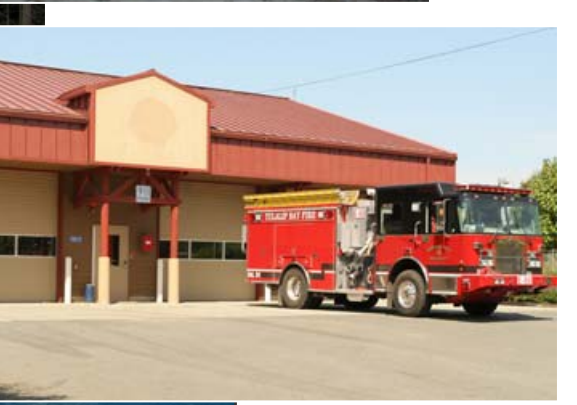
Tulalip Tribes

Tribal-/State-Level

Hazard Mitigation Plan



April 2006

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Tulalip Tribes Tribal-/State-level Hazard Mitigation Plan

Prepared for
The Tulalip Tribes of Washington

Funded by
Federal Emergency Management Agency
Pre-Disaster Mitigation Program
Application #: PDMC-10-WAIT004-2005
Agreement #: EMS-2005-PC-0009
&
The Tulalip Tribes

Prepared by
The Tulalip Office of Emergency Management

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April, 2006

Special Thanks to:
Chief J.A. Goss, Jr.
Tulalip Tribal Police

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List of Acronyms

BFE	Base Flood Elevation
BNSF	Burlington Northern/Santa Fe Railroad
CEMP	Comprehensive Emergency Management Plan
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
DEM	Digital Elevation Model
DNR	Washington Department of Natural Resources
EMPG	Emergency Management Performance Grant
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GIS	Geographic Information Services
HIVA	Hazard Identification and Vulnerability Analysis
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
MM	Modified Mercalli Scale
NEHRP	National Earthquake Hazard Reduction Program
NFIP	National Flood Insurance Program
NIMS	National incident Management System
NOAA	National Oceanic & Atmospheric Administration
NWTEMC	Northwest Tribal Emergency Management Council
OEM	Office of Emergency Management
OFM	Washington State Office of Financial Management
PDM	Pre-Disaster Mitigation
PGA	Peak Ground Acceleration
PSCV	Puget Sound Convergence Zone
QCV	Quil Ceda Village
SFEIS	Supplemental Final Environmental Impact Statement

SFHA	Special Flood Hazard Area
SMPG	Shoreline Master Program Guidelines
TDS	Tulalip Data Services
TERO	Tribal Employment Rights Office
U&A	Usual and Accustom Fishing Areas
UBC	Uniform Building Code
URM	Unreinforced Masonry
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WA EMD	Washington Emergency Management Department
WRIA	Water Resource Inventory Area

1. Introduction

The purpose of this Tulalip Tribes Tribal-level Hazard Mitigation Plan (HMP) is to guide current and future efforts to effectively and efficiently mitigate natural hazards on the Tulalip Indian Reservation and Usual and Accustomed fishing areas and, in coordination with other agencies and jurisdictions as appropriate, to mitigate and respond to natural hazards that are generated off the Reservation or that cross the Reservation boundaries. This Tulalip Tribes HMP establishes goals, lists objectives necessary to achieve the goals, and identifies policies, tools, and actions that will help meet the objectives. These short- and long-term actions will reduce the potential for losses on the Reservation due to natural hazards. In short, this plan is intended to help create a disaster-resistant community by reducing the threat of natural hazards to life, property, emergency response capabilities, economic stability, and infrastructure, while encouraging the protection and restoration of natural and cultural resources.

The natural hazards that have affected the Reservation in the past and will affect the Reservation in the future include floods, earthquakes, severe winter storms, wildfires, landslides and tsunamis.

To protect the political integrity, economic security, health, and welfare of the Tulalip Tribes, its members, and all persons present on the Reservation, it is important for the Tulalip Tribes to minimize threats to public health and safety and damage to property from future hazard events. In developing a policy response, it is important to recognize that floods, earthquakes, severe winter storms,, wildfires, landslides, and other such events are naturally occurring processes that will present occasional disruption to the lives of Reservation residents. Any policy must also recognize that there are many private and public structures and facilities that have been constructed through time without regard to potential natural hazards. Fortunately, there are many things that can be done to reduce future risk and loss through on-the-ground structural and non-structural projects as well as regulatory actions.

This HMP is one such action to reduce future risk and losses since it evaluates risks and identifies mitigation actions and also will qualify the Tulalip Tribes for funding under the Pre-Disaster Mitigation Program (PDM) that is administered by the Federal Emergency Management Agency (FEMA). This program provides funding for hazard mitigation planning and for mitigation projects that are implemented before a disaster. This plan may also help the Tulalip Tribes acquire funding under other programs, including the following:

- Hazard Mitigation Grant Program (HMGP), which provides post-disaster funds for hazard reduction projects (e.g., elevation, relocation, or buyout of structures),

With this eligibility for grant programs, there is an opportunity to look to the future and work cooperatively and creatively to mitigate future damages and threats to public health and safety. This Hazard Mitigation Plan addresses the primary natural hazards that

threaten the Reservation. Although many of the specific recommendations in the plan are directed at the Reservation, many will be most effective if implemented on a watershed-wide basis. It is therefore intended that this plan provides solutions that other jurisdictions can use and benefit from and that can be cooperatively implemented.

Purpose/Goals

The goals and objectives of the Tulalip Tribes HMP are to:

1. Protect people, property and the natural environment
    - Purchase hazard-prone areas for conservation and risk reduction
    - Buy-out or relocate structures located in high-risk hazard areas
    - Encourage low impact development through land-use regulations
2. Ensure continuity of critical economic and public facilities and infrastructure
    - Support redundancy of critical government functions
    - Retrofit or build to highest standards, critical facilities and infrastructure
3. Promote and protect Tribal sovereignty and identity
    - Increase mitigation and emergency management capabilities for the Tulalip Tribes and Quil Ceda Village
    - Enable the Tulalip Tribes to be self-sufficient for at least 72 hours after a disaster
4. Increase public awareness of natural hazards and involvement in hazards planning
    - Encourage organizations, businesses, and local governmental agencies within community and region to develop partnerships
    - Implement hazard awareness, preparedness and reduction programs

This HMP provides detailed recommendations and an action plan designed to meet each objective and, ultimately, the goals of the plan.

The Tulalip Tribes HMP is divided into eight sections:

- Section 1 is this introduction.
- Section 2 describes how the HMP was prepared.
- Section 3 describes the land use, socioeconomic conditions, and physical characteristics of the Reservation.
- Section 4 presents an assessment of hazard risks on the Reservation.
- Section 5 presents the Tulalip Tribes mitigation strategy.
- Section 6 describes local mitigation planning coordination.
- Section 7 describes the HMP maintenance process.

The references cited in this plan are footnoted and any additional references are shown in Section 8.

2. Planning Process

This section will discuss the planning process used to develop the Tulalip tribal-level Hazard Mitigation Plan. The Tulalip Tribes consider hazards mitigation planning to be an on-going process, so the process to develop the current plan is essentially a continuation of the previous planning process used to develop the 2004 local-level Tulalip Hazard Mitigation Plan.

The planning process is an extremely important aspect in the development of a hazard mitigation plan. It is crucial for the success of the plan to have the public ask questions and comment on the plan. Also, by involving the public in the planning process, it increases the public's awareness of the hazards on the Tulalip Reservation and informs them about the importance of hazard mitigation planning. Having public involvement in the planning process also allows for the plan to reflect the public's views and opinions.

The following sections will detail who was responsible for developing and producing the plan, and other associated activities such as coordinating the planning process; a listing of participating departments and agencies; and a timeline of the plan development process, dating back to 2002 and ending with the adoption of the tribal level plan by the Tulalip Board of Directors.

2.1. Preparation of the Plan

In January 2005, the Tulalip Tribes local-level Hazard Mitigation was approved by the State of Washington and FEMA. Subsequently it was brought to the attention of the Tulalip Tribes that they have the right as a sovereign state to prepare a state-level plan as part of the government-to-government relationship between Indian Tribes and FEMA.

On March 4th, 2005, The Tulalip Tribes Board of Directors passed **Resolution 2005-79** requesting the Tribes to prepare a state-level hazard mitigation and to pursue grant funding for the project. The Tulalip Board of Directors gave the Tulalip Tribal Police Department's Office of Emergency Management (OEM) the responsibility to prepare the 2006 Tulalip Tribal/State-level Hazard Mitigation Plan. The Tulalip OEM contracted with Glenn Coil, the consultant hired to prepare the local-plan, to prepare a Pre-Disaster Mitigation planning grant to FEMA in order to secure funding to develop the state-level plan. The grant, **PDMC-10-WAIT004-2005**, was approved in September 2005, and work began in earnest on the plan in October. A short (and perhaps overly ambitious) deadline was set to complete the project, with a draft set for completion by February 2005 and final Tulalip Board of Directors approval by April. Glenn was retained to coordinate the planning process and draft the plan. Lynda Harvey and Lorelei Ranney at Tulalip OEM helped with the planning process, including contacting department heads and setting up meetings, as well as coordinating with the Tulalip Grants Department in administering the grant. In April of 2006, the draft of the plan was completed. On August 11th, 2006

the 2006 Tulalip Tribes Tribal/State-level Hazard Mitigation Plan was approved and adopted by the Tulalip Board of Directors as **Resolution 06-221.** More detail on the planning process is shown in the timeline in Section 2.3.

2.2. Plan Participants

Every effort was made to include all of the Tulalip departments and agencies in the planning process. Special attention was focused on partnering with Tulalip Data Services (TDS) and the TDS Geographical Information Systems (GIS) workgroup, the Department of Natural Resources and the Department of Community Development. **Table 2-1** shows a list of all tribal departments involved in the planning process.

Table 2-1: Participating Tulalip Departments and Agencies

Tulalip Departments and Agencies	
Administration	Garden Project
A. R. M. Employment	Governmental Affairs
Auto Maintenance	Grants & Self Governance
Beda?chelh	Ground/ Building Maintenance
Bingo	Hatchery
Boys & Girls Club	Health Clinic/ Pharmacy
Business Park	Heritage School
Cablevision	Human Resources
Casino	Leasing/Real Estate
Community Development	Legal/ Reservation Attorney
Community Resources	Montessori School
Community Services	Natural Resources
Construction Development	Police Department
Compliance	Public Health & Safety Network
Cultural Resources	Quil Ceda Village
Custodial Maintenance	Quil Ceda Liquor Store/ Smoke Shop
Daycare	Recreation
Dental Clinic	See-Yaht Sub/ Communications
Dock Security/Marina	Tribal Employment Rights Office (TERO)

Tulalip Departments and Agencies	
ECEAP	Transitional House
Education	Tribal Court
Elders/ Senior Services	Tribal Gaming
Employment	Tulalip Data Services
Enrollment	Tulalip Liquor Store/ Smoke Shop
Family & Youth Services	Utilities
Finance	Veterans
Fire Department	Water Quality Laboratory
Fisheries	Work First
Forestry	Youth Hope House
	Youth Prevention

2.3. Plan Preparation Timeline

This section documents how the plan was developed and who was involved in the effort, dating back to 2002. Dates shown are the occurrence of key events and meetings relating to the plan and the planning process.

Previous planning process up to adoption of Tulalip local-level hazard mitigation plan by Tulalip Board of Directors:

January, 2002

In January 2002, representatives from each agency of the Tulalip Tribes were invited to discuss the creation of the Tulalip Tribes Hazard Mitigation Plan. In attendance were representatives from the Tulalip Tribes Police Services, Tulalip Bay Fire Department, Tulalip Health Services, Tulalip Social Services, Tulalip Utilities, Tulalip Casino and Tulalip Office of Neighborhoods. Discussion in this meeting led to the creation of a steering committee. Chief J Goss was chosen to chair this committee.

January, 2002

A second meeting was held by the steering committee and it was decided that each agency would create a report outlining its roles and responsibilities in an emergency. A key list of contact people within the Tribe and the agencies was established.

February, 2002

A compilation of the reports gathered from each agency within the Tribe was used to create a skeletal format for the Tulalip Tribes Emergency Response Plan.

January, 2003

The first draft of the Tulalip Tribes Emergency Response Plan was completed.

February, 2004

February 03, 2004, the Tulalip Office of Neighborhoods was created to help address crime prevention, community emergency response and mitigation at the neighborhood level as well as reservation wide.

March, 2004

In March 2004, representatives of the local tribes in the Snohomish County area (the Tulalip Tribes, the Stillaguamish, and the Sauk-Suiattle) were invited to the Snohomish County Department of Emergency Management's (DEM) office at Paine Field in Everett, Washington for a presentation of the DEM's 2004 Hazard Identification and Vulnerability Analysis (HIVA). This document was to be the basis of the risk assessment used for the County's Hazard Mitigation Plan. The purpose of this meeting was to inform the tribal representatives of the County's efforts in hazard mitigation planning and to also inform them of the potential hazards they could experience in their jurisdictions. Glenn Coil, a graduate student at the University of Washington's Department of Urban Design and Planning, who helped prepare the HIVA for the UW's Institute for Hazards Mitigation and Planning, conducted the presentation and led the discussion about tribal efforts in hazard mitigation planning. From this meeting, it was decided that the Tulalip Tribes would contract with Glenn Coil to assist in the preparation of a hazard mitigation plan for the Tulalip Reservation. The risk assessment and an expanded list of representatives from the different agencies and community groups having a stake in the planning process were also drafted.

May 20th, 2004

An invitation was sent to agencies and community representatives on the reservation for a meeting on this date to discuss the progress of the risk assessment. Glenn Coil gave an update on the risk assessment. During this meeting, a discussion was conducted about finalizing the list of representatives from the community and agencies as the Stakeholder Group. There was also discussion of expanding on the Steering Committee to coordinate the plan preparation to ensure that the whole community had an opportunity to offer input into the planning process. Preliminary goals and strategies were also discussed and the need that they are concurrent with state goals and strategies was stressed.

June 10th, 2004

A neighborhood meeting was held to discuss the creation of neighborhood blockwatch, emergency preparedness and hazard mitigation. This meeting was attended by thirty-five households in the housing development. Blockwatch captains were identified and agreed to continue to receive educational materials regarding crime prevention, emergency preparedness and hazard mitigation. These individuals committed to actively participating in ongoing community meetings to contribute crucial input to the overall planning process.

July 28th, 2004

A community meeting was held on this date to discuss the Tulalip Hazard Mitigation Plan's progress and to allow community members and representatives to ask questions about the plan. During this meeting there was a lively debate about the DMA 2000, the Tribe's and State's requirements for the plans, and about the types of projects that are eligible for funding. Brainstorming during this meeting helped develop an outline of potential projects the Tulalip Tribes would like to pursue in its plan. At this time it was decided that better efforts at involving the community were still needed.

September 3rd, 2004

A meeting was held on this date to discuss the progress of the hazard mitigation plan and set a deadline for the draft review and adoption of final document. At this meeting, it was decided two methods were to be used to involve the community better: Schedule an open meeting at a set time each week so that members of the community could come by and ask questions and offer feedback on the plan. Effort would be made to interview all key representatives and community members in the Stakeholder group who were not able to attend previous meetings. Notification of this would be through the community newspaper, via e-mail and phone calls, and via word-of-mouth between community members.

September 28th, 2004

A planning was held to finalize a schedule to conduct meetings/interviews with appropriate tribal department heads and staff.

October 1st, 2004

On this date, the Tulalip Tribes posted a government-wide email to all Tulalip Tribes employees to solicit community input for the purpose of incorporation into the Tulalip Hazard Mitigation Plan. A copy of the solicitation was also prepared for the Tulalip See-Yaht-Sub newspaper and Cable Channel 10 with the Tulalip Tribes Cablevision.

October 4th and October 5th, 2004

Scheduled individual and group interviews were held throughout these two days with governmental department heads to assure that every attempt was made to solicit public comment on the Tulalip Hazard Mitigation Plan. Departments that participated in these interviews can be found in Section 3.2.

October 22nd, 2004

A final meeting was held to conclude public comment on the Tulalip Hazard Mitigation Plan. It was decided in this meeting that the plan would be considered complete and submitted to the Tulalip Board of Directors for final review, approval and adoption.

November 12th, 2004

The final draft of the Tulalip Hazard Mitigation Plan was submitted to the Tulalip Board of Directors for review, approval and adoption. **Resolution #04-441** was voted on and approved with a 4 for, 0 against vote to adopt the Tulalip Hazard Mitigation Plan.

January 5th, 2005

Tulalip Hazard Mitigation Plan approved by FEMA and Washington State EMD as a local plan falling under the Washington State Enhanced Hazard Mitigation Plan.

Current planning process:

January, 2005

During a meeting with FEMA officials regarding emergency management, it was pointed out that the Tulalip Tribes, as a sovereign nation, have the right to apply directly to FEMA for disaster aid and pre-disaster mitigation funding. They also have the right and are encouraged to prepare a state-level hazard mitigation plan. PDM planning grant funding was available from FEMA to help prepare a plan.

A meeting was held within the Tribes to decide whether to pursue a tribal-level plan. It was decided that a plan was vital to the health and safety of the Tribes and Reservation and should be pursued. Due to the lack of tribal staffing and resources, it was decided to pursue a PDM grant in order to hire a consultant with expertise in developing tribal hazard mitigation plans. The Tribes would contribute staff time for planning, coordination and administration of the planning process.

February, 2005

A meeting was held to discuss the grant proposal and what the plan and planning process would entail.

March 4th, 2005

The Tulalip Tribes Board of Directors, in a 6-0 vote, approved a resolution supporting the preparation of the plan and the pursuit of the PDM grant to fund a consultant to assist with the project.

March 11th, 2005

The PDM planning grant to develop a tribal-level hazard mitigation plan for the Tulalip Tribes was submitted. It was decided that the Tulalip Office of Emergency Management would meet once a month to discuss the plan, pending approval of the grant. After approval, development of the plan would begin in earnest.

May 10th, 2005

A meeting was held between the plan consultant and the Tulalip OEM regarding the State-level plan and the PDM grant prepared. A preliminary list of steering committee members was drafted. The formation of the Northwest Tribal Emergency Management Council and the role it will play in emergency management and hazards mitigation planning was also discussed.

June 3rd, 2005

The Tulalip OEM's mitigation plan consultant, Glenn Coil, presented an overview of the Tulalip local-level Hazard Mitigation Plan at the 2005 Washington State Tribal Hazmat workshop. He also discussed the Tribes' plans for developing a tribal-level mitigation plan.

July 8th, 2005

A letter was sent from FEMA to the Tulalip Tribes informing them that their PDM grant was selected for further review for possible award.

September, 2005

The Tulalip Tribes were notified that their PDM grant application was approved. The Tulalip OEM met with their consultant to scope out the planning process and assess potential stumbling blocks. Based on feedback from FEMA and others, it was decided that extra effort would be made to identify and assess Tribal buildings, critical facilities and infrastructure.

October, 2005

Work on the plan generally included reviewing existing literature and data gathering. The Pierce County (WA) Hazard Mitigation Plan's section on Critical Facility Vulnerability Assessments was used identified as model for the critical facilities aspect of the plan.

October 21st, 2005

The first meeting was held between Tulalip OEM, Tulalip Data Services, Tulalip GIS and Tulalip Building Safety, with invitations extended to all. The main purpose was to see if any existing data on Tribal buildings was available and if not, to see was could be done to create it. It was immediately realized that data was lacking for the level of detail proposed for this plan. As no grant funding was allocated for the creation of new data, other efforts would have to be made. It was decided that the 3 groups, OEM, TDS and Building Safety would work together to build a database of Tribal facilities that would include vulnerability assessments as time and resources allow.

October 28th, 2005

A planning meeting was held to discuss the building inventory and to inform others about the plan and planning process. Issues facing the Tulalip Marina were discussed.

November 4th, 2005

A planning/stakeholder meeting was held. This meeting included representatives from the Tulalip Elders and from Tulalip Education/Day care. Past tsunamis and future events were discussed.

November 18th, 2005

The purpose of this meeting was to see what work the Tulalip Department of Natural Resources has done in mapping and identifying hazard-prone areas and properties. As part of the Tulalip Hazard Mitigation Plan, Tulalip OEM wants to buy back property most vulnerable to natural hazards and wants to use "best available science" to justify said buyouts.

Todd Zackey, the Natural Resources GIS person, told us that they are completing a draft map of past landslides along the Tulalip Coast. Nonetheless this study is woefully inadequate and they need more money to prepare a more in-depth study looking at soils and geology. There was a discussion of whether PDM grant money would be able to fund said study. Todd estimated that a study would cost about $350- $400,000 and take about 3- 4 years. Glenn and Lynda said they would talk to Sharon Loper at FEMA to see whether this was something fundable.

Besides the geological studies, Todd confirmed locations identified by OEM, using Washington State and USGS data, as the most vulnerable areas. These include homes on bluffs along Hermosa Point, Mission Beach, and the Priest Point area in general.

November 22nd, 2005

A meeting was held to discuss the progress on the critical facilities and building footprints database. It was reported that due to a lack of staff/resources, not as much progress had been made as been hoped for.

December 14th, 2005

A meeting was held to discuss the progress of the plan. Mitigation items were proposed, which included buying out properties located along Priest Point, a local hazard mitigation plan for Quil Ceda Village and critical facilities mapping. Furthermore, Tribal goals and objectives were refined and new ones proposed.

December 28th, 2005

On this date, a trip was made by the planning team down to Washington State Emergency Management Division's offices at Camp Murray to discuss critical facilities and infrastructure planning. The purpose was to develop partnerships in this critical area of emergency planning and to see what efforts the State was doing as a way to improve Tribal capabilities in this area.

January 18th, 2006

A meeting was held within Tulalip OEM to discuss the progress of the plan.

January 31st, 2006

A stakeholders planning meeting was held this day which included a representative from Tulalip Maintenance Department. A discussion was made of how many buildings the Tribes own and how many they manage. A discussion was also made of which buildings needed seismic retrofits and back-up generators.

February 2nd, 2006

Region I Homeland Security Tribal Committee meeting was held. Ryan Ike from FEMA made a presentation on the National Flood Insurance Program. The Tulalip Tribes were interested in joining the program as part of the hazard mitigation process. Ryan informed the attendees that FEMA was modernizing the floodplain maps for the region and that Snohomish County's would be completed in a few years. In the interim, the Tulalip Tribes can hold off on joining the program until vulnerable areas are definitively identified and officially mapped.

February 7th, 2006

Meeting with Joe Sparr, Director of Community Development. The purpose was to inform of the Planning Department of Tulalip OEM's hazards planning and to solicit feedback on mitigation actions proposed.

February 9th, 2006

A stakeholders/ planning meeting was held this day.

February 13th, 2006

A wrap up planning meeting was held on this day to close out the official planning process and to begin finishing the draft plan. An e-mail was sent to all Tribal staff and program mangers to attend. As the draft was being finished, more meetings would be held as needed.

March 2nd, 2006

Meeting with Tulalip Board of Directors. The Tulalip OEM presented to the Board on the status of the HMP and to inform them of possible mitigation items. The Quil Ceda Village local HMP was also proposed. The Board asked questions about the PDM program, and what mitigation actions/ projects were eligible for grant funding.

March 6th, 2006

A meeting with Community Development was held in order to discuss the draft plan and to figure out how to best partner and involve Community Development in emergency management and hazards planning. Mitigation actions related to the Community Development office were discussed.

April 2006

A first draft of the plan was completed. A copy was sent to FEMA Region X for pre-review. The plan was also made available via the Tulalip website as a public notice. A tribal-wide e-mail was sent informing people that the draft was available for review.

May 18th, 2006

As part of the effort for risk identification, a boat trip from Tulalip Bay was made to visually survey the Tulalip coast. The main purpose was to identify structures vulnerable to landslides and tsunamis. The trip departed from Tulalip Bay Marina 2 hours after high tide and followed the coast south to Priest Point, paying close attention to homes above the bluffs on Mission Beach Road, Mission Beach Heights Road and Priest Point Drive. From Priest Point, the trip went back north across the mouth of Tulalip Bay to Hermosa

Point. Numerous properties were identified at Hermosa Point that were vulnerable to landsliding. The trip continued north to Spee-Bi-Dah via Sunny Shores before returning back to the Tulalip Bay Marina. The results of this survey were added to the draft plan.

