Puget Sound region has felt the effects of drought in the past and will continue to do so in the future. The Kitsap Peninsula may be particularly vulnerable because there are no mountains that retain water in the form of snowpack. Kitsap County has experienced abnormally dry to drought conditions throughout 2022 and has experienced the 2nd driest September on record for the past 128 years.

The possibility of a prolonged drought does exist within the area. Normally, average rainfall is about 34-42 inches annually; however, there is a considerable difference in precipitation levels within the region. Several consecutive, hot, dry summer months can create parched and tinder-dry conditions. These have become more frequent in recent years, impacting soil absorption, increasing wildfire potential, and raising the potential for flooding events. The region would not need a full-blown drought to begin to experience water shortages, leading to considerable cultural and economic impacts in addition to impacts to infrastructure and lives.

**Key Terminology:**

**Drought:** A deficiency in precipitation over an extended period, usually a season or more, that results in a water shortage severe enough to cause adverse impacts on vegetation, animals, and/or people. It is a normal, recurrent feature of climate that occurs in all climate zones, from very wet to very dry.

**Groundwater:** Water that collects or flows beneath the Earth's surface, filling porous spaces in soil, sediment, and rocks. Groundwater originates from rain and melting snow and ice and is the source of water for aquifers, springs, and wells.

## Impacts

Extremely dry conditions could force the closure of forests to recreation, hunting, camping, and hiking. Campfires and outdoor burning are often limited to a few months each summer and longer during extremely dry conditions. Drought also affects the environment in many ways. Plants and animals depend on water, just as people do. When a drought occurs, their food supply can shrink, and their habitat can be damaged. Sometimes the damage is only temporary and their habitat and food supply return to normal when the drought is over. However, drought's impact on the environment can last a long time, possibly forever. Often the greatest danger during drought conditions is the increased likelihood and severity of wildfires.

**Marine Impact** – Drought and accompanying low river flows into Puget Sound can exacerbate warm Puget Sound marine water conditions. From the fall of 2013 to the winter of 2016 waters in the Pacific were abnormally warm; this phenomenon was termed "the Blob". This coincided with a drought in 2015 that reduced river flows.

According to the Washington State Department of Ecology[1], ". . . unusually hot temperatures don't end at the water's edge; record-breaking temperatures are being recorded within Puget Sound." Scientists noted that warming temperatures from the Pacific Ocean have migrated into Puget Sound. Warmer ocean water and lower summer river flows decrease the amount of available oxygen, which is not good news for fish. The Puget Sound water temperatures were 4-degrees Fahrenheit higher than normal.

Monitoring by the Washington State Department of Ecology and other scientific partners in county, state, and federal agencies suggest that these warming conditions are causing negative side effects on

the Puget Sound marine environment. There has been an increase in harmful algae blooms, shellfish closures, lower dissolved oxygen levels, and unfavorable conditions for salmon and other cold-loving marine species. Warm water inherently holds less oxygen and fosters disease.

In drought conditions, river flow decreases and becomes warmer than normal, challenging fish populations across the state. Low flows in some streams and rivers have impacted migrating juvenile salmon as is illustrated in the table below. The Department describes how drought conditions can harm salmon and other fish populations at several points of their life cycles as follows:

**Juvenile Fish** – Downstream migration of juvenile salmon in the spring is dependent on adequate stream flows created by runoff from melting snow. When snow-packs melt early, juvenile salmon, trout, and other fish species become stranded in isolated pools. Warmer-than-normal stream temperatures and low dissolved-oxygen levels in isolated pools can be lethal to fish. Juvenile fish trapped in small pools are susceptible to predators such as birds and raccoons.

**Adult Fish** – Adult salmon have difficulties reaching upstream spawning grounds if river flows remain below normal. Some species spawn in channel margins, side channels, and smaller tributaries. If those areas are inaccessible because of low flows, some fish would have to spawn in mainstem waters, where salmon nests – known as Redds – could be lost when flows drop. In the fall, Redds in the mainstem become susceptible to bed scour from high water or flooding. Warm water temperatures increase the likelihood of certain diseases in adult fish populations, especially fungal and bacterial diseases, leading to fish kills or reduced reproductive success.

**Fish Hatcheries** – The Suquamish Tribe’s Grovers Creek Salmon Hatchery would be impacted by poor water quality, high temperatures, and reduced water supplies. This would result in an increase in fish disease, treatment costs, and fish mortalities. A lack of water would require an increased reliance on pumping water from deep wells, adding cost to operations. Early releases of juvenile salmon – plus additional stress related to handling, trucking, and relocating the fish – also will increase mortalities.

**Impact Threatens the Suquamish Way of Life** – For millennia, the Suquamish Tribe has depended on fish, shellfish, game, and plants supplied by a variety of ecosystems within Puget Sound. The fruits of these Pacific Northwest ecosystems provide for the Tribe's economic, nutritional, and cultural needs. However, decades of development have significantly degraded these ecosystems. The combined impacts of development, climate change, and ocean acidification threaten to radically change the availability of natural resources on which the Suquamish have always depended.

Development has exposed streams, which means salmon must swim through long stretches of unshaded streams, increasing their vulnerability to higher stream temperatures and lower stream volumes. The burning of coal, oil, and gas produces an abundance of heat-trapping carbon dioxide gas in the atmosphere, causing the Earth's climate to warm. Increasing amounts of carbon dioxide being absorbed by the ocean are making the ocean more acidic. Compounding this even further is the increasing presence of drought conditions.

**Economic Impact** – Members of the Suquamish Tribe have become very self-reliant in terms of supporting their financial well-being. Seafood, game, and traditional plants remain essential to the Suquamish culture and diet. Approximately 20% of Tribal members support their families by earning income from the harvest of fish and shellfish. Proceeds from harvesting geoduck clams are used to support elders' programs. Maintaining the Tribe’s economic vitality requires maintaining their ability to rely on harvesting natural resources.

**Cultural Impact** – The ancestral Suquamish have lived in Central Puget Sound for at least 13,000 years. The major Suquamish winter village was at Old Man House on the shoreline of Agate Passage at **dxʷsəq̓ʷəb** meaning place of clear salt water. The Suquamish name translates the people of the clear salt water. The Suquamish depended on salmon, cod and other bottom fish, clams and other shellfish, berries, roots, ducks and other waterfowl, deer, and other land game for food for family use, ceremonial feasts, and for trade.

## History

The Pacific Northwest winter of 2014-15 was unusually warm relative to average winter conditions. Precipitation that would normally have fallen as snow in the mountains and surrounding uplands fell instead as rain. This contributed to a significant reduction in Washington's late spring snowpack followed by the hottest summer on record.

In March 2015, Governor Inslee declared a drought emergency for the Olympics, Central Cascades, and Walla Walla regions, where snowpack totals ranged from 7 to 67 % of normal. By July 7, the entire state was in a drought. The drought peaked in late August, with 85% of Washington in “extreme drought.” Two-thirds of the state was still in extreme drought at the start of the water year, October 1st.

The impacts of reduced snowmelt and continued warm-dry weather caused stream flows across Washington to decline and in many cases fall below previous record low values. Washington state leaders decided to let the drought declaration expire at the end of 2015, after heavy rainfall during the month of December. After a winter that defied expectations, on April 1, 2016, Washington became the only one among 11 Western states completely free of drought, according to the U.S. Drought Monitor.

Multiple measurable and documented droughts have hit the region over the past 100 years, but the following are the most notable:

- April 1934 – March 1937: The longest drought in the region’s history.
- October 1976 – September 1977: The worst drought on record. Stream flows averaged between 30% and 70% of normal. Temperatures were higher than normal, which resulted in algae growth and fish killings.
- January – March 2001: the second driest winter on record in 106 years. Stream flows approached the low levels of the 1976-77 droughts.
- March – December 2005: Less than 75 % of normal water supplies statewide; much of Western Washington was abnormally dry; statewide drought emergency declared.
- April – December 2015: Water supplies across the state approximately 75 % of normal levels; snowmelt runoff was the lowest on record in over 60 years; statewide drought declaration.

## Vulnerability

The Reservation’s entire population is directly or indirectly vulnerable to drought events. Residents may be directly affected by a reduced water supply, which may result in reduced well production, dry wells, and/or saltwater intrusion, as well as potential water use restrictions and increased water rates. The potential reduction of groundwater due to drought could have significant negative impacts on the Reservation because its potable water supply comes from underground aquifer systems. Over-pumping and saltwater intrusion may be expected to occur under drought conditions.

In the conventional sense, drought conditions result in a shortage of water that can lead to forests and local agriculture being devastated. When agricultural crops dry out, normal harvest yields will be severely diminished, resulting in economic loss. When natural vegetation dries out, it becomes much more susceptible to wildfire, thereby increasing a Reservation’s vulnerability to such an event. In the

event of severe drought, the firefighting capabilities of fire agencies will be severely impacted. All these considerations make a community vulnerable.

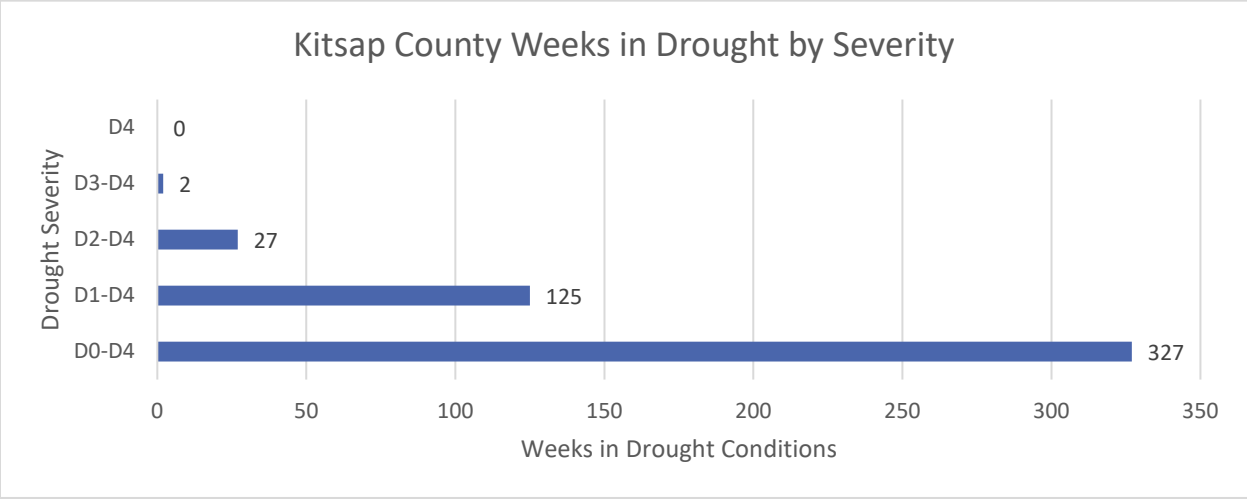
But as discussed previously, of much greater significance to the Suquamish Tribe is the vulnerability of a drought's impact to fishing habitats that depend on adequate water levels for their very existence. These are delicate ecosystems that provide basic sustenance for the Tribe's economic, nutritional, and cultural needs. The environmental impacts of a drought on these ecosystems can take several years to recover. Weather related drought conditions are a natural occurrence, but growth compounds the degree of impact they cause, thereby increasing the vulnerability. As growth places more pressure on limited local resources, future impacts may be greater, suggesting increasing vulnerability.

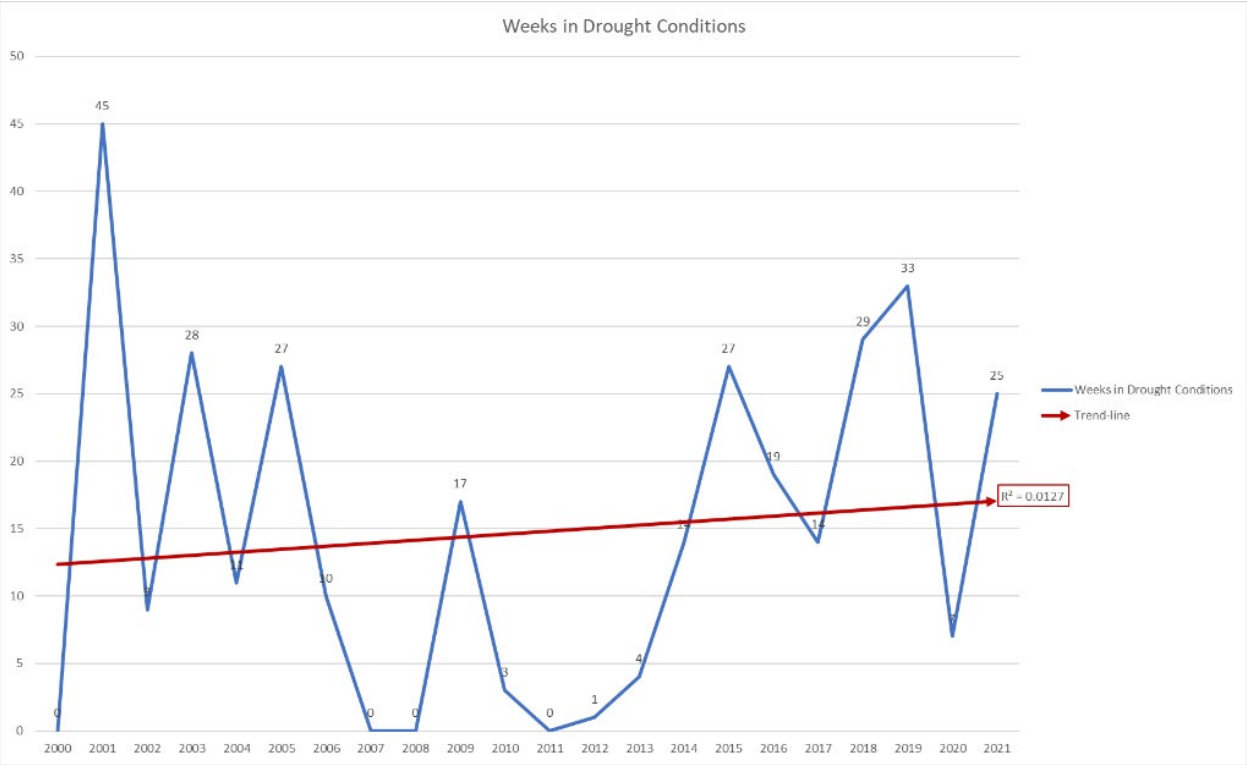
## Probability of Occurrence

History suggests a high probability of occurrence. Although the Reservation's entire population is vulnerable to the effects of drought, severity has historically been low, being more inconvenient than threatening. Locally, actual drought conditions have been limited to a few days, even during extended dry periods. However, Kitsap County has seen an increasing trend in the number of weeks Abnormally Dry (D0) to Extreme Drought (D3) since the year 2000/

According to the Kitsap County Multi-Hazard Mitigation Plan, empirical studies conducted over the past century have shown that meteorological drought is never the result of a single cause. It is the result of culminating causes, often synergistic in nature; these include the global weather patterns that produce persistent, upper-level high-pressure systems along the West Coast with warm, dry air resulting in less precipitation. Scientists do not know how to predict drought more than a month in advance in most locations. Predicting drought depends on the ability to forecast precipitation and temperature. Anomalies of precipitation and temperature may last from several months to several decades. How long they last depend on interactions between the atmosphere and the oceans, soil moisture and land surface processes, topography, internal dynamics, and the accumulated influence of weather systems on a global scale.

Based on the state's history of drought from 1895 to 1995, the state can expect severe or extreme drought at least 5 percent of the time in the future. The east slopes of the Cascades and much of Western Washington can expect severe or extreme drought from 5 to 10 percent of the time. (Washington State Hazard Mitigation Plan)






## Risk Assessment

**Loss Estimation** – There are no recognized standards in place to quantifiably estimate damage from drought events. This is largely because the scope, nature, and type of damage can vary considerably. Furthermore, history demonstrates that a drought's impact is widespread with regional implications, rather than being isolated to specific geological hazard zones. A drought has the potential to affect all people, all property, and essential economic infrastructure, all of which have significant cultural consequences. Because delicate ecosystems and habitat are slow to recover, losses to the Suquamish Tribe would be long lasting. Drought conditions damage fishing and essential harvesting grounds, impacting essential resources that Tribal members rely on for their basic sustenance and economic security. Therefore, except for the collateral damage from wildfire, which is estimated in the Wildfire section of this plan, the risk assessment for drought is based on scientific study and analysis of habitat, past experiences, and lessons learned from previous drought events.

**Risk Rating Summary for Drought Events**: – The following table summarizes the Probability of Occurrence (P), Degree of Impact (DI), and Type of Impact (TI) ratings assigned to potential drought events on the Port Madison Indian Reservation. (Reference Section 3, Risk Assessment Rating Criteria)

| Risk Rating Summary for Drought Events | | | | |
|---|---|---|---|---|
| | **Probability/Impact** | **Rating** | | **Description** |
| P= | 50 - 75% Probable | High | 4 | There is a great likelihood this type of hazardous event will occur within the next 50 years. |
| DI= | Moderate Event | Moderate | 3 | An event that damages a substantial portion of the Reservation, while large areas within the total population sustain few if any direct effects; yet with widespread impact to commerce, infrastructure, and services. |
| TI= | **Life Safety (Weight 60%)** *Event related deaths, injuries, PTSD, & mental health issues* | Very Low | 1 | No injuries or loss of life |
| | **Property (Weight 10%)** *Rebuilding cost for repairing event related property and infrastructure damage* | Very Low | 1.5 | No measurable rebuilding cost |
| | **Economy (Weight 15%)** *Economic losses to businesses resulting in job loss, extended unemployment, & underemployment* | High | 4 | Loss of business <30%; economic recovery within 2 – 5 years |
| | **Environment (Weight 15%)** *Effects on the environment to include damage to the Tribe's culturally sensitive sites, soils, estuaries, fish, and wildlife* | High | 4 | Significant environmental damage; recovery requires 2 - 5 years |

**Overall Risk Rating Formula:**

Risk Rating = (P (Probability) + DI (Degree of Impact) + TI (Type of Impact)) / 3

**Risk Rating Calculation for Flood Events:**

**P = 4**

**DI= 3**

TI = (Life = 1 x .6) + (Property = 1 x .1) + (Economy = 4 x .15) + (Environment = 4 x .15)

TI = 0.60 + 0.10 + 0.60 + 0.60

**TI = 1.9**

**Risk Rating =** (4 + 3 + 1.9) / 3 is 8.9 / 3 = **2.97**

**Risk Rating Classification for Drought Events:** The following table indicates where the risk rating for drought events falls within the risk rating classifications. The rating of 2.97 classifies the drought risk as moderate in terms of the probability of occurrence in combination with its consequential impact to the community.

| Risk Rating Classification for Drought Events | | | |
|---|---|---|---|
| **Risk Rating** | | **Classification** | **Description** |
| Very High | 5 | Urgent Priority | Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action |
| High | 4 | High Priority | Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action |
| **Moderate** | **3** | **Modest Priority** | **Vulnerability is considered as a low probability with moderate impact, which warrants moderate priority mitigation action** |
| Low | 2 | Low Priority | Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

## Conclusions

Although the Overall Risk Rating is moderate (2.97), the threat of drought within the Reservation is very real. The wildfire risk associated with drought can be mitigated through forest management practices, fire safety campaigns, and wildland fire vigilance. However, these efforts only address managing the fuel and attempt to prevent the occurrences of wildfire, which only addresses the symptom. They fail to address the underlying problem, which is the drought conditions that set the stage for wildfire and potential for increased flooding events, as the soil is less able to absorb moisture following extended or severe dry conditions. Therefore, drought-related wildfire and flooding will continue to occur in the area periodically. The impacts of climate change will bring complexity and potentially compounding issues with regards to drought. As temperatures rise, the area is expected to see increased periods of extreme heat events and reduced snowpack and earlier melt for snow in the mountain regions. This, in turn, poses much higher risks to the natural habitats that salmon require. Additionally, the higher amounts of precipitation in the form of rain expected for the region may extend periods between drought conditions but be further complicated by potentially higher degrees of wildfire and flooding events following extreme periods of high temperatures.

There is interdependence among the unique Puget Sound ecosystems to maintain balance between the Pacific Northwest's social, economic, and environmental interests. For millennia, the Suquamish Tribe has depended on fish, shellfish, game, and plants supplied by these ecosystems. The fruits of habitats within these ecosystems provide for the Tribe's economic, nutritional, and cultural needs. Therefore,

what is of much greater concern for the Suquamish Tribe is the broader impact of drought on the Puget Sound region's ecosystems. There is interdependence between the essential habitat these ecosystems provide and the Suquamish Tribe's economic vitality and the preservation of its very culture.

## Problem Statements

The following problem statements reflect specific vulnerabilities identified in the process of conducting the risk assessment. These are included to summarize the Reservation's most significant risks and vulnerabilities related to drought.

- The increasing likelihood of drought conditions within the Reservation changes the risk profile of wildfire and flooding vulnerability. As discussed in the Wildfire section, the region does have a history of wildfire. In recent history, wildfire vulnerability has been low because the region's weather characters maintain vegetation moisture content. However, the region's most recent trend toward higher probability of drought conditions is increasing this vulnerability.
- The Tribe is very economically vested in its fish and shellfish harvesting programs. Therefore, the Tribe also is very dependent upon habitat preservation within the many ecosystems located throughout the entire Puget Sound region. The increasing likelihood of drought conditions within the Puget Sound has potential for generating serious impacts to the Tribe's economic vitality.
- Increasing and complicated drought conditions posed by climate change also bring an associated vulnerability in the form of changes to Puget Sound's marine environment. Studies by the State's Department of Ecology and others indicate that warming conditions are causing negative side effects such as increased algae bloom, lower dissolved oxygen levels, shellfish closures, and unfavorable conditions for salmon and other cold-water species. Record-breaking temperatures (currently 4 degrees Fahrenheit higher than normal) are being recorded within Puget Sound from warmer ocean water migrating into the Sound, compounded by diminished stream and river flow that is essential to estuarine circulation. Warm water inherently holds less oxygen fostering disease. Fish populations across the state are being challenged by low flow in streams and rivers.
- The very fabric of the Tribe's deep-rooted native culture is dependent upon the region's habitat vitality and their ability to sustain salmon, cod and other bottom fish, clams and other shellfish, berries, roots, ducks and other waterfowl, and deer and other land game. The Tribe relies on these essential natural resources for food for family use, to support ceremonial feasts, and for important trade. Therefore, the increasing likelihood of drought conditions within the region has serious implications to preserving the Tribe's long-standing cultural heritage.

## Mitigation Strategies

The following mitigation strategies offer a series of sample recommendations. They must be considered, approved, and funded by the authority having authority to be implemented. They are in no way intended to imply a call to action, constitute serving as an action plan, or be binding recommendations.

The Suquamish Tribe's treaty-reserved cultural, environmental, and economic interests extend well beyond territory located within the Port Madison Indian Reservation. Therefore, the following mitigation strategies also may have relevant application throughout the region as defined by the Tribe's Usual and Accustomed Grounds. (Reference Chapter 2, Suquamish Tribal Profile)

- PE-9: Promote the use of public education programs to advocate for the use of measures designed to increase drought resistance such as planting drought resistant landscapes and reducing water consumption.
- DS-1: Continue active Tribal participation in local community, county, state, and federal growth management planning efforts, the development of land use and zoning standards, the process of conducting environmental impact studies, and permitting processes so that the Tribe's risk management interests are addressed.
- IE-10: Formulate local policies that can be implemented by Tribal government to support the water conservation measures needed to preserve water supplies during times of water shortage and drought.
- EP-4: Evaluate the feasibility and benefits of implementing further water conservation planning efforts to ensure adequate preservation of the Suquamish area's watershed areas.
- EP-5: Provide for additional research and compilation of water resource data regarding aquifer recharge areas to identify long-term recommendations for assuring adequate water system capabilities and to identify alternative water supply sources as a back-up contingency during periods of drought conditions.
- EP-6: Continue active Tribal representation in the relevant forums to assure the Tribe's habitat preservation interests are considered and accounted for within stream and shoreline management practices and decisions.
- EP-7: Continue active Tribal representation in the relevant forums to develop and implement measures aimed at reducing the effects of global warming.

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*Place of the clear salt water*

# WILDFIRE

Multi-Hazard Mitigation Plan 2022

**Risk Rating**

**2.55**

THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

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## Overview

As history consistently demonstrates throughout the Pacific Northwest, wildfires are highly possible and can pose a serious threat to life and property. Sources of ignition can include lightning, arson, recreational activities, debris burning, and fireworks. Individuals cause about 80% of fires, often due to negligent behavior, with the remaining 20% attributed to natural causes. The probability of a destructive wildfire is heavily influenced by weather and fuel conditions, topography, and human activities. Wildland and urban wildfires are most likely to occur during the local dry season, mid-May through October, and anytime during prolonged dry periods causing drought or near-drought conditions.

**Key Terminology:**

**Fuel -** Combustible material, which includes vegetation, such as grass, leaves, ground litter, plants, shrubs, and trees that feed wildfire.

**Wildfire -** An uncontrolled fire involving combustible natural vegetation that occurs in countryside or wilderness area; ranging from a small grass and/or brush fire to a large-scale forest fire. Wildfire is further defined using the following two distinctions:

**Urban Wildfire** – An uncontained wildfire requiring suppression action usually spreading through ground cover, vegetative fuels, brush, grass, and landscaping; often threatening residential and commercial structures within an urban environment with access to established roadways and water systems.

**Wildland Fire** – An uncontained wildfire located within woodlands, forests, grasslands, brush, and other such vegetation or combination of vegetation where suppression efforts are not readily supported by established roadways and water systems.

## Impacts

Wildfires can result in the loss of valuable timber resources, causing the destruction of wildlife habitats, leading to watershed contamination, destroying popular recreational areas, as well as creating conditions of increased vulnerability to erosion, flooding, and landslides. A significant wildfire on the Reservation could create impacts that are unique to the Tribe by destroying culturally sensitive areas and/or resources that are significant to Tribal culture. Because the nature of the Reservation creates a residential/wildland interface, an urban wildfire always has the potential of extending into residential communities with devastating results. There are several high-density housing developments within the Reservation that could be ravaged by an urban wildfire getting out of control.

When considering wildfire vulnerability, it is important to recognize that wildland fires typically generate a range of secondary effects that are often more widespread and prolonged than the fire itself. Wildfire smoke is composed of harmful chemicals and tiny particles suspended in the air that present a significant health hazard for workers exposed to it. These particles can irritate the lungs and cause serious or even fatal health effects. Regional wildfires in the area have led to extended periods of hazardous air-quality events that impact the health and wellbeing of the general population, but especially those whose work is primarily outdoors. Wildland fires can cause direct economic losses by destroying harvestable timber and leaving lasting scars to the land. Erosion becomes a significant secondary hazard when wildland fires strip slopes of their vegetation. This exposes them to greater amounts of rain and run-off, which can increase potential for flash flooding, weaken soil and cause failures on slopes. Erosion and major landslides can occur several years after a wildland fire. The following secondary effects are possible:

**Damaged Fisheries** – Critical fisheries throughout the region can suffer from increased water temperatures, sedimentation, and changes in water quality and chemistry.

**Soil Erosion** – The protective covering provided by foliage and dead organic matter is removed, leaving the soil fully exposed to wind and water erosion. Accelerated soil erosion occurs, causing landslides and threatening aquatic habitats.

**Spread of Invasive Plant Species** – Non-native woody plant species frequently invade burned areas. When weeds become established, they can dominate the plant cover over broad landscapes, and become difficult and costly to control.

**Disease and Insect Infestations** – Unless diseased or insect-infested trees are swiftly removed, infestations and disease can spread to healthy forests and private lands. Timely active management actions are needed to remove diseased or infested trees.

**Destroyed Endangered Species Habitat** – Catastrophic fires can have devastating consequences for endangered species, such as when the Biscuit Fire in Oregon destroyed 125,000 to 150,000 acres of spotted owl habitat.

**Soil Sterilization** – Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost. It can take decades or even centuries for ecosystems to recover from a fire. Some fires burn so hot that they can sterilize the soil.

## History

Old-growth trees and fire scars suggest wildfires occurred about 450, 480, 540, and 670 years ago. Historically, wildfires were not considered a hazard as fire is a normal part of most forest and range ecosystems. Wildland fires historically burn on a regular cycle. The burning cycle in western Washington appears to have occurred every 100 – 150 years. Due to a preponderance of evidence being obliterated by logging, major windstorms toppling older trees, and more recent wildfires in the area, it is difficult to determine if this remains true in current times. However, recorded information on wildfires in the region indicates an active history of wildfires. As communities expand farther into forested lands to maintain the wilderness ambiance, urban wildfires are becoming a significant hazard, having the potential for loss of life and destruction of property.

## Vulnerability

With much of the Reservation land still in various stages of forestation, all areas are vulnerable to wildfire. Many individual homes and developments border forestland. Drought conditions often increase the wildfire danger in early fall. Recent history of wildfires in the region indicates that most were human-caused and extinguished before major damage occurred. Urban wildfires can be caused by a few different scenarios, but are started by campfires, along highways from sparking sources or careless drivers, electrical fires from high wind events, or fireworks. Though the benefit of established roadways and water systems means that urban wildfires are typically extinguished quickly, the potential for them to extend into inaccessible areas is very real. Therefore, the potential for an urban wildfire to become a wildland fire is a very real and constant threat. The destruction of large tracts of forest land would have an immediate economic impact to the Reservation while collateral economic and social effects could impact the Tribe for years, suggesting moderate vulnerability. As the climate continues to change this region is expected to experience more frequent and severe extreme weather events, including heat related events, which can dry out ignition materials. Additionally, due to the interface of human populations near forested lands prescribed burns which can be a healthy way to manage forestry and underbrush is difficult and relies heavily on weather conditions being appropriate.

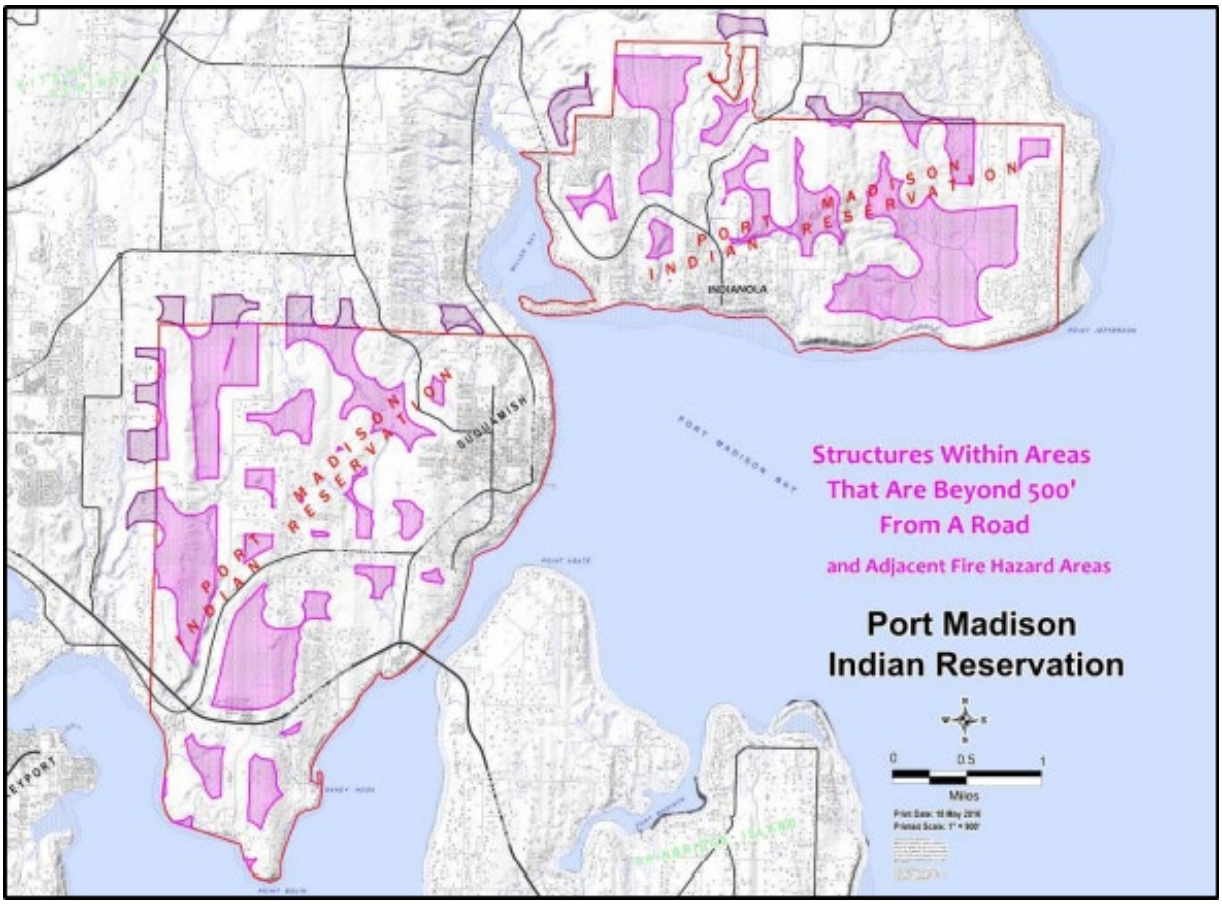
## Probability of Occurrence

The existence of large, forested areas, increasing population and recreational activities, and the anticipated impacts of a changing climate combine to suggest a high probability of occurrence. The probability of forest and wildland fires fluctuates continually depending on variables such as drought effects, meteorological influences, and human caused incidents, both intentional and accidental. The warm summer months are the most common cause of wildfire in the area.

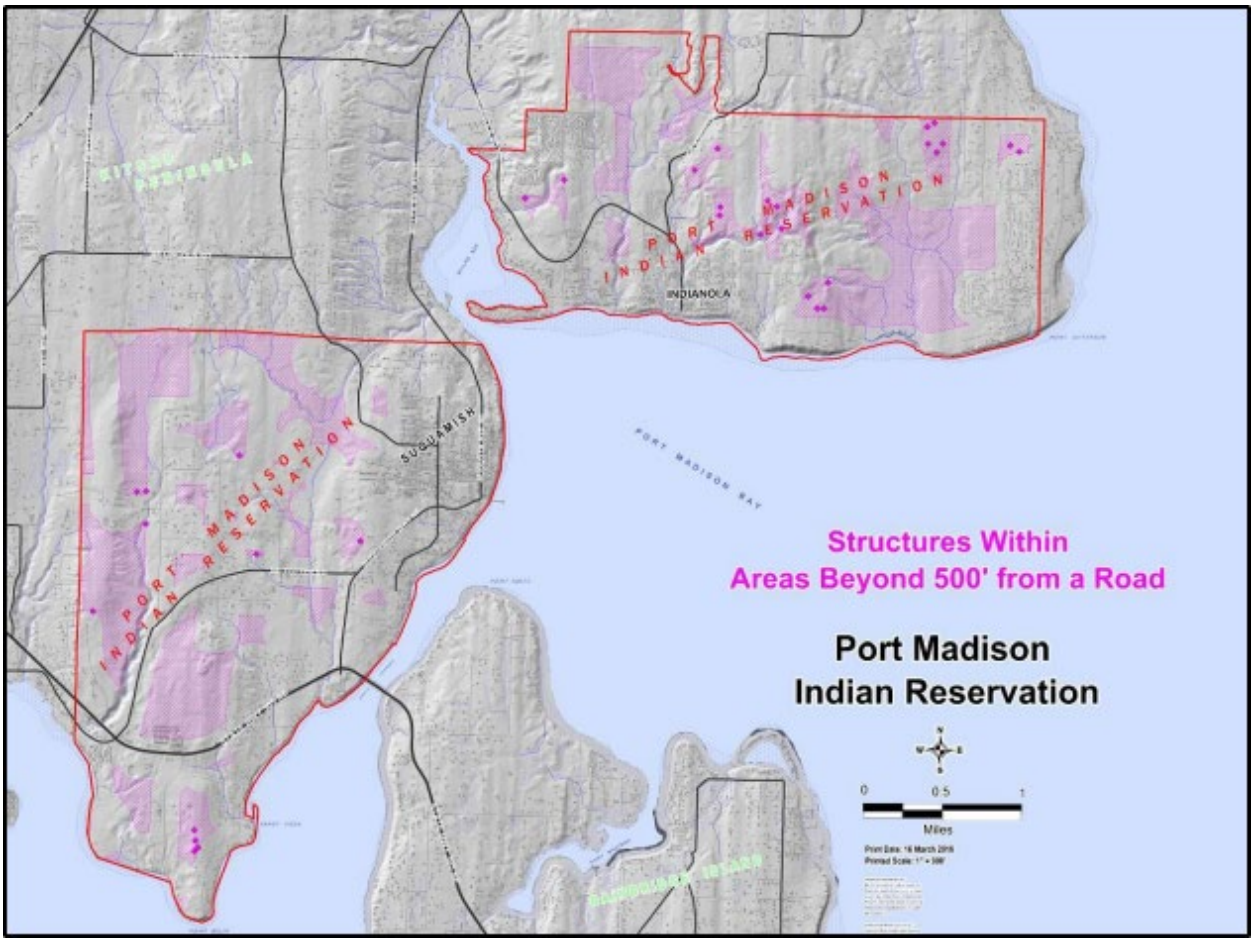
## Risk Assessment

The following is a summary of the information gathered during the hazard assessment process.