June 7th, 2006

The Tulalip Tribes were informed that the plan received pre-adoption approval from FEMA.

July 25th, 2006

A meeting was held with the Tulalip tribal attorney to discuss the plan and to make changes that were suggested by the attorney. This review was necessary prior to approval by the Tulalip Board of Directors.

August 11th, 2006

The 2006 Tulalip Tribes Tribal/State-level Hazard Mitigation Plan was approved and adopted by the Tulalip Board of Directors as **Resolution 06-221** (found in Appendix A) by a vote of 5 for and 0 against.

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3. Community Profile

The Tulalip Tribes Tribal/State Hazard Mitigation Plan covers all the people, property, infrastructure and natural environment within the exterior boundaries of the Tulalip Reservation as established by the Point Elliott Treaty of January 22, 1855 and by Executive Order of December 23, 1873, as well as any property owned by the Tulalip Tribes outside of this area. Furthermore the Plan covers the Tulalip Tribes Usual and Accustom Fishing areas (U&A) as determined by Judge Walter E. Craig in United States of America et. al., plaintiffs v. State of Washington et. al., defendant, Civil 9213 Phase I, Sub Proceeding 80-1, "In Re: Tulalip Tribes' Request for Determination of Usual and Accustom Fishing Places." This planning scope does not limit in any way the Tulalip Tribes' hazard mitigation and emergency management planning concerns or influence.

This section will provide detailed information on the history, geography, climate, land use, population and economy of the Tulalip Tribes and its Reservation. An understanding of these characteristics is essential to understanding and mitigating natural and human-caused hazards.

A few quick facts about the Tulalip Tribes and Reservation:

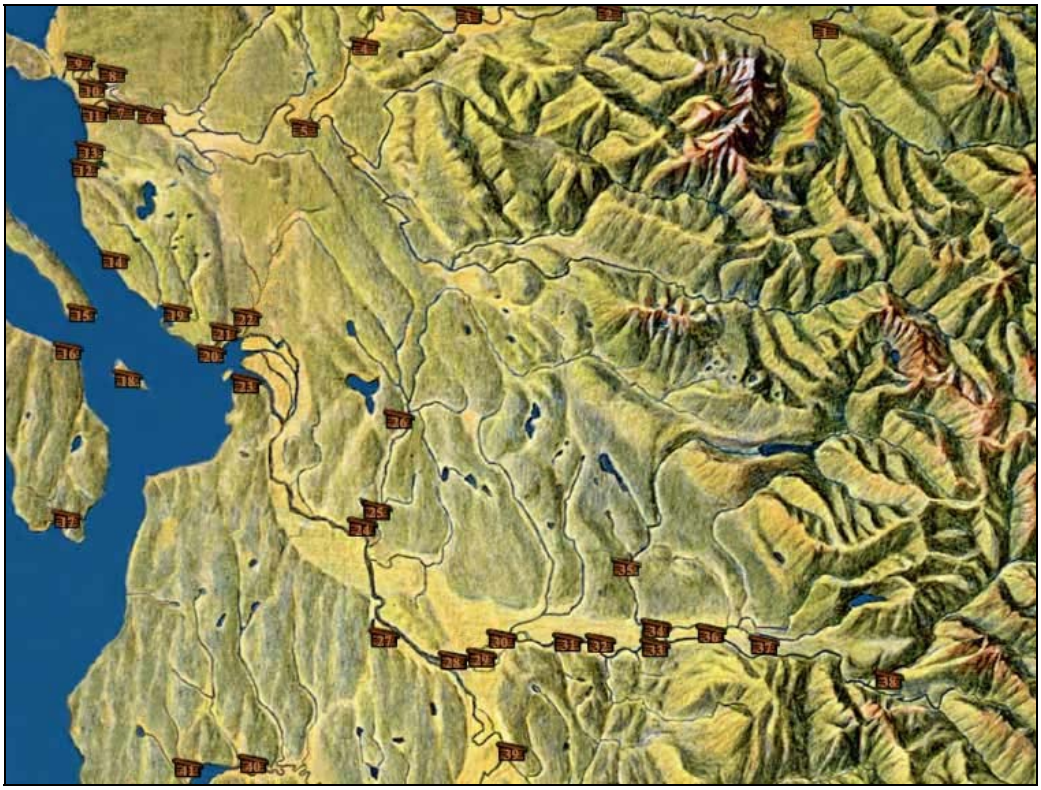
- Part of the original homeland of the Snohomish and other Salish Indian tribes, who have occupied the Puget Sound region for thousands of years
- Located at 48.07° North latitude and -122.25° West longitude
- Reservation Land Area: 35 square miles or about 22,000 acres
- Usual and Accustom Fishing Areas: 4,417 square miles
- Quil Ceda Village, established 2002, is a municipal and corporate body of the Tulalip Tribes
- Tulalip tribal membership of about 3,600
- Reservation contains about 9,200 permanent residents, including Tribal and non-tribal members
- 4th largest employer in Snohomish County, with over 3,000 jobs

3.1. Tulalip Reservation History

Although there is no definitive scientific consensus, current scientific data and research indicates that Native Americans arrived from Siberia via the Bering Sea land bridge beginning 17,000 to 11,000 years ago in a series of migratory waves during the end of the last Ice Age. Indians in the region share a similar cultural heritage based on a life focused on the bays and rivers of Puget Sound. Throughout the Puget Sound region, there were numerous small tribes that subsisted primarily on salmon, halibut, shellfish, and whales. While seafood was a mainstay of the native diet, cedar trees were the most important

building material. Cedar was used to build both longhouses and large canoes. Even clothing was made from the bark of cedar trees. The natural abundance of the region allowed many tribes to develop complex cultures. The tribal groups in the area shared a common language, known generally as Salish or more precisely as Puget Salish or Lushootseed. Some of the major tribes in the area of the present Tulalip Reservation include the Snohomish, Snoqualmie, Stillaguamish, Skagit, Suiattle, Swinomish and Duwamish (and whose homelands can be located by the rivers that bear their tribal names). The area now known as Snohomish County was home to at least 40 villages in 1800, including at least 5 on the present site of the Tulalip Reservation. The Snohomish or Sdoh-doh-hohbsh Tribe occupied the immediate Tulalip area including Possession Sound and the river and estuary that bears their name. **Figure 3-1** shows the villages located in the Snohomish County area in 1800. Villages numbered 14, 19, 20, 21, and 22 are located on the present site of the Tulalip Reservation. For more detailed information on the local villages, and the map, please see "The Coast Salish Villages of Puget Sound"[1], prepared by Tom Dailey.

Figure 3-1: Villages in the Snohomish County Area, circa 1800



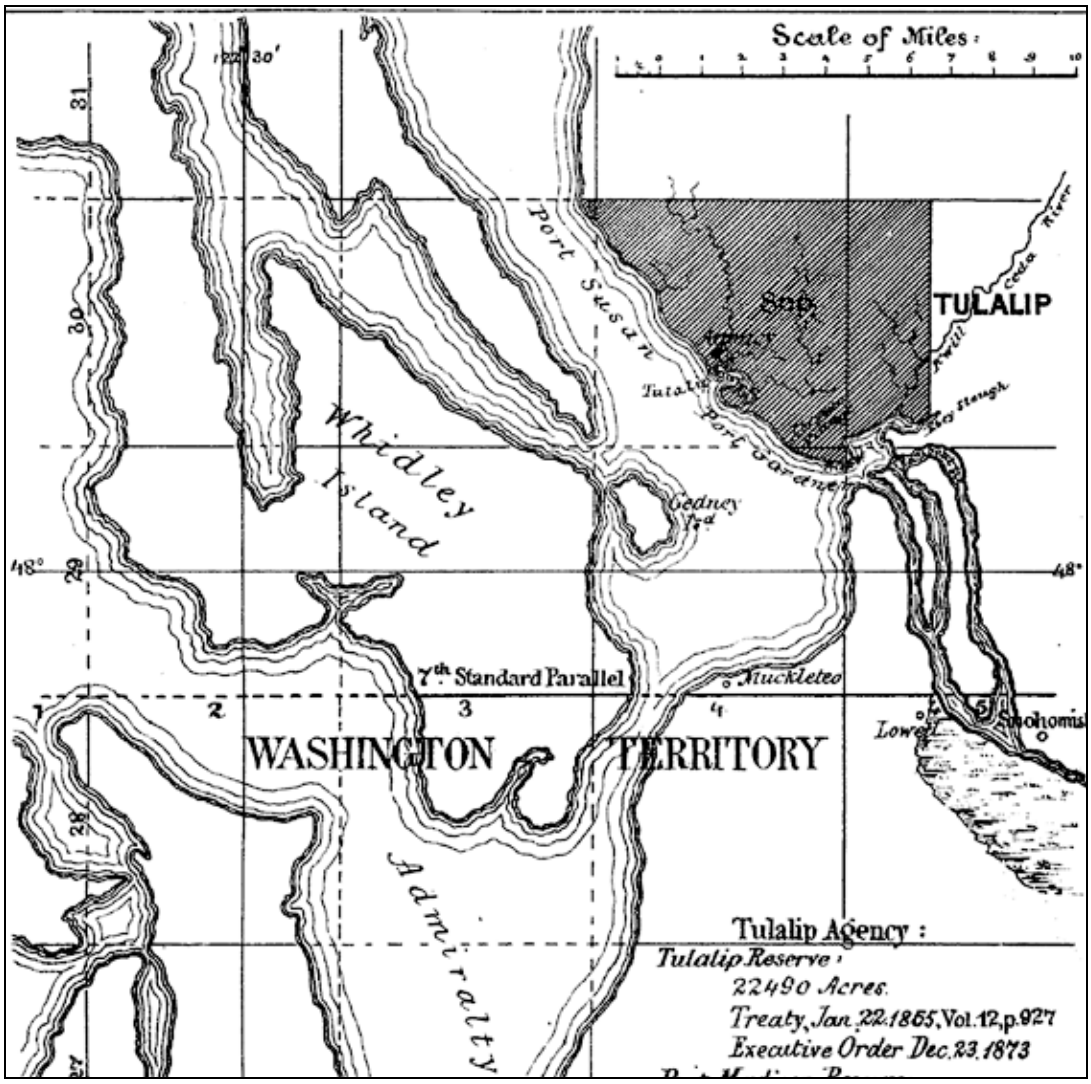
Increasing pressure from European-American settlers exacerbated the problems faced by a native population already decimated by diseases such as smallpox and tuberculosis,

[1]Coast Salish Villages of Puget Sound. http://coastsalishmap.org/start_page.htm

which culminated in the signing of treaties in 1854 and 1855 that ceded much of native territory to the United States.

The Tulalip Reservation was established by the Point Elliott Treaty of January 22, 1855 and by Executive Order of December 23, 1873. It was established to provide a permanent home for the Snohomish, Snoqualmie, Skykomish, Skagit, Suiattle, Samish and Stillaguamish Tribes and allied bands living in the region. **Figure 3-2** shows the Tulalip Reservation in 1879.[2] Catholic Missionaries moved into the area, and soon established a missionary school and church.

Figure 3-2: Tulalip Reservation, 1879[3]



[2] University of Washington Digital Collection, scanned from 1879 U.S. Office of Indian Affairs Annual Report, http://content.lib.washington.edu/aipnw/maps.html
[3] ibid.

The natives on the Reservation did not adapt to agriculture too readily, as the federal government had hoped, and many either returned to a sustenance lifestyle based on fishing and gathering, or just moved off the Reservation to find employment to support their families. The allotment of land to tribal members and families began in 1883 and ended in 1909.[4]

The modern Tulalip Tribal government was organized under the Indian Reorganization Act of 1934. When the government was formed, most of the Native families living on the reservation were Snohomish or Snoqualmie, but there were other bands represented as well. There was much debate on what to call the group of tribes. Finally Tulalip was suggested, the name used by the Department of the Interior to refer to the reservation and the shallow bay by which the Tribal Center, Longhouse, Marina and other tribal facilities now occupy.

Tulalip's Constitution and Bylaws were approved January 24, 1936 and a Charter ratified October 3, 1936. The governing body is the seven-member Board of Directors. The Tulalip tribal government is responsible for administering lands, leasing, loans, education, social services, health, land use planning, environmental protection, police, criminal and civil courts, enrollment, water resources and roads, hunting and fishing and recreation.

Presently, the Tribes have incorporated a tribal municipality, Quil Ceda Village, to provide city services and infrastructure to help facilitate development of a major business park along the I-5 corridor. Businesses located within Quil Ceda Village include the Seattle Premium Outlets shopping mall (with over 100 shops) and retail chains Wal-mart and Home Depot. The Tribes have also developed its own businesses, including two new casinos, a bingo facility and two liquor stores. These actions have resulted in increased revenue for the Tribes, which have led in turn to the development and expansion of tribal government services and facilities, such as the Tulalip Health Clinic.

3.2. Geographic Setting

The Tulalip Reservation is located in Snohomish County about 35 miles from downtown Seattle, Washington, and just north of Everett, Washington. It encompasses a land area of about 22,000 acres or about 35 square miles. It is located on the north side of the mouth of the Snohomish River, and along Possession Sound. Major development is located along Tulalip Bay, and along Interstate 5, which serves as its eastern border. The City of Marysville is adjacent to the reservation across I-5. **Figure 3-3** shows the general location of the Tulalip Reservation in relationship to Seattle and the Puget Sound region as well as the Usual and Accustom fishing areas. **Figure 3-5** shows the Tulalip Reservation.

[4] http://www.goia.wa.gov/tribalinfo/tulalip.html

Lakes, Rivers and Streams

The Snohomish River's delta forms the southern boundary of the Reservation along Steamboat Slough. The Snohomish River (average annual discharge of 3,945 cubic feet per second) is a major producer of several species of salmon, including steelhead. Development is limited in this area due to the debris and sediment load of the Snohomish River. The river deposits debris and sediment along the mouth of the river and into Possession Sound adjacent to the Reservation's coast and routinely damages docks and bulkheads, as well as floods low-lying areas such as Priest Point. The Reservation is located in two sub-basins, the Tulalip and Quil Ceda basins, although a very small portion in the northwest is drained by the Stillaguamish coastal basin. The Tulalip sub-basin, located in the western 2/3's of the reservation, is drained by Tulalip Creek and Battle (Mission) Creek. The Quil Ceda sub-basin, in the low eastern part of the reservation, is drained by Sturgeon and Quil Ceda Creeks. Quil Ceda Creek, which is currently suffering from the effects of pollution and urban waste run-off, is the largest stream on the Reservation, and was once the location of large runs of salmon.

The reservation also contains a few ponds and lakes, notably, Weallup Lake, Ross Lake, John Sam Lake, Mary Shelton Lake, Lake Agnes, and Fryberg Lake. There is also a fish hatchery located on Upper Tulalip Creek Pond, which is formed by a dam.

Hills and Mountains

The western 2/3^{rds} of the Reservation is comprised of three generally parallel, rolling ridges from 400 to 600 feet high drained by Tulalip and Battle Creeks. These ridges are the southern end of what is known as the Tulalip Plateau, an elongated mound surrounded by the waters of Port Susan to the west and the low-lying and flat Marysville Trough to the east. This plateau ends abruptly as steep sea cliffs which drop as much as 300 feet at the coast.

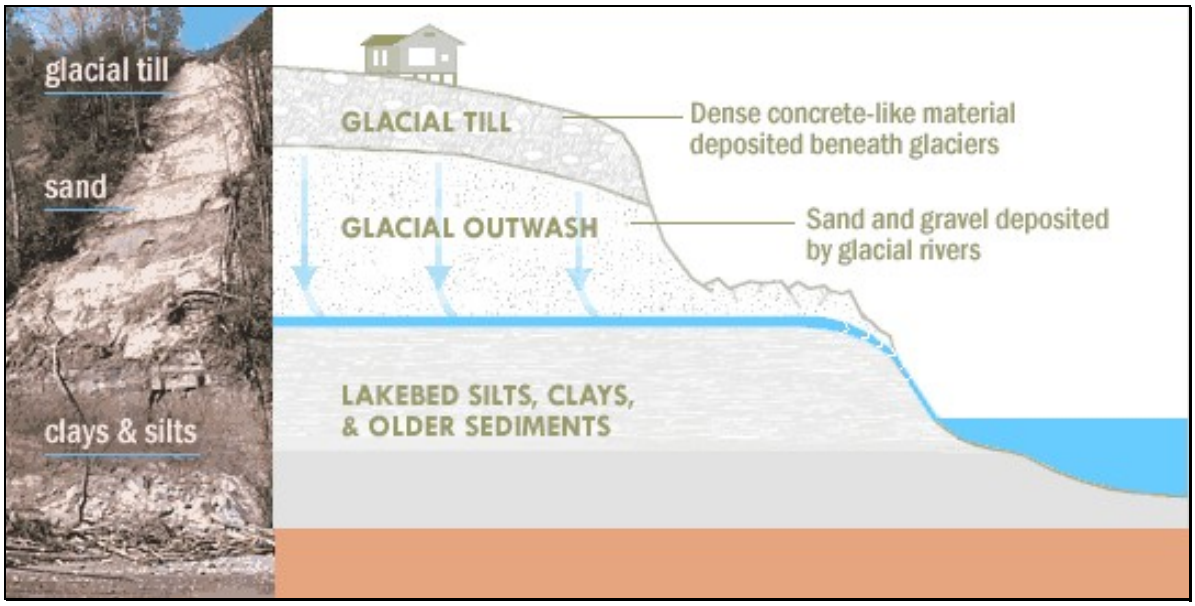
Figure 3-3: Context Map of Tulalip Reservation

Soils and Geology

About 14,000 years ago the Vashon Glacier was covering the Tulalip Reservation with about 3,000 feet of ice. The glacier carved out a trough and when it melted the sea level rose 300 feet and filled the trough in creating Puget Sound. The top layer is *Vashon till* and can be found to depths up to 30 feet. Below Vashon till is *Esperance sand* and then *Lawton clay*. Vashon till is a stable mix of rocks, dirt, clay and sand that has the consistency of concrete. Esperance sand is a permeable mixture of sand and gravel. Lawton clay is an impermeable layer of clay, which is made up of fine sediments and

large boulders.[5] See **Figure 3-4** for a cross section of the soils that make up the coastal geology of the Tulalip Reservation.

Figure 3-4: Soil Characteristics of the Tulalip Reservation[6]



[5] KCEM , http://www.metrokc.gov/prepare/docs/RHMPLANDSLIDES.pdf
[6] Puget Sound Landslides http://www.ecy.wa.gov/programs/sea/landslides/about/geology.html

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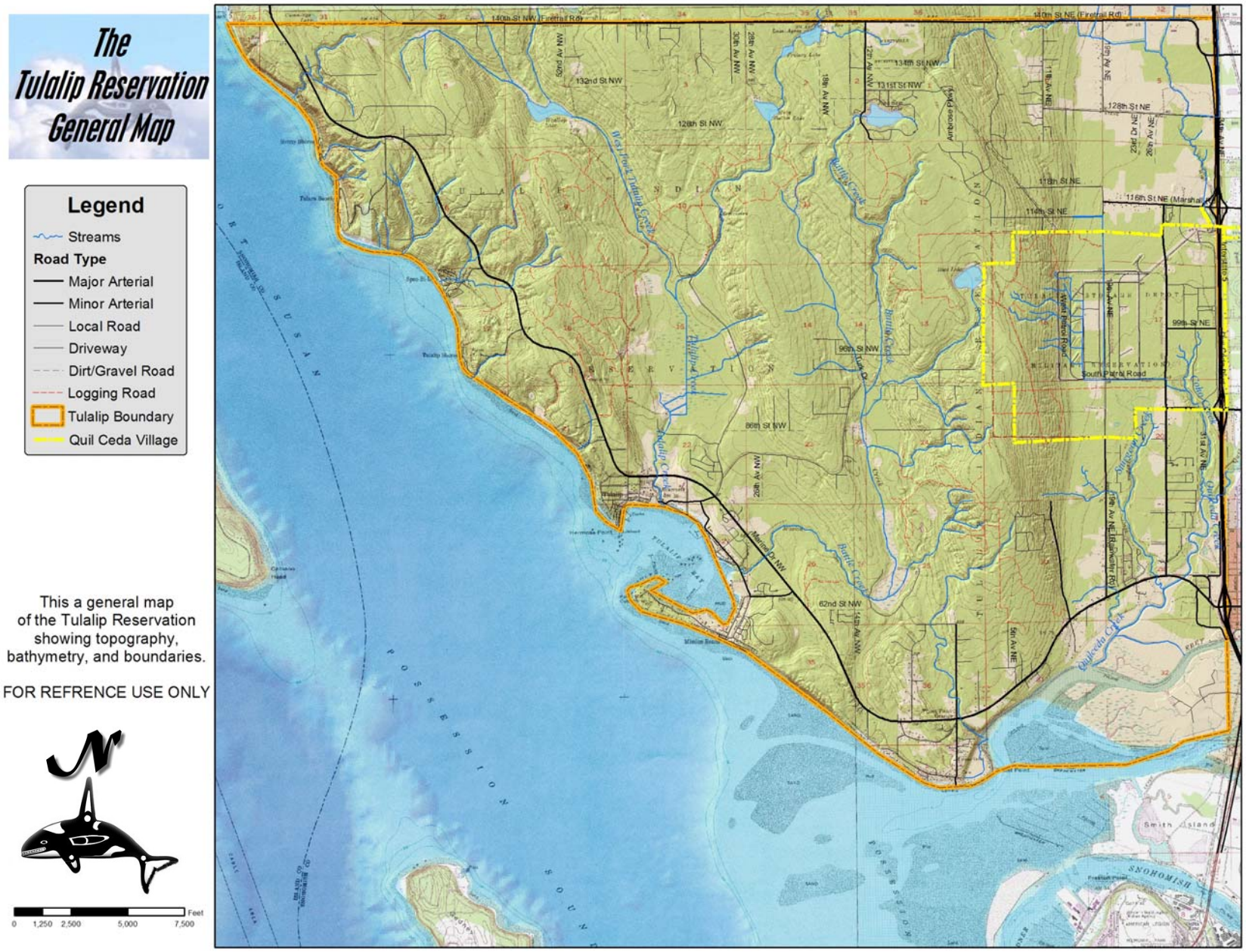
Figure 3-5: The Tulalip Reservation



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3.3. Climate

The Tulalip Tribes of Tulalip 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. On the Tulalip Reservation, the average temperature for January is 38° F and 63° F for July. Summer highs can be in the high 90s, while winter lows can reach 0°. Average annual rainfall is 35 inches. Winds vary in direction, but are predominantly southerly and westerly. Winter winds average 25 mph with gusts up to 50 mph not uncommon. 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 Tulalip Bay and the Snohomish River delta due to the proximity to Puget Sound.

3.4. Land Use and Future Development Trends

The Tulalip Reservation has a unique land ownership and land use system compared to other jurisdictions in Washington State. This is because the Tulalip Reservation is not a State; rather it is a sovereign nation within Washington State and held in Trust for its native inhabitants, namely Tulalip Tribes members, by the United States Federal government. Nonetheless, Federal policy and relations between Native Americans and non-native Americans, has led to about 11,400 acres or 48% of the land area being alienated or owned by non-natives. This land is referred to as Fee Land. With greater economic independence in recent years, the Tribe has been buying back alienated land. As of 2006, it is estimated that the Tribes and members now own about 60% of the Reservation land base.

The Treaty of Point Elliot or Muckl-te-oh of 1855 established the Reservation, to be reserved "for exclusive use[7]" by all the native inhabitants of the region. Article 3 defines the location and eventual use of the Reservation:

There is also reserved from out the lands hereby ceded the amount of thirty-six sections, or one township of land, on the northeastern shore of Port Gardner, and north of the mouth of Snohomish River, including Tulalip Bay and the before-mentioned Kwilt-seh-da Creek [Quil Ceda Creek]*, for the purpose of establishing thereon an agricultural and industrial school, as hereinafter mentioned and agreed, and with a view of ultimately drawing thereto and settling thereon all the Indians living west of the Cascade Mountains in said Territory. Provided, however, That the President may establish the central agency and general reservation at such other point as he may deem for the benefit of the Indians.[8]*

[7] Point Elliot Treaty 1855 http://www.nwifc.wa.gov/tribes/treaties/tpointell.asp
[8] ibid.