*Map of Wildfire Hazard Zones beyond 500' from a roadway* -- The following map illustrates the wildfire zones based on the criterion of identifying areas of forested lands beyond 500 feet of vehicular access. This criterion is based on two primary factors that make these areas vulnerable because a wildfire within these zones could easily develop into a wildland fire scale event. The first factor recognizes unpopulated zones where a wildfire can gain significant headway before it is discovered and reported. The second factor considers access restrictions where the implementation of fire suppression efforts will be significantly delayed due to a lack of developed access roadways, which will compound the deployment of supporting water supply.




*Map of Structures Located within Wildfire Hazard Zones* – The following map illustrates both the wildfire hazard zones and identifies the structures located within these zones.




**Structures Located within Wildfire Hazard Zones** – The following table summarizes the estimated number of structures located within the wildfire hazard zones. (Reference Map 10.2)

| Structures within Wildfire Hazard Zones | | | | |
|---|---|---|---|---|
| | | Structure Values | Content Values | Totals |
| Critical Facilities[1] | 0 | N/A | N/A | - |
| Residential[2] | 52 | $20,784,400 | $15,588,300 | $36,372,700 |
| Non-Residential[3] | 0 | N/A | N/A | - |
| | | | | **$36,372,700** |
| Residential structure values estimated using a $399,700 average. Contents are estimated at 75% of the structure's value. | | | | |

[1] As defined in the Tribal Profile.

[2] Any structure, movable or immovable, permanent, or temporary, that is adapted for both human residence and lodging whether occupied or not.

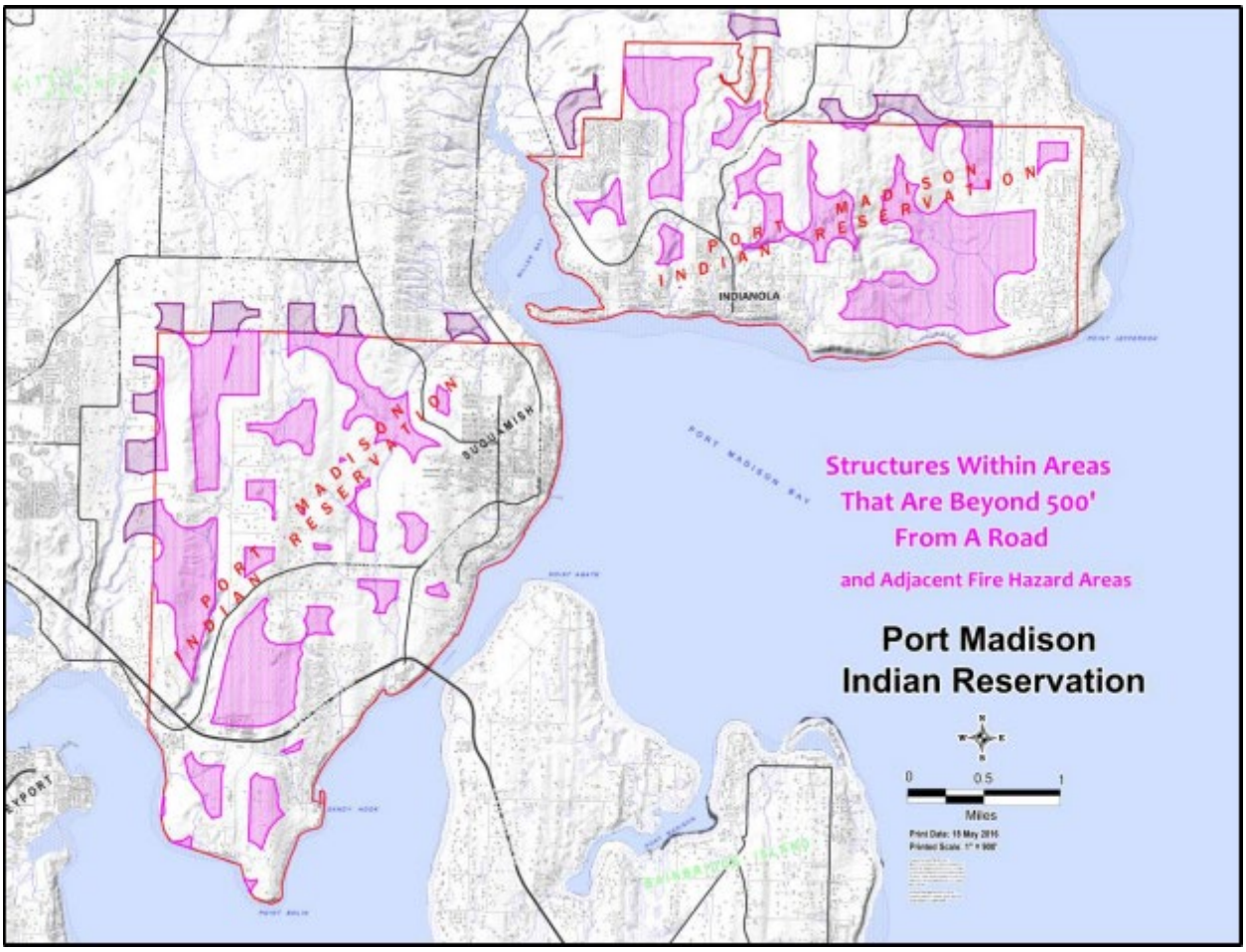
[3] Non-residential buildings consist of buildings other than dwellings, including warehouse and industrial buildings, commercial buildings, buildings for public entertainment, hotels, restaurants, educational, health buildings, etc.

**Affected Wildfire Hazard Zone** – The following table summarizes the estimated population and culturally sensitive areas located within the wildfire hazard zones as they are defined in Map 10.1.

| Affected Wildfire Hazard Zone | | | |
|---|---|---|---|
| Approximate Population[4]: | 128 | Approximate Acreage: | **1,801** |
| Description of Culturally Sensitive Areas: There are not specifically culturally sensitive areas that are known to be located within the wildfire hazard zones. | | | |

[4] Approximate population estimation is based on the 2020 Census 2.4 persons per household multiplied by the number of residential structures.

*Map of Culturally Sensitive Sites within Wildfire Hazard Zones* – The following map identifies that there are no culturally sensitive sites located within the wildfire hazard zones. However, as is common to wildfire events, the potential exists for secondary damage in the form of excessive erosion, which in this case would empty into the Doe-Kag-Wats Marsh Complex, which is a delicate wetland habitat.




**Risk Rating Summary for Wildfire Events** – Based on the data obtained, the following table summarizes the Probability of Occurrence (P), Degree of Impact (DI), and Type of Impact (TI) ratings assigned to potential wildfire events on the Port Madison Indian Reservation. (Reference Section 3, Risk Assessment Rating Criteria)

| Risk Rating Summary for Wildfire Events | | | | |
|---|---|---|---|---|
| | **Probability/Impact** | **Rating** | | **Description** |
| P= | 50 - 75% Probable | High | 4 | There is a great likelihood this type of hazardous event will occur within the next 50 years. |
| DI= | Localized Event | Low | 2 | An event that only damages and/or directly threatens isolated portions of the Reservation's population and property; but has little impact on commerce, infrastructure, and services. |
| TI= | **Life Safety (Weight 60%)** *Event related deaths, injuries, PTSD, & mental health issues* | Very Low | 1 | No injuries or loss of life |
| | **Property (Weight 10%)** *Rebuilding cost for repairing event related property and infrastructure damage* | Moderate | 3 | $50,000 – 1 million to rebuild |
| | **Economy (Weight 15%)** *Economic losses to businesses resulting in job loss, extended unemployment, & underemployment* | Very Low | 1 | Little to no economic recovery required |
| | **Environment (Weight 15%)** *Effects on the environment to include damage to the Tribe's culturally sensitive sites, soils, estuaries, fish, and wildlife* | High | 4 | Significant environmental damage; recovery requires 2 - 5 years |

**Overall Risk Rating Formula:**

Risk Rating = (P (Probability) + DI (Degree of Impact) + TI (Type of Impact)) / 3

**Risk Rating Calculation for Wildfire Events:**

**P = 4**

**DI= 2**

TI = (Life = 1 x .6) + (Property = 3 x .1) + (Economy = 1 x .15) + (Environment = 4 x .15)

TI = 0.60 + 0.30 + 0.15 + 0.60

**TI = 1.65**

**Risk Rating =** (4 + 2 + 1.65) / 3 **is** 7.65 / 3 = **2.55**

**Risk Rating Classification for Wildfire Events:** The following table indicates where the risk rating for wildfire events falls within the risk rating classifications. The rating of 2.55 classifies the wildfire event risk as moderate in terms of the probability of occurrence in combination with its consequential impact to the community.

| Risk Rating Classification for Wildfire Events | | | |
|---|---|---|---|
| **Risk Rating** | | **Classification** | **Description** |
| Very High | 5 | Urgent Priority | Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action |
| High | 4 | High Priority | Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action |
| **Moderate** | **3** | **Modest Priority** | **Vulnerability is considered as a low probability with moderate impact, which warrants moderate priority mitigation action** |
| **Low** | **2** | **Low Priority** | **Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action** |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

## Conclusions

Although the Overall Risk Rating is moderate (2.55), the threat of wildfire within the Reservation is very real. There is no question that the impacts of a major wildfire could be devastating in many respects. Local history supports the predictability of this potential and its possibility for devastation. The Reservation's demographic characteristics have changed over the past 100 years. Expansive forests have become developed communities with wildland urban interface characteristics. Though these conditions exist throughout most of the Reservation, the degree of impact from a wildfire is likely to be moderate. This is due in large part to the probability of early detection, available access, and readily available water supply capabilities. But the potential for devastating wildfire remains.

## Problem Statements

The following problem statements reflect specific vulnerabilities identified in the process of conducting the risk assessment. These are included to summarize the community's most significant risks and vulnerabilities related to wildfires.

- Each of these zones provides essential habitat for native wildlife and provides the community with the preservation of important open space, all of which would be vulnerable to wildfire.
- The Inland Marsh Complex (Resource 14), located in the western portion of the Reservation is a traditional cultural property with significant plant resources. This area is a unique and sensitive wetland habitat that would be particularly vulnerable to effects of a wildfire.
- The Doe-Kag-Wats Marsh Complex (Resource 11) is located directly downstream from the largest wildfire hazard zone, which serves as the Marsh's watershed. This means it collects all this area's natural runoff and empties directly into this sensitive wetland habitat. This

downstream relationship makes this delicate wetland habitat particularly vulnerable to secondary erosion damage that would follow a wildfire.

- There are several zones, particularly in the eastern portion of the Reservation, that have residential structures located within them. Because most of these homes are accessed by a single one-lane driveway, an active wildfire in these zones could easily cut-off escape egress for the occupants as well as access to fire suppression resources to protect these properties.
- Some of these vulnerable wildfire zones are located directly adjacent to developed communities such as Miller Bay Estates, the White Horse development, and Camp Indianola. Unrestrained wildfire in these zones would generate added vulnerability by threatening to expose these adjacent developments.

## Mitigation Strategies

The following mitigation strategies offer a series of sample recommendations. They must be considered, approved, and funded by the authority having authority to be implemented. They are in no way intended to imply a call to action, constitute serving as an action plan, or be binding recommendations.

The Suquamish Tribe's treaty-reserved cultural, environmental, and economic interests extend well beyond territory located within the Port Madison Indian Reservation. Therefore, the following mitigation strategies also may have relevant application throughout the region as defined by the Tribe's Usual and Accustomed Grounds. (Reference Chapter 2, Suquamish Tribal Profile)

- PE-7: Develop Evacuation Plans for the Port Madison Indian Reservation and deliver public information and engagement opportunities regularly regarding evacuation plans and activation.
- PE-10: Deliver public education to engage the community as stewards for maintaining their private property in accordance with defensible space wildfire prevention recommendations as well as following the open burning practices known to reduce the risk of wildfire.
- PE-11: Advocate using the International Association of Fire Chiefs (IAFC) "Ready, Set, GO!" program as the model for citizens to follow in managing defensible space strategies for protecting their property from wildfire.
- DS-1: Continue active Tribal participation in local community, county, state, and federal growth management planning efforts; the development of land use and zoning standards; the process of conducting environmental impact studies; and permitting processes so that the Tribe's risk management interests are addressed.
- DS-8: Continue to ensure that all the Tribe's development projects meet or exceed all applicable best practice standards related to wildfire prevention.
- DS-9: Adhere to and enforce road width and secondary egress design standards to ensure development is supported with adequate access and egress provisions.
- IE-1: Continue collaborative relationships with the Kitsap County Public Works Department's efforts to mitigate landslide, mudslide, and erosion hazards within the Reservation; provide educational resources; and seek grant opportunities that will support mitigation efforts.
- IE-11: Continue to utilize open burning regulations, permitting processes, and compliance enforcement to reduce wildfire vulnerability.
- EP-8: Continue active Tribal representation in the relevant forums to assure the Tribe's habitat preservation interests are considered and accounted for within forestry management practices and decisions.

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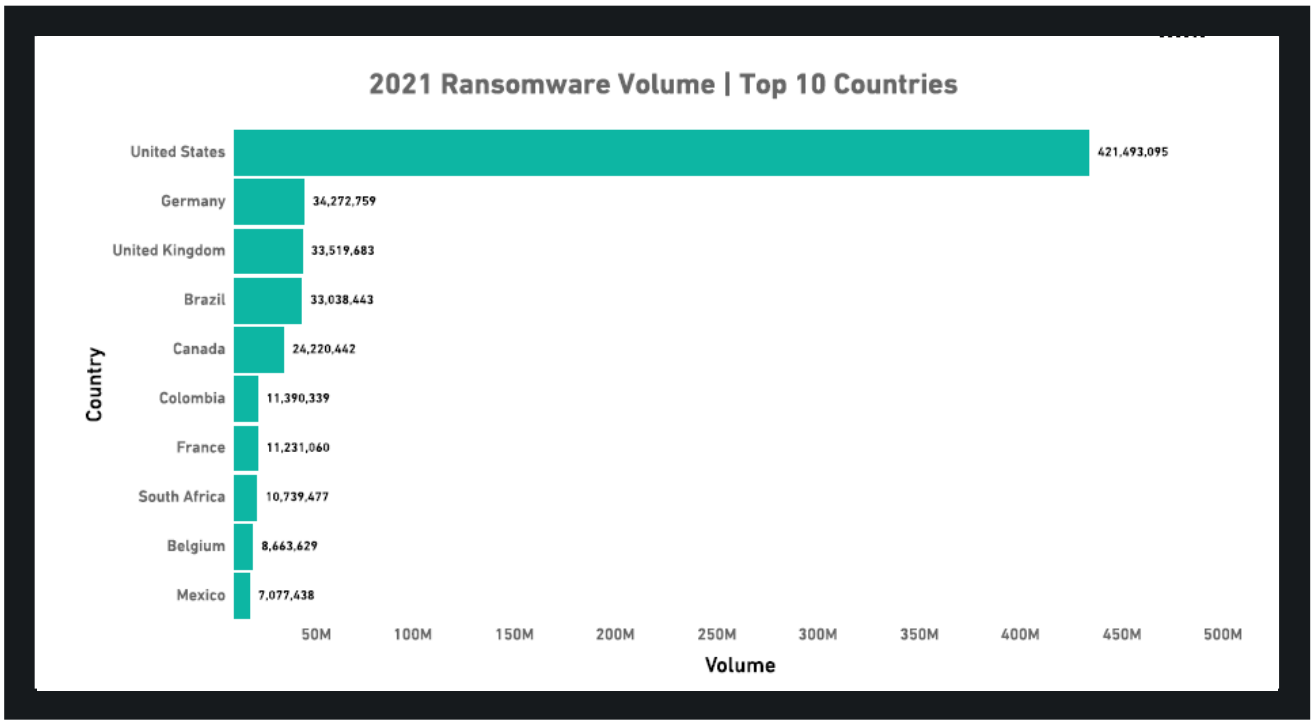
*Place of the clear salt water*

# CYBERSECURITY EVENT

Multi-Hazard Mitigation Plan 2022




SonicWall's mid-year report from 2022

**Risk Rating**

# 3.23


THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

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## Overview

Advances in technology have far reaching benefits across governments, public-sector entities, businesses, organizations, and individuals around the globe. However, the opportunities afforded by our growing interconnectivity, via cyberspace, increases our risk of a cyber-attack or cyber-incident that could threaten our security.

Cyber-crime has become increasingly sophisticated and dangerous.

A cyberattack can be employed by sovereign states, individuals, groups, societies, or organizations, and it may originate from an anonymous source. They can range from installing spyware on a personal computer to attempting to destroy the infrastructure of entire nations.

**Key Terminology:**

**Cyber-risk:** An area, if exploited, could be leveraged by a cyber-attack. Risk measures the likelihood and impact of a security breach. Cybersecurity risks relate to the loss of confidentiality, integrity, or availability of information, data, or information (or control) systems and reflect the potential adverse impacts to organizational operations (i.e., mission, functions, image, or reputation) and assets, individuals, other organizations, and the Nation.

**Cyber-threat:** Any circumstance or event with the potential to adversely impact organizational operations, organizational assets, individuals, other organizations, or the Nation through a system via unauthorized access, destruction, disclosure, modification of information, and/or denial of service.

**Cyber-attack:** An attack, via cyberspace, targeting an enterprise's use of cyberspace for the purpose of disrupting, disabling, destroying, or maliciously controlling a computing environment/infrastructure; or destroying the integrity of the data or stealing controlled information.

**Cyber-incident:** An occurrence that actually or imminently jeopardizes, without lawful authority, the confidentiality, integrity, or availability of information or an information system; or constitutes a violation or imminent threat of violation of law, security policies, security procedures, or acceptable use policies.

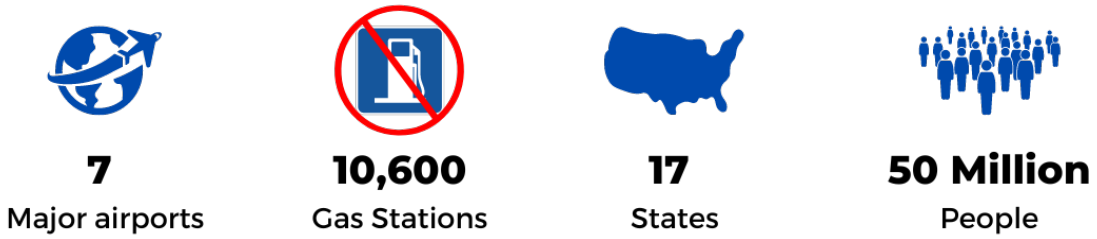
## Impacts

The impacts of a cyber-incident or attack can be divided into two broad categories, primary effects, and secondary effects. The primary effects impact the targeted systems and organization, they can be broken down into three areas: time, cost, and reputation. Depending on the severity and type of incident or attack, the time it takes to recover could be a few hours to days, weeks and even months. The costs associated with paid ransom, lost productivity, revenue, outsourcing support for response and recovery, insurance and potential loss of customers or business relationships can significantly impact the organization long-term.

The secondary or indirect impacts from a cyber-incident or attack can filter down to the consumer or customers of the organization services. This was widely publicized during the Colonial Pipeline incident, but has been identified in multiple cyber-attacks against healthcare facilities, transportation agencies, agricultural supply chains, public utilities, and financial institutions throughout the U.S.

Example of the secondary impacts:

**Colonial Pipeline** is the largest pipeline system in the U.S. providing 45% of refined oil products for the Eastern Coast of the United States. The cyber-attack compromised the billing system the company utilized and demanded a ransom-payment to provide the decryption keys for the organizations data that was held hostage. This led to major disruptions throughout the energy and transportation sectors. Daily long-haul flights were directly impacted out of North Carolina and multiple flights were re-routed for additional stops to mitigate the fuel shortage. Anxiety about access to fuel led to panic-induced fuel hoarding by consumers contributing to the fuel shortage and triggered a U.S Consumer Product Safety Alert, after several panicked-consumers attempted to collect fuel in unfit containers such as, plastic bags and Styrofoam coolers. One week after the attack occurred approximately 10,600 fuel stations in the eastern U.S. were without fuel. The response was so large the Department of Transportation declared a state of emergency across 17 states and the D.C. Metro-area. This was further classified as threat to National Security, and the largest publicly disclosed cyber-attack against critical infrastructure in the U.S.




## History

While the Suquamish Tribe has not yet been hit with a cyber-attack, the risk is growing. A recent FBI (Federal Bureau of Investigation) notification warns of an uptick in attacks against Tribal casinos, identifying several ransomware groups, including Bitpaymer, Conti, Cuba, REvil, Ryuk, and Snack, all of whom have launched successful attacks on casinos, shutting down operations and stealing data. The groups targeted Tribes with the assumption they lack extensive cybersecurity infrastructure and enforcement reach. Damages have been in the millions of dollars, and not only affected gaming floors but also Tribal Enterprises that including restaurants, hotels, and gas stations, but also impacted Tribal Governments and services throughout the nation. In at least one case, ransomware operators took down a Tribal police department's computer system, the 9-1-1 system, and the public health system.

**2014**: Quapaw Nation of Oklahoma is one of the first Tribes to suffer losses due to ransomware in 2014, when a ransomware attack wipes out their entire data archives.

**2019:** Native American Rehabilitation Association (NARA) hit by ransomware. Systems shut down for days, confidential patient data as well as personal information was compromised. Eastern Band of Cherokee Indians victim of large cyberattack. This was a ransomware attack that locked out Tribal government members and prompted the declaration of a State of Emergency for the Tribal government, and was treated as an act of domestic terrorism, as this was caused by an insider threat.

**2020**: Nez Perce Tribe in Idaho closed casinos for ten days after a ransomware attack. In the same month, the Yocha Dehe Wintun Nation's casino in California was struck by ransomware.

**2021**: Mandan, Hidatsa & Arikara Nation experienced shutdown of IT systems. Seminole Nation casino in Oklahoma was forced to shut down. Lucky Star Casino, operated by the Arapaho and Cheyenne Tribes, shut down due to ransomware.

**2022**: CommonSpirit Health is the nation's second-largest nonprofit health system in the U.S., has a significant presence in western Washington, and has the only publicly accessible hospital in Kitsap County. The system was hit with a ransomware attack impacting 142 hospitals and 2,200 care sites across 21 states. This incident has led to many hospitals and care sites having to delay critical patient care and, in some locations, ambulances were diverted to other hospitals in the region. "In an Oct. 13 article by Debbie Cockrell for The News Tribune, Cockrell reports that "Operations at a VMFH hospital in Kitsap County have become especially difficult, with staff citing the ongoing IT issue, high patient demand and not enough staff. The Kitsap Sun reported that Saturday night [Oct. 8] the charge nurse in the emergency room at St. Michael Medical Center in Silverdale resorted to calling 911 dispatch for help in handling its backup of patients."

In a 2022 report from a U.S. cybersecurity company, "Ransomware climbed an unprecedented 105% in 2021, and the explosive growth of strategies such as double and even triple extortion ensured that these attacks were more successful than ever. But as cybercriminals have grown more sophisticated and successful, they have also grown more ruthless — many of the high-profile ransomware attacks in 2021 looked more like acts of war than ever before, endangering us food supply, us water supply, us fuel supply, us hospitals, and us municipalities."

Since 2019, the amount of ransomware attacks has grown 231.75% globally, and in 2021 alone the volume of attacks in the U.S. reached 421.5 million. While cyber-attacks on infrastructure are not new, they have increased in volume in recent years and continue to grow more complex and pose increased threats to consumers via extortion, as well as the cascading impacts attacks on infrastructure have on society.

## Vulnerability

Tribal Governments and Enterprises are vulnerable to cyber-attacks at varying degrees of probability. Tribes are high-value soft targets for cyber-criminals due to time-constraints, available expertise on staff, and limited resources. While the Suquamish Tribal Government's IT department utilizes a multi-layered approach to cyber-risk-reduction for government assets and staff, there are vulnerabilities that remain. As Tribal Government departments emerge from the COVID-19 pandemic and return to the office and fresh staff are hired, there is a limited capacity of time and resources for inter-departmental training to ensure staff understand the impacts of and can identify cyber-threats.

The nature of cyber-crime today indicates that there will always be a growing degree as more of our systems, technologies, and work rely on access to the internet, as well as internal and external networks. Additionally, tensions between the United States and countries with Nation State sponsored cybercriminals pose additional risk to the safety and security to our national infrastructure.

The greatest vulnerability to those who live and work on the Port Madison Indian Reservation is the absolute reliance on infrastructure and businesses outside our authority. The cascading impacts of a major cyber-attack on any of the 16 Critical Infrastructure Sectors identified by Cybersecurity & Infrastructure Security Agency not only could negatively impact other sectors, further compounding the risk, but directly jeopardize the health and safety of communities impacted by the attack.

Initial reports of a ransomware attack on CommonSpirit Health, the parent organization to St. Michaels Medical Center, Kitsap County's only hospital, were publicly shared on October 3rd and as of October 18th some systems have started being restored. This incident has had significant impacts in delays to healthcare, in part due to low staffing and hospital policies which existed before this incident.

## Probability of Occurrence

As recently as July of 2021 one cyber-industry firm claimed different Tribal enterprises were impacted weekly. As of 2019, as many as 3 state or local governments were attacked daily with ransomware alone. and globally, there are 20 ransomware attempts every second.

Over the past five years the healthcare industry has been attacked multiple times, including impacts on our local hospital and affiliated clinics. The trend in attacks against the healthcare industry has exponentially increased in recent years and are anticipated to continue to be high value targets for cyber criminals. In October of 2022, the local hospital St. Michaels Medical Center was impacted significantly by a ransomware attack against their parent organization CommonSpirit Health. Initial reports of the issue were publicly shared on October 3rd and as of October 17th there has been no resolution. This is not the first cyber-incident on this health care facility, which experienced several data breeches in recent years.

The increase in international-relationship tensions between the United States and other nations or nation-state actors that are known to have carried out several cyberattacks against businesses and critical infrastructure in the U.S. pose significant risk. The probability of direct attacks against Suquamish Tribal Government or Port Madison Enterprises because of the international tension is extremely low, though it could increase the likelihood of domestic cyber-crime that could directly impact the community. However, attacks against critical infrastructure including; hospitals and healthcare, agriculture, industrial systems, transportation, supply-chains, power and water utilities, and communications systems among others could have dire impacts to the Suquamish Tribe and all who live on the Port Madison Indian Reservation.

## Risk Assessment

**Risk Rating Summary for Cybersecurity Events**: – The following table summarizes the Probability of Occurrence (P), Degree of Impact (DI), and Type of Impact (TI) ratings assigned to potential drought events on the Port Madison Indian Reservation. (Reference Section 3, Risk Assessment Rating Criteria)

| Risk Rating Summary for Cybersecurity Events | | | | |
|---|---|---|---|---|
| | **Probability/Impact** | **Rating** | | **Description** |
| P= | 50 - 75% Probable | High | 4 | There is a great likelihood this type of hazardous event will occur within the next 50 years. |
| DI= | Moderate Event | Moderate | 3 | An event that damages a substantial portion of the Reservation, while large areas within the total population sustain few if any direct effects; yet with widespread impact to commerce, infrastructure, and services. |
| TI= | **Life Safety (Weight 60%)** *Event related deaths, injuries, PTSD, & mental health issues* | Low-Moderate | 2.5 | Loss of life <5; serious injuries <5 - Minor injuries, with no loss of life |
| | **Property (Weight 10%)** *Rebuilding cost for repairing event related property and infrastructure damage* | Very Low | 1 | No measurable rebuilding cost |
| | **Economy (Weight 15%)** *Economic losses to businesses resulting in job loss, extended unemployment, & underemployment* | High | 4 | Loss of business <30%; economic recovery within 2 – 5 years |
| | **Environment (Weight 15%)** *Effects on the environment to include damage to the Tribe's culturally sensitive sites, soils, estuaries, fish, and wildlife* | High | 4 | Significant environmental damage; recovery requires 2 - 5 years |

**Overall Risk Rating Formula:**

Risk Rating = (P (Probability) + DI (Degree of Impact) + TI (Type of Impact)) / 3

**Risk Rating Calculation for Flood Events:**

**P = 4**

**DI= 3**

TI = (Life = 2.5 x .6) + (Property = 1 x .1) + (Economy = 4 x .15) + (Environment = 4 x .15)

TI = 1.5+ 0.10 + 0.60 + 0.60

**TI = 2.7**

**Risk Rating = (**4 + 3 + 2.7) / 3 is 9.7 / 3 = **3.23**

**Risk Rating Classification for Cybersecurity Events:** The following table indicates where the risk rating for cybersecurity events falls within the risk rating classifications. The rating of 3.23 classifies the cybersecurity event risk as moderate in terms of the probability of occurrence in combination with its consequential impact to the community.

| Risk Rating Classification for Cybersecurity Events | | | |
|---|---|---|---|
| **Risk Rating** | | **Classification** | **Description** |
| Very High | 5 | Urgent Priority | Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action |
| High | 4 | High Priority | Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action |
| **Moderate** | **3** | **Modest Priority** | **Vulnerability is considered as a moderate probability with moderate impact, which warrants moderate priority mitigation action** |
| Low | 2 | Low Priority | Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

## Conclusions

The federal government set aside funding for cybersecurity to the order of $1 billion dollars, but the current language requires that funding for Tribal governments be passed through state governments.

The Overall Risk Rating is moderate **3.23**, which means the threat of a cyberattack against Suquamish Tribal entities or the heavily relied on and interconnected critical infrastructure could experience a range of impacts. Cyberattacks carried out against Suquamish Tribal entities, such as the Tribal Government or Port Madison Enterprises would result in mostly economic impacts for a short duration, extended response time cannot be ruled out and would have greater impacts to the community. Cyberattacks against infrastructure the community relies on are often interconnected to other infrastructure systems which could have dire consequences for members within the community. The rate of cyberattack attempts and successful breeches is exponentially increasing in frequency, the type of impacts is expanding, and the community has already seen impacts to health and wellbeing elated to cyberattacks, when the parent company for local hospitals was targeted with ransomware.

It is not a question of if; rather, it is a matter of when.

The cascading impacts caused by cyberattacks extend to the community, properties, economy, and the environment. The extent of the impacts varies widely depending on the scope of the event, the entity targeted, system redundancies, and how fast the entity can recover from the event.

## Problem Statements

The following problem statements reflect specific vulnerabilities identified in the process of conducting the risk assessment. These are included to summarize the community's most significant risks and vulnerabilities related to cybersecurity events.

- Every facet of our lives relies on our interconnectivity to the internet both for personal and professional reasons. The interconnectivity and dependence on the infrastructure to complete transactions, communicate, maintain and regulate industrial control systems, send and receive information, transportation, and healthcare to name a few, can have dire consequences for both intentional and unintentional cybersecurity events.
- There is currently no system in place that helps employees stay informed or receive training on cyber-hygiene or best practices.
- IT security teams do not have visibility into operational technology systems, especially those in critical infrastructure. This includes systems such as water treatment and HVAC, among others.
- Cybercrime is becoming increasingly sophisticated in how access to systems is gained that include social engineering or phishing that can be hard to distinguish from normal and everyday network activity.
- Cyberattacks on critical infrastructure have grown exponentially and are expected to continue both locally and distant, which can have dire consequences to members of the community. From power disruptions, delays to healthcare, and supply chain disruptions, every cyberattack in some way affects the population.

## Mitigation Strategies

The following mitigation strategies offer a series of sample recommendations. They must be considered, approved, and funded by the authority having authority to be implemented. They are in no way intended to imply a call to action, constitute serving as an action plan, or be binding recommendations.

The Suquamish Tribe's treaty-reserved cultural, environmental, and economic interests extend well beyond territory located within the Port Madison Indian Reservation. Therefore, the following mitigation strategies also may have relevant application throughout the region as defined by the Tribe's Usual and Accustomed Grounds. (Reference Chapter 2, Suquamish Tribal Profile)

- PE-12: Provide awareness, training, and educational materials on basic cyber awareness and hygiene to engage the community.
- DS-10: Evaluate all Operational Technology assets for cyber risk and add to a central asset management system.
- DS-11: Deliver cyber awareness training annually to all staff members of the Tribe, including an emphasis on cyber hygiene, phishing, and other social engineering attempts.
- DS-12: Conduct outreach with Port Madison Enterprise IT and establish an information sharing agreement on cyber threats with local businesses.
- DS-13: Conduct risk analysis of all discovered Operational Technology assets.
- DS-14: Evaluate the existing security controls against the CIS and NIST Controls for cybersecurity.
- DS-15: Develop pre-planned incident response plans for common attacks such as ransomware and share with local businesses.

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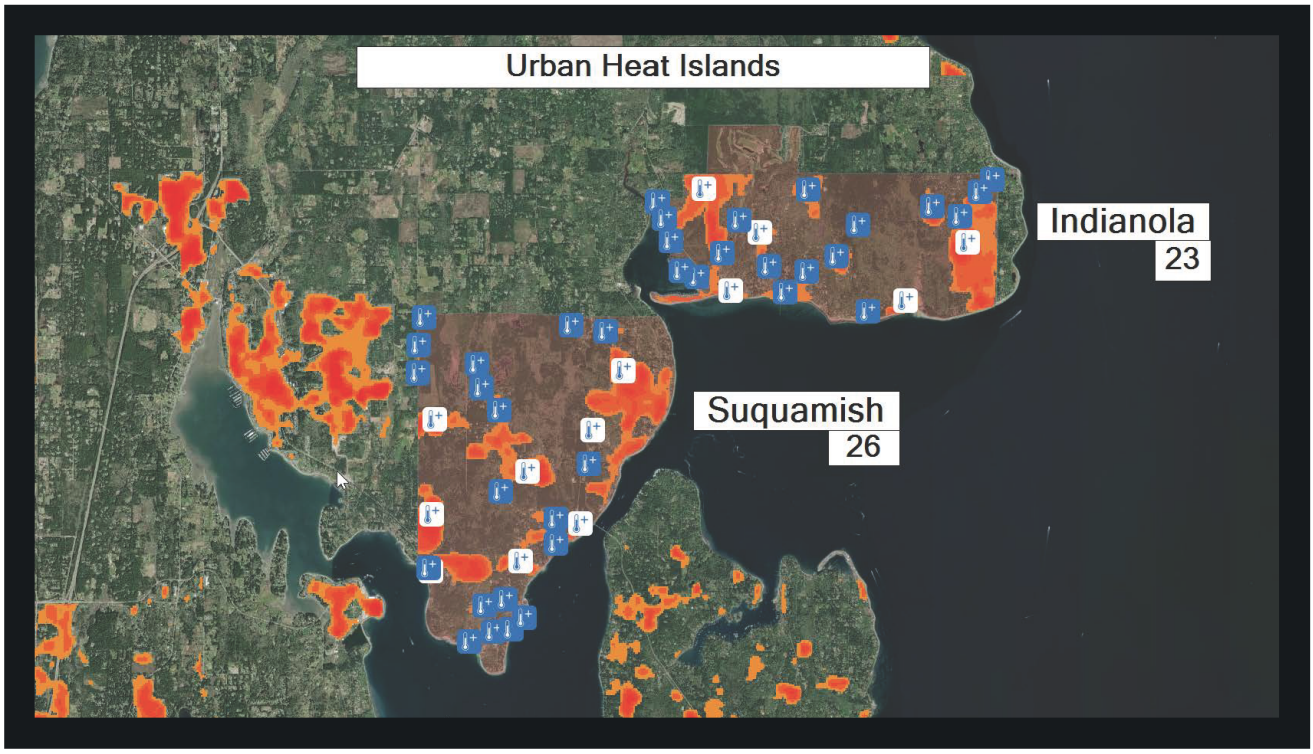
*Place of the clear salt water*