From 1883 to 1909, land was allotted to tribal members and family. After several years, Tribal members were free to sell their land to non-tribal members, and thus began the alienation process. **Figure 3-6** shows the allotment of lands from 1883 to 1909. Note the reserved land along Tulalip Bay and some of the family names on Tribal allotments, many of which are familiar today.

Presently, as of 2004, 11,392 acres are Fee land and 12,442 acres are Trust Lands. Of the 294 parcels held in trust, 180 are tribally owned and 114 are owned by tribal members. Furthermore, 47 parcels are Pending Trusts and 16 are Fee Simple. More recently about 300 acres of land was acquired in the Snohomish River delta near Marysville called Qwuloolt which is to be restored to tidal marshland. **Figure 3-7** shows the current land ownership of the Reservation. Please note the tribally owned parcel at Camano Head. This was the site of a landslide that killed many Tribal members' ancestors in the 1830s while clamming. It caused a small tidal wave, a tsunami, that then swept across Possession Sound and destroyed a village at Hat Island.

Zoning and Future Land Use

Figure 3-8 shows the current zoning of the land of the Tulalip Reservation. **Figure 3-9** shows the proposed future land use of the Tulalip Reservation. Note that Tribal Trust lands located along the steep landslide-prone bluffs are now designated as *Conservation.*

Figure 3-6: Original Allocation of 1883

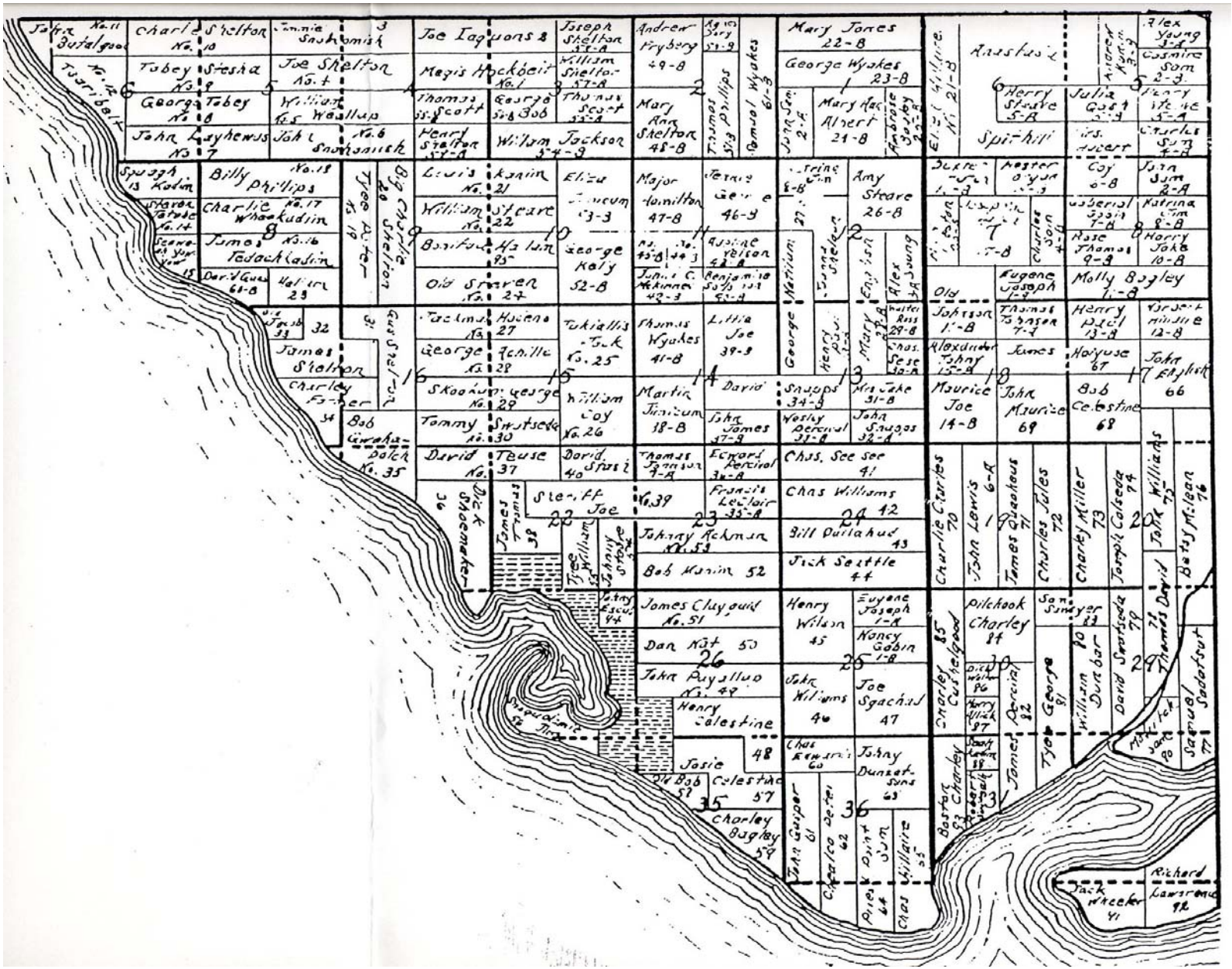

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Figure 3-7: 2004 Land Ownership

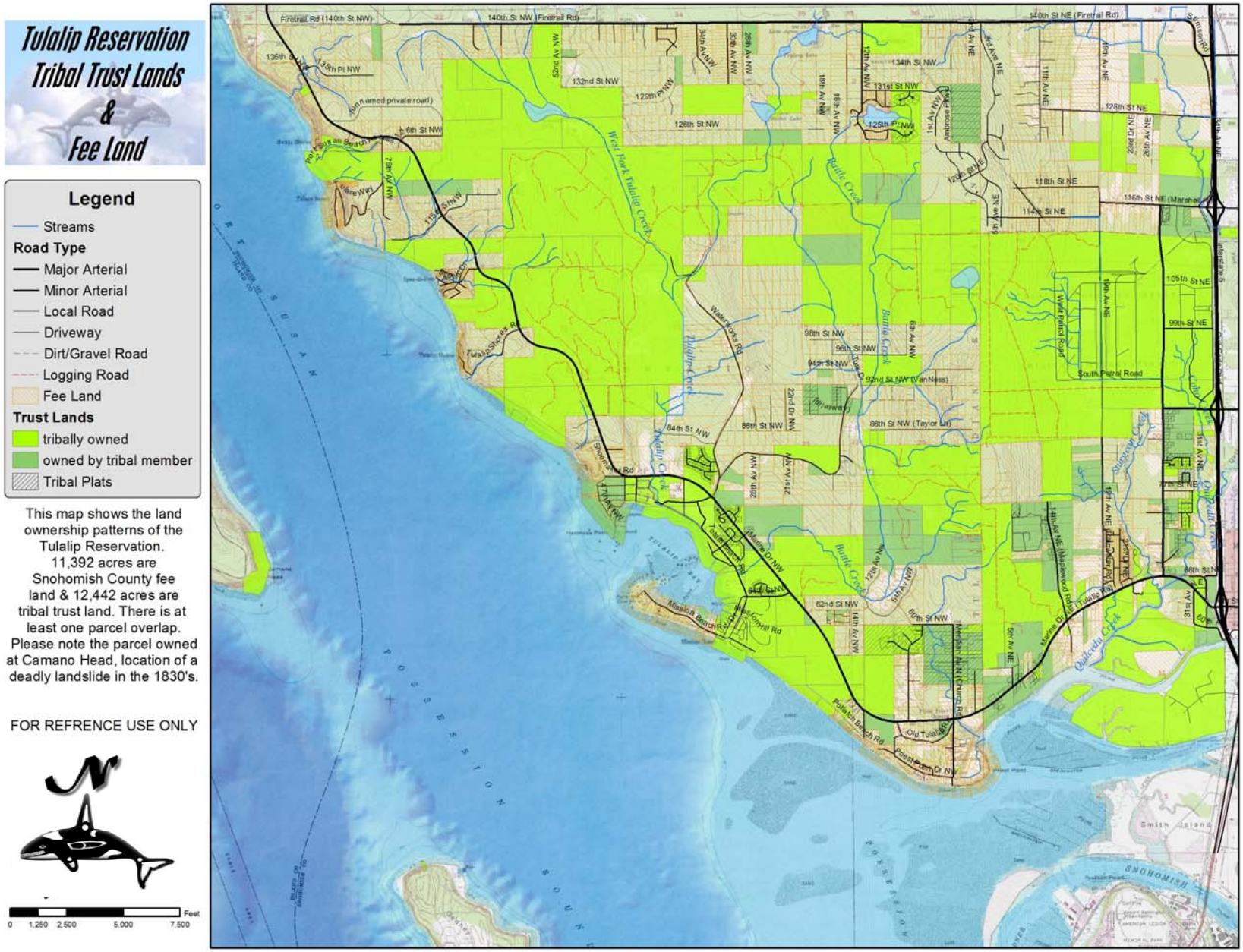

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Figure 3-8: 2004 Tulalip Reservation Zoning

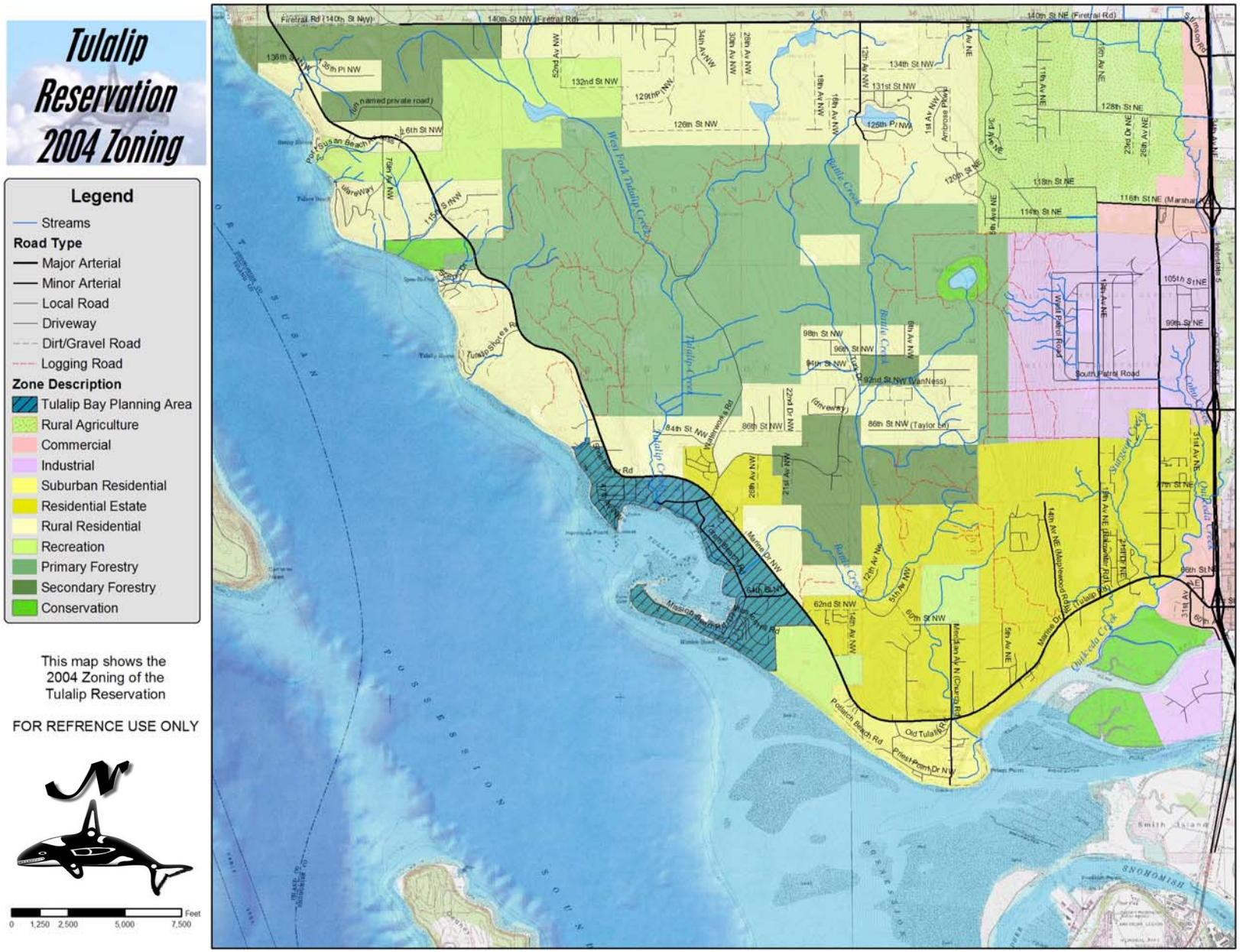

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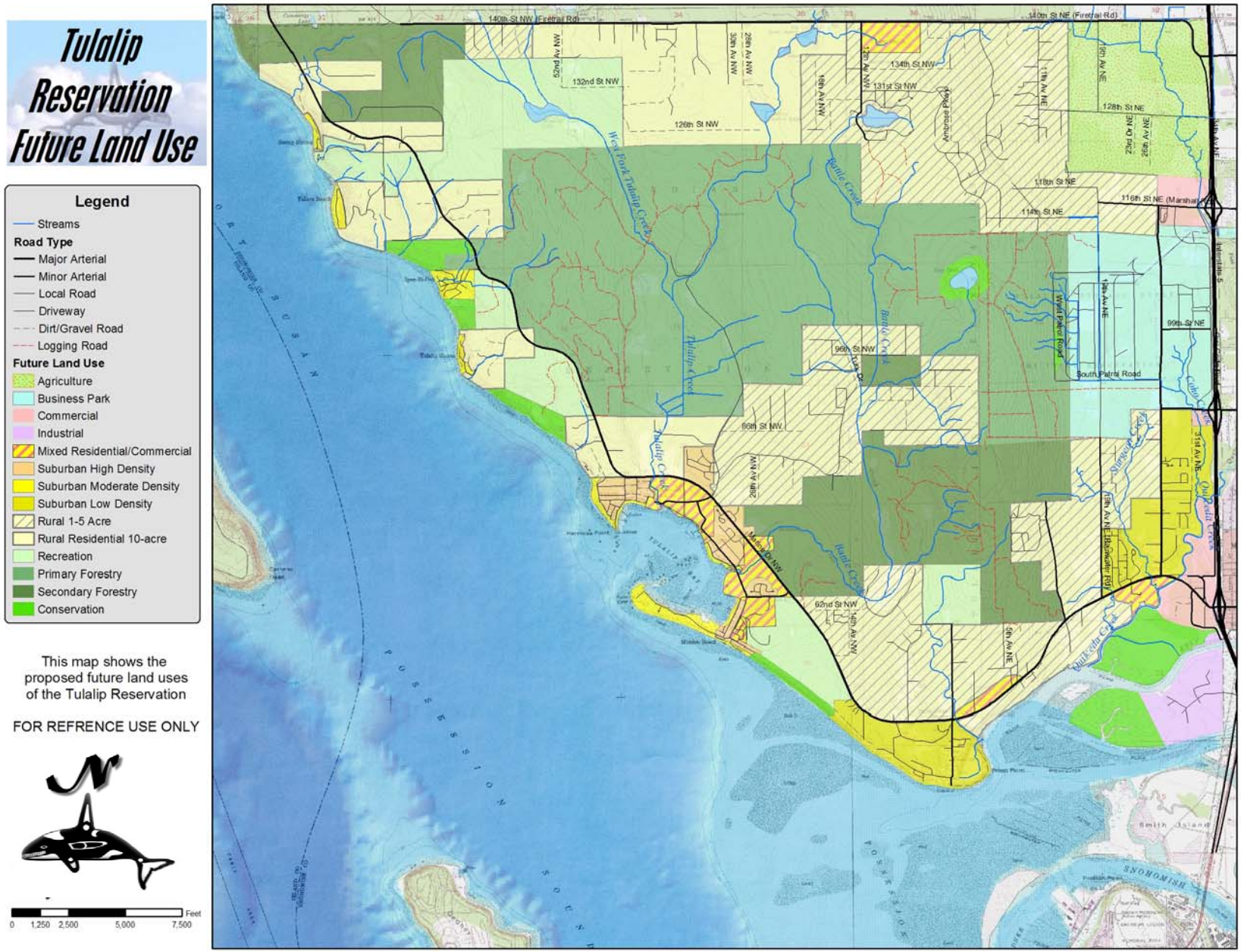
Figure 3-9: Tulalip Reservation Future Land Use



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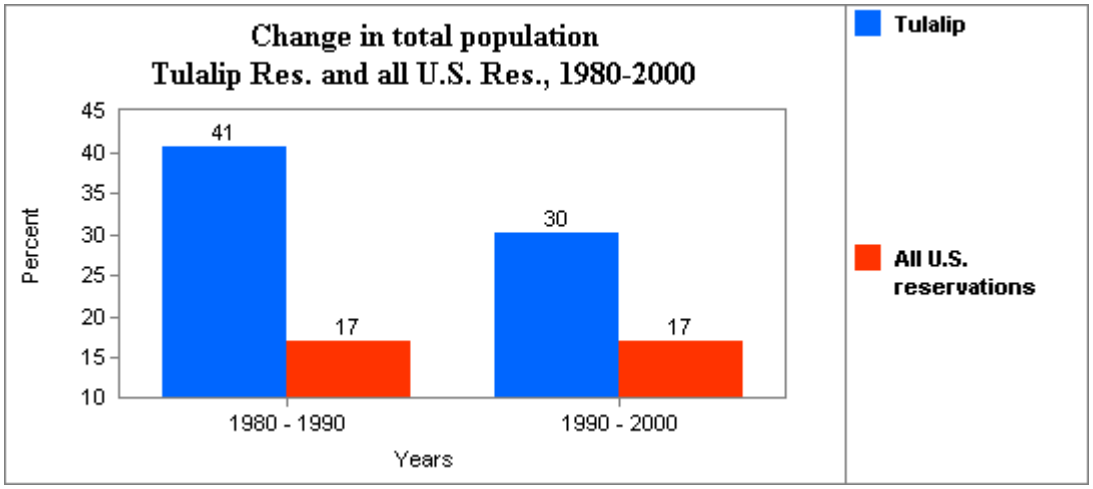
3.5. Demographics

This section will discuss the population characteristics of the Tulalip Reservation, and will also discuss why demographics are important to hazard mitigation planning, especially in terms of vulnerable populations. In general this section will discuss population characteristics of the Reservation as a whole and the Native American population in particular.

Tulalip Reservation General Population Characteristics[9]

The U.S. Census Bureau reported that 9,246 people of all races lived on the Tulalip Reservation in 2000, compared to 7,103 in 1990, and 5,046 in 1980. The population on the Tulalip Reservation increased by 30.2 percent from 1990 to 2000. Compared to other reservations across the United States, the Tulalip Reservation has experienced some of the highest growth. From 1990 to 2000, reservations in the United States grew about 17%. See **Figure 3-10**.

Figure 3-10: Tulalip's Growth Compared to All U.S. Reservations



The Tulalip Reservation is the home of the Tulalip Indians, a tribe formed under the Indian Reorganization Act of 1934. Native Americans, including tribal members, make up about 22% of the population. Whites make up the largest ethnic group, with 72.1%. During the last century, much of the Tribes' land was sold off to non-tribal interests, and thus the reason the Reservation has a large non-Native American population. Of those who reported being of mixed descent, 25% listed American Indian and almost 75% White as one of their ethnic groups. As of 2002, The Tulalip Tribes had 2,359 members living on reservation.

The Tulalip Reservation has 3,314 households, averaging 2.79 persons per household. Average family size is 3.17 persons. For Native Americans, the average household size is 3.38 persons, while average family size is 3.62 persons. In 2000 the Tulalip Reservation had 3,638 housing

[9] Office of Financial Management 2000 Census Community Profiles
http://www.ofm.wa.gov/census2000/profiles/reservation/280534290.pdf

units, 91.1% of which are occupied. Of all occupied housing on the Reservation, 82.1% of housing is owner occupied, while 17.9% is renter occupied. Native Americans occupy 590 housing units, 47.8% by owners and 52.2% by renters.

Why Consider Demographics in Hazard Mitigation Plans?

It is important for hazard-related plans to consider the demographics of the communities they seek to protect. Some populations experience greater risk from hazard events not because of their geographic proximity to the hazard but because of decreased resources and/or physical abilities. Elderly people, for example, may be more likely to be injured in a disaster and are also more likely to require additional assistance after a disaster. Research has shown that people living near or below the poverty line, the elderly and especially older single men, the disabled, women, children, ethnic minorities and renters have all been shown to experience, to some degree, more severe effects from disasters than the general population.

Vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during and after a hazard event, their capabilities during a hazard, and in access to resources for post-disaster recovery. Despite the fact that they often disproportionately experience the effects of a disaster, vulnerable populations are rarely accounted for in the current hazard planning process. There is a need for increased awareness of these differences.

The remainder of this section will detail the numbers of potentially vulnerable populations residing in Tulalip Reservation. Particular focus will be on the Tulalip Tribal members living on the Reservation. The general demographic information can be quite misleading in regards to the real social and economic situation faced by those living on the Reservation. The majority White population, who are generally in middle and upper incomes groups, hide the reality of the poverty, lack of education, and overall vulnerability of the Native American population. The demographic information for the Tulalip Reservation is based on the 2000 United States Census data and from information supplied by the State of Washington Office of Financial Management (OFM).

Income

Impoverished people are more adversely impacted from disasters than members of the general population. In the United States, individual households are expected to use private resources to prepare for, respond to, and recover from disasters to some extent. This expectation means that households living in poverty are automatically disadvantaged when confronting hazards. Additionally, the poor typically occupy the more poorly built and inadequately maintained housing of any given community. Mobile or modular homes, for example, are more susceptible to damage in hurricanes, tornadoes and floods than other types of housing. In urban areas, the poor often live in older houses and apartment complexes, which are more likely to be made of un-reinforced masonry, a building type that is particularly susceptible to damage during earthquakes.

The 2000 per capita income on the Tulalip Reservation was $19,858, while the median household income was $47,453. The incomes for Native Americans were significantly lower. Native American per capita income was $10,282, while median household income was $20,911. **Table 3-1** shows the comparison of income and poverty for the Native American population, the Reservation and Washington State. About 10% of Tulalip Reservation residents are below the poverty line (meaning they spend more than 1/3 of income on an economy food budget). Among Native Americans it is 25.4%. Among the population under 18 in Tulalip Reservation, 13.2% are below the poverty line, while amongst the Native population it is 21.5%. Among those 65 and older, 6.3% fall below the poverty line. For the 65 and older Native population, 41.5% fall below the poverty line.

Table 3-1: Population under the Poverty Line

	Median Household Income	Percent of total population below poverty line	Percent of children (18 & under) below poverty line	Percent of elderly (65 & older) below poverty line
Native American Population	**$33,214**	**25.4**	**21.5**	**41.5**
Tulalip Reservation	$47,453	10.1	13.2	6.3
Washington State	$45,776	10.6	13.2	7.5

Age Distribution

The vulnerability of elderly populations can vary quite significantly based on health, age, and economic security. However, as a group, the elderly are more apt to lack the physical and economic resources necessary for response, and are more likely to suffer health-related consequences making recovery slower. They are more likely to be vision, hearing, and/or mobility impaired, and more likely to experience mental impairment or dementia. Furthermore, they are more likely to live in assisted-living facilities, where emergency preparedness occurs at the whim of operators. Certainly, the elderly require specific planning attention, an especially important consideration given the current aging of the American population.

According to 2000 US Census Bureau data, 10.3% or 953 of Tulalip Reservation's population is 65 or older. This is less than the state average of 11.2%. Of this, 350, or 36.3% of elderly persons, have disabilities of some kind. For Native Americans, only 3.8% of the population is 65 or older, but 64.6% have a disability. **Figure 3-11** shows the distribution of age in Tulalip Reservation as a whole, while **Figure 3-12** shows the age distribution of Tulalip Tribal members living on the Reservation in 2002.

Figure 3-11: Tulalip Reservation Age Distribution

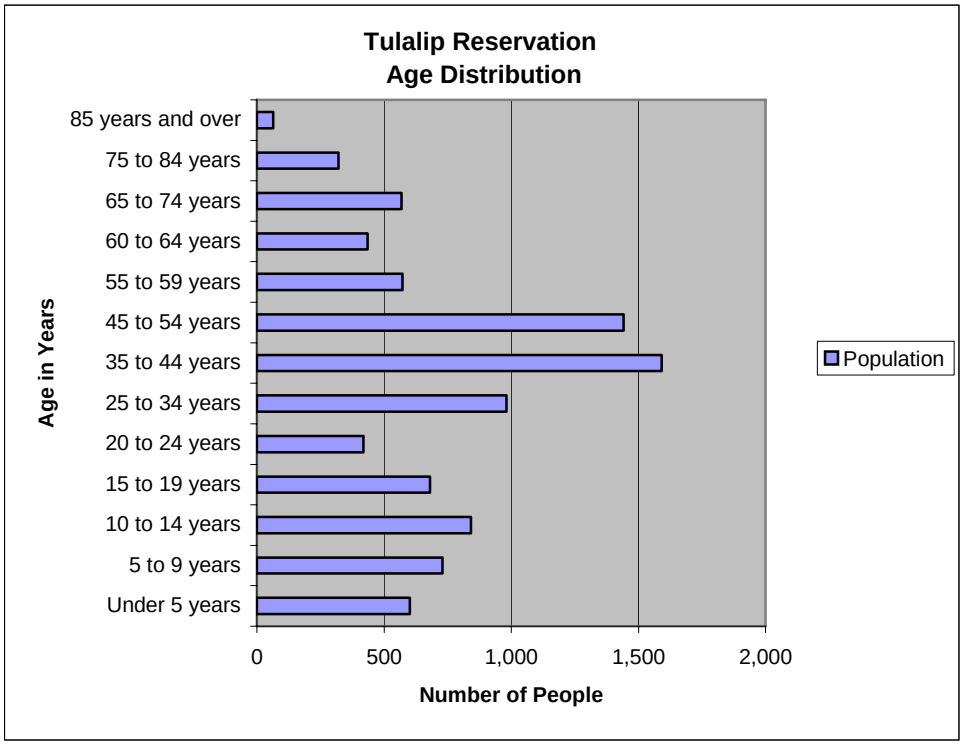
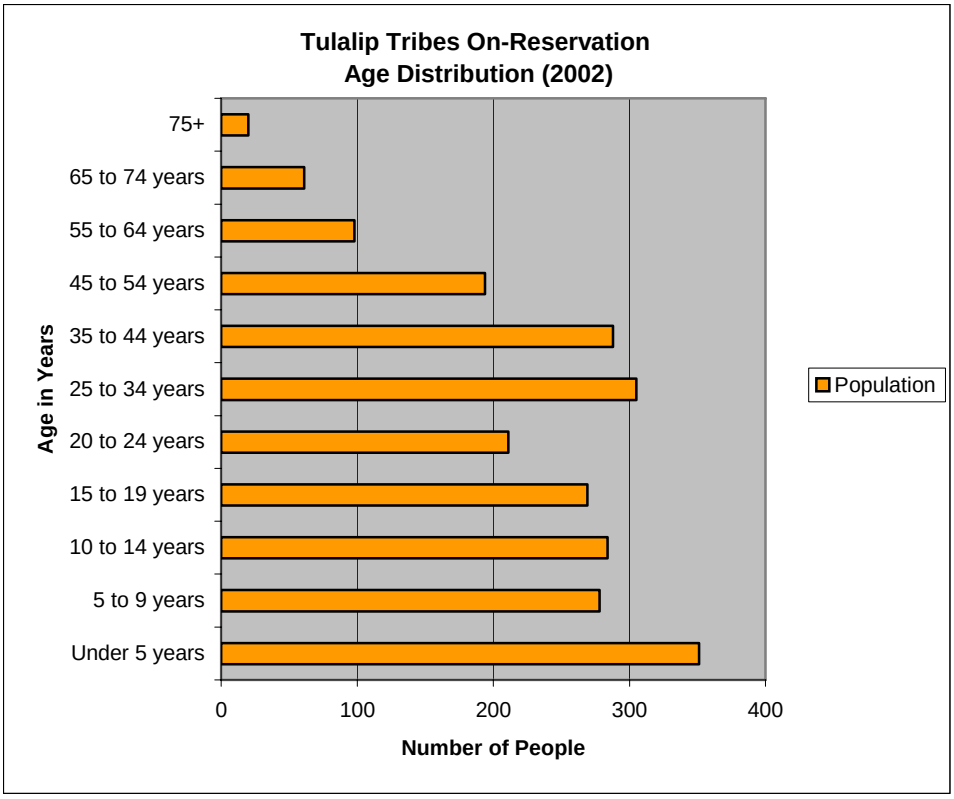


Figure 3-12: Tulalip Tribal Population Age Distribution

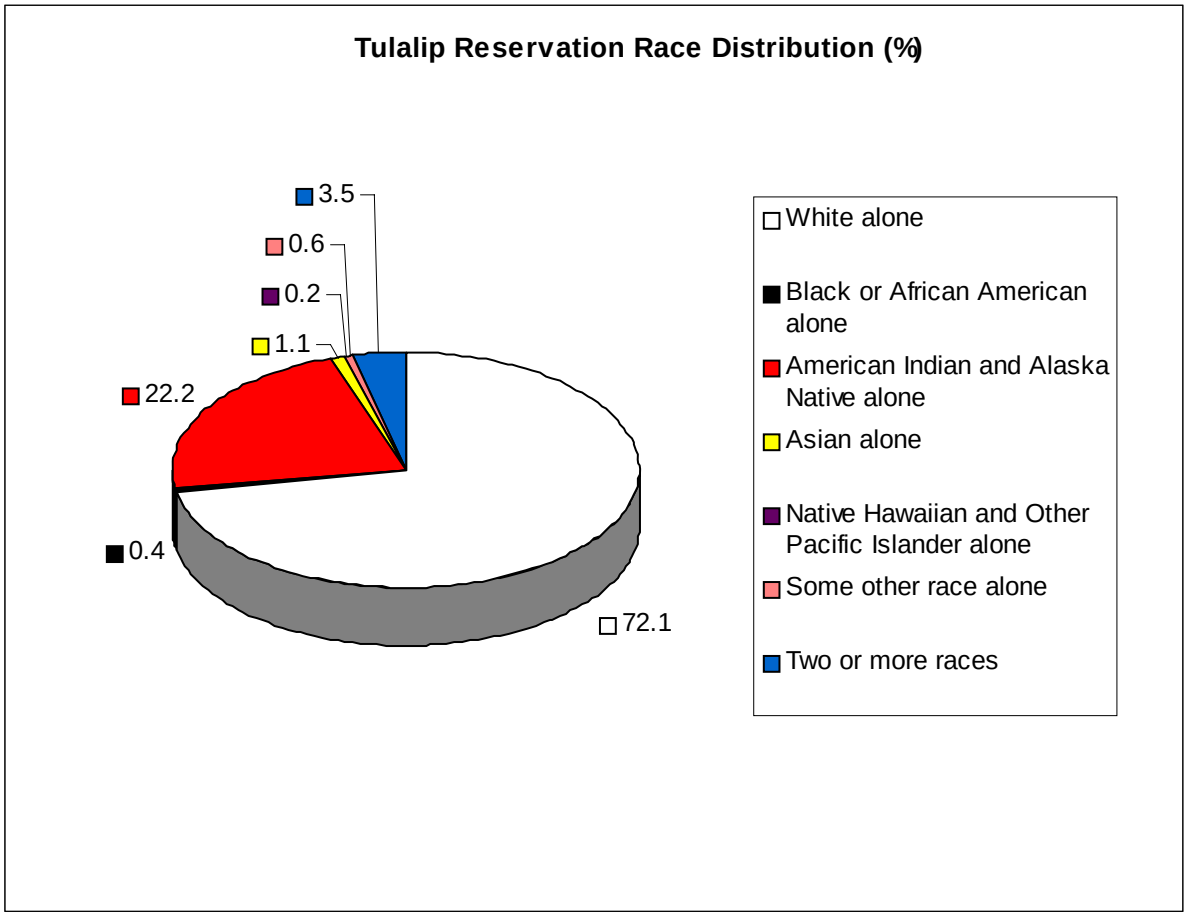


Race, Ethnicity and Language

Many researchers have focused on the increased disaster vulnerability that ethnic minorities experience in the United States. As one researcher has pointed out, "History is less likely to count minority victims in death tolls, and to minimize disasters that affect mostly minority victims as 'less disastrous' ".[10] Research shows that minorities are less likely to be involved in pre-disaster planning, experience higher mortality rates during an event, and post-disaster recovery can be ineffective and is often characterized by cultural insensitivity. Furthermore, because higher proportions of ethnic minorities live below the poverty line than the majority white population, poverty can compound vulnerability.

Racially, Tulalip Reservation is a generally homogenous area, with Native American tribal members and Whites being the largest ethnic groups. The next largest race is Asian, who number about 103 on the reservation. **Figure 3-13** shows the racial distribution of Tulalip Reservation.

Figure 3-13: Tulalip Reservation Race Distribution



[10] Steinberg 2000

Tulalip Reservation has a 4% foreign-born population. Approximately 1.8% or 152 of Tulalip Reservation's residents reported speaking English "less than 'very well' " in the 2000 Census.

The Native-American inhabitants are extremely vulnerable to the effects of hazards. Most Tribal members are poorer than their white counterparts who live on the Reservation, and are more likely to be less educated. Until recently, many Native Americans did not have access to, or did not know how to access basic services, such as health care and schooling. Furthermore, 2.4% of Native-American housing lacks complete plumbing facilities, 2.5% lack complete kitchen facilities and 10.8% do not have telephone service. Mitigation efforts should be focused on making Tribal members much more aware of natural hazards, and how to prepare and respond to them.

Disabled Populations

Because the disabled are significantly more likely to have difficulty responding to a hazard event than the general population, people living with disabilities have a special stake in emergency planning efforts. According to U.S. Census figures, 54 million American(s), roughly one-fifth of the U.S. population, live with a disability. These numbers are rising; furthermore, disabled populations are increasingly integrated into society.[11] This means that a relatively large segment of the population will require assistance during the 72 hours post-event, the period generally reserved for self-help.[12]

Disabilities can vary greatly in severity and permanence, making populations difficult to define and track. There is no "typical" disabled person, which can complicate disaster-planning processes that attempt to incorporate them. Furthermore, disability is likely to be compounded with other vulnerabilities, such as age, economic disadvantage and ethnicity, all of which mean that housing is more likely to be substandard. In fact, in at least one city, census data indicates that disabled populations are concentrated in older, higher-density housing that is more susceptible to earthquake damage.[13]

The Tulalip Reservation has generally the same percentage as the state of young people who are disabled, while a slightly higher percentage of adults 21-64 years old. The Reservation has a lower percentage of elderly who are disabled. For Native Americans, once again, the percentages are much higher (see **Table 3-2**).

Table 3-2: Disability Status of Non-Institutionalized Population

Age	Number on Tulalip Reservation	Percent of Age Group, Reservation	**Percent of Age Group, Native Americans**	Percent of Age Group, State
5-20 yrs	171	7.2	**10**	7.7
21-64 yrs	1,105	20.9	**24.2**	17.8
65+ yrs	350	36.3	**64.6**	42.8

[11] Bolin 1994
[12] Tierney et al. 1988
[13] Tierney et al. 1988

3.6. Economy

Development Trends

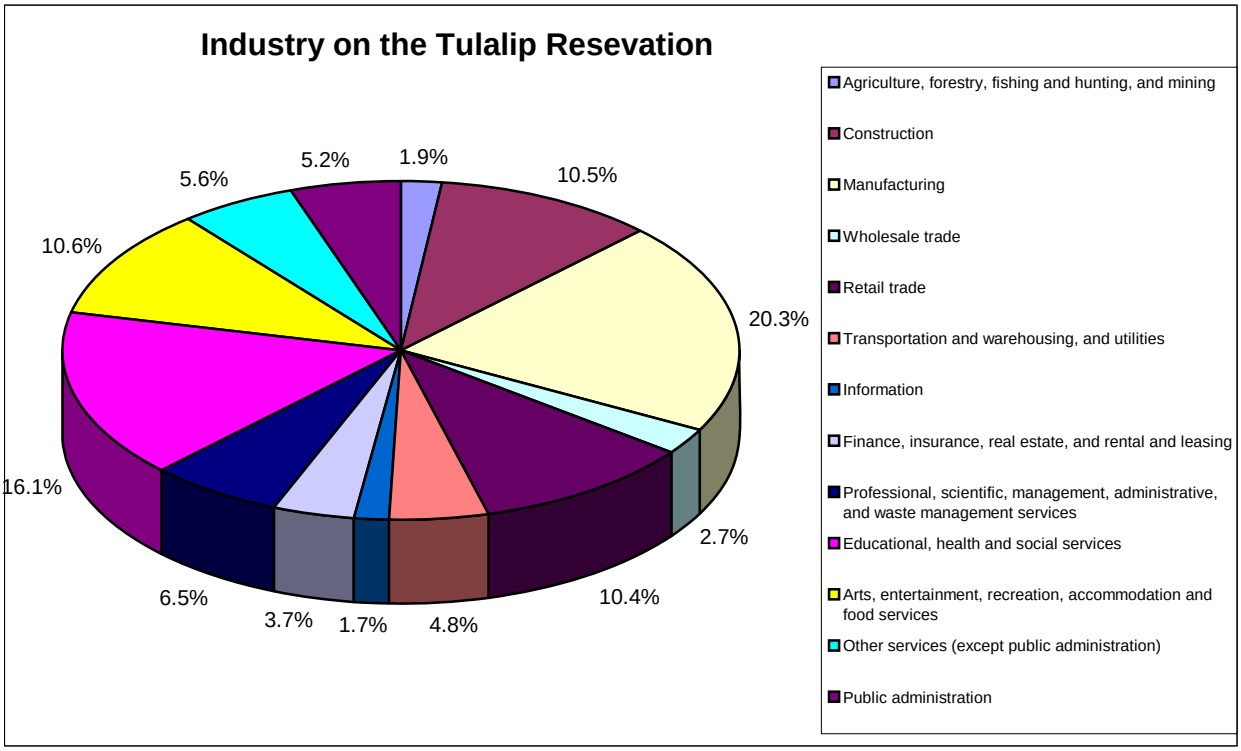
The 2000 Census reported that the Tulalip Reservation had 4,156 residents over the age of 16 who were employed, about 60% of the population. This is similar to the state average, with 61.4% of the population employed. Since the census has been taken, the Reservation has seen great increases in employment, due largely to the increase in local government, new retail operations along I-5 (such as Wal-Mart and Home Depot), and the new Tulalip Casino. Nonetheless much of this employment is low wage service-based jobs that do not offer much in terms of career advancement or economic independence. Unemployment continues to be a major problem among the Native American population. Unemployment statistics compiled by the Bureau of Indian Affairs found that in 2001, 26% of Tulalip Tribal membership living on-reservation were unemployed.

Industry

In 2000, the largest majority of residents were employed in the manufacturing industry. Other industries residents were employed in were Educational, Health and Social Service (16.1%), Arts, Entertainment, Recreation, Accommodation and Food Services, with 10.6% of the working population, Construction (10.5%), and Retail Trades, with 10.4%.[14] The Tulalip Tribes is the single largest employer on the Reservation, and the 4th largest in Snohomish County, with more than 3,000 jobs. For Native Americans, the leading industry for employment was Arts, Entertainment, Recreation, Accommodation and Food Services, with 38.3%, and Public Administration, with 12%. **Figure 3-14** shows the employment by industry for all Tulalip residents.

[14] U.S. Census Bureau 2000

Figure 3-14: Industry in Tulalip Reservation by Percentage of Jobs



Occupation

The Tulalip Reservation's residents are employed in a diverse field of occupations. For the residents of the Tulalip Reservation, the top three occupations are Management, Professional, and Related Occupations (25.8%), Sales and Office Occupations (23.4%), and Production, Transportation, and Material Moving Occupations (17.2%).[15] The mean travel time to work is 30.3 minutes. Although fishing accounts for only 1.9% of the employment and is listed as an occupation of 1.8% of residents, it is a very important industry for many Tribal members, many of whom rely on the food for sustenance and supplemental income. Figure 3-16 shows the occupations of Tulalip's Native American population in 2000. More than 40% are employed in service-based jobs. **Figure 3-15** shows percentages for occupations of residents on the Tulalip Reservation. Although fishing accounts for only 1.9% of the employment and is listed as an occupation of 1.8% of residents, it is a very important industry for many Tribal members, many of whom rely on the food for sustenance and supplemental income. **Figure 3-16** shows the occupations of Tulalip's Native American population in 2000. More than 40% are employed in service-based jobs.

[15] U.S. Census Bureau 2000

Figure 3-15: Occupation in Tulalip Reservation

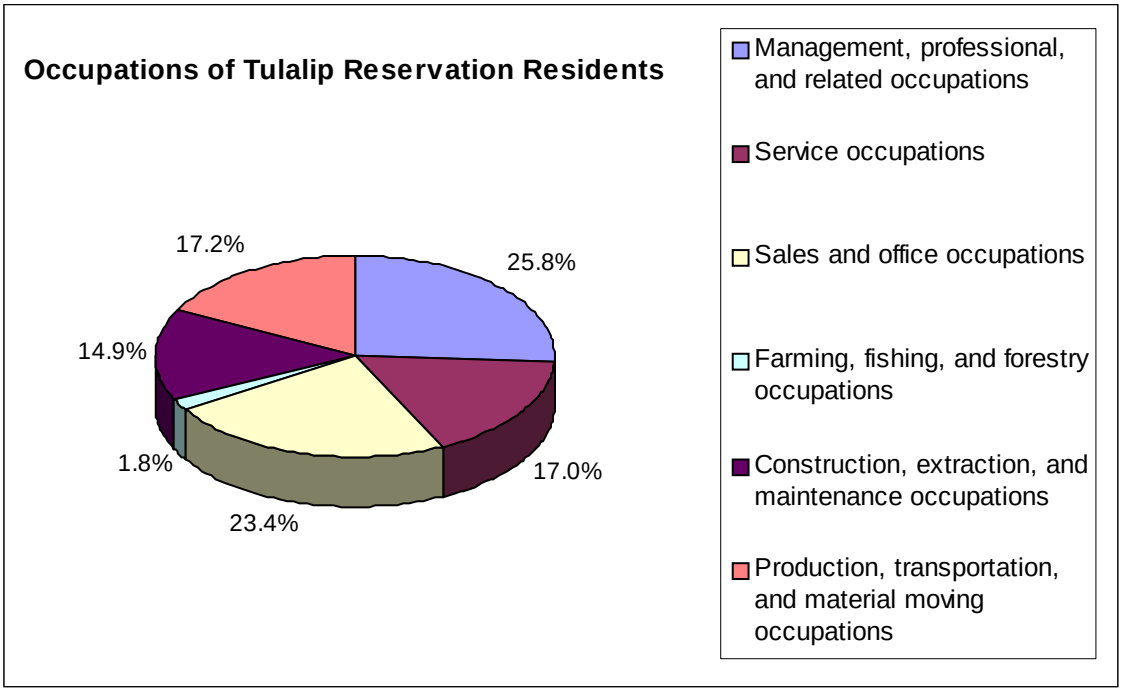
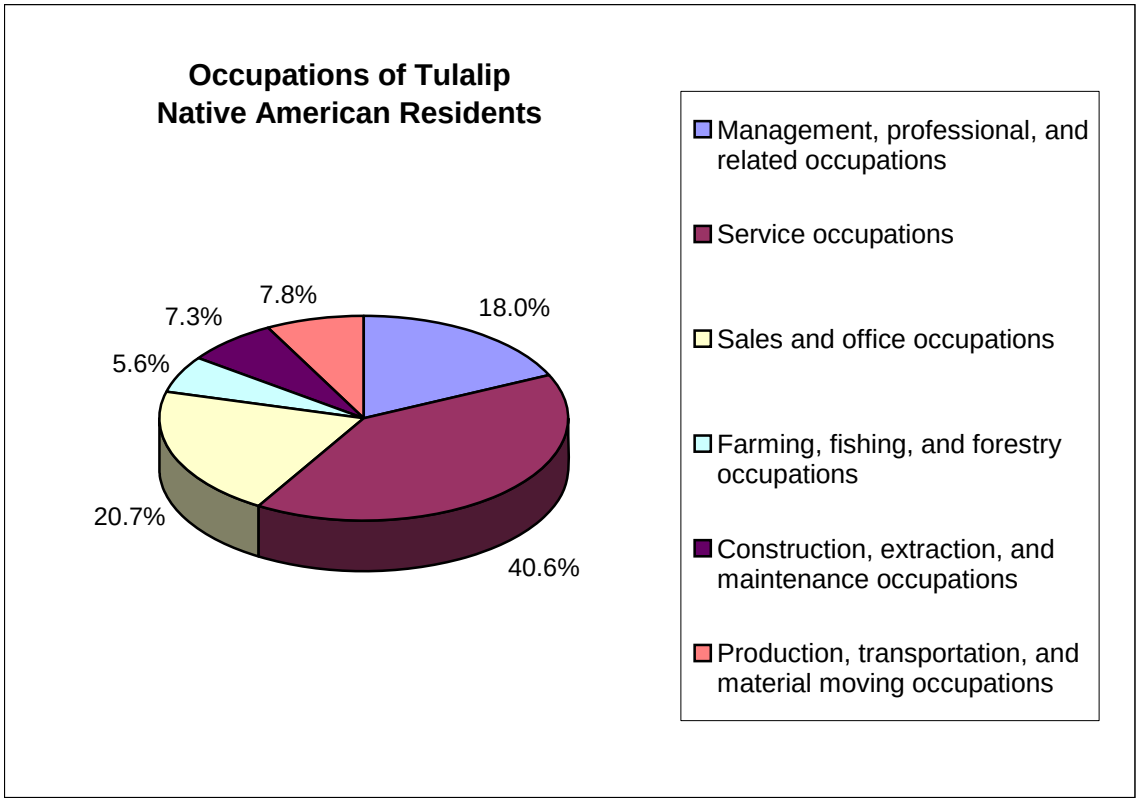


Figure 3-16: Occupation of Tulalip Native Americans



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4. Risk Assessment

4.1. Introduction

This chapter will look at the potential hazards that could affect the Tulalip Reservation, and then determine the vulnerabilities of people, property and the environment. An inventory and assessment of Tribally-owned property and critical facilities and infrastructure will be made to determine loss estimations. The geographic focus will be on the area of the Tulalip Reservation. In addition, one section will review the hazards that could affect Tulalip's Usual and Accustomed fishing areas (commonly called "U & A"). The format of the chapter will be as follows:

Section 4.1: Introduction and overview, including methodology and summary of findings
Sections 4.2-4.7: Detailed profiles of natural hazards affecting Tulalip, including loss estimations
Section 4.8: Hazardous Materials profile
Section 4.9: Profile of hazards affecting Usual and Accustom fishing area, including vulnerabilities
Section 4.10: Critical Facilities and Infrastructure assessments
Section 4.11: Hazard Risk Rating

Hazards Profiled

The first step in preparing a risk assessment for the Tulalip Reservation is to identify which natural hazards affect the Reservation. Numerous documents including the Washington State Hazard Mitigation Plan were analyzed. The 2004 Snohomish County Hazard Identification and Vulnerability Analysis (HIVA) analyzed 8 natural hazards to see if they affected the county region. They were:

- Avalanches
- Earthquakes
- Floods
- Landslides/Mass Movements
- Severe Weather
- Tsunamis/Seiches
- Volcanoes
- Wildfires

Further analysis was done to identify which of these hazards specifically affect the Tulalip Reservation. The study was conducted by analyzing data and maps used for the HIVA, and by interviewing Tribal and County officials. The hazards that could potentially affect the Reservation are:

- Earthquakes
- Floods

- Landslides/Mass Movements
- Severe Weather
- Tsunamis/Seiches
- Wildfires

These hazards were analyzed for the 2004 Tulalip local-level HMP. Avalanches and volcanic eruptions were excluded from the hazards studied. The Tulalip Reservation is located along the coast, and does not have the steep rugged mountains or snow cover needed to experience avalanches. The Tulalip Reservation is west of a volcano, Glacier Peak, but is not considered a risk to the Reservation due to river drainage courses and prevailing winds. Most ash and smoke (tephra) would blow east, particularly with the strong winds of the Convergence Zone. Lava and mudflows (lahars) would not flow through any watersheds that drain the Reservation. Brief mention will be made of these hazards in the section analyzing the Usual and Accustom fishing area though. A volcanic eruption would have severe effects on the natural environment and would disrupt fisheries that the Tulalip Tribes depend on.