# CLIMATE CHANGE

Multi-Hazard Mitigation Plan 2022

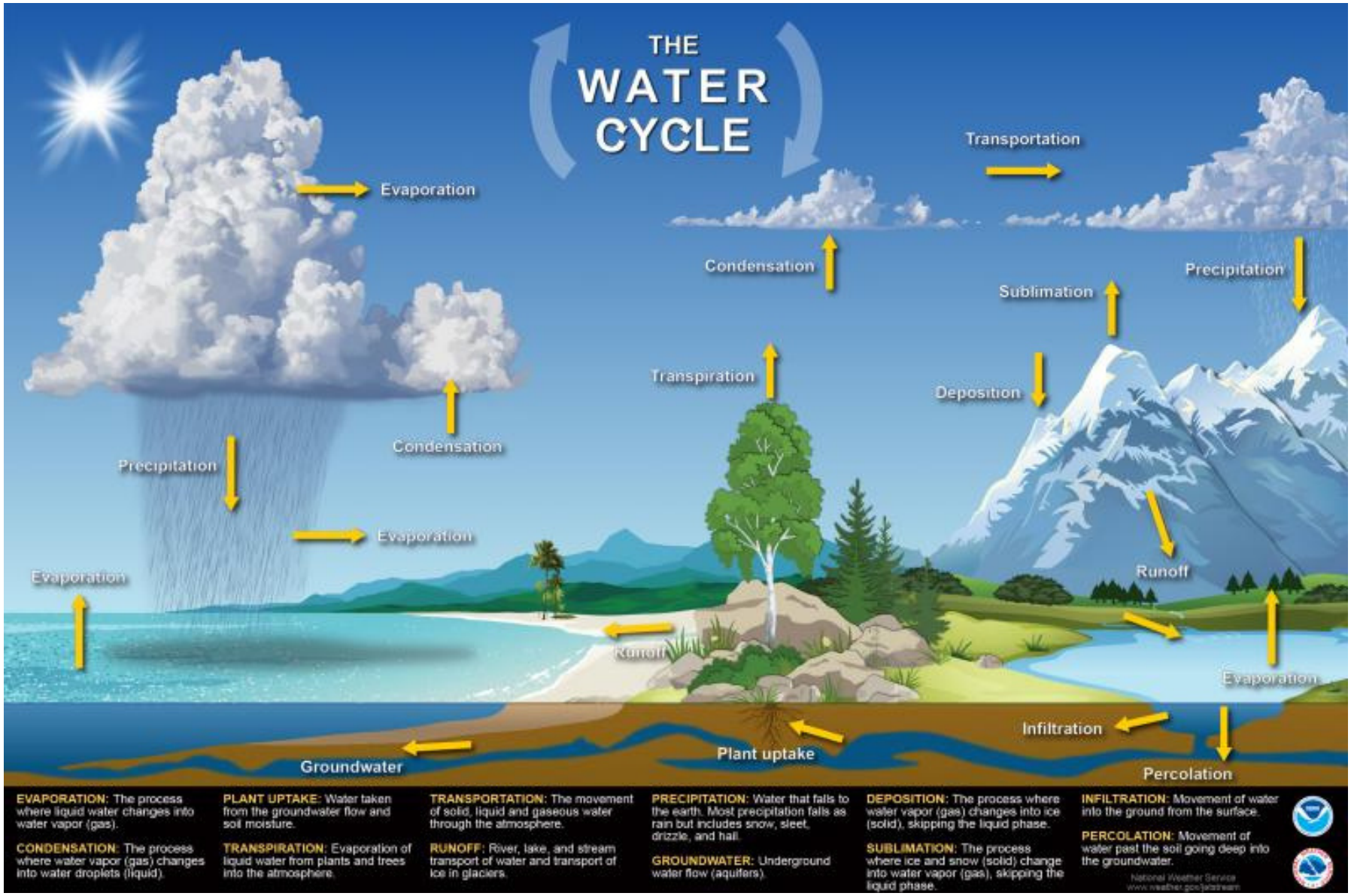



**Risk Rating**

**3.86**

THE SUQUAMISH TRIBE
Office of Emergency Management
18490 Suquamish Way, Suquamish WA, 98392
360-598-3311

# Climate Change




Source: National Weather Service JetStream Max Project

## Overview

Earth's climate is influenced by interactions involving the Sun, ocean, atmosphere, clouds, ice, land, and life. The climate varies by region because of local differences in these interactions. For at least the last million years, the Earth has experienced warming and cooling climate cycles, some of these cycles have developed slowly over time, while others have been abruptly brought on by momentous events. On average, these climate cycles have fallen and risen approximately 9°F (3°C), each time taking Earth into an ice age followed by a warming cycle. The most recent ice age in Earth's history, the Pleistocene epoch, began 2.580 million years ago and ended 11,650 years ago. The current cycle has been warming at a rate 10x faster than the average rate of warming following an ice age. The global temperature has risen 2°F since the late 19$^{th}$ century.

## Key Terminology

**Extreme Weather Events:** Extreme weather event is a broad term used to refer to an instance of severe weather with a high potential to cause death and destruction. Climate change is responsible for many extreme weather events, for example, wildfire, bombogenesis, polar vortex, and derecho.

**Sea Level Rise**: The sea level is the horizontal plane or level corresponding to the surface of the sea at the mean level between high and low tide. Sea-level rise refers to the steadily increasing sea levels that scientists are recording on a global scale.

**Weather vs. Climate**: ***Weather*** describes the short-term atmospheric changes in a small area. ***Climate***

refers to the general atmospheric conditions of a large region.

**1.5 ℃ pathwa**y: The term 1.5℃ pathway refers to a potential future temperature of the Earth, according to the Intergovernmental Panel on Climate Change (IPCC). According to the IPCC, we are projected to exceed a 2°C (3.6°F) rise in global temperatures compared to pre-industrial levels.

**Biodiversity**: is diversity among and within plant and animal species in an environment. Climate change has a severe negative effect on biodiversity. Biodiversity is important to maintain a healthy environment (such as in pollination of plants and continuing the nutrient cycle), but we humans depend on biodiversity as well for medicines, food, and the joy we get from seeing flourishing plants and animals.

**Urban Heat Island:** Refers to the fact that cities tend to get much warmer than their surrounding rural landscapes, particularly during the summer. This temperature difference occurs when cities' unshaded roads and buildings gain heat during the day and radiate that heat into the surrounding air. As a result, highly developed urban areas can experience mid-afternoon temperatures that are 15°F to 20°F warmer than surrounding, vegetated areas.

## Impacts

Over the 21st century, climate scientists expect Earth's temperature to continue increasing, highly likely more than it did during the 20th century. Two anticipated results are rising global sea levels and increasing frequency and intensity of heat waves, droughts, and floods. These changes will affect every aspect of human society, including economic prosperity, human and environmental health, and national security.

*The following secondary effects are possible:*

**Mental Health and Wellbeing** – Climate-driven hardships can also affect mental health, resulting in outcomes ranging from stress to suicide. Oregon, Washington, and Idaho all rank among the top 10 states in terms of prevalence of mental illness and lowest access to mental health care. Children and youth, in general, will experience cumulative mental health effects of climate change over their lifetimes. The cultural practice of harvesting and consuming First Foods is integral to tribes and Indigenous health. First Foods are foods that tribes have historically cultivated for subsistence, economic, and ceremonial purposes. The loss or decline of First Foods is projected to have cascading physical and mental health impacts for tribes and Indigenous peoples.

**Food Insecurity –** Climate change is projected to impact First Foods, or foods that tribes have historically cultivated for subsistence, economic, and ceremonial purposes. The cultural practice of harvesting and consuming First Foods is integral to Tribes. The loss or decline of First Foods is projected to have cascading physical and mental health impacts for Tribes. Changes in drought conditions and increased water temperatures have increased the potential for freshwater harmful algal blooms in recreational waters. Toxins from marine harmful algal blooms can accumulate in shellfish, leading to illnesses for those who eat them.

**Water-Related Illness** – Future extreme precipitation events could increase the risk of exposure to water-related illnesses as the runoff introduces contaminants and pathogens (such as Cryptosporidium, Giardia, and viruses) into drinking water. The Oregon Health Authority recorded spikes in cases of Salmonella and E. coli during months with extreme heat in 2015. A large outbreak of Shigellosis (a bacterial diarrheal disease) occurred in late 2015, affecting many homeless people in the Portland Metro region; this outbreak was associated with unusually extreme precipitation.

**Infectious Diseases** – In the last several years, the region has seen an increase in some infectious diseases. A potential increase in Lyme disease cases in some states is associated with rising temperatures and changing tick habitat. The Washington Department of Health's vector surveillance program has observed an earlier onset of West Nile virus-carrying mosquitoes, associated with higher temperatures, and an increasing number of human infections, with some resulting in fatalities. Before 1999,>Cryptococcus gatti infections were limited to the tropics, but Cryptococcus gatti is now established in Northwest soil, with 76 cases occurring in Oregon in 2015

**Air Quality** – More frequent wildfires and poor air quality are expected to increase respiratory illnesses in the decades to come. Wildfire smoke can be severe, particularly in communities in the eastern Northwest. Smoke events during 2004–2009 were associated with a 7.2% increase in respiratory hospital admissions among adults over 65 in the western United States. In Boise, Idaho, 7 of the last 10 years have included smoke levels considered "unhealthy for sensitive groups" (including children) for at least a week during the fire season, causing some cancellation of school-related sports activities. Additionally, projected increases in ground-level ozone (smog), small particulate matter (PM2.5), and airborne allergens can further complicate respiratory conditions.

**Human Health** – While the Northwest is not typically considered a high-risk area for heat-related illness, heat waves (defined as 5-day, 1-in-10-year events) across the country are projected to increase in frequency and intensity. In the Northwest, nighttime heat waves (defined as 3-day, 1-in-100-year events) have a greater influence on human health than daytime heat waves and have increased in frequency since 1901. These changes are projected to make heat-related illness more common in the

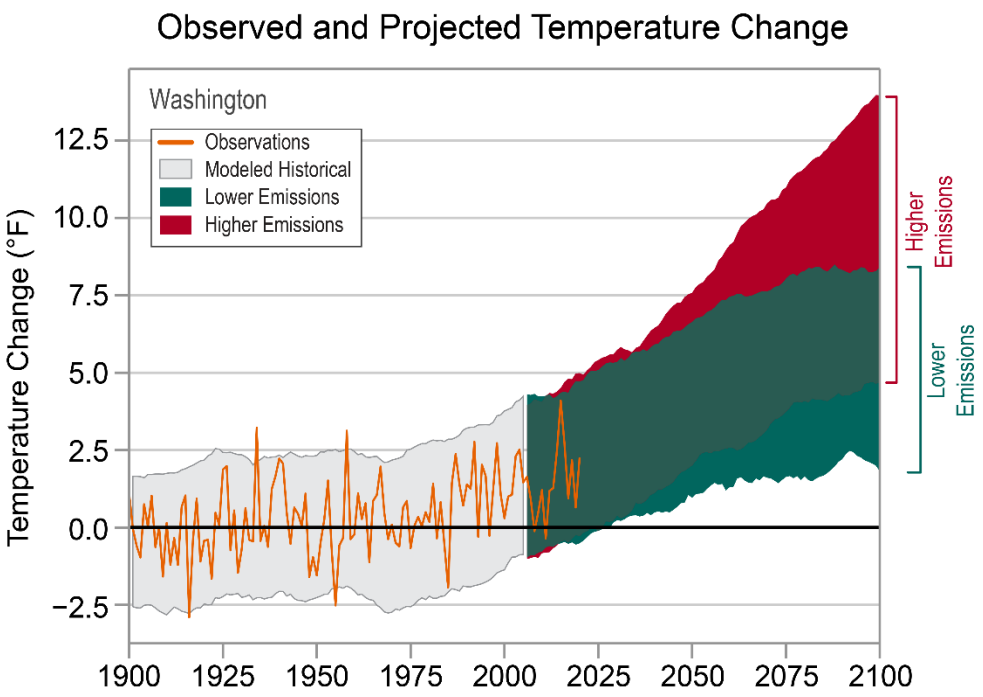
future. Agricultural workers are at increased risk for heat-related injuries because they work outside during the summer harvest season

**Wildfire Risks** – Topsoil exposed to extreme heat can become water repellant, and soil nutrients may be lost. It can take decades or even centuries for ecosystems to recover from a fire. Some fires burn so hotly that they can sterilize the soil.

## History & Projections

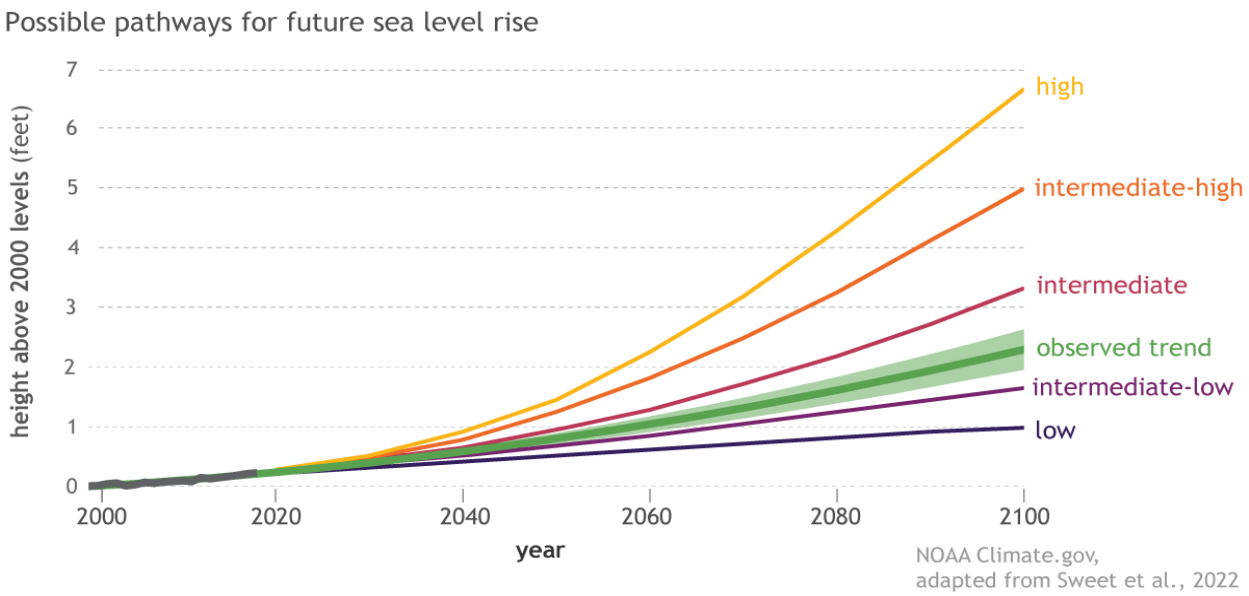
**Higher Temperatures:**

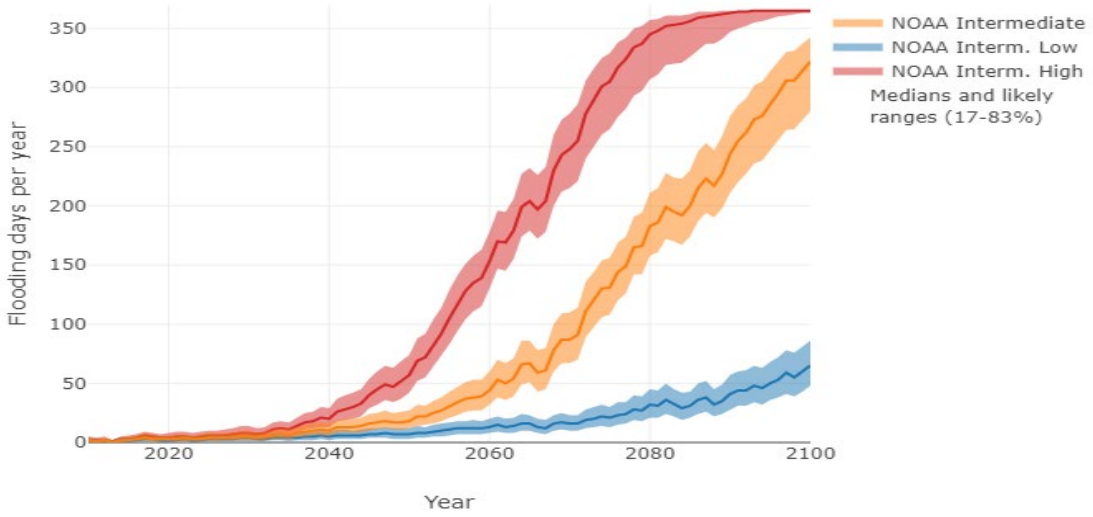
Since the beginning of the 20th century, Washington State temperatures have risen nearly 2°F, with fewer freezing days and cold nights since 1900. Historically unprecedented warming is expected to continue through this century. Earlier snowpack melting combined with more precipitation falling at higher elevations as rain contributes to increasing springtime flooding and lower summer stream levels, which has devastating impacts to salmon habitats and impacts to the overall ecosystem. Furthermore, the increasing extreme heat events and drier summer months have led to an increase in wildfire events and air quality issues.



**Sea Level Rise**:

According to the IPCC 6, risks to coastal cities and settlements are projected to increase by at least one order of magnitude by 2100 without significant adaptation and mitigation action. Those who live in coastal 100-year flood zones will see risk increase by 20% if global mean sea level rises by 0.49 feet relative to current levels, risk double with a rise of 2.46 feet, and triple with a rise of 4.59 feet, assuming present-day population and protection levels. Early impacts of accelerating sea-level rise have been detected at sheltered or subsiding coasts, flooding at high tides, water-table salinization, ecosystem and agricultural transitions, increased erosion, and coastal flood damage. Without adaptation the above will significantly impact traditional food sources of the Suquamish Tribe and the community.



Observed sea level from 2000-2018, with future sea level through 2100 for six future pathways (colored lines). The pathways differ based on future rates of greenhouse gas emissions and global warming and differences in the plausible rates of glacier and ice sheet loss. NOAA (National Oceanic and Atmospheric) Climate.gov graph, adapted from Sweet et al., 2022.

## Vulnerability

The Suquamish Tribe's innate connection to the lands, environment, culturally sensitive sites, and Usual & Accustomed Fishing Grounds are inextricably interwoven into their culture. All the above are vulnerable to both primary and secondary hazards posed by climate change and cascading impacts that they contribute to. The Tribe's reliance on infrastructure that is outside of the Tribe's authority significantly limits the scope of impacts climate adaptation measures have, unless surrounding jurisdictions, businesses and organizations have similar or even stronger adaptation policies, actions, and plans in place. For many of these entities, they are only beginning to establish climate adaptation plans or are in the process of developing their plans. The impacts of climate change are interconnected to all the hazards and will exacerbate the degree of risk those hazards have on the community. The entire reservation is vulnerable to severe weather events which are anticipated to become more frequent and extreme over time. As vital resources become less available in other regions of the country or globe, human migration is expected to put further strain on the resources in the regions receiving human migrants. Some populations experience greater impacts caused by natural hazards and disasters. This especially applies to the 1,243 Tribal members and those who historically had higher barriers to access resources, including the 1,006 people living on the reservation who have a disability, 760 people living on the reservation for whom poverty status was determined, approximately 33 people living on the reservation that have limited English Proficiency, and approximately 449 children under the age of 5 living on the reservation.