Summary of Vulnerability and Losses

Overall the Tulalip Reservation and the Puget Sound estuary, of which the Tulalip Tribes' Usual and Accustomed fishing area is part, are extremely vulnerable to natural hazards. The Tulalip Reservation lies within one of the most seismically and volcanically active regions on Earth. In particular 2-3 crustal faults, of which little is known, run just north and south of the Reservation. Every year brutal winter storms batter the coast, flooding low lying areas and damaging property. The most recent event was the Super Bowl Storm of 2006, which inundated most of Priest Point. Furthermore the Reservation is walled by imposing unstable cliffs carved by recent glaciations that reach up to 300 feet high and can collapse at any time and without warning onto properties below.

This section will discuss the Presidential Declared Disasters that impacted Tulalip and the region in the past and then will give a summary of the potential losses estimated for each of the hazards profiled later in this chapter.

Presidential Declared Disasters

Presidential Declared Disasters are typically events that cause more damage than state, tribal and local governments/resources can handle without the assistance of the federal government. Generally there is not a specific dollar loss threshold that must be met. A Presidential Major Disaster Declaration puts into motion long-term federal recovery programs, some of which are matched by state programs, and designed to help disaster victims, businesses, and public entities.[16]

[16] FEMA, http://www.fema.gov/library/dproc.shtm

Historically, Snohomish County has had 18 Presidential Declared Disasters with the frequency increasing over the past ten years. The most recent declaration occurred May 17th, 2006 for the Super Bowl Storm. These are listed in **Table 4-1**. It is not known at this time how much damage the Tulalip Reservation received from these disasters, nor how much financial assistance was given to Tribal members and residents of the Reservation. It has been noted by Tribal staff during meetings that the Tulalip Tribes had difficulty getting assistance after the Nisqually earthquake in 2001. For future events, it is essential that the Tulalip Tribes apply directly to FEMA for disaster assistance rather than through Snohomish County. Not only will a better assessment be made of damages, but more financial assistance is possible.

Table 4-1: Presidential Declared Disasters

Disaster #	Type of Event	Date
137	Flood, Wind	October-62
185	Flood	December-64
196	Earthquake	May-65
492	Flood	December-75
545	Flood, Landslide	December-77
612	Flood	December-79
623	Volcano	May-80
784	Flood	November-86
883	Flood	November-90
896	Flood	December-90
981	Wind	January-93
1079	Flood	Nov-Dec 1995
1100	Flood	Jan-Feb 1996
1159	Ice, Wind, Snow, Landslide, Flood	Dec 1996-Feb 1997
1172	Flood, Landslide	March-97
1361	Earthquake	February-01
1499	Severe Storm, Flooding	November-03
1641	Severe Storms, Flooding, Tidal Surge, Landslides, and Mudslides	May 17th, 2006 (for storm Jan. 27-Feb 4th, 2006)

Summary of Loss Estimations for each Hazard

As stated above, this part will summarize the total estimated losses for each natural hazard that could affect the Tulalip Reservation. This estimate includes losses to all structures, not just tribally owned or controlled. More detail on how these estimates based on FEMA methodology were derived can be found in each hazard profile. It should be

noted though that these estimates are based on worse-case scenarios and on preliminary, incomplete data. It is generally impossible to predict exactly what damage an event will incur, but nonetheless general estimates can be made to guide planning, preparedness, response and better decision making. Furthermore it can also help increase awareness of the potential effects of natural disasters. These loss estimates also do not take into account potential economic losses, which in many cases may be worse than structural and content losses.

Earthquakes:

Estimated loss to earthquake-prone structures: **$47,416,702**

Estimated loss to contents: **$23,708,351**

Floods:

Estimated loss to flood-prone structures: **$12,102,237**

Estimated loss to contents: **$9,076,678**

Landslides:

Estimated loss to landslide-prone structures: **$22,596,640**

Estimated loss to contents: **$2,054,240**

Severe Weather:

Estimated loss to severe weather-prone structures: **$14,196,618**

Estimated loss to contents: **$7,098,309**

Tsunami:

Estimated loss to tsunami-prone structures: **$66,181,675**

Estimated loss to contents: **$3,090,837**

Wildfires:

Estimated loss to wildfire-prone structures: **$1,815,650**

Estimated loss to contents: **$453,913**

Estimated loss to land/natural resources: **$3,549,110**

Methodology of Hazard Profiles

The next 6 sections will profile, in detail, each of the hazards mentioned above, and will answer the question of "how bad could each hazard be?" Maps will be shown detailing the location where the hazard may affect the Reservation. A discussion of past occurrences will be made. The profile will also discuss the frequency of the hazard occurring, how severe it could be, and the amount of warning time the community has to prepare for, or evacuate from, the hazard event.

Included in each hazard profile will be an inventory of the assets, such as buildings, infrastructure, and people that could be affected by each of the hazard events. Each section will conclude with a loss estimation that will determine, in monetary terms, how much the Reservation could be affected by a hazard event.

The results of this risk assessment will be summarized and ranked according to severity and will be discussed in Section 4.11.

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4.2. Earthquakes

Definitions

Benioff Earthquake: Sometimes called "deep quakes," these occur in the Pacific Northwest when the Juan de Fuca plate breaks up underneath the continental plate, approximately 30 miles beneath the earth's surface.

Crustal Earthquake: Crustal quakes occur at a depth of 5 to 10 miles beneath the earth's surface and are associated with fault movement within a surface plate.

Earthquake: An earthquake is the shaking of the ground caused by an abrupt shift of rock along a fracture in the earth such as a fault or a contact zone between tectonic plates. Earthquakes are measured in both magnitude and intensity.

Intensity: Intensity is a measure of the effects of an earthquake. It is measured by the Modified Mercalli scale and is expressed in Roman numerals.

Liquefaction: Liquefaction is the complete failure of soils, occurring when soils lose shear strength and flow horizontally. It is most likely to occur in fine grain sands and silts, which behave like viscous fluids when liquefaction occurs. This situation is extremely hazardous to development on the soils that liquefy, and generally results in extreme property damage and threats to life and safety.

Magnitude: Magnitude is the measure of the strength of an earthquake, and is typically measured by the Richter scale. As an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

Peak Ground Acceleration: Peak Ground Acceleration (PGA) is a measure of the highest amplitude of ground shaking that accompanies an earthquake, based on a percentage of the force of gravity.

Subduction Zone Earthquake: This type of quake occurs along two converging plates, attached to one another along their interface. When the interfaces between these two plates slips, a sudden, dramatic release of energy results, propagated along the entire fault line.

General Background

The Puget Sound region is seismically active, with hundreds of earthquakes occurring each year. Most of these earthquakes are so small only sensitive instruments can detect them. However, at least 20 damaging earthquakes have occurred in Western Washington during the past 125 years. Large quakes in 1946, 1949, 1965 and 2001 killed 16 people and caused more than $3.59 billion (2004 dollars) in property damage. In fact, recent seismic studies have increased concern among the scientific and engineering communities regarding both magnitude and frequency of damaging earthquakes in the Pacific Northwest.

More than 90% of all Pacific Northwest earthquakes occur along the crustal plate boundary between the Juan de Fuca plate and the North American plate. Seismicity catalogs are the fundamental tool used to determine where, how often, and how big earthquakes are likely to be. However, because of the short time (from a geological perspective) that written records have been kept and the relative infrequency (from a human perspective) of such events, seismicity statistics are necessarily based on historically short catalogs.

The results from examining the historical record, monitoring seismic and geodetic changes, and study of the geologic record are combined to characterize seismic sources. This data is used to identify seismic source zones, the regions of the earth's crust where earthquakes occur. Although there are large uncertainties associated with source characterization (we have not yet figured out how to place instruments in the crust at the depths where earthquakes are generated), the Pacific Northwest has been studied extensively in recent years and some valuable new insights have been developed as a result of this attention. It is now generally agreed that three source zones exist for Puget Sound quakes: a shallow (crustal) zone; the Cascadia Subduction zone; and a deep or intraplate ("Benioff") zone.

Estimating the expected ground motion at a given distance from an earthquake of a certain magnitude is the second element of earthquake hazard assessment. The parameters that must be identified in order to estimate ground motions at any location are:

earthquake magnitude,

type of faulting,

distance of the site from the epicenter,

and local site conditions (hard rock, soft rock, stiff soil, soft soil, etc).

Hazard values calculated for rock/stiff soil (the most common classifications) are lower than hazard values calculated for unconsolidated or soft soil sites typically found along river valleys. The type of faulting is also important because high angle reverse thrust displacements (most common in Puget Sound shallow fault zones) are far more damaging than, for example, strike-slip faults.

The third element of earthquake hazard assessment, the actual calculation of expected ground motion values, involves determining the annual probability that certain ground motion accelerations will be exceeded, then summing over the time period of interest. The most commonly mapped ground motion parameters are the horizontal and vertical **peak ground accelerations** (**PGA**) for a given site classification (soil or rock type). Maps of PGA values now form the basis of seismic zone maps that are included in building codes, including the U.S. Uniform Building Code (UBC). Building codes that include seismic provisions specify the horizontal force due to lateral acceleration that a building should be able to withstand during an earthquake. PGA values are directly related to these lateral forces that could damage "short period structures" (i.e. single-family dwellings, the most common structures in the county). Maps of longer period spectral response components may also need to be developed to determine the lateral

forces that damage larger structures with longer natural periods (apartment buildings, factories, high-rises, bridges).

Earthquakes are caused by the fracture and sliding of rock within the Earth's crust. The Earth's crust is divided into eight major pieces (or plates) and many minor plates. These plates are constantly moving, very slowly, over the surface of the globe. As these plates move, stresses are built up in areas where the plates come into contact with each other. Within seconds, an earthquake releases stress that has slowly accumulated within the rock, in some instances over hundreds of years. Sometimes the release occurs near the surface, and sometimes it comes from deep within the crust.[17]

The impact of any earthquake event is largely a function of ground shaking, liquefaction and distance from the source of the quake. Liquefaction results generally in softer, unconsolidated soils. A program called the National Earthquake Hazard Reduction Program (NEHRP) creates maps based on soil characteristics so that locations potentially subject to liquefaction may be identified. **Table 4-2** provides a description of the NEHRP soil classification.

Table 4-2: NEHRP Soil Classification System

NEHRP Soil Type	Description	Mean Shear Velocity to 30 m (m/s)
A	Hard Rock	1500
B	Firm to Hard Rock	760-1500
C	Dense soil, soft rock	360-760
D	Stiff Soil	180-360
E	Soft clays	<180
F	Special study soils (liquefiable soils, sensitive clays, organic soils, soft clays > 36 m thick)	

The degree of ground shaking (or damage) caused by an earthquake is often assigned a numerical value from Roman Numeral I to XII on the Modified Mercalli (MM) Scale and is referred to as intensity. This helps to assess and understand the physical affects of the earthquake. **Table 4-3** provides a comparison of Peak Ground Acceleration to the MM Intensity scale.[18]

[17] http://www.metrokc.gov/prepare/hiva/earthquakes.htm
[18] Cascadia Region Earthquake Workgroup, Professor Anthony Qamar, University of Washington

Table 4-3: Mercalli Scale and Peak Ground Acceleration Comparison

MMI	Potential Damage	Est. PGA	Source
I	None	< .017	USGS
II – III	None	.017	USGS
IV	None	.014 - .039	USGS
V	Very Light	.039 - .092	USGS
VI	None to Slight USGS – Light	.02-05	Munich Re-ins
	URM[19] – stair-step cracks	.04-.08	Goettle
		.06 - .07	Bolt 1988
	Damage to chimneys	.06 - .13	Table 3.2 Seismic Provisions
	Threshold of damage	.092 - .18	USGS
VII	Slight – Moderate USGS - Moderate	.05.-10	Munich Re-ins
	URM – Significant cracking of parapets; masonry may fall	.08-.16	Goettle
		.10 - .15	Bolt
		.1	Trifunac 1976
	Threshold of structural damage	.18 - .34	USGS
VIII	Moderate – Extensive USGS – Moderate to Heavy	.10 - .20	Munich Re-ins
	URM – extensive cracking; fall of parapets and gable ends	.16 - .32	Goettle
		.25 - .30	Bolt 1988
		.13 - .26	Table 3.2 NEHRP
		.2	Trifunac 1976
		.35 - .65	USGS
IX	Extensive – Complete USGS - Heavy	.20 - .50	Munich Re-ins
	Structural collapse of some URM buildings; walls out of plane Damage to seismically designed structures	.32 - .55	Goettle
		.50 - .55	Bolt 1988
		.26 - .44	Table 3.2
		.3	Trifunac 1976
		.65 – 1.24	USGS

[19] URM: Unreinforced Masonry

MMI	Potential Damage	Est. PGA	Source
X	Complete Ground Failures USGS- Very Heavy (X+)	.50 – 1.00	Munich Reins
	Structural collapse of most URM buildings	.55 - .80	Goettle
		>.6	Bolt 1988
	Notable damage to seismically designed structure	.44 - .64	bldgs w T >.5
	Ground Failures	> 1.24	USGS

Richter Scale[20]

The Richter magnitude scale was developed in 1935 by Charles F. Richter of the California Institute of Technology as a mathematical device to compare the size of earthquakes. The magnitude of an earthquake is determined from the logarithm of the amplitude of waves recorded by seismographs. Adjustments are included for the variation in the distance between the various seismographs and the epicenter of the earthquakes. On the Richter Scale, magnitude is expressed in whole numbers and decimal fractions. For example, a magnitude 5.3 might be computed for a moderate earthquake, and a strong earthquake might be rated as magnitude 6.3. Because of the logarithmic basis of the scale, each whole number increase in magnitude represents a tenfold increase in measured amplitude; as an estimate of energy, each whole number step in the magnitude scale corresponds to the release of about 31 times more energy than the amount associated with the preceding whole number value.

At first, the Richter Scale could be applied only to the records from instruments of identical manufacture. Now, instruments are carefully calibrated with respect to each other. Thus, magnitude can be computed from the record of any calibrated seismograph. Earthquakes with magnitude of about 2.0 or less are usually call micro-earthquakes; they are not commonly felt by people and are generally recorded only on local seismographs. Events with magnitudes of about 4.5 or greater - there are several thousand such shocks annually - are strong enough to be recorded by sensitive seismographs all over the world. Great earthquakes, such as the 1964 Good Friday earthquake in Alaska, have magnitudes of 8.0 or higher. On the average, one earthquake of such size occurs somewhere in the world each year. Although the Richter Scale has no upper limit, the largest known shocks have had magnitudes in the 8.8 to 8.9 range. Recently, another scale called the moment magnitude scale has been devised for more precise study of great earthquakes. The Richter Scale is not used to express damage. An earthquake in a densely populated area which results in many deaths and considerable damage may have the same magnitude as a shock in a remote area that does nothing more than frighten the wildlife. Large-

[20] http://vulcan.wr.usgs.gov/Glossary/Seismicity/description_earthquakes.html

magnitude earthquakes that occur beneath the oceans may not even be felt by humans. **Table 4-4** shows a description of Richter scale magnitudes.

Table 4-4: Richter Scale

Descriptor	Richter magnitudes	Earthquake Effects	Frequency of Occurrence (worldwide)
Micro	Less than 2.0	Micro-earthquakes, not felt.	About 8,000 per day
Very minor	2.0-2.9	Generally not felt, but recorded.	About 1,000 per day
Minor	3.0-3.9	Often felt, but rarely causes damage.	49,000 per year (est.)
Light	4.0-4.9	Noticeable shaking of indoor items, rattling noises. Significant damage unlikely.	6,200 per year (est.)
Moderate	5.0-5.9	Can cause major damage to poorly constructed buildings over small regions. At most slight damage to well-designed buildings.	800 per year
Strong	6.0-6.9	Can be destructive in areas up to about 100 miles across in populated areas.	120 per year
Major	7.0-7.9	Can cause serious damage over larger areas.	18 per year
Great	8.0-8.9	Can cause serious damage in areas several hundred miles across.	1 per year
Rare great	9.0 or greater	Devastating in areas several thousand miles across.	

Hazard Profile

Earthquakes were profiled for The Tulalip Reservation by using two methodologies: using GIS data to determine the location of earthquakes, and particularly the NEHRP soils that can exaggerate the effects of an earthquake, and by using Hazus-MH, which was used to model the potential severity of different types of earthquakes, and how the Reservations' assets could be affected. The sections below will profile, in detail, the earthquake hazard as it affects the Tulalip Reservation.

Past Events

There have been several earthquakes in the past that have affected the Puget Sound Region and more specifically the Tulalip Reservation. The actual effect of these earthquakes on the Tulalip Reservation has been less severe that in other areas within the region, but nonetheless significant damage has occurred to the older and dilapidated

structures occupied by tribal members. **Table 4-5** is a summary of large earthquakes that have occurred in the Puget Sound Region.[21]

Table 4-5: Large Earthquakes in the Puget Sound Region

Date	Location	Magnitude	Type
1872	North Cascades	7.4	Crustal Zone
1882	Olympic Area	6.0	Benioff Zone
1909	Puget Sound	6.0	Benioff Zone
1915	North Cascades	5.6	--
1918	Vancouver Island	7.0	--
1920	Puget Sound	5.5	--
1932	Central Cascades	5.2	Crustal Zone
1939	Puget Sound	5.8	Benioff Zone
1945	North Bend	5.5	Crustal Zone
1946	Puget Sound	6.3	Benioff Zone
1946	Vancouver Island	7.3	Benioff Zone
1949	Olympia	7.1	Benioff Zone
1965	Puget Sound	6.5	Benioff Zone
1981	Mt. St. Helens	5.5	Crustal Zone
1990	NW Cascades	5.0	Crustal Zone
1995	Robinson Point	5.0	Crustal Zone
1996	Duvall	5.6	--
2001	Nisqually\Puget Sound	6.8	Benioff Zone

1872, 75 miles northeast of Everett: This shallow earthquake had a magnitude of approximately 7.4 on the Richter scale. This was approximately 75 miles northeast of Everett near Mount Baker and just east of the Cascade crest (largest recorded earthquake in Washington). No record of any fatalities in Snohomish County.

1949, Nisqually Delta Area north of Olympia: This earthquake had a magnitude of 7.1 on the Richter scale. The Snohomish County zone that experienced the most intense effects extended along the South Stillaguamish River valley from Granite Falls to Arlington, and along the Snohomish and Skykomish River Valleys from Everett to Snohomish and Monroe. Within this area the effects included fallen chimneys and

[21] Hazard Identification and Vulnerability Analysis, King County Office of Emergency Management. September 1998

building cornices; cracked plaster; broken water and gas mains; damaged docks, bridges, and water storage tanks; cracked ground and pavement; and landslides, mudflows and debris slides.

1996, Duvall: This earthquake had a magnitude of 5.6 on the Richter scale. Near the epicenter, merchandise fell off of shelves and at least one resident reported a cracked chimney. In Snohomish County, 16,000 residents were reportedly without power for several hours as a result of breakers tripping in four substations. Monroe experienced damage buildings. There was, however, no report of physical damage to electrical power facilities.[22]

2001, Nisqually Delta Area North of Olympia: This earthquake had a magnitude 6.8 on the Richter scale. Snohomish County had damages that were between $2 million and $3 million for public and private sector combined. There were 13 minor injuries. A few older unreinforced masonry structures suffered significant damage, but there were no building collapses in the county. The greatest shaking and highest percentage of damaged structures were in the main stem river valleys and the cities or towns built along the rivers: Darrington, Sultan, Monroe and Snohomish. The Tulalip Tribes also experienced significant damage to its structures and housing. Although exact figures are not known, it is estimated that at least 80% of Tribal housing experienced damage from the quake.

Location

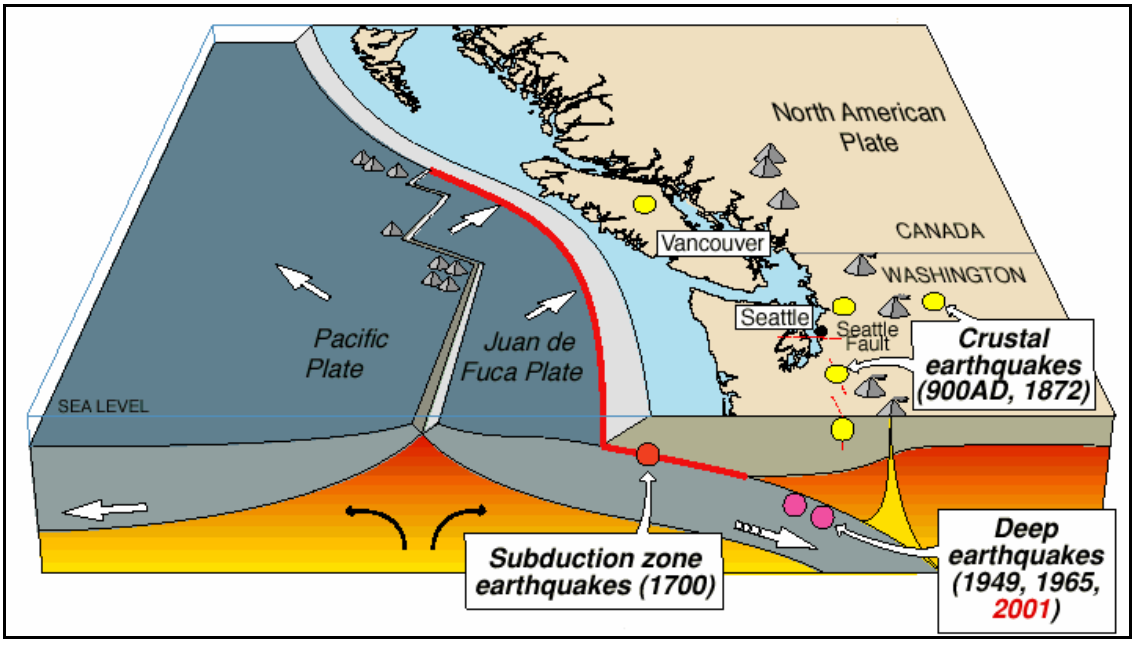
The Tulalip Reservation is located in one of the most earthquake prone regions of the United States. This section will detail the different types of earthquakes that can affect the Reservation. There will also be a discussion of the soil make-up of the Reservation to identify areas of highest concern. Structures located on softer soils are more vulnerable to the shaking caused by earthquakes.

In Western Washington, the primary plates of interest are the Juan De Fuca and North American plates. The Juan De Fuca plate moves northeastward with respect to the North American plate at a rate of about 4cm/yr. The boundary where these two plates converge, the Cascadia Subduction Zone, lies approximately 50 miles offshore of the west coastline and extends from the middle of Vancouver Island in British Columbia to northern California. As it collides with the North American plate, the Juan De Fuca plate slides (or subducts) beneath the continent and sinks into the earth's mantle.

The three source zones that exist for Puget Sound quakes are a shallow (crustal) zone; the Cascadia Subduction zone; and a deep or intraplate ("Benioff") zone. These are shown in **Figure 4-1**.

[22] http://www.eqe.com/publications/duvall/duvall1.pdf

Figure 4-1: Earthquake Types in Western Washington



Cascadia Subduction Zone

Subduction Zone earthquakes occur along the Cascadia subduction fault, as a direct result of the convergence of these two plates. These are the world's greatest earthquakes and are observed at subduction zone boundaries. A subduction earthquake would be centered off the coast of Washington or Oregon where the plates converge and would typically have a minute or more of strong ground shaking. These magnitude 8 to 9.5 Richter scale thrust-type subduction earthquakes occur from time to time as two converging plates slide past one another. There are no reports of such earthquakes in the Cascadia Subduction Zone off the Oregon/Washington coast since the first written records of permanent occupation by Europeans in 1833 when the Hudson Bay Trading Company post was established at Fort Nisqually. However, paleoseismic evidence suggests that there may have been as many as five of these devastating energy releases in the past 2000 years, with a very irregular recurrence interval of 150 to 1100 years. Written tsunami records from Japan, correlated with studies of partially submerged forests in coastal Washington and Oregon, give a probable date for the most recent of these huge quakes as January 26, 1700.