## Probability of Occurrence

Impacts from the changing climate are currently being observed and worsening impacts are projected to occur over the coming decades. It is universally accepted that even with extreme changes to current greenhouse gas emissions and strong policy changes to reduce the severity of climate change, every community will still experience impacts related to a changing climate. There is, however, a range of severity that is based on levels of mitigation done on a local, regional, national, and global scale. This will significantly alter how a changing climate impacts the community.

## Risk Assessment

*The following is a summary of the information gathered during the hazard assessment process.*

**Risk Rating Summary for Climate Change Events**: – The following table summarizes the Probability of Occurrence (P), Degree of Impact (DI), and Type of Impact (TI) ratings assigned to potential drought events on the Port Madison Indian Reservation. (Reference Section 3, Risk Assessment Rating Criteria)

| Risk Rating Summary for Climate Change Events | | | | |
|---|---|---|---|---|
| | **Probability/Impact** | **Rating** | | **Description** |
| P= | 50 - 75% Probable | High | 4 | There is a great likelihood this type of hazardous event will occur within the next 50 years. |
| DI= | Moderate Event | Moderate | 3 | An event that damages a substantial portion of the |

| | | | | |
|---|---|---|---|---|
| | | | | Reservation, while large areas within the total population sustain few if any direct effects; yet with widespread impact to commerce, infrastructure, and services. |
| TI= | **Life Safety (Weight 60%)** *Event related deaths, injuries, PTSD, & mental health issues* | Low - Moderate | 2.5 | No injuries or loss of life |
| | **Property (Weight 10%)** *Rebuilding cost for repairing event related property and infrastructure damage* | Low-Moderate | 2.5 | No measurable rebuilding cost |
| | **Economy (Weight 15%)** *Economic losses to businesses resulting in job loss, extended unemployment, & underemployment* | High | 4 | Loss of business <30%; economic recovery within 2 – 5 years |
| | **Environment (Weight 15%)** *Effects on the environment to include damage to the Tribe's culturally sensitive sites, soils, estuaries, fish, and wildlife* | High | 4 | Significant environmental damage; recovery requires 2 - 5 years |

**Overall Risk Rating Formula:**

Risk Rating = (P (Probability) + DI (Degree of Impact) + TI (Type of Impact)) / 3

**Risk Rating Calculation for Climate Related Events:**

**P = 4**

**DI= 3**

TI = (Life = 2.5 x .6) + (Property = 2.5 x .1) + (Economy = 4 x .15) + (Environment = 5 x .15)

**TI = 3.1**

**Risk Rating =** (5+3.5 +3.1) / 3 is 11.6 / 3 = **3.86**

**Risk Rating Classification for Climate Change Events:** The following table indicates where the risk rating for climate change events falls within the risk rating classifications. The rating of 3.86 classifies the climate change event risk as moderate-high in terms of the probability of occurrence in combination with its consequential impact to the community.

| Risk Rating Classification for Climate Change Events | | |
|---|---|---|
| **Risk Rating** | **Classification** | **Description** |

| | | | |
|---|---|---|---|
| Very High | 5 | Urgent Priority | Vulnerability is considered as a high probability with a high degree and/or type of impact, which means its significance warrants immediate mitigation action |
| **High** | **4** | **High Priority** | **Vulnerability is considered as a moderate probability with high impact, which warrants high priority mitigation action** |
| **Moderate** | **3** | **Modest Priority** | **Vulnerability is considered moderate with moderate impact, which warrants moderate priority mitigation action** |
| Low | 2 | Low Priority | Vulnerability is considered as a low probability with moderate impact, which warrants low priority mitigation action |
| Very Low | 1 | Not a Priority | Vulnerability is considered as a low probability with minimal impact, which does not warrant any mitigation action |

## Conclusions

The Overall Risk Rating is a moderate-high 3.86, based on a conservative interpretation of the climate data collected so far and the impact it could have to businesses and Tribal government. Climate change is a certainty - how we choose to respond or mitigate the effects is based on the risk calculations above. Climate change will affect tribal ecosystems and have a large impact on fisheries and tribal business.

It is not a matter of; rather, it is a matter of when.

Tribal entities must take as many mitigation actions as prudent to combat the effects of climate change while leveraging relationships with outside entities to encourage more action be taken globally to limit the effects of climate change.

## Problem Statements

The following problem statements reflect specific vulnerabilities identified in the process of conducting the risk assessment. These are included to summarize the community's most significant risks and vulnerabilities related to impacts from climate change.

- Tribes, agriculture-workers, and low-income populations in urban and rural environments are three sets of frontline communities (those communities likely to experience climate impacts first and worst) in this region.
- Climate change data and information is widely available; however, it can change frequently and has deep interconnections to other hazards. A more appropriate assessment model is needed for emergency managers to use at the most local level and considers the cascading impacts.

- Each of these zones provides essential habitat for native wildlife and provides the community with the preservation of important open space, all of which will be vulnerable to impacts caused by climate change.
- The Inland Marsh Complex, located in the western portion of the Reservation is a traditional cultural property with significant plant resources. This area is a unique and sensitive wetland habitat that would be particularly vulnerable to rising temperatures, changes to yearly growth cycles, and more frequent severe storms.
- The Doe-Kag-Wats Marsh Complex will be directly impacted by sea-level rise, more frequent severe storms, and the subsequent erosion that follows these.
- There are approximately 26 Urban Heat Islands on the Suquamish side of the reservation and 23 on the Indianola side, most are either residential, commercial, or both areas. The higher temperature in these areas will increase health risks to sensitive populations, vegetation, and infrastructure.
- Globally, impacts from climate change will create additional food insecurity due to the threatened agriculture in those regions from sea-level rise, rising temperatures, and changes to growing seasons.

## Mitigation Strategies

The following mitigation strategies offer a series of sample recommendations. They must be considered, approved, and funded by the authority having authority to be implemented. They are in no way intended to imply a call to action, constitute serving as an action plan, or be binding recommendations. The Suquamish Tribe's treaty-reserved cultural, environmental, and economic interests extend well beyond territory located within the Port Madison Indian Reservation. Therefore, the following mitigation strategies also may have relevant applications throughout the region as defined by the Tribe's Usual and Accustomed Grounds. (Reference Chapter 2, Suquamish Tribal Profile)

- PE-13: Deliver public education to engage the community as stewards for maintaining their private property in ways that reduce the negative impacts of climate change on private properties.
- DS-1: Continue active Tribal participation in local community, county, state, and federal growth management planning efforts; the development of land use and zoning standards; the process of conducting environmental impact studies; and permitting processes so that the Tribe's risk management interests are adequately addressed.
- DS-16: Continue to ensure that all the Tribe's development projects meet or exceed all applicable best practice standards and encourage nature-based solutions when possible and applicable.
- IE-1: Continue collaborative relationships with the Kitsap County Public Works Department's efforts to mitigate landslide, mudslide, and erosion hazards within the Reservation; provide educational resources; and seek grant opportunities that will support mitigation efforts.
- EP-9: Continue active Tribal representation in the relevant forums to ensure the Tribe's habitat preservation interests are adequately considered and accounted for to preserve natural aquaculture and traditional foods.
- EP-10: Conduct slope stability analysis for shoreline critical infrastructure to prioritize critical infrastructure locations most likely to experience impacts from rising sea levels and more frequent and intense storms brought on by climate change.

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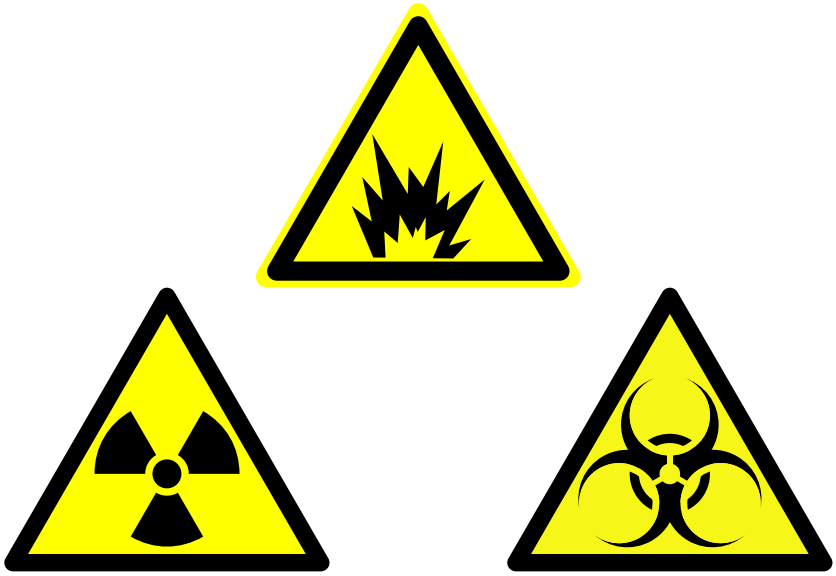
# OTHER HAZARDS

Multi-Hazard Mitigation Plan 2022



THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

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## Overview

The primary scope and purpose of the Multi-Hazard Mitigation Plan is to assess the risks associated with natural hazards and to develop strategies to mitigate them. However, the Tribe also recognizes that it is important to acknowledge the potential for other hazards that may have comparable impact. This section recognizes the potential for human-caused events, disease-related events, and failure of technological systems, all of which could have a catastrophic impact on the community and/or the environment. This section also addresses how these types of hazards may combine with a natural disaster to produce secondary and/or collateral damage.

## Hazardous Materials

Virtually every household and business within the community stores uses varying amounts and types of hazardous materials. Hazardous materials can cause widespread damage to people, property, and the environment. A hazardous materials release can easily occur in the form of collateral damage from a natural hazard event, such as an earthquake, flood, or even severe weather. Release of a hazardous material can rapidly become the most dangerous secondary impact of a natural hazard event. That is why it is important to identify where hazardous materials are stored. Though large reportable quantities of hazardous materials may not be stored within the Port Madison Indian Reservation, there are several arterial routes through the Reservation by which the transportation of hazardous materials routinely occurs. Accidents involving the transportation of hazardous chemicals could be just as catastrophic as accidents involving stored chemicals, more so, given that the location of a transportation accident would not be predictable.

The Tribe relies on its three neighboring fire departments (North Kitsap Fire & Rescue, Poulsbo Fire Department, and Bainbridge Island Fire Department) for first response to hazardous materials events. The resource capability of these first response agencies provides a limited capability for mitigating hazardous material incidents. However, for incidents involving hazardous materials beyond this local first response capability, regional mutual-aid agreements are in place with Navy Base Kitsap and the Puget Sound Naval Shipyard to provide higher level technician level expertise as well as specialized resource capability. The Tribe also has access to state and federal agencies such as the Washington State Patrol, the Department of Ecology, and the Environmental Protection Agency to provide the resources and expertise needed to mitigate a hazardous materials event.

## Utilities Failure

Technological system failures can impact all utilities within the Port Madison Indian Reservation. Impact can occur because of system failure, or because of an accidental incident severing line.

Power outages also can impact other utilities that rely on electrical power. Examples include the well pumps used to recharge and maintain water supplies, pumps used to maintain sewage systems, electrical systems used to maintain water treatment facilities and processes, power to maintain communication system infrastructure, etc.

**Electrical Power** – A power failure is any interruption or loss of electrical service due to disruption of power generation or transmission caused by an accident, natural hazards, equipment failure, or fuel shortage. These interruptions can last anywhere from a few seconds to several days. Power failures are considered significant when a local emergency management organization is required

to coordinate basic services such as the provision of food, water, and heating. Power failures are common with severe weather and winter storm events.

**Water Systems Disruption** – A breach in local water system infrastructure would have significant impacts until they are restored or until alternative temporary water sources can be established. Long-term disruption of the water supply would have significant impacts on residences and businesses should demand exceed the capabilities of secondary supplies and water conservation measures be unable to provide enough relief to reduce demand to equal the secondary supply capabilities.

**Wastewater Disruption** – Disruption of wastewater collection and sewage treatment would have significant regional impacts. Wastewater treatment plants also may have emergencies internal to the plant such as chlorine gas leaks or oxygen deficiencies that render them incapable of treating waste. The disruption of service also may have significant environmental impacts on the waterways adjacent to the treatment plants.

## Terrorism & Domestic Terrorism

Fortunately, the Port Madison Indian Reservation does not have any nationally known sites currently considered terrorist targets. However, we live in an era where the potential for terrorism is an all-encompassing threat that is ever present to all facilities and all citizens. The Tribe's government operations would be impacted with even the threat of a terrorist act.

The greatest fear is those attacks in public places from lone attackers. The Reservation does have several large public gathering structures such as the Clear Water Casino Resort, the House of Awakened Culture Complex, the Suquamish Museum, and the Chief Kitsap School Complex that may serve as potential terrorist targets. It is more likely sites in neighboring King or Pierce County would be the direct target rather than within the Reservation. But there is a potential for the Reservation to become a refuge community for sheltering residents of neighboring communities in the event of a major terrorist event. Kitsap County has five military installations with highly protective military assets associated with the U.S. Strategic Deterrent Doctrines that are all within 20 miles of the Reservation. As such, there also is a potential for a terrorist act as well as attacks on military service personnel.

Hate crimes and mass shootings have become an all-too-common reality today and may be committed by individuals, groups, or organizations in public or non-public places. Individuals as well as domestic terrorist groups have used the tactic of committing hate crimes and mass shootings to fulfill their political aims. Disgruntled individuals who commit mass shootings may fall into any of several categories, including killers of family, of coworkers, of students, and of random strangers. Individual motives for these shootings vary.

## Radiological Emergencies

Nuclear facilities exist in the Puget Sound area. Puget Sound Naval Shipyard and Naval Submarine Base Bangor are both located within proximity to the Reservation. The Puget Sound Naval Shipyard decommissions nuclear submarines, which includes recycling gray water and removing spent fuel rods and storing them until shipped for disposal. It also is the home of modern nuclear aircraft carriers and submarines. Naval Base Kitsap is home to numerous nuclear-powered submarines, most of which are designed to carry nuclear weapons.

The region's military bases receive, assemble, ship, and store nuclear materials. Although great safety precautions are used and the risk is quite low, the potential for an accident to occur is ever present. An accidental release of radioactive materials may cause harm to humans and animals. It may enter the

human food chain via crops or dairy products. Another aspect contributing to the hazard is public perception. Even if not exposed to an actual physical threat, many people are likely to panic, believing radiation may have affected them. There also would be long-term issues with potentially contaminated public and private properties.

## Mass Casualty Incidents

The potential for a mass casualty incident (MCI) exists anywhere there are many people who are at risk of injury. The mechanism for injury can include examples such as a stadium collapse, a multi-vehicle and/or mass transportation incident, structural collapse, an explosion, a hazardous materials release, fire in a multi-occupancy building, etc.

An incident is considered an MCI when the number and severity of injuries overwhelm the immediate resource capabilities of local responders. Local first responders have access to mutual aid, but these take time to mobilize and require a considerable coordinated effort to manage effectively. In addition, hospitals throughout the region are currently understaffed and struggling to meet the current demand. Washington State is currently the lowest-ranked state in the nation for the number of hospital beds per person, at 1:1,000.

Transportation systems within the region include road, air, and maritime corridors, all of which set the stage for an MCI within the Reservation. The impacts of a major transportation incident would depend on the location. State Highway 305, along with a series of major arterials throughout the Reservation, serves as heavily traveled transportation corridors. All parts of the Reservation are vulnerable to an aircraft accident due to overhead flight patterns that support multiple airports within the region, all of which have the potential for a mid-air collision or an incident arising from an equipment malfunction or pilot error. However, since most incidents occur during takeoff or landing, the potential threat to the Reservation is minor. The maritime system also presents a potential for an emergency that could indirectly affect the Reservation. This could arise from a vessel collision with another vessel, striking an object, structural failure, a fire onboard, or adverse weather.

## Epidemic Emergencies

An epidemic refers to the outbreak and rapid spread of a disease in a community affecting a substantial number of people or animals in a brief period. In 2020 the Coronavirus Pandemic had significant impacts on the community and around the globe. Tribal members were identified by the CDC (Centers for Disease Control) (Centers for Disease Control) to be among the high vulnerability population for increased risk due to their communal lifestyle and health-related vulnerabilities. Central to Tribal culture is the custom of family members caring for small children and elders. This creates an interdependency among family members for basic care, frequent interaction, and sharing of meals setting the stage for the spread of contagious disease.

Therefore, a disease of epidemic and pandemic proportions within the Reservation has already demonstrated very real impacts. Such an epidemic can be brought on by persons, animals, or materials from elsewhere. The standard fall/winter flu season creates its own minor epidemic on a yearly basis with some strains causing greater damage than others. In cases like this, the elderly is often hit the hardest, resulting in several deaths attributable to flu each year.

The potential for epidemics is anticipated to increase in the future due to climate change. In such a case, disease may reach a larger concentration of the population due to the absence or breakdown of normal intervening factors such as infrastructure failure impacting sewer treatment and potable water supplies.

**Olympic Regional Tribal-Public Health Collaboration and Mutual Aid Agreement**: The Suquamish Tribe, other Tribal Governments, and the County Health Districts within the state's Homeland Security Region 2 entered into a Mutual Aid Agreement in 2010. The purpose of this agreement is to voluntarily aid and assist each other by the interchange of public health resources and services if a public health incident, emergency or disaster situation should occur and overwhelm the capabilities of an immediate local or regional response by leveraging collective resources.

## Conclusions

Human-caused events, disease-related events, and failure of technological systems, as well as the secondary or collateral damage if one of these events were to occur in combination with a natural disaster are real threats facing the Port Madison Indian Reservation. Efforts to mitigate these threats should be ongoing and carried out in conjunction with regional resources and partners. Training and planning for first responders will be paramount to the response to these types of events.

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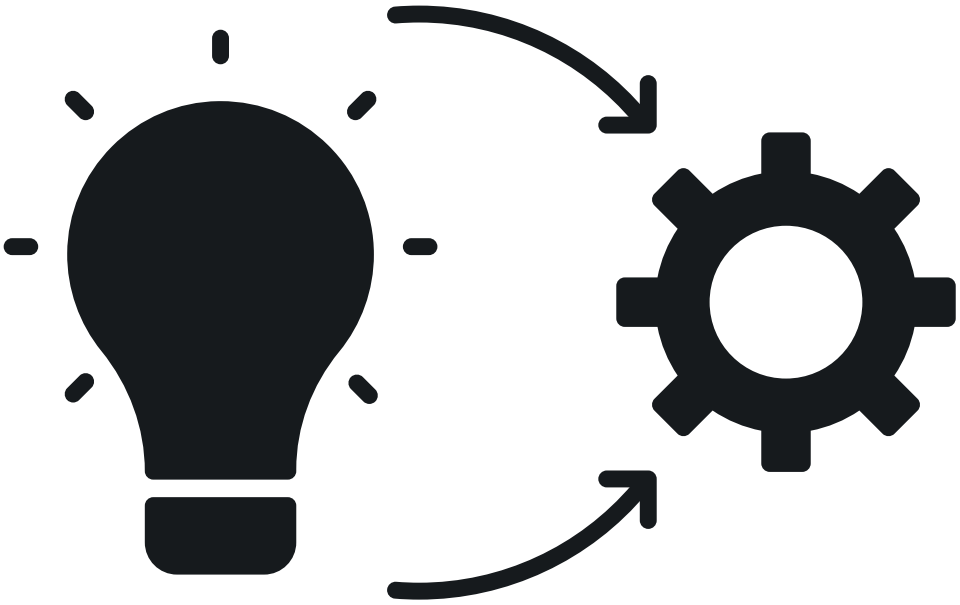
# PLAN IMPLEMENTATION

Multi-Hazard Mitigation Plan 2022



THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

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## Overview

This section provides the blueprint for guiding the Suquamish Tribe's efforts to reduce potential losses from the natural hazards identified in the Risk Assessment sections. The format of this chapter is as follows:

Capability Assessment – This section provides an assessment of the Tribe's capability to prevent, respond to, and recover from incidents involving natural hazards.

Summary of Mitigation Strategies – This section summarizes the mitigation strategies from each hazard classification by grouping those with universal application among multiple hazard classifications. The summary also provides initial recommendations regarding potential implementation timelines, who the Tribe's lead entity may be, space for cost estimates, and potential funding options.

Current & Potential Funding Sources – This section identifies current and potential sources for obtaining the Federal, State, and Tribal, as well as local and private funding needed to implement the proposed mitigation activities.

## Capability Assessment

The hazard assessment process included an evaluation of Tribal laws, regulations, policies, programs, and response plans relevant to hazard mitigation. Reviewing and monitoring development activities in hazard-prone areas is an integral part of developing mitigation strategies. The Tribal capability assessment includes a general description of the capabilities of Suquamish's local authority.

**Tribal Planning Capabilities**

- **Suquamish Tribe Comprehensive Emergency Management Plan (2019)**

  The CEMP was updated in 2019, adopted in 2014 with the purpose of establishing a systematic, coordinated, and effective emergency management plan for the Tribe on the Port Madison Indian Reservation for its people, facilities, and services. This plan establishes a coordinated plan of action for the Tribe, its community members, personnel, and facilities, establishes fundamental policies, identifies responsibilities and procedures, establishes an understanding of the authority, responsibilities and functions of the Tribe adjacent local government, Kitsap County, Washington State, and Federal jurisdiction.

- **Suquamish Tribe Forestry Management Plan (2010)**

  The Forestry plan was adopted in 2014 and provides policy guidance to the Tribal Forestry program in determining how annual harvests are selected, gives instructions in the performance of forestry tasks, and gives educational tools for Tribal allotment owners and the Tribal Council.

- **Suquamish Tribe Solid Waste Code (2004)**

  The Solid Waste Code was adopted in 2004 and was established to protect the health, safety, and welfare of the residents and the natural resources of the Port Madison Indian Reservation and to provide the statutory basis for a coordinated program which addresses the accumulation, collection, and disposal of solid waste; resource recovery, recycling, and utilization of recyclable materials; and the creation and operation of disposal sites and transfer stations. The Public Nuisance code was passed in 2017 to strengthen the Solid Waste Code.

## Hazard Response

The Tribe's Emergency Management Program oversees all the Tribe's emergency response and disaster mitigation programs. This office works with local, state, and federal partners, as well as other tribes, to coordinate their disaster planning efforts. The offices actively seek opportunities to secure grant funding to support the Tribe's emergency management planning and training efforts.

The Tribe coordinates with the Kitsap County Department of Emergency Management (KCDEM), FEMA and the Washington Emergency Management Department (WA EMD (Emergency Management Division)) to provide training to tribal police officers, department leads, Tribal leadership, and relevant staff in accordance with the National Incident Management System (NIMS). Adequate training ensures that the Tribe is compliant with NIMS and may effectively respond to a major event in a manner that effectively integrates with other agencies.

**Communications:**

The following communication systems are currently available and in use on the Reservation:

- NOAA weather radios in some homes and offices
- Kitsap County 911 emergency services radio network
- Kitsap County ARES/RACES/ACS: Amateur Radio Emergency Service (ARES), Radio Amateur Civil Emergency Service (RACES), Alternate Communications System (ACS)
- MOU with Kitsap County for disaster notification, coordination, and communication

**Local Partners:**

The Tribe works closely with each of the following partners in a variety of capacities, all of which provide and/or add to portions of the Tribe's emergency management capability. Many of these partners also have contracted assistance in the form of mutual-aid and interlocal agreements that make additional resources available from throughout the region.

- Washington Homeland Security Region 2
- Washington State Patrol (WSP)
- Washington State Department of Health
- Washington State Department of Natural Resources (DNR)
- Kitsap County Sheriff (KCSO)
- Kitsap 911 (CENCOM)
- Kitsap Public Utilities District
- Kitsap Public Health District
- Kitsap Animal Control
- Kitsap Mental Health
- American Red Cross
- St. Michael Medical Center
- Puget Sound Energy
- Suquamish Police Department (SPD)
- Poulsbo Police Department (PPD)
- North Kitsap Fire & Rescue (NKF&R)
- Poulsbo Fire Department (PFD)

- Bainbridge Island Fire Department (BIFD)

**Federal/Regional Capabilities:**

As a sovereign government entity, the Suquamish Tribe could access federal assistance directly. This includes asking for federal funding assistance and resource support and initiating requests for Presidential Disaster Declarations.

**Support Following a Presidential Declaration:**

There is considerable support for risk reduction measures following the declaration of a federal disaster. Some of the more significant resources include:

- The Hazard Mitigation Grant Program (HMGP) helps for a wide range of mitigation projects following a presidential declaration. Eligibility is restricted to projects that have gone through a comprehensive hazard mitigation planning process in accordance with FEMA criteria.
- Minimal Repair Program funds risk reduction such as the anchoring of manufactured homes.
- The Small Business Administration will fund eligible mitigation measures to qualified owners of damaged homes.
- Outreach is available through Disaster Reconstruction Assistance Centers (DRACs), Recovery Information Centers, or Hazard Mitigation Teams.
- Benefit/Cost Mitigation support is available from FEMA for infrastructure repair.

## Risk Rating Summary

The Suquamish Tribe's Hazard Mitigation Plan was developed for the purpose of assessing vulnerability and to develop a series of proposed mitigation strategies to reduce the potential severity of natural hazards within the Port Madison Indian Reservation. Each hazard classification was assigned a Risk Rating by the Planning Committee based on the hazard assessment data. The Risk Rating was determined based on the combined Probability of Occurrence (P), Degree of Impact (DI), and Type of Impact (TI) ratings assigned to potentially occurring events on the Port Madison Indian Reservation. The following table summarizes these Risk Ratings. Refer to the individual sections for further descriptions and information on each of the hazards. The hazards are sorted from the highest Risk Rating to lowest.

| Risk Rating Summary | | | |
|---|---|---|---|
| **Hazard** | **Rating** | **Classification** | **Trend from Last Report** |
| **Earthquakes** | 4.51 | High to Very High | Higher |
| **Climate Change** | 3.86 | Moderately High | New |
| **Severe Weather** | 3.74 | Moderately High | Slightly Higher |
| **Cybersecurity Event** | 3.23 | Moderate | New |
| **Tsunami** | 3.08 | Moderate | Unchanged |
| **Landslides** | 3.02 | Moderate | Unchanged |
| **Drought** | 2.97 | Moderate | Unchanged |
| **Flooding** | 2.62 | Moderately Low | Unchanged |
| **Wildfire** | 2.55 | Moderately Low | Unchanged |

Note: Climate Change has an impact on all hazards and is newly evaluated in this report. Cybersecurity Events are a new hazard evaluated for this report.

## Summary of Mitigation Strategies and Goals

The following table groups each of the proposed mitigation strategies into broad categories. The purpose is to consolidate and summarize the mitigation strategies contained within each hazard assessment section into one central location, correlate those that have universal application with multiple hazard classifications, and establish a timeline to help focus plan implementation. The following is an explanation of each category and table element:

**Category –** Four broad categories provide a grouping of strategies with a common approach.

- Category 1 – Public Education (PE) Strategies
- Category 2 – Development Standards (DS) Strategies
- Category 3 – Infrastructure Enhancement (IE) Strategies
- Category 4 – Environmental Protection (EP) Strategies

**Mitigation Strategies –** The proposed mitigation strategies were developed to mitigate the problem statements identified in each hazard assessment section. They are general statements regarding approaches that may lessen the community's vulnerability by reducing the degree of risk and therefore potential impact. Following each mitigation strategy is a tracking number based on the category it is assigned to.

**Associated Hazards –** The hazards the mitigation strategy is associated with:

- Earthquake (EQ)
- Climate Change (CC)
- Severe Weather (SW)
- Cybersecurity Event (CE)
- Tsunami (T)
- Landslides (L)
- Drought (D)
- Flooding (F)
- Wildfire (W)

**Timeline –** Estimates the amount of time, if and when funded, it will take to complete each goal. Numbers are years to be understood as a full 12 months following mutual acceptance of agreement between the Suquamish Tribe and funding agency. Conditions and timeframes within funding agreements will supersede this projected timeline and discrepancies will be noted in future updates.

**Lead Tribal Entity –** Identifies the entity and/or department within Tribal Administration that would likely assume the lead role for organizing resources, seeking funding sources and managing the appropriations; and/or for overseeing and facilitating project implementation, monitoring, and evaluation.

Tribal Agency Acronyms:

| | |
|---|---|
| DCD | Department of Community Development |
| DNR | Department of Natural Resources |
| IT | Information Technology Department |
| OEM | Office of Emergency Management |

**Funding Options –** Identifies potential funding sources for implementing the strategy.

Funding Agency Acronyms

| | |
|---|---|
| BIA | Bureau of Indian Affairs |
| WA DOE | Washington State Department of Ecology |
| WA EMD | Washington State Emergency Management Department |
| EPA | Environmental Protection Agency |
| FEMA | Federal Emergency Management Agency |
| HMGP | Hazard Mitigation Grant Program |
| HUD | Housing and Urban Development |

**Prioritization of Mitigation Strategies and Goals:**

The following criteria was used to determine the most logical and beneficial prioritization of the strategies and goals laid out in the Summary of Mitigation Strategies and Goals section below and the recommended timeline to begin projects aligned with the strategies and goals.

1. Level of risk to the community presented by the risk rating criteria and summary.
2. The value the strategy or goal has on increasing resilience to the community.
3. Realistic likelihood of adequate and appropriate funding being acquired to meet the minimum requirements of the project.

**Prioritization Scale & Timeline**

| | |
|---|---|
| **5 - Highest Priority** | **Immediate action is necessary** |
| **4 - Moderately High Priority** | **Within 1-2 years** |
| **3 - Moderate Priority** | **Within 2-4 years** |
| **2 - Moderately Low Priority** | **Within 3-5 years** |
| **1- Lowest Priority** | **Greater than 5 years** |

## Summary of Mitigation Strategies and Goals

The following table groups each of the proposed mitigation strategies into broad categories. The purpose is to consolidate and summarize the mitigation strategies contained within each hazard assessment section into one central location, correlate those that have universal application with multiple hazard classifications, and establish a timeline to help focus plan implementation.

| Mitigation | Description | Associated Hazards | Lead Entity | Funding Options | Timeline | Priority |
|---|---|---|---|---|---|---|
| Public Education Strategies | | | | | | |
| PE-1 | Deliver public education in an effort to engage the community as stewards for maintaining the effectiveness of both domestic and commercial storm water drainage systems located on private property. | F, SW, L | OEM | FEMA, HMGP | 2 Months | 4 |
| PE-2 | Deliver public education to develop a culture of disaster preparedness based on the need for citizens to be self-reliant and prepared to care for themselves for at least two weeks. | SW, EQ | OEM | FEMA, HMGP | 2 Weeks | 5 |
| PE-3 | Promote public education opportunities that inform residents on energy efficient mitigation that reduce heat accumulation for extreme heat. | SW | OEM | FEMA, HMGP | 1 Month | 4 |
| PE-4 | Deliver earthquake safety and survival public education such as the “Drop Cover and Hold,” “The Great Washington Shake-Out” programs and other relevant earthquake safety programs. | EQ | OEM | FEMA, HMGP | 1 Month | 5 |
| PE-5 | Encourage residents to secure their structures by promoting programs such as the “Bolt It, Brace It – Do it” program for the purpose of teaching local citizens and builders how to effectively assess buildings for earthquake retrofitting and conduct the required modifications. (Potential partnership opportunities may be available with the Homebuilders Association, Olympic Peninsula Chapter of International Code Council, and Simpson Strong-Tie) | EQ | OEM | FEMA, HMGP | 1 Month | 5 |
| PE-6 | Encourage residents to secure their household and workplace objects using resources such as: Is Your Home Protected from Earthquake Disaster, A Homeowner’s Guide to Earthquake Retrofit (IBHS 1999) for economic and efficient mitigation techniques. | EQ | OEM | FEMA, HMGP | 1 Month | 5 |
| PE-7 | Create, test, and evaluate Evacuation Plans for the Reservation, deliver public information and education on all aspects of the plans, and establish communication and coordination procedures with local jurisdictions. | EQ, W | OEM | FEMA, HMGP | 1 Year | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| PE-8 | Coordinate areas with members of the community areas that will serve as communication and information hubs following a disaster to allow information to be exchanged between residents in the community and the emergency operations center. | EQ | OEM | FEMA, HMGP | 3 Months | 5 |
| PE-9 | Promote the use of public education programs to advocate for the use of measures designed to increase drought resistance such as planting drought resistant landscapes and reducing water consumption. | D | DNR | FEMA, WA DOE | 3 Months | 3 |
| PE-10 | Deliver public education to engage the community as stewards for maintaining their private property in accordance with defensible space wildfire prevention recommendations as well as following the open burning practices known to reduce the risk of wildfire. | W | DNR | FEMA, WA DOE | 6 Months | 2 |
| PE-11 | Advocate using the International Association of Fire Chiefs (IAFC) “Ready, Set, GO!” program as the model for citizens to follow in managing defensible space strategies for protecting their property from wildfire. | W | DNR | FEMA, WA DOE | 1 Month | 2 |
| PE-12 | Provide awareness, training, and educational materials on basic cyber awareness and hygiene to engage the community. | CE | IT | FEMA, HMGP | 3 Months | 5 |
| PE-13 | Deliver public education to engage the community as stewards for maintaining their private property in ways that reduce negative impacts of climate change to private property. | CC | DNR | FEMA, HMGP | 6 Months | 4 |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Development Standards Strategies | | | | | | |
| DS-1 | Continue active Tribal participation in local community, county, state, and federal growth management planning efforts; the development of land use and zoning standards; the process of conducting environmental impact studies; and permitting processes so that the Tribe’s risk management interests are addressed. | F, SW, L, T, D, W, CC | DCD | FEMA, HMGP | 6 Months | 5 |
| DS-2 | Continue to assure that all the Tribe’s development projects meet or exceed all applicable best practice standards related to managing landslide, mudslide, and erosion vulnerability to assure wetland preservation, provide shoreline protection, and protect critical areas. | F, SW, L | DCD | FEMA, WA DOE | 1 Year | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DS-3 | Support and/or encourage electrical utilities to use underground construction methods where possible to reduce power hazards and outages from windstorms. | SW | DCD | FEMA, HMGP | 1 Year | 5 |
| DS-4 | Continue to ensure the enforcement of impervious surface limitations by way of local building and development standards, promoting the use of pervious surfaces where advantageous in landslide vulnerable areas. | L | DCD | HMGP, WA DOE | 3 Months | 4 |
| DS-5 | Continue to ensure the enforcement of seismic building standards by way of local building and development standards. | EQ | DCD | FEMA, HMGP | 6 Months | 5 |
| DS-6 | Continue to ensure that all the Tribe's development projects meet or exceed all applicable best practice and building standards so that buildings are constructed with adequate seismic resilience and stability. | EQ | DCD | FEMA, HMGP | Ongoing | 5 |
| DS-7 | Consider developing and implementing local building regulations that would require major building renovations to include structural and nonstructural retrofitting of any structures identified as seismically vulnerable. | EQ | DCD | FEMA, HMGP | 1 Year | 5 |
| DS-8 | Continue to ensure that all the Tribe's development projects meet or exceed all applicable best practice standards related to wildfire prevention. | W | DCD | HMGP, WA DOE | 1 Year | 3 |
| DS-9 | Adhere to and enforce road width and secondary egress design standards to ensure development is supported with adequate access and egress provisions. | W | DCD | FEMA, HMGP | 3 Months | 2 |
| DS-10 | Evaluate all Operational Technology assets for cyber risk and add a central asset management system. | CE | IT | FEMA, HMGP | 6 Months | 4 |
| DS-11 | Deliver cyber awareness training annually to all staff members of the Tribe, including an emphasis on cyber hygiene, phishing, and other social engineering attempts. | CE | IT | FEMA, HMGP | Ongoing | 5 |
| DS-12 | Conduct outreach with Port Madison Enterprise IT and establish an information sharing agreement on cyber threats with local businesses. | CE | IT | FEMA, HMGP | 1 Year | 4 |
| DS-13 | Conduct risk analysis of all discovered Operational Technology assets. | CE | IT | FEMA, HMGP | 6 Months | 3 |
| DS-14 | Evaluate the existing security controls against the CIS (Cybersecurity Information Sheet) and NIST (National Institute of Standards and Technology) (National Institute of Standards and Technology) Controls for cybersecurity. | CE | IT | FEMA, HMGP | 3 Months | 5 |
| DS-15 | Develop pre-planned incident response plans for common attacks such as ransomware and share with local businesses. | CE | IT | FEMA, HMGP | 2 Months | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| DS-16 | Continue to ensure that all the Tribe's development projects meet or exceed all applicable best practice standards and encourage nature-based solutions when possible and applicable. | CC | DCD | FEMA, HMGP | Ongoing | 3 |
| Infrastructure Enhancement Strategies | | | | | | |
| IE-1 | Continue collaborative relationships with the Kitsap County Public Works Department's efforts to mitigate landslide, mudslide, and erosion hazards within the Reservation; provide educational resources; and seek grant opportunities that will support mitigation and nature-based solutions. | F, SW, L, W, CC | DCD | HMGP, WA DOE | 6 Months | 4 |
| IE-2 | Evaluate the Indianola Spit's access/egress vulnerability to potential flooding of NE William Rogers Road, implementing mitigation measures that would prove suitable and cost effective. | F, T | DCD | FEMA, HMGP | 6 Months | 3 |
| IE-3 | Evaluate the Doe-Kag-Wats estuary's access/egress vulnerability to potential flooding and related hazards of the access road; implementing mitigation measures that would prove suitable and cost-effective. | F, T | DCD | FEMA, HMGP | 6 Months | 3 |
| IE-4 | Continue to develop and implement prevention programs designed to keep vulnerable trees from threatening lives, property, and public infrastructure during windstorm events. | SW | DNR | HMGP, WA DOE | 1 Year | 4 |
| IE-5 | Encourage seismic strength evaluations of the Tribe's critical facilities to identify vulnerabilities and where feasible, implement retroactive mitigation measures based on current seismic standards to reduce their vulnerability. | EQ | DCD | FEMA, HMGP | 6 Months | 5 |
| IE-6 | Seek opportunities to reinforce resilience to Tribal-owned critical infrastructure to support Continuity of Operations and Continuity of Government for Tribal Government. | EQ | DCD | FEMA, HMGP | 3 Months | 4 |
| IE-7 | Evaluate the effectiveness and feasibility of a tsunami early warning system for communities located within the 25-foot inundation zone; implementing those measures that would prove suitable and cost effective. | T | OEM | FEMA, HMGP | 1 Year | 5 |
| IE-8 | Develop and establish evacuation routes for communities located within the 25-foot inundation zone. | T | OEM | FEMA, HMGP | 3 Months | 5 |
| IE-9 | Evaluate the cost/benefit value of potential relocation of structures located within the 25- foot inundation zone; implementing those measures that would prove suitable and cost effective. | T | DCD | FEMA, HMGP | 6 Months | 4 |
| IE-10 | Formulate local policies that can be implemented by the Tribal government to support the water conservation measures needed to preserve water supplies during times of water shortage and drought. | D | DNR | FEMA, HMGP | 6 Months | 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| IE-11 | Continue to utilize open burning regulations, permitting processes, and compliance enforcement to reduce wildfire vulnerability. | W | DNR | FEMA, HMGP | 3 Months | 3 |
| Environmental Protection Strategies | | | | | | |
| EP-1 | Continue active Tribal representation in the relevant forums to assure the Tribe's habitat preservation interests are considered and accounted for within both wetland preservation and shoreline management decisions. | F, L | DNR | HMGP, WA DOE | Ongoing | 5 |
| EP-2 | Continue to actively promote reforestation practices following logging and land clearing to minimize landslides, mudslides, and erosion vulnerability. | L | DNR | HMGP, WA DOE | Ongoing | 5 |
| EP-3 | Continue to actively promote the preservation of natural vegetation to maintain soil stability and to minimize landslides, mudslides, and erosion vulnerability. | L | DNR | HMGP, WA DOE | Ongoing | 5 |
| EP-4 | Evaluate the feasibility and benefits of implementing further water conservation planning efforts to ensure adequate preservation of the Suquamish area's watershed areas. | D | DNR | HMGP, WA DOE | 6 Months | 3 |
| EP-5 | Provide for additional research and compilation of water resource data regarding aquifer recharge areas to identify long-term recommendations for assuring adequate water system capabilities and to identify alternative water supply sources as a back-up contingency during periods of drought conditions. | D | DCD | HMGP, WA DOE | 1 Year | 3 |
| EP-6 | Continue active Tribal representation in the relevant forums to assure the Tribe's habitat preservation interests are considered and accounted for within stream and shoreline management practices and decisions. | D | DNR | HMGP, WA DOE | Ongoing | 5 |
| EP-7 | Continue active Tribal representation in the relevant forums to develop and implement measures aimed at reducing the effects of global warming. | D | OEM | HMGP, WA DOE | Ongoing | 5 |
| EP-8 | Continue active Tribal representation in the relevant forums to assure the Tribe's habitat preservation interests are considered and accounted for within forestry management practices and decisions. | W | DNR | HMGP, WA DOE | Ongoing | 5 |
| EP-9 | Continue active Tribal representation in the relevant forums to assure the Tribe's habitat preservation interests are considered and accounted for to preserve natural aquaculture and traditional foods. | CC | DNR | HMGP, WA DOE | Ongoing | 5 |
| EP-10 | Conduct slope stability analysis for shoreline critical infrastructure to prioritize critical infrastructure locations most likely to experience impacts from rising sea levels and more frequent and intense storms brought on by climate change. | CC | DCD | HMGP, WA DOE | 6 Months | 4 |