Since the installation in 1969 of a multi-station seismograph network in Washington, there has been no evidence of even small subduction-type earthquakes in the Cascadia region, indicating the plates are locked. However, parts of subduction zones in Japan and Chile also appear to have had very low levels of seismicity prior to experiencing great earthquakes. Therefore the seismic quiescence observed historically along coastal region of Washington and Oregon does not refute the possibility that an earthquake having a magnitude of greater than 8 could occur there. Recent shallow geodetic strain measurements near Seattle indicate that significant compressional strain is accumulating

parallel to the direction of convergence between the Juan de Fuca and North America plates, as would be expected prior to a great thrust earthquake off the coast of Oregon, Washington and British Columbia. Usually, these types of earthquakes are immediately followed by damaging tsunamis and numerous large aftershocks.

Benioff (Deep) Zone

Western Washington is most likely to experience intraplate or "deep" earthquakes of magnitude 6 to 7.4 on the Richter scale. This occurs within the subducting Juan de Fuca plate at depths of 50 -70 km. As the Juan de Fuca plate subducts beneath North America, it becomes denser than the surrounding mantle rocks and breaks apart under its own weight, causing Benioff zone earthquakes. The Juan de Fuca plate begins to bend even more steeply downward, forming a "knee". It is at this knee where the largest Benioff zone earthquakes occur.

The largest of these events recorded in modern times were the 7.1 magnitude Olympia earthquake in 1949 and the 6.8 magnitude Nisqually earthquake in 2001. Strong shaking during the Olympia earthquake lasted about 20 seconds. For the Nisqually quake, duration of shaking in Snohomish County varied from about 30 seconds to "more than 2 minutes" up-river from Sultan. Since 1870, there have been seven deep earthquakes in the Puget Sound basin with measured or estimated magnitudes of 6.0 or larger. The epicenters of all of these events have been located within about 80 kilometers of each other between Olympia and just north of Tacoma. Scientists estimate the recurrence interval for this type of quake to be 30 - 40 years for magnitude 6.5, and 50 - 70 years for magnitude 7.0. Because of their depth, intraplate earthquakes are least likely to produce significant aftershocks.

Crustal Zone

The third source zone is the crust of the North American plate. These are known as shallow earthquakes. Of the three source zones, this is the least understood. A variety of lines of evidence leads to the conclusion that the Puget Lowland area is currently shortening north-south at a rate of about 0.5 cm (one-fifth of an inch) per year. Shallow earthquakes of magnitude up to 7.0 or more on the Richter scale can happen anywhere in the Puget Sound region. Such earthquakes have the potential to cause greater loss of life and property on the Tulalip Reservation than any other kind of disaster. Fortunately, great crustal quakes do not seem to happen very often: perhaps no more than once every 1000 years.

The structure of the crust in the Puget Sound area is complex, with large sedimentary rock-filled basins beneath Tacoma, Seattle and Everett. The Seattle basin is the deepest, at 8-10 km.

In addition to the 1872 Mount Baker earthquake, seismologists have found evidence that a devastating crustal quake occurred on a fault near Seattle approximately 1100 years ago. Several known major fault zones cross Whidbey Island and run east to southeast into Snohomish County. Seismologists have recently identified a near-surface fault zone

in the northeast corner of Snohomish County near the Town of Darrington. This fault, the Darrington Seismic Zone Devil's Mountain Fault - North Whidbey Fault complex, is estimated to be capable of generating at least a 6-7 magnitude crustal earthquake on the Richter scale. The Duvall Fault near Lake Margaret on the King - Snohomish County border has produced two (magnitude 5.2 and 5.6) earthquakes in the past 70 years (1932 and 1996).

Crustal earthquakes are the least predictable of Puget Sound's seismic threats, and also are the most likely to be followed by significant aftershocks. Following a great crustal earthquake of magnitude 7.0 or more, one of the greatest dangers to human life is that buildings or other structures damaged in the initial shock but still in use and believed safe could collapse in a strong aftershock.

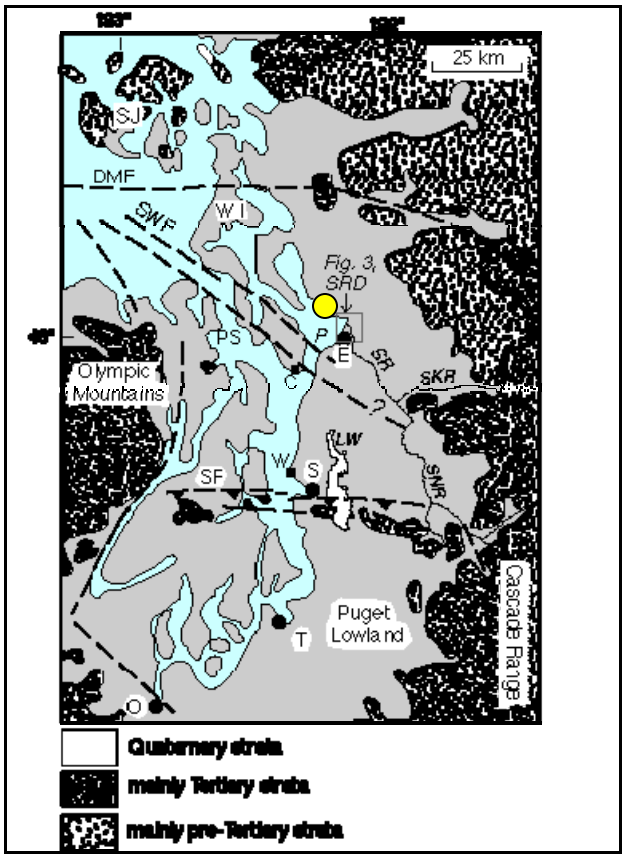
How many other crustal faults pose significant earthquake hazards to the Puget Sound region is not yet known, but geologists and geophysicists are studying the South Whidbey Island fault and the Olympia fault for evidence of recent earthquakes. In addition, a potential Everett fault has been identified and is currently being researched. Recently, there has been a study of earthquake activity in the Snohomish River Delta region. In particular, the scientists have found two crustal events from around 900-950 AD and 1450-1620 AD.[23] The study took soil samples from the delta and found evidence of liquefaction through upward thrusts of sand and woody debris.[24]

Furthermore, The Tulalip Reservation is located in a basin of softer soils, known as the Everett Basin, which can intensify the effect of an earthquake. The Reservation is also located between the two recently identified crustal faults mentioned above known as the Devil's Mountain Fault and the South Whidbey Fault. **Figure 4-2** shows these faults, labeled DMF and SWF, and the location of the Reservation identified with a yellow point.

[23] http://depts.washington.edu/presence/records/makenice.cgi?ID=121

[24] Bourgeois, Joanne and Johnson, Samuel Y. "Geologic evidence of earthquakes at the Snohomish delta, Washington, in the past 1200 years, " Geological Society of America, 2001, GSA Bulletin Vol.113, p. 482-494

Figure 4-2: Faults near Tulalip Reservation



National Earthquake Hazard Reduction Program (NEHRP)

In addition to understanding the different types of earthquakes that can affect the Tulalip Reservation, it is also crucial to have knowledge of the soil make-up of the Reservation. This will narrow down what areas of the Reservation will be more impacted by an earthquake event. The NEHRP classification system is used to accomplish this. In the event of an earthquake, NEHRP soils B and C typically can sustain ground shaking dependent on the magnitude. The areas that will be most affected by ground shaking are located in NEHRP soils D, E and F. In general these areas will also be most susceptible to liquefaction, a secondary effect of an earthquake where soils lose their shear strength and flow horizontally. The NEHRP Soils Classifications and Liquefaction Risk for the Tulalip Reservation are shown in **Figure 4-4** and **Figure 4-5**.

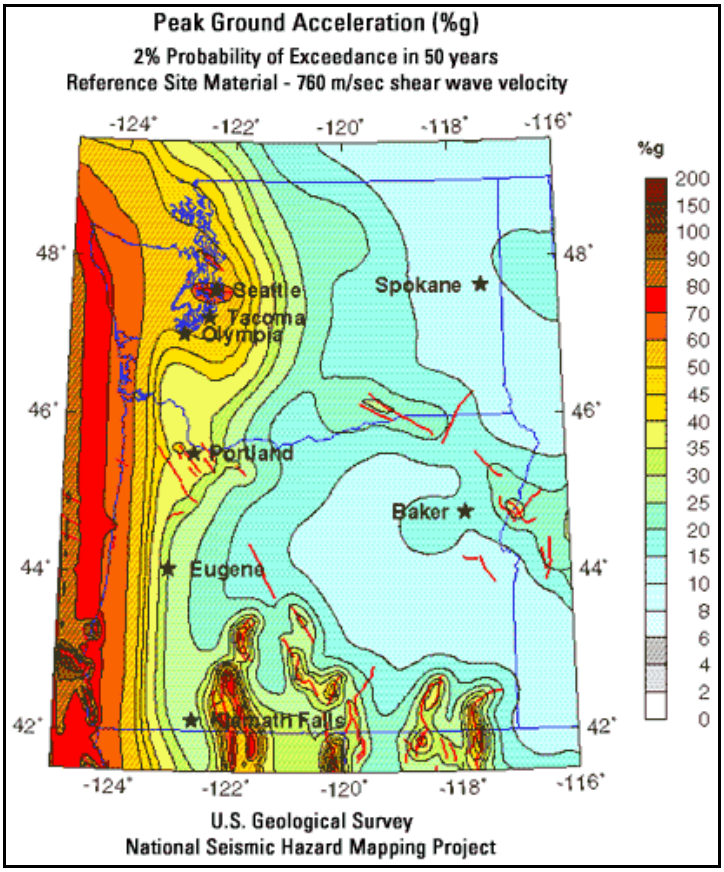
Frequency

The USGS has created a probabilistic hazard map based on peak ground acceleration that takes into account new information on several fault zones. The Puget Sound area, including the Tulalip Reservation, is in a higher risk area, with a 2% probability of exceedance in a 50-year period of seeing ground shaking at 70% of gravity from a

Subduction Zone event. **Figure 4-3** displays the expected peak horizontal ground motions for this probability.[25]

Dr. Art Frankel of the USGS estimated that a Cascadia Subduction zone earthquake has a 10% to 15% probability of occurrence in 50 years. A crustal zone earthquake in general has a recurrence interval of about 500 to 600 years. A Benioff zone earthquake has an 85% probability of occurrence in 50 years indicating a greater likelihood of occurring than all other types of earthquake events. Its recurrence interval is approximately 30 to 50 years. The South Whidbey and Seattle faults have a 2% probability of occurrence in 50 years. The Devil's Mountain Fault - North Whidbey Fault complex does not yet have enough information to determine the probability of occurrence of this event. In general, it's difficult to estimate the probability of occurrence of these crustal earthquake events.

Figure 4-3: Probabilistic Hazard Map



Severity

As noted earlier the Tulalip Reservation has the potential to be affected by a subduction, Benioff, or crustal zone earthquake. A subduction zone earthquake could produce an

[25] http://wrgis.wr.usgs.gov/docs/wgmt/pacnw/lifeline/eqhazards.html

earthquake with a magnitude 8.5 Richter scale on the Reservation. Benioff zone earthquakes as large as magnitude 7.1 are expected everywhere west of the eastern shores of Puget Sound.[26] A crustal zone earthquake could produce a 7.1 magnitude earthquake affecting the Reservation. **Table 4-6** provides a description of the expected severity of the earthquakes.

Table 4-6: Severity of Tulalip Reservation Earthquakes

Type of Earthquake	Expected Magnitude
Cascadia Subduction Zone	9.0 for approximately 4 minutes with aftershocks
Benioff	7.1 with no aftershocks
Crustal - North Whidbey, Devil's Peak Complex South Whidbey Possible Everett Fault	7.1 with some aftershocks

Warning Time

Although, there is a large amount of information that is known about possible earthquake locations, there is no current reliable way to predict what day or month an earthquake will occur at any given location. There is current research that is being conducted with warning systems that use the low energy waves that precede major earthquakes.[27] These potential warning systems give approximately 40 seconds notice that a major earthquake is about to occur. The warning time is very short but it could allow for someone to get under a desk, step away from the hazardous material they are working with or shut down a computer system.

Secondary Hazards

There are several secondary effects of earthquakes. Earthquakes can cause large and sometimes disastrous landslides and mudslides, including debris flows from volcanoes (lahars) not directly associated with eruptions. River valley and coastal hydraulic-fill sediment areas are also vulnerable to slope failure, often as a result of loss of cohesion in clay-rich soils. Soil liquefaction occurs when water-saturated sands, silts or gravelly soils are shaken so violently that the individual grains lose contact with one another and "float" freely in the water, turning the ground into a pudding-like liquid. Building and road foundations lose load-bearing strength and may actually sink quicksand-like into

[26] http://wrgis.wr.usgs.gov/docs/wgmt/pacnw/lifeline/eqhazards.html
[27] California Institute of Technology, Caltech 336, "System gets the jump on quakes"

what was previously solid ground. Lastly, unless properly secured, hazardous materials releases can cause significant damage to the surrounding environment and people.

Tsunamis and seiches are also a major secondary hazard caused by earthquakes. These can be caused directly by the earthquake, or by an earthquake-induced landslide into Puget Sound or other bodies of water.

Exposure Inventory

This section will detail the Tulalip Reservation's inventory of people, property, and infrastructure exposed to earthquakes. To put it succinctly, all of its assets are exposed to the different kinds of earthquakes that can occur in the Puget Sound area. Nonetheless, a more detailed inventory can be made of the assets located in highly vulnerable soils, such as NEHRP D, E and F classified soils and in liquefaction risk areas. 2003 Snohomish County Assessor's data and the Tulalip Tribes' GIS database of buildings and critical facilities were used to identify property listed in this inventory.

As mentioned, all property is exposed to earthquakes. For the whole Reservation:

- There are **4845** parcels in total that are exposed to earthquakes
- The total assessed market value of these parcels is **$693,397,750**
- The total market land value is **$409,465,400**
- The total market improvement value is **$283,932,350**

Population

For the Tulalip Reservation, the whole population is considered exposed to earthquakes. This number in 2000 was 9,246 persons. Estimates were not made for populations living within each NEHRP and/or Liquefaction Class.

Property on NEHRP D soils

This section will detail the property that is located on NEHRP D soils.

There are **2,904** parcels located on NEHRP D soils, about **60%** of all parcels.

- These parcels have a total market value (land + improvements) of **$396,870,950**
    - These parcels account for **57%** of all the value of the Tulalip Reservation's parcels
- Total market land value of parcels is **$228,229,000**
- These parcels make up **56%** of the market land value of all parcels on the Reservation
- Total market improvement value is **$168,641,950**

- These parcels make up **59%** of the market improvement value of all parcels on the Reservation

Table 4-7: Parcels on NEHRP D Soils

Tulalip Parcels on NEHRP D Soils	
Land Use Code and Description	Number of Parcels
001 Reference Account	1
111 Single Family Residence - Detached	1515
113 Manufactured Home (Leased Site)	95
114 Manufactured Home (Owned Site)	302
121 Two Family Residence (Duplex)	2
123 Four Family Residence (Four Plex)	1
143 Single Family Residence Condominium	6
160 Hotel / Motel 1 - 99 Units	2
183 Non Residential Structure	52
184 Septic System	2
185 Well	1
186 Septic & Well	13
189 Other Residential	2
198 Vacation Cabins	3
343 Electrical Machinery, Equipment & Supplies	1
349 Other Fabricated Metal Products NEC	1
351 Engineering, Lab & Scientific Research	8
451 Freeways	2
459 Other Highway & Street Right-of-Way NEC	3
481 Electric Utility	1
483 Water Utilities & Irrigation & Storage	3
484 Sewage Disposal	1
489 Other Utilities NEC	4
511 Motor Vehicles & Automotive Equipment	1
519 Other Wholesale Trade, NEC	1
539 Other Retail Trade NEC	2
541 Groceries (With or Without Meat)	1
551 Motor Vehicles	2
553 Gasoline Service Stations	2
581 Eating Places (Restaurants)	3
582 Drinking Places (Alcoholic Beverages)	1
598 Fuel & Ice	1
624 Funeral & Crematory Services (Inc. Cemetery	1
639 Other Business Services NEC	1
641 Automobile Repair & Services	1
672 Protective Functions & Related Activities	1
681 Nursery, Primary & Secondary School	2
691 Religious Activities (Churches Synagogue	3
692 Welfare & Charitable Services	1
711 Cultural Activities (Inc. Libraries)	1
749 Other Recreation NEC	1

Tulalip Parcels on NEHRP D Soils	
830 Open Space Agriculture RCW 84.34	25
880 DF Timber Acres Only RCW 84.33	17
881 DF Timber Acres / Imp/Unimp Ac With Bldg	3
910 Undeveloped (Vacant) Land	727
915 Common Areas	3
940 Open Space General RCW 84.34	4
950 Open Space Timber RCW 84.34	4
No data	74
Grand Total	**2904**

Property on NEHRP E soils

This section will detail the property that is located on NEHRP E soils.

There are **266** parcels located on NEHRP E soils, about **5%** of all parcels.

- These parcels have a total market value (land + improvements) of **$36,280,000**
  - These parcels account for **5%** of all the value of the Tulalip Reservation's parcels
- Total market land value of parcels is **$21,995,300**
- These parcels make up **5%** of the market land value of all parcels on the Reservation
- Total market improvement value is **$14,284,700**
- These parcels make up **5%** of the market improvement value of all parcels on the Reservation

Table 4-8: Parcels on NEHRP E Soils

Tulalip Parcels on NEHRP E Soils	
Land Use Code and Description	Number of Parcels
111 Single Family Residence - Detached	120
113 Manufactured Home (Leased Site)	1
114 Manufactured Home (Owned Site)	8
122 Three Family Residence (Tri Plex)	1
182 Houseboat	1
183 Non Residential Structure	20
198 Vacation Cabins	1
241 Logging Camps & Logging Contractors	2
344 Transportation Equipment	1
662 Special Construction Trade Services	1
711 Cultural Activities (Inc. Libraries)	1
880 DF Timber Acres Only RCW 84.33	2

Tulalip Parcels on NEHRP E Soils	
910 Undeveloped (Vacant) Land	95
915 Common Areas	4
939 Other Water Areas, NEC	1
No data	7
Grand Total	**266**

Property on NEHRP F soils

This section will detail the property that is located on NEHRP F soils.

There are **19** parcels located on NEHRP F soils, about **0.02%** of all parcels.

- These parcels have a total market value (land + improvements) of **$672,600**
  - These parcels account for **0.1%** of all the value of the Tulalip Reservation's parcels
- Total market land value of parcels is **$618,600**
- These parcels make up **0.15%** of the market land value of all parcels on the Reservation
- Total market improvement value is **$54,000**
- These parcels make up **0.02%** of the market improvement value of all parcels on the Reservation

Table 4-9: Parcels on NEHRP F Soils

Tulalip Parcels on NEHRP F Soils	
Land Use Code and Description	Number of Parcels
111 Single Family Residence - Detached	1
910 Undeveloped (Vacant) Land	6
939 Other Water Areas, NEC	10
No data	2
Grand Total	**19**

Vulnerability

Older structures, such as housing, are vulnerable to earthquakes. Homes located on, above or below steep slopes are vulnerable due to the secondary hazards associated with earthquakes, such as landslides.

Most vulnerable are the older critical and historic Tribal structures that were not built to current earthquake standards and have already experienced earthquakes. This includes many structures located in Tulalip Bay, such as St. Anne's Church and the Tribal Center.

Other vulnerabilities include tribal housing, most of which were built below earthquake codes and were already damaged by the Nisqually quake.

Loss Estimation

FEMA has developed a detailed methodology to estimate damages from earthquakes based on the strength and location of an earthquake and also the characteristics of Tulalip structures, such as year built, foundation and building materials, such as wood-frame, tilt-up or steel frame. Unfortunately, at this time it is not possible to conduct a detailed inventory of all structures on the Tulalip Reservation to come up with an accurate loss estimate. For this estimate, general values were used. The values used in this loss estimation are a hypothetical estimate of all *potential* damage. Its purpose is to come up with a value that can be used to compare with other hazards, in order to prioritize and focus mitigation efforts. Loss estimate accounted for all structures on Tulalip Reservation.

Assumptions:

PGA value used for this estimate is 0.4%.

The estimated damage to wood frame structures (which most Tulalip buildings are, built pre-code, is 16.7% of improvement value

FEMA suggests that damage to content value be estimated as ½ of the damage to improvements, or 8.35%

Loss estimation:

Estimated loss to earthquake-prone structures is **$47,416,702**

Estimated loss to contents is **$23,708,351**

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Figure 4-4: Tulalip NEHRP Classification

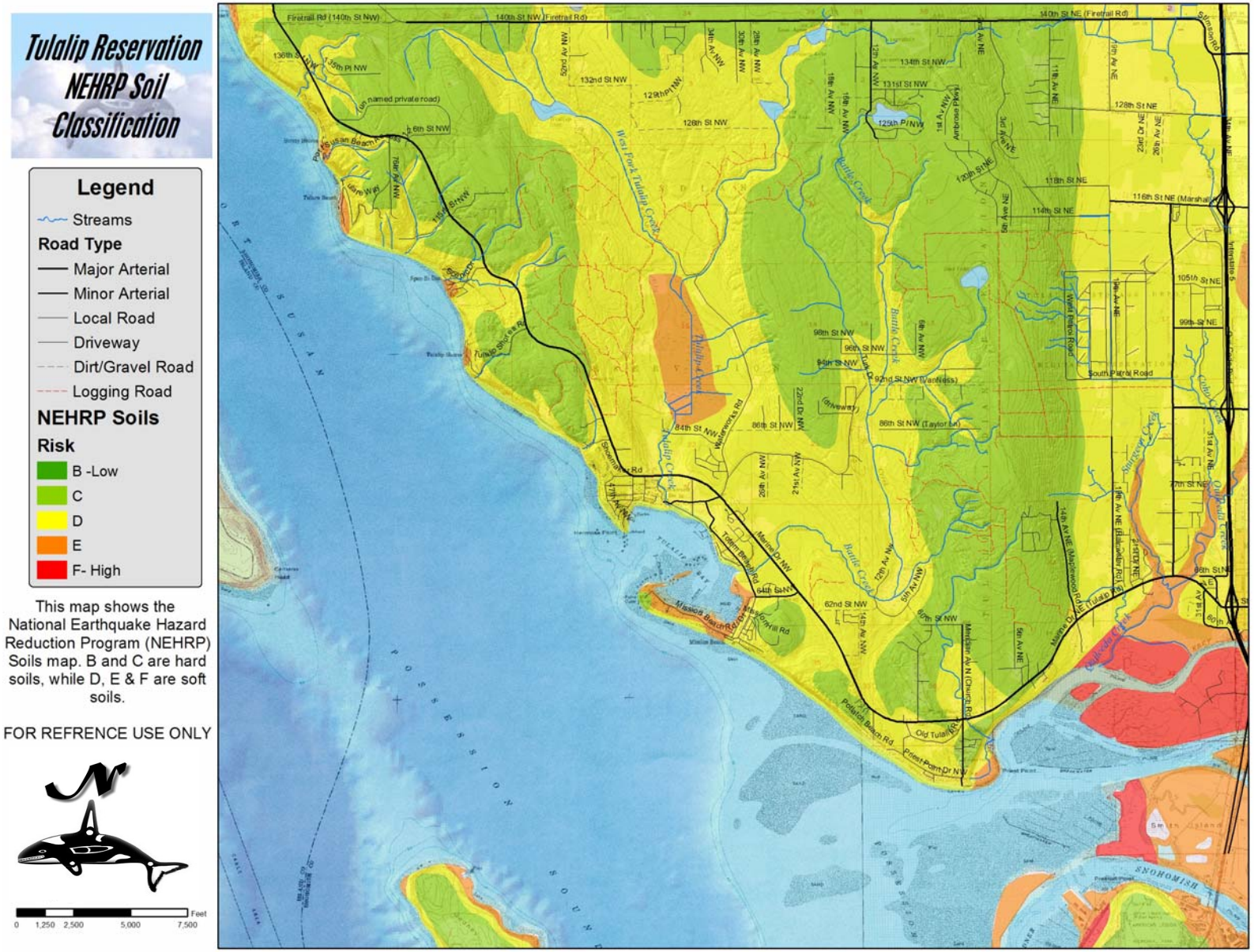

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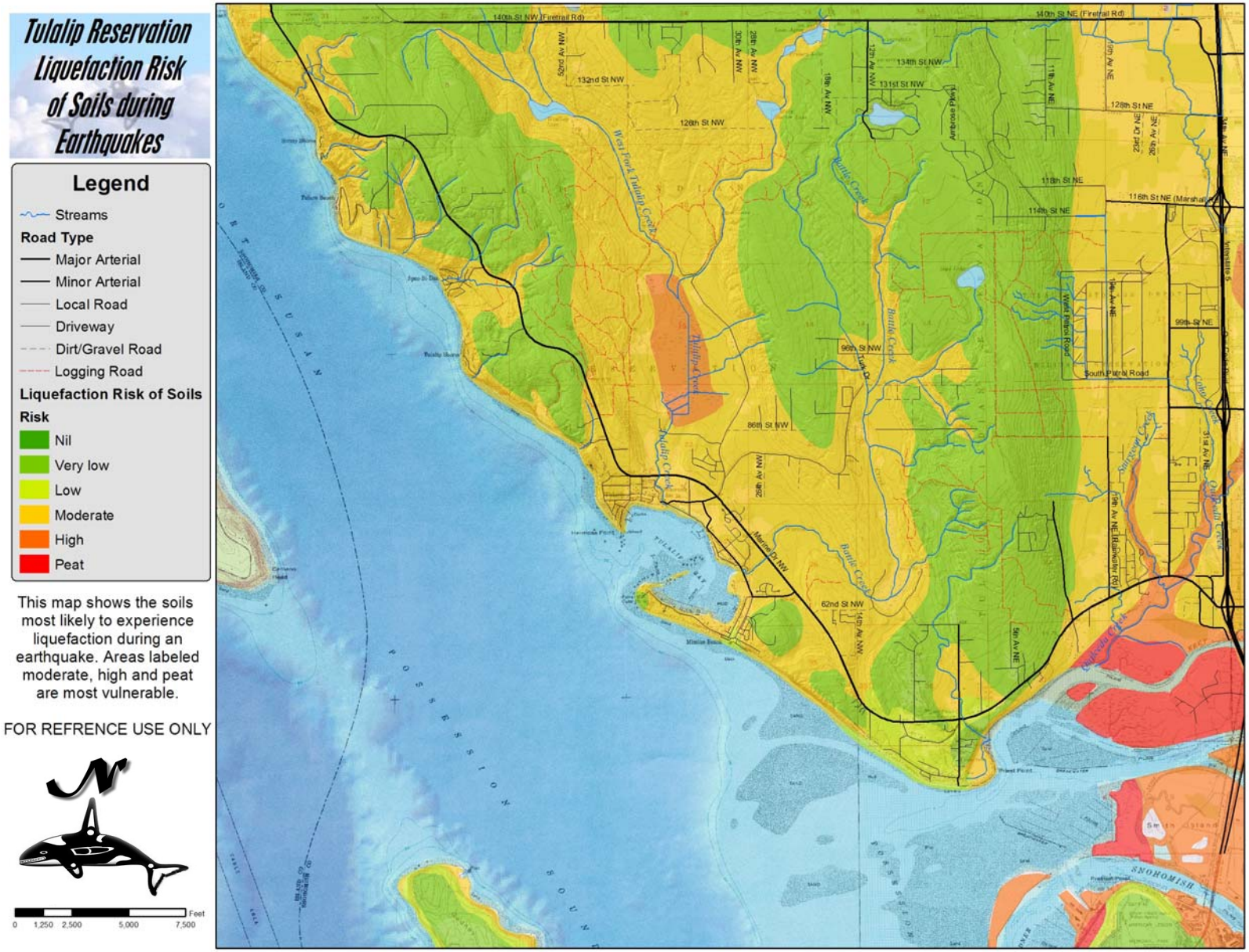
Figure 4-5: Tulalip Soil Liquefaction Risk



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4.3. Flood

Definitions

Base Flood Elevation (BFE): The base flood elevation is the elevation of a 100 year flood event, or a flood, which has a 1% chance of occurring in any given year.

Basin: A basin is the area within which all surface water- whether from rainfall, snowmelt, springs or other sources- flows to a single water body or watercourse. The boundary of a river basin is defined by natural topography, such as hills, mountains and ridges. Basins are also referred to as **Watersheds** or **Drainage Basins**.

Cubic Feet per Second (cfs): Discharge or river flow is commonly measured in cfs. One cubic foot is about 7.5 gallons of liquid.

Flood Insurance Rate Map (FIRM): FIRMs are the official maps on which the Federal Emergency Management Agency (FEMA) has delineated the Special Flood Hazard Area (SFHA).

Floodplain: Floodplains are the land area along the sides of rivers that becomes inundated with water during a flood. Floodplain can be defined in different ways, but is commonly defined as the area that is also called the 100 year floodplain. The term 100 year flood is misleading. It is not the flood that will occur once every 100 years. Rather, it is the flood that has a 1% chance of being equaled or exceeded each year. Thus, the 100 year flood could occur more than once in a relatively short period of time. Because this term is misleading, FEMA has properly defined it as the 1% annual chance flood. This 1% annual chance flood is now the standard used by most Federal and State agencies and by the National Flood Insurance Program.[28]

Floodway: Floodways are areas within a floodplain that are reserved for the purpose of conveying flood discharge without increasing the base flood elevation more that one-foot. Generally speaking, no development is allowed in floodways, as any structures located there would block the flow of floodwaters.

Floodway Fringe: Floodway fringe areas are those lands that are in the floodplain but outside of the floodway. Some development is generally allowed in these areas with a variety of different restrictions.

Flood Zone Designations: These are the different flood hazard zones FEMA uses for FIRMs. These designations may be found on the flood hazard maps for Whitman County's communities.

Zone A: An area inundated by 100-year flooding, for which no Base Flood Elevations (BFEs) have been determined.

Zone AE: An area inundated by 100-year flooding, but for which BFEs have been determined.

Zone ANI: An area that is located within a community or county that is not mapped on any published FIRM.

[28] Definition from: FEMA, http://www.fema.gov/fhm/fq_gen23.shtm

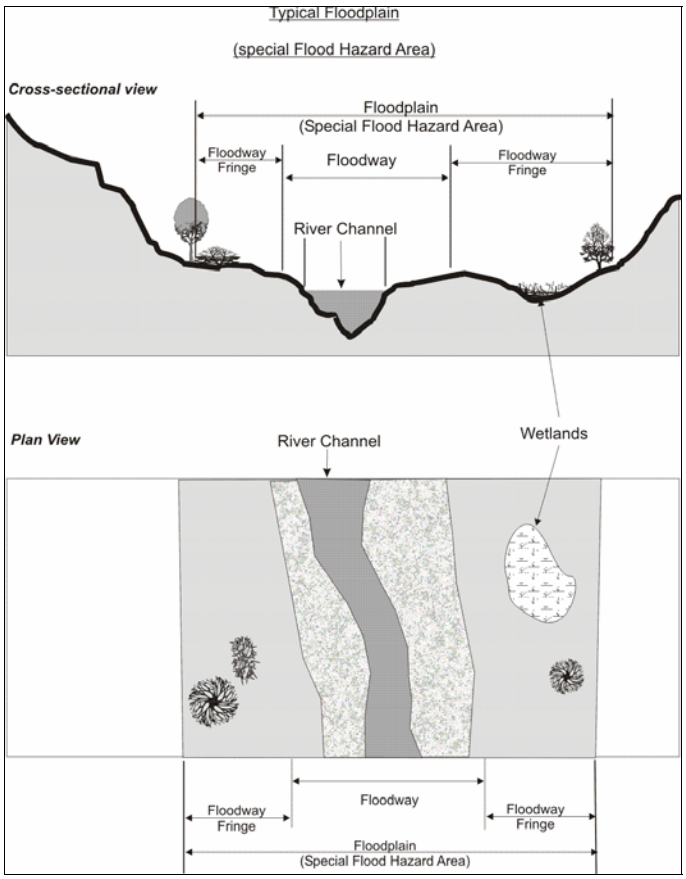
Zone X500: An area inundated by 500-year flooding; an area inundated by 100-year flooding with average depths of less than 1 foot or with drainage areas less than 1 square mile; or an area protected by levees from the 100-year flooding.

National Flood Insurance Program:[29] In 1968, Congress created the National Flood Insurance Program (NFIP) in response to the rising cost of taxpayer funded disaster relief for flood victims and the increasing amount of damage caused by floods.

The Mitigation Division is a section of the Federal Emergency Management Agency (FEMA) manages the NFIP, and oversees the floodplain management and mapping components of the Program. Nearly 20,000 communities across the United States and its territories participate in the NFIP by adopting and enforcing floodplain management ordinances to reduce future flood damage. In exchange, the NFIP makes federally backed flood insurance available to homeowners, renters, and business owners in these communities.

FEMA contracted the Army Corps of Engineers to map the floodplains, floodways, and floodway fringes. **Figure 4-6** depicts the relationship among the three designations.

Figure 4-6: Floodway Schematic



[29] Definition from FEMA: http://www.fema.gov/nfip/whonfip.shtm

Pre and Post FIRM rates:[30] Category of rates published in the National Flood Insurance Program Manual, applying to buildings located in a community qualifying for the regular flood program. Post-FIRM rates are used on building construction that started after December 31, 1974, or after the community's initial Flood Insurance Rate Map was published, whichever is later. These rates are lower than pre-FIRM rates.

Repetitive Loss Properties:[31] Any NFIP-insured property that, since 1978 and regardless of any change(s) of ownership during that period, has experienced:

a) Four or more paid flood losses in excess of $1000.00; or
b) Two paid flood losses in excess of $1000.00 within any 10-year period since 1978 or
c) Three or more paid losses that equal or exceed the current value of the insured property.

Special Flood Hazard Area: The base floodplain delineated on a Flood Insurance Rate Map. The SFHA is mapped as a Zone A in riverine situations and zone V in coastal situations. The SFHA may or may not encompass all of a community's flood problems.

Stream Bank Erosion:[32] Stream bank erosion is common along rivers, streams and drains where banks have been eroded, sloughed or undercut. However, it is important to remember that a stream is a dynamic and constantly changing system. It is natural for a stream to want to meander, so not all eroding banks are "bad" and in need of repair.

Generally, stream bank erosion becomes a problem where development has limited the meandering nature of streams, where streams have been channelized, or where stream bank structures (like bridges, culverts, etc.) are located in places where they can actually cause damage to downstream areas. Stabilizing these areas can help protect watercourses from continued sedimentation, damage to adjacent land uses, control unwanted meander, and improvement of habitat for fish and wildlife.

Subbasin: A subbasin is a tributary basin of a larger basin or watershed.

Water Resource Inventory Area (WRIA): WRIAs were formalized under WAC 173-500-040 and authorized under the Water Resources Act of 1971, RCW 90.54. Ecology was given the responsibility for the development and management of these administrative and planning boundaries. These boundaries represent the administrative under pinning of this agency's business activities. The original WRIA boundary agreements and judgments were reached jointly by Washington's natural resource agencies (Ecology, Natural Resources, Fish and Wildlife) in 1970.

Wild and Scenic River: A federal designation that is intended to protect the natural character of rivers and their habitat without adversely affecting surrounding property.

Zero-Rise Floodway: A 'zero-rise' floodway is an area reserved to carry the discharge of a flood without raising the base flood elevation. Some communities have chosen to implement zero-rise floodways because they provide greater flood protection than the floodway described above, which allows a one foot rise in the base flood elevation.

[30] Definition from: http://insurance.cch.com/rupps/post-firm-rates.htm
[31] Definition from FEMA: http://www.fema.gov/nfip/replps.shtm
[32] Definition from: http://washtenawcd.org/az/streambankeros.php

General Background

A flood is the inundation of normally dry land resulting from the rising and overflowing of a body of water. A natural geologic process that shapes the landscape, floods provide habitat and create rich agricultural lands. Human activities and settlements tend to use floodplains, frequently competing with the natural processes and suffering inconvenience or catastrophe as a result. Human activities encroach upon floodplains, affecting the distribution and timing of drainage, and thereby increasing flood problems. The built environment creates often localize flooding problems outside natural floodplains by altering or confining drainage channels. This increases flood potential in two ways: 1) it reduces the stream's capacity to contain flows; and 2) increases flow rates downstream. Floods also cause erosion and landslides, and can transport debris and toxic substances that can cause secondary hazards.

Hazard Profile

The Tulalip Reservation does not experience the exposure to or severity of flooding typically found in the region and Snohomish County in particular. The Reservation is located along the Port Susan/Possession Sound coast and at the mouth of the Snohomish River, but nonetheless is less exposed because it is located on hills above areas subject to major flooding. The Reservation is drained by some small creeks that can overflow, occasionally causing minor flooding. The Reservation can also experience coastal flooding from storm surges during severe weather. The sections below will profile in detail the exposure and vulnerability the Tulalip Reservation faces in regards to flooding.

Past Events

The Tulalip Reservation does not have a well-documented history of flooding. This is due primarily to the fact that the Reservation is drained by small coastal creeks and does not have any significant development adjacent to the creeks. The Upper Tulalip Creek Pond, used by the Tulalip Salmon Hatchery and protected by a 70 year old dam, overtopped during the New Year's Day Storm of 1997. Tens of thousands of Coho rearing in the pond were carried over the dam and Totem Beach Road, into the stones and brush below. It is estimated that 400,000 fish were lost.[33] In 2000, the Tulalip Reservation saw significant street flooding caused by blocked drainages on Totem Beach Road, Quil Ceda Boulevard and Marine Drive near 31st Ave. Firetrail Road saw flooding in 3 locations: the overtopping of Cummings Lake and two washouts caused by small creeks that cross under the road. Properties located along Priest Point are known to experience 2-3 feet of flooding caused by the overflow of the Snohomish River and/or a strong storm surge, although exact dates of past flooding are not known. The most recent event occurred during the Super Bowl Storm of 2006, where the Point was inundated by a combination

[33] Tulalip Tribes Assess Coho Damage from Winter Flood
http://www.tulalip.nsn.us/htmldocs/nr061697.htm

of high tides and a strong storm surge. Images of the flooding are shown in **Figure 4-7** and **Figure 4-8**. The locations of past events are shown in **Figure 4-9**.

Figure 4-7: Priest Point Flooding, Super Bowl Storm, 2006

Figure 4-8: More Priest Point Flooding, Super Bowl Storm, 2006

Location

There are three types of flooding that could affect the Tulalip Reservation: riverine flooding, tidal flooding and flash/surface flooding. The Tulalip Reservation was excluded for study (Zone ANI) during the creation of FEMA Flood Insurance Rate Maps (FIRM), so 100- and 500- year floodplains are not defined.

Riverine Flooding

Most residents of the Tulalip Reservation are familiar with the annual conditions responsible for the potential of riverine flooding. "Flood season" begins in mid-November and continues to mid-February. In general, the first element leading to a potential flood is a heavy, fresh snow in the mountains. If a weather front with warm winds, usually from the southwest, and heavy rainfall follows the snow before it has a chance to settle and solidify, a flood potential exists. It is rare for rain to cause flooding without the other elements being present. High tides may be responsible for holding up the normal discharge of river runoff into Puget Sound, while low tides facilitate the discharge from the Snohomish River system. The Reservation is least exposed to this type of flooding, as it is generally located above the floodplain of the Snohomish River. There are some exceptions though. The marshy delta islands located near Ebey Slough and Steamboat Slough known as Big Flats can flood, as well as some of the marshy wetlands near the mouth of Quil Ceda Creek. Priest Point can be affected by riverine flooding too. Heavy floods on the Snohomish River carry large amounts of silt and debris, such as logs. The discharging flood can deposit this debris and silt along Priest Point, damaging bulkheads and property adjacent to the river mouth. Floods on Priest Point can reach depths of 2-3 feet.

Tidal Flooding

The potential for flooding in low-lying coastal areas exists when favorable atmospheric conditions (i.e. very low pressure) occur simultaneously with periods of unusually high tides. No significant damage has been experienced on the Reservation in the recent past due to tidal flooding. Storm surges, also known as storm tides, can affect a number of beachfront areas within the Tulalip Reservation. Generally, storm surges are caused by an increase in the usual tide level by a combination of low atmospheric pressure and onshore winds. During a storm surge tides may run from two to four feet above the predicted tide level. Storm surges can usually be predicted up to 12 hours before occurrence; however, only an approximate height can be predicted because of the large number of variables. The effects of a storm surge generally range from saltwater inundation to the battering of beachhead property by water driven debris. The beachfront areas on the Reservation include Priest Point, Mission Beach and the Tulalip Bay area, and the small coastal settlements of Tulalip Shores, Spee-Bi-Dah, Tulare Beach, and Sunny Shores. Property most often damaged by storm surge includes beachfront homes and businesses, bulkheads, marinas, docks and ferry terminals. The Super Bowl of 2006 that damaged Priest Point is an example of this type of flooding.

Flash Flooding and Surface Flooding

Several factors contribute to flash flooding. The two key elements are rainfall intensity and duration. Topography, soil conditions, urbanization and groundcover also play an important role. Flash floods occur within a few minutes to a few hours of excessive rainfall, a dam or levee failure, or a sudden release of water held by an ice or log jam. They can roll boulders, tear out trees, destroy buildings and bridges, and scour out new stream channels. Most flood deaths are due to flash floods.

Flash flooding can occur on the small creeks located on the Reservation if the conditions are right. These creeks include Tulalip Creek, Mission Creek and the Quil Ceda River. Unnamed creeks feeding Weallup Lake and Lake Agnes are known to overflow and sometimes washout Firetrail Road. The dam overtopping of Upper Tulalip Creek Lake in 1997 can be described as a flash flood because the rain was so rapid and heavy that the lake, dam and river could not accommodate the flow of water. In addition, localized surface or "urban" flooding occurred countywide during the "Holiday Blast" storm of December 1996 to January 1997 as a result of drainage systems that were incapable of carrying exceptional volumes of snowmelt and heavy rain runoff. There are numerous locations on the Reservation where urban flooding occurs, which are shown in **Figure 4-9**. As more of the Reservation's natural watershed is converted to human habitation and transportation systems, the urban flooding potential will continue to grow.

Frequency

The frequency of flooding on the Tulalip Reservation is similar to Snohomish County. Minor flooding can be experienced at least every year, especially during the fall and winter, while damaging flooding is experienced at least every 5 years.

Severity

Flooding on the Tulalip Reservation is not known to be as severe as that in Snohomish County in general. Roads can be blocked by blocked culverts or even washed-out. Homes located on low-lying areas along the coast, such as Tulare Beach and Priest Point, can be damaged by storm surge and/or flooding from the Snohomish River. During past events, 5 homes have made claims for damage from flooding. These claims totaled $37,000 for damage to buildings and $12,000 for damage to contents of buildings. Damage to the Tulalip Salmon Hatchery can be severe though. In 1997, 400,000 fish were lost, which translated into millions of dollars in lost revenue from fishing.

Warning Time

Flooding on the Snohomish River can be predicted days in advance, as it usually takes days for the highest flood stages to be reached. The Tulalip Reservation is located at the mouth of the river, so would be last to experience flooding from the river. Storm surges are harder to predict. Severe weather can be predicted hours to days in advance, while high tides can be predicted years in advance. Nonetheless because of its location at the

northern edge of the Convergence Zone, unpredictable winds and severe weather is possible that can cause a massive storm surge, damaging low-lying waterfront properties.

Secondary Hazards

The major secondary hazards caused by flooding are landslides and erosion. Severe weather and flooding can saturate the soil, making it more susceptible to landslides. Flash flooding can cause erosion along streams, while storm surges can cause coastal erosion. Debris from flooding, such as logs, can also cause damage. Hazardous materials can also be transported by floodwaters.

Exposure Inventory

The Tulalip Reservation's main vulnerability to flooding is to properties located along the coast and the along mouth of the Snohomish River. For this exposure inventory, all properties located adjacent to the shore were inventoried. GIS was used to determine exposed properties. Please note that a detailed inventory was not done. Some parcels, whose property lines extend to the shore, may not necessarily have structures located along the shore. Until further, more detailed analysis is conducted, this is the best available information regarding flood prone properties on the Tulalip Reservation. Snohomish County Assessor's data (2003) was used for land use information. Findings include:

There are **785** parcels exposed to flooding, **16%** of all parcels located on the Reservation

These parcels have a total market value (land + improvements) of **$154,571,100**

This is **22%** of all the value of all parcels on the Tulalip Reservation

Total market land value of parcels is **$109,748,000**

These parcels' market land value make up **27%** of all the land value on the Reservation

Total market improvement value is **$44,823,100**

These parcels contain **16%** all improvement values on the Reservation.

Table 4-10 shows the land use of parcels exposed to flooding. The vast majority of parcels are single family residences. At least 128 parcels are undeveloped, and thus have potential for new structures.

Table 4-10: Flood-prone Parcels

Tulalip Reservation Flood-prone Parcels	
Land Use Code and Description	Number of Parcels
111 Single Family Residence - Detached	562
112 Common Wall Single Family Residence	4
113 Manufactured Home (Leased Site)	3

Tulalip Reservation Flood-prone Parcels	
114 Manufactured Home (Owned Site)	7
122 Three Family Residence (Tri Plex)	1
182 Houseboat	1
183 Non Residential Structure	8
198 Vacation Cabins	2
241 Logging Camps & Logging Contractors	1
344 Transportation Equipment	1
459 Other Highway & Street Right-of-Way NEC	1
662 Special Construction Trade Services	1
818 Farms - General (No Predominant Activity	1
910 Undeveloped (Vacant) Land	128
915 Common Areas	4
934 Oceans & Seas	1
939 Other Water Areas, NEC	9
940 Open Space General RCW 84.34	1
No Data	49
Grand Total	**785**

Of the parcels listed above, about 55 parcels are Tribal Trust Lands, most of which are large undeveloped land holdings. None of the Tribe's critical facilities or structures are exposed to flooding.

Population

Population exposed to flooding was estimated by multiplying the number of residential parcels found in Table 4-10 by the average household size on the Tulalip Reservation, which is 2.79.[34]

The estimated exposed population to flooding is 1,613 persons[35]

17% of the Tulalip Reservation's population is exposed to flooding

Vulnerability

This section will discuss areas and properties most vulnerable to flooding.

Properties located along the shore, especially low lying areas, are most vulnerable to coastal flooding. These include residential properties along Tulalip Bay, Tulare Beach and Priest Point. Due to low elevations, homes located along Tulare Beach and Priest Point are most vulnerable.

The Tulalip Salmon Hatchery is vulnerable to flooding. Any losses at the hatchery can have a negative impact on the fishing industry for the Tulalip Tribes and other fishermen.

[34] U.S. Census Bureau, Census 2000
[35] 578 residences*2.79 average household size

Vulnerable roads include Firetrail Road, which has seen past washouts, and other main arterials whose drainages can get clogged. These roads include Quil Ceda Boulevard, Totem Beach Road and the intersection of 31st Ave and Marine Drive.

National Flood Insurance Policies and Claims

The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA) and is intended to provide insurance to flood-prone properties. The Tulalip Tribes does not participate in the program, but Snohomish County does, and thus the Tulalip Reservation is covered. NFIP policies and claims serve as a good indicator of flood-prone properties and locations. Most people who take out a flood insurance policy have experienced flooding in the past. The Tulalip Reservation has 23 NFIP policies, which are shown in **Figure 4-10**. During past flood events, 5 policyholders filed claims for flood damage. These are also shown in **Figure 4-10**.

Loss Estimation

Flood loss estimates are based on damage curves developed by FEMA. These numbers do not represent the total estimated value a flood may cost, but rather a hypothetical estimate of all *potential* damage. Its purpose is to come up with a value that can be used to compare with other hazards, in order to prioritize and focus mitigation efforts.

Assumptions:

Flooding can reach depths of 3 feet

Exposed structures are assumed to be 1 story, no basement structures. Analysis of assessor's data found that 66% of structures exposed are 1 story, while 73% of structures have no improved basements

Building damage estimates for these assumptions are 27% of improvement value

Building content damage (damage to TVs, furnaces, furniture) estimates are 40.5% of ½ of the improvement value

Loss estimate:

Estimated loss to flood-prone structures is **$12,102,237**

Estimated loss to contents is **$9,076,678**

Figure 4-9: Known Flood Hazard Locations

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Figure 4-10: NFIP Policies and Claims

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4.4. Landslides

Definitions

Debris Slides: Debris slides consist of unconsolidated rock or soil that have moved rapidly down slope. They occur on slopes greater than 65%.