## Current & Potential Funding Sources

This section identifies current and potential sources of federal, tribal, state, local and private funding to implement the mitigation actions and activities identified in the previous section. Since the Suquamish Tribe is a sovereign government with a limited revenue base, the primary funding source to support the implementation of mitigation measures will come from the Federal government through grant programs. In addition, there are also some limited funding options available through the State of Washington, Kitsap County, as well as some capacity to generate matching funds for grants from the Tribe.

**Federal Funding Sources** – There are a variety of federal programs available that can become potential funding sources. Examples include:

- **Pre-Disaster Mitigation Program** – Administered by FEMA, this program provides funds to develop mitigation plans and implement mitigation projects. (Eligibility requires a FEMA approved Hazard Mitigation Plan and qualifies the Tribe as a direct grantee)
- **Hazard Mitigation Grant Program (HMGP)** – Administered by FEMA and the Washington State Emergency Management Division, this program provides post-disaster funds for hazard reduction projects (e.g., elevation, relocation, or buyout of structures).
- **Flood Control Assistance Account Program** – Administered by the Washington State Department of Ecology (Ecology), this program provides funds for developing flood hazard management plans, for flood damage reduction projects and studies, and for emergency flood projects (e.g., repair of levees).
- **Flood Mitigation Assistance Program** – Administered by FEMA, this program provides funds for flood mitigation on buildings that carry flood insurance and have been damaged by floods.
- **Community Development Block Grant** – Administered by the Department of Housing and Urban Development, this program provides funds for a variety of community development projects.
- **Small Business Administration Loans** – Administered by the Small Business Administration, this program provides access to assistance designed to help businesses recover from disaster damage.

**Federal Support Agencies** – There are a variety of federal agencies that can serve as support agencies that can provide access to resources, grant programs, materials, etc. These agencies include:

- **Department of Homeland Security** – Provides access to resources and grant programs aimed at developing local capacity for first responders.
- **Indian Health Service** – Provides access to resources and funds for hazard mitigation projects specific to public health and safety.
- **U.S. Fire Administration** – Serves as the parent organization for the National Emergency Management Institute (EMI) and the National Fire Academy (NFA). Both agencies conduct national research, maintain information databases, provide community preparedness and emergency management training, and provide access to public educational resources and materials.

- **Environmental Protection Agency** – Provides access to funds for projects with dual hazard mitigation and environmental protection goals as well as related planning efforts such as spill prevention and response planning.
- **Rural Development Agency, USDA** – Provides access to grant opportunities and low interest loans for housing assistance, business assistance, community development, and emergency community water and wastewater assistance in areas covered by a federal disaster declaration.
- **Bureau of Indian Affairs** – Provides access to programs, resources, and funds to support tribal activities.

**Tribal** – The Suquamish Tribe is fully committed to the public safety and welfare of those who reside, visit and work within the Port Madison Indian Reservation. Tribal funding sources come from the revenue generated by tribally owned businesses such as the Suquamish Clearwater Casino, the White Horse Golf Club, the Kiana Lodge, Suquamish Seafood Enterprises, and an assortment of businesses operated by Port Madison Enterprises. The Tribe also generates revenue from the leasing of trust land to businesses and homeowners. Though revenue sources are limited, the Tribe recognizes the need to match grant funding, either through direct financial contribution or through the allocation of in-kind services, such as labor and expertise.

In addition, the Tribe is a signatory to the Washington State gaming compact which states in 14.2 under charitable donations- One-half of one percent (0.5%) of the net win derived from Tribal Lottery System activities, determined on an annual basis, shall be donated to non-tribal bona fide non-profit and charitable organizations in the State of Washington. This is known as Appendix X Grants which the Tribal Council grants equally on a quarterly basis to Community Grants and Tribal Grants. The emergency management program would be eligible to apply for the tribal grants portion for mitigation funding.

This message was sent with high importance.

**State/Local** – In some cases, there are funding sources that may be available from the State of Washington and/or through partnerships with Kitsap County, especially on mitigation actions that overlap jurisdictions, such as road and flood mitigation projects. The main resource for funding opportunities from the State of Washington is from the Washington State Emergency Management Division, which helps fund mitigation projects. The Tribe actively seeks to foster relationships with the State of Washington, its various departments, and Kitsap County, as well as neighboring communities. These partnerships provide important opportunities to collaborate with multiple agencies when pursuing funding opportunities and to coordinate mitigation measures that are regional in nature.

**Private** – Though potential funding sources from the private sector are not specifically identified, local businesses and residents located within the Reservation may be willing to participate and contribute to local mitigation efforts.

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*Place of the clear salt water*

# PLAN MAINTENANCE

Multi-Hazard Mitigation Plan 2022

THE SUQUAMISH TRIBE

Office of Emergency Management

18490 Suquamish Way, Suquamish WA, 98392 360-598-3311

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## Plan Maintenance Process

The federal hazard mitigation planning regulations (44 CFR (Code of Federal Regulations) 201.4) require tribal-level plans such as this Hazard Mitigation Plan to be reviewed, revised, and submitted for approval to the FEMA Regional Director every five years. The regulations require a plan maintenance process that includes an established method and schedule for monitoring, evaluating, and updating the plan; a system for monitoring implementation of mitigation measures and project closeouts; and a system for reviewing progress on achieving goals as well as specific activities and projects identified in the mitigation plan.

The Suquamish Tribe's Hazard Mitigation Plan is a living document that is intended to provide a guide for hazard mitigation to the Suquamish Tribe. The Plan can be revised more frequently than every three years if the conditions under which it was developed change significantly (e.g., a major disaster occurs or funding availability changes). This section details the Tribe's method and schedule for monitoring, evaluating, and updating the Hazard Mitigation Plan and for monitoring the progress of mitigation actions.

## Responsibility for Plan Maintenance

The Suquamish Tribal Council has final authority and responsibility over the Suquamish Tribe's Hazard Mitigation Plan. Responsibility for plan maintenance and coordinating implementation of mitigation measures will be delegated to the Tribe's Office of Emergency Management, which also will be responsible for providing annual progress reports to the Council and for generating the five-year update to be submitted to the Council and subsequently to FEMA for approval.

## Monitoring, Evaluating, and Updating the Plan

The Suquamish Tribe's Emergency Management Coordinator will review this Hazard Mitigation Plan annually and will update the Plan every five years. Annual reviews will identify progress made on the implementation of mitigation measures and projects. Annual reviews also will assess the impacts of disasters within the Reservation region to determine whether the Hazard Mitigation Plan should be revised based on the latest information. The annual review will occur during the last quarter of each calendar year to coincide with the Tribe's fiscal year and to prepare for any applicable grant reporting deadlines.

The effectiveness of projects and other actions will be evaluated at appropriate, project specific intervals or, at a minimum, when the Hazard Mitigation Plan is updated every five years as required for Tribal level plans submitted directly to FEMA. The process of updating the Hazard Mitigation Plan will include a review of hazard and vulnerability assessments along with effectiveness of coordination with other planning efforts; potential losses, Tribal capability, funding sources, and recommended and potential new mitigation measures. In support of the five-year update, the Emergency Management Coordinator will:

1. Examine and revise the Hazard Risk Assessment as necessary to ensure that it describes the current understanding of hazard risks.
2. Examine progress on recent mitigation efforts and determine the effectiveness of the mitigation actions and projects recommended in this Hazard Mitigation Plan.
3. Identify implementation problems (technical, political, legal, and financial) and develop recommendations to overcome them.
4. Recommend ways to increase participation by the Suquamish Tribe's governmental departments and to improve coordination with other collaborating jurisdictions and partner agencies.

5. Review and, if desirable, revise the Suquamish Tribe's Hazard Mitigation Plan.

The updated Hazard Mitigation Plan will be presented to the Suquamish Tribal Council for approval and adoption before it is submitted to FEMA for re-approval.

## Monitoring Progress of Mitigation Actions

The Suquamish Tribe's Emergency Management Coordinator will frequently review progress on the implementation of mitigation actions. The Emergency Management Coordinator also will meet with representatives from Tribal departments to discuss the progress of mitigation activities. The implementation of all short-term mitigation actions will be monitored by the Emergency Management Coordinator on an ongoing basis until implementation is complete. Long-term actions being actively implemented will be monitored on an ongoing basis, or at least annually as needed. Long-term actions planned will be reviewed during plan updates every three years.

The system for reviewing progress on achieving goals, objectives, and specific actions included in the mitigation strategy will be based on a checklist of all objectives and actions. This checklist will be reviewed annually by the Suquamish Tribe's Emergency Management Coordinator. As described in the previous section, progress on mitigation actions will be described in an annual report to the Tribal Council and in the five-year update of the Hazard Mitigation Plan.

## Ongoing Public Participation

The plan will be available on the Suquamish Tribe website, Suquamish.nsn.us, for download. A physical copy will be available at the Emergency Management Coordinators office.

During outreach activities designed to educate the public about natural hazards, information regarding the plan and how to obtain a copy will be made available on the Suquamish Tribe Website.

Future updates will continue to actively seek public input whenever possible, including opportunities to review new data created for the plan.

## Compliance with Federal Statutes

The Suquamish Tribe will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, in compliance with 13.11 (c) of 44 CFR 201.7. The Suquamish Tribe will amend this plan whenever necessary to reflect changes in tribal or federal laws and statues as required in 44 CFR 201.7 (d)

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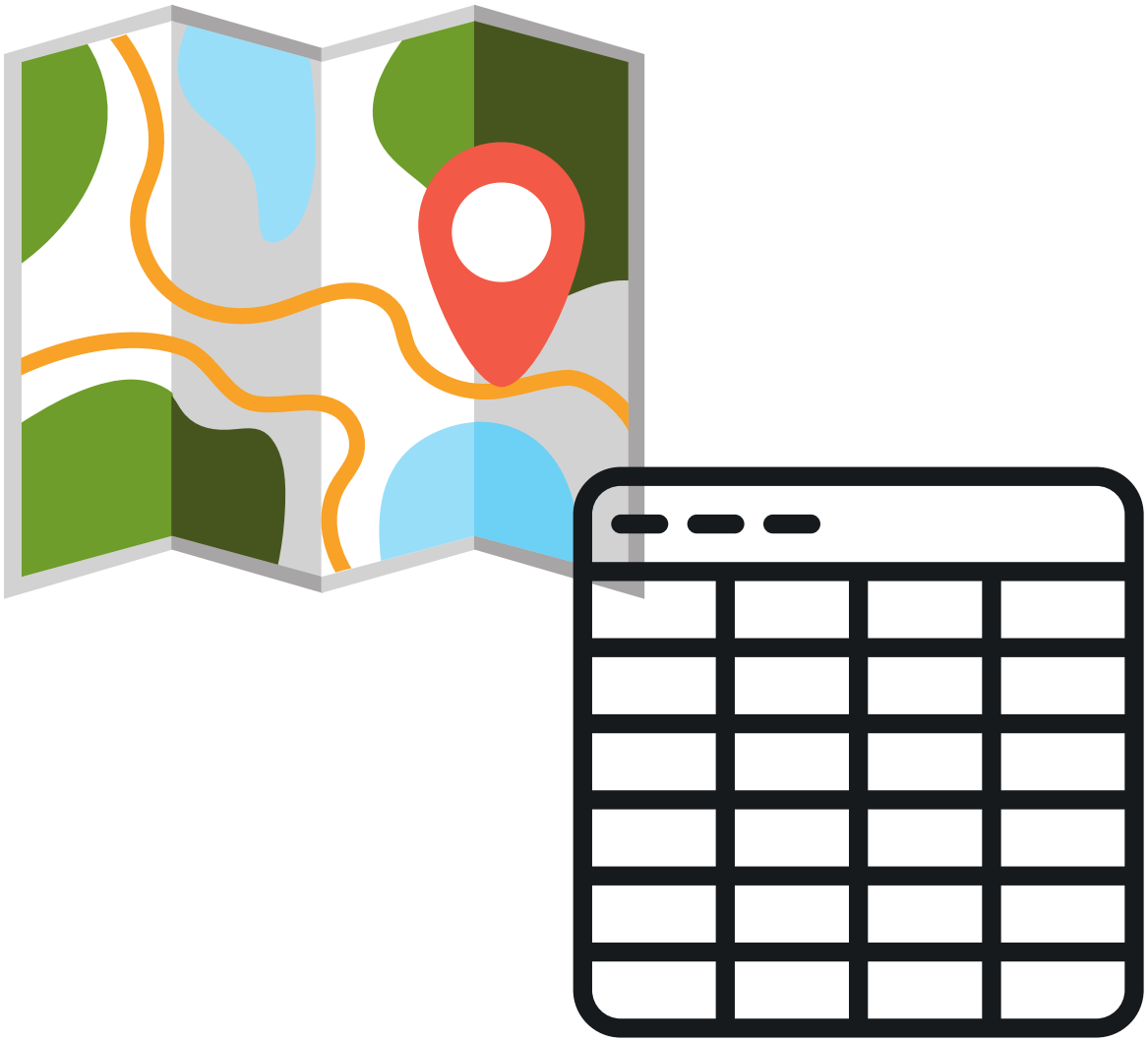
*Place of the clear salt water*

# REFERENCES

Multi-Hazard Mitigation Plan 2022



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