Earthflows: Earthflows are slow to rapid down slope movements of saturated clay-rich soils. This type of landslide typically occurs on gentle to moderate slopes but can occur on steeper slopes especially after vegetation removal.

Landslide: Landslides can be described as the sliding movement of masses of loosened rock and soil down a hillside or slope. Fundamentally, slope failures occur when the strength of the soils forming the slope exceeds the pressure, such as weight or saturation, acting upon them.

Mass movements:[36] A collective term for landslides, mudflows, debris flows, sinkholes and lahars.

Rock falls: A type of landslide that typically occurs on rock slopes greater than 40% near ridge crests, artificially cut slopes and slopes undercut by active erosion.

Rotational-Translational slides: A type of landslide characterized by the deep failure of slopes, resulting in the flow of large amounts of soil and rock. In general, they occur in cohesive slides masses and are usually saturated clayey soils.

Sinkholes:[37] A collapse depression in the ground with no visible outlet. Its drainage is subterranean, its size typically measured in meters or tens of meters, and it is commonly vertical-sided or funnel-shaped.

Steep Slope: Different communities and agencies define it differently, depending on what it is being applied to, but generally a steep slope is a slope in which the percent slope equals or exceeds 25%.

General Background

Landslides (or more properly, mass movement, which includes the mudslides and debris flows more typical of the greater Puget Sound area) are caused by a combination of geological and climatological conditions. This includes steep topography, as well as the encroaching influence of urbanization. The geological conditions of western Washington are primarily a legacy of repeated glacial episodes of advance and retreat during the past 2 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. One of the most active erosive processes during this period has been mass

[36] Snohomish HIVA
[37] ibid.

wasting. This is the action of landslides and mudslides. Finally, and probably of greatest significance, the vulnerable natural setting is being steadily invaded by human residential, agricultural, commercial and industrial development and the infrastructure that supports it.

A landslide is a mass of rock, earth or debris moving down a slope. Landslides may be minor or very large, and can move at slow to very high speeds. They can be initiated by storms, earthquakes, fires, volcanic eruptions, and by human modification of the land.

Mudslides or mudflows (or debris flows) are rivers of rock, earth, organic matter and other soil materials saturated with water. They develop in the soil overlying bedrock 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."

A debris flow or mudflow can move rapidly down slopes or through channels, and can strike with little or no warning at avalanche speeds. The slurry can travel miles from its source, growing as it descends, picking up trees, boulders, cars, and anything else in its path. Although these slides behave as fluids, they pack many times the hydraulic force of water due to the mass of material included in them. Locally, they can be some of the most destructive events in nature.

A sinkhole is a collapse depression in the ground with no visible outlet. Its drainage is subterranean; its size is typically measured in meters or tens of meters, and it is commonly vertical-sided or funnel-shaped.

Landslides are caused by one or a combination of the following factors: change in slope gradient, which increases the load the land must bear, shocks and vibrations, change in water content, ground water movement, frost action, weathering of rocks, and removal or changing the type of vegetation covering slopes.

In general, landslide hazard areas occur where the land has certain characteristics, which contribute to the risk of the downhill movement of material. These characteristics include:

- A slope greater than 15 percent.
- Landslide activity or movement occurred during the last 10,000 years.
- Stream or wave activity, which has caused erosion, undercut a bank or cut into a bank to cause the surrounding land to be unstable.
- The presence or potential for snow avalanches.
- The presence of an alluvial fan, which indicates vulnerability to the flow of debris or sediments.
- The presence of impermeable soils, such as silt or clay, which are mixed with granular soils such as sand and gravel. [38]

[38] http://www.metrokc.gov/prepare/hiva/landslide.htm

Hazard Profile

Past Events

There is little recorded information for Snohomish County regarding landslides, and even less is known about landslides on the Tulalip Reservation. Although Snohomish County's records are less than complete, during the "Holiday Blast" winter storm of 1996-97, more than half of the county's $60-70M in reported damages occurred as a result of landslides, mudslides and debris flows. Drainage systems and catchment basins could not handle the volume of runoff, focusing the water's energy against vulnerable slopes and manmade structures. In some cases, saturated soils simply became overloaded with the weight of snow and rainwater and collapsed. Private homeowners, particularly in those areas where the natural drainage has been paved, diverted or otherwise modified by man, reported significant damage. This storm was the first well-documented event with landslides.

Another large slide occurred in the town of Woodway, Snohomish County, just north of the City of Shoreline, King County, during the early morning of January 15th, 1997. It cut fifty feet into the property above, passed over the railroad tracks and knocked a freight train into the Sound.[39] **Figure 4-11** provides a picture of the Woodway slide. The steep coastal bluffs where this occurred are similar to the Tulalip's steep coastal bluffs and serve as a good indicator of what a major landslide on the Reservation may look like.

Figure 4-11: 1997 Woodway Slide

Location

A recent study of historic landslides in Seattle commissioned by Seattle Public Utilities has identified four types of landslides in the region:[40]

[39] http://www.ecy.wa.gov/programs/sea/landslides/show/woodway.html
[40] Shannon and Wilson, January, 2000

- **High Bluff Peeloff** - block falls of soil from high bluffs (primarily along the near-vertical cliffs of Puget Sound).
- **Groundwater Blowout** - catastrophic groundwater soil bursts caused by the buildup of groundwater pressures along the contact of pervious/impervious soil units.
- **Deep-Seated Landslides** - deep, rotational or translational sliding and slumping caused by groundwater pressures within a hillside.
- **Shallow Colluvial (Skin) Slides** - shallow rapid sliding of the outer surface of a hillside slope sometimes also resulting in a debris flow.

The most common type of slide in the Puget Sound area to be the shallow colluvial slide, occurring particularly in response to intense, short-duration storms. The largest and most destructive are deep-seated slides, although they are less common than other types. The preponderance of landslides occur in January after the water table has risen during the wetter months of November and December. In addition to the coastal bluffs, land sliding is most prevalent around the slopes of the Puget Sound's steep, linear hills. Water is involved in nearly all cases; and, consistent with other studies in the region; human influence was identified in more than 80% of the reported slides.

In addition, the recognition of ancient dormant mass movement sites is important in the identification of those areas most susceptible to flows and slide 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.

The diagrams below show different kinds of slides that can occur in the Puget Sound Region (**Figure 4-12**, **Figure 4-13**,

Figure 4-14, and **Figure 4-15**).[41] Puget Sound's shoreline contains many large, deep-seated dormant landslides. Shallow slides are the most common type and the most probable for Tulalip. Occasionally large catastrophic slides occur on Puget Sound.

Recently the Tulalip Department of Natural Resources has mapped landslides and potentially unstable slopes along the coast from the northern reservation border down to Priest Point. To date this is the best available data regarding landslide hazards on Tulalip. Maps of the landslide/unstable slopes are shown in **Figure 4-21**, **Figure 4-22**, **Figure 4-23**, **Figure 4-24**, **Figure 4-25** and **Figure 4-26**.

[41] http://www.ecy.wa.gov/programs/sea/landslides/about/about.html

Figure 4-12: Deep Seated Slide

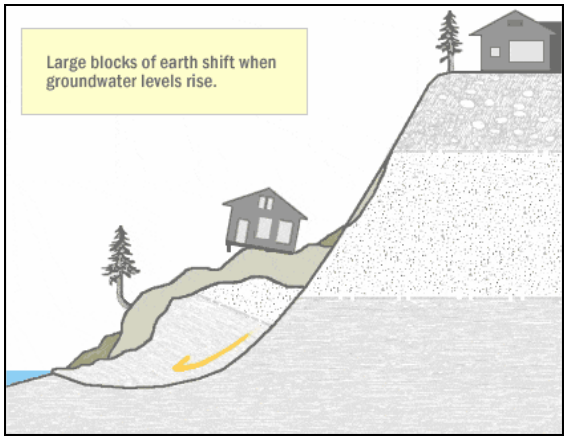


Figure 4-13: Shallow Slide

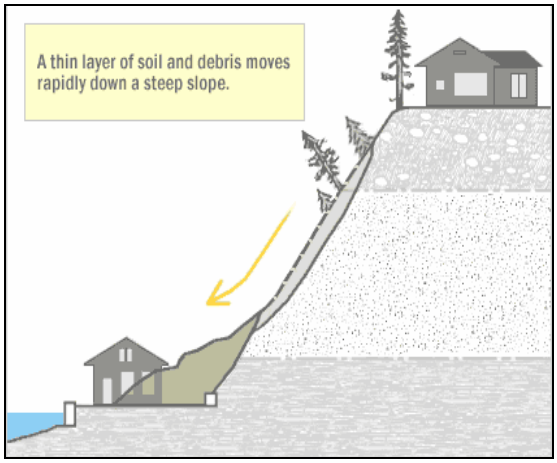


Figure 4-14: Bench Slide

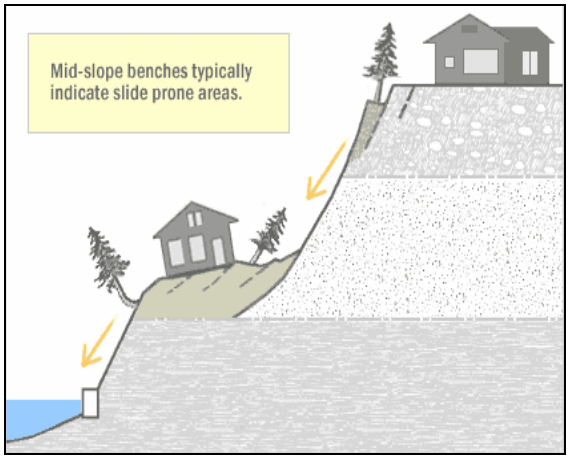
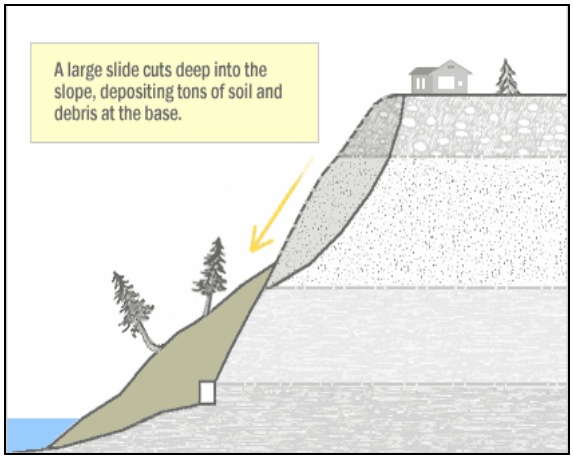


Figure 4-15: Large Slides



Frequency

Landslides are often triggered by other natural hazards such as earthquakes, heavy rain, floods or wildfires. The frequency of a landslide is related to the frequency of earthquakes, heavy rain, floods, and wildfires. On the Tulalip Reservation, landslides typically occur during and after major storms. Recent events occurred during the Holiday Blast storm of 1996-7. Flows and slides are commonly categorized by the form of initial ground failure, but they may travel in a variety of forms along their paths. The velocity of movement may range from a slow creep of centimeters per year to many meters per second, depending on slope angle, material and water content.

Severity

Landslides destroy property, infrastructure, transportation systems, and can take the lives of people. Slope failures in the United States result in an average of 25 lives lost per year and an annual cost to society of about $1.5 billion. [42]

The 1996 Holiday Blast storm caused about $30-35 million in damage throughout Snohomish County due to landslides, mudslides and debris flows. This was about half of all damage caused by the storm. The landslides caused by the storm also caused tens of millions of dollars of damage to road infrastructure. The actual amount of damage that occurred on the Tulalip Reservation is not known, but there were road washouts caused by landslides on Tulare Beach Road and on the steep narrow cliff side private road that leads to Sunny Shores.

Warning Time

Mass movements can occur either very suddenly or slowly. There are methods used to monitor mass movements that can provide an idea of type of movement and amount of time prior to failure. It is also possible to determine what areas are at risk during general

[42] http://www.metrokc.gov/prepare/hiva/landslide.htm

time periods. Assessing the geology, vegetation, and amount of predicted precipitation for a given area can help in these predictions.

Secondary Hazards

Landslides can typically cause several different types of secondary effects. Several landslides have blocked egress and ingress on roads. This has the potential to cause isolation for affected residents and businesses. Roadway blockages caused by landslides can also create traffic problems resulting in delays for commercial, public and private transportation. This could result in economic losses for businesses.

Other potential problems resulting from landslides are power and communication failures. Vegetation on slopes or slopes supporting poles can be knocked over resulting in possible losses to power and communication lines. This, in turn, creates communication and power isolation. Landslides also have the potential of destabilizing the foundation of structures that may result in monetary loss for residents.

It is possible for landslides to affect environmental processes. Landslides can damage rivers or streams, potentially harming water quality, fisheries and spawning habitat.

The major natural secondary hazards caused by landslides, especially landslides along the coast or along the large lakes, are tsunamis/seiches. When a landslide falls into the water, such as Puget Sound, it creates a sloshing effect that generates a tidal wave or tsunami that can cause as much or even more damage than the landslide itself. One of the most infamous of these was the landslide that occurred on Camano Head in the early 1800s. It killed about a hundred people, mostly women and children, and sent a tsunami southeast towards Hat Island, which destroyed a village and killed many people there. Such a similar event could affect the Tulalip Reservation, particularly Tulalip Bay and Priest Point.

Exposure

The Tulalip Zoning Ordinance (Ordinance number 80) defines bluffs and steep slopes as Environmentally Sensitive Lands, where development should be regulated. These steep slopes are defined as

- Slopes over 15% or otherwise subject to slope instability, potential landslide or significant erosion[43]

Furthermore, Snohomish County Code defines landslide hazard areas as “areas potentially subject to mass earth movement based on a combination of geologic, topographic, and hydrologic factors, with a vertical height of 10-feet or more. These include the following:

- Areas of historic landslides as evidenced by landslide deposits, avalanche tracks, and areas susceptible to basal undercutting by streams, rivers or waves;

[43] Tulalip Zoning Ordinance 23.2

- Areas with slopes steeper than 15 percent which intersect geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock, and which contain springs or ground water seeps;
- Areas located in a canyon or an active alluvial fan, susceptible to inundation by debris flows or catastrophic flooding." [44]

For this study, a slope map generated from a 10-meter resolution digital elevation model (DEM) was used to identify general areas exposed to landslides. This is shown on **Figure 4-20**. The slope map shows areas of 15% or more slope. Recently the Tulalip Department of Natural Resources has mapped landslides and potentially unstable slopes along the coast from the northern border down to Mission Beach[45]. To date this is the best available data regarding landslide hazards on Tulalip. Maps of the landslide/unstable slopes are shown in **Figure 4-21**, **Figure 4-22**, **Figure 4-23**, **Figure 4-24**, **Figure 4-25** and **Figure 4-26**. Furthermore, the Tulalip Department of Community Development commissioned a study of unstable slopes above and below homes along Mission Beach. The Washington State Department of Natural Resources is currently in the process of creating a Landslide Hazard Zonation database that should used in the future to identify landslide hazard areas.

Exposure Inventory

The Tulalip Reservation's main areas of exposure and vulnerability to landslides are to the homes located along the high, steep bluffs along Port Susan and Possession Sound. Using GIS, 2003 Snohomish County Assessor's parcel data was overlain onto the steep slope locations in order to inventory the amount and value of structures and properties exposed to landslides. Although this may not be as accurate as carrying out a detailed assessment, it does serve as a good starting point to determine the Tulalip's exposure and vulnerability to landslides. Findings include:

- There are **619** parcels exposed to landslides, about **13%** of all parcels located on the Reservation
- These parcels have a total market value (land + improvements) of **$111,127,400**

- These parcels account for **16%** of all the value of the Tulalip Reservation's parcels
  - Total market land value of parcels is **$70,042,600**
  - These landslide-prone parcels make up **17%** of the market land value of all parcels on the Reservation
  - Total market improvement value is **$41,084,800**

[44] Snohomish County Code 30.91L.040

[45] The Washington State Dept. of Ecology has mapping from the 1970s that shows landslides hazards for the coastal areas of the State. See http://www.ecy.wa.gov/programs/sea/landslides/maps/maps.html

- These landslide-prone parcels make up **14%** of the market improvement value of all parcels on the Reservation

- **Table 4-11** shows the land use of parcels exposed to flooding. The vast majority are single-family residences and other housing. Undeveloped parcels are also frequent, with 152 identified.

Table 4-11: Landslide-prone Parcels

Tulalip Reservation Landslide-prone Parcels	
Land use Code and Description	Number of Parcels
111 Single Family Residence - Detached	360
112 Common Wall Single Family Residence	4
113 Manufactured Home (Leased Site)	5
114 Manufactured Home (Owned Site)	13
115 Manufactured Home (Mobile Home Park)	29
150 Mobile Home Park 1 - 99 Units	1
183 Non Residential Structure	7
186 Septic & Well	1
198 Vacation Cabins	3
459 Other Highway & Street Right-of-Way NEC	2
483 Water Utilities & Irrigation & Storage	1
624 Funeral & Cemetery Services	1
910 Undeveloped (Vacant) Land	152
915 Common Areas	5
934 Oceans & Seas	1
940 Open Space General RCW 84.34	1
950 Open Space Timber RCW 84.34	2
No data	31
Grand Total	**588**

Population

Population exposed to landslides was estimated by multiplying the number of residential parcels found in **Table 4-11** (412 parcels) by the average household size on the Tulalip reservation, which is 2.79.[46]

The estimated population exposed to landslides is **1,149**

This amounts to about **12%** of the population living on the Tulalip Reservation exposed to landslides

Vulnerability

This section will discuss areas and property most vulnerable to landslides.

[46] U.S. Census Bureau, Census 2000

The properties most vulnerable to landslides as of April 2006 are the houses located along the cliff at Hermosa Point. Some are literally hanging over the edge of the rapidly eroding landslide-prone bluff. Mitigation action needs to be taken immediately. The ideal mitigation action would be to relocate the vulnerable homes. This mitigation action will be discussed further in the mitigation section. Vulnerable homes are shown in **Figure 4-16, Figure 4-17** and **Figure 4-18**.

Figure 4-16: Vulnerable Homes on Hermosa Point 1

Figure 4-17: Vulnerable Homes on Hermosa Point 2

Figure 4-18: Vulnerable Homes on Hermosa Point 3

Homes located along the bluffs on Potlatch Beach Road and Priest Point Drive are vulnerable to landslides.

The communities of Tulalip Shores, Tulare Beach, and Sunny Shores are extremely vulnerable to landslides. All three communities, but especially Tulare Beach and Sunny Shores, can become isolated by landslides blocking or washing out roads. These roads are Tulare Way, Port Susan Beach Road and Tulalip Shores Road. Much of Sunny Shore is located on a steep, winding private road that sees frequent landslides. Many homes here are perched on precariously steep slopes and are extremely vulnerable to landslides.

Mission Beach and Mission Beach Heights Road homes above and below the bluff are extremely vulnerable to landslides. The Tulalip Department of Community Development commissioned a study which was completed in 2004 to assess the slopes at Mission Beach Heights. It was found that

> "…based on field observations, we have concluded that portions of the slope have a high risk of future landsliding. We encountered slide debris at several accessible locations at the toe of the slope. Exposed landslide scarps varying in heights were observed along most of the slope within the project area."[47]

Mission Beach Heights and the steep slopes are shown in **Figure 4-19.**

[47] Mission Beach Heights Slopes, Executive Summary, Nelson Geotechnical Associates, August 16th, 2004

Figure 4-19: Mission Beach Heights

Loss Estimation

Currently there are no standards in place to estimate losses from landslides. Large landslides occur infrequently and tend to be very localized, damaging only one or a few homes. Nonetheless the damages can be quite high, and many homes are frequently condemned after experiencing a landslide. The values used in this loss estimation are a hypothetical estimate of all *potential* damage. Its purpose is to come up with a value that can be used to compare with other hazards, in order to prioritize and focus mitigation efforts.

Assumptions:

Damage to improvements of a parcel (that is, the building) is estimated to be 55%

Content loss is 10% of ½ of the improvement value. Landslides typically destroy the structural integrity of the building, leading to condemnation, but hardly ever destroy the contents (clothes, televisions etc.) or injure people

Loss estimate:

Estimated loss to landslide-prone structures is **$422,596,640**

Estimated loss to contents is **$2,054,240**

Figure 4-20: Landslide Hazard Location (General)

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Figure 4-21: Tulalip Landslides 1

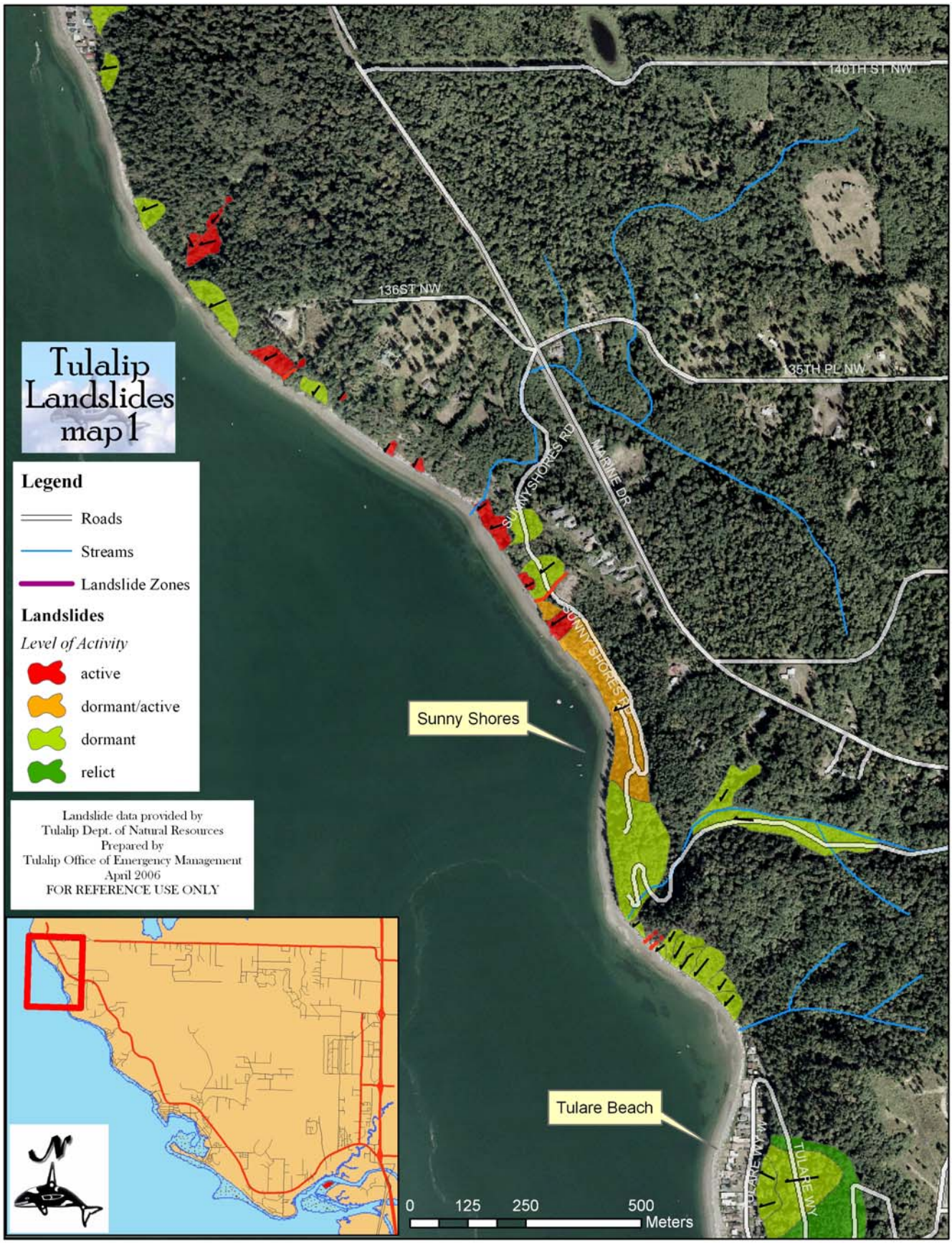

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Figure 4-22: Tulalip Landslides 2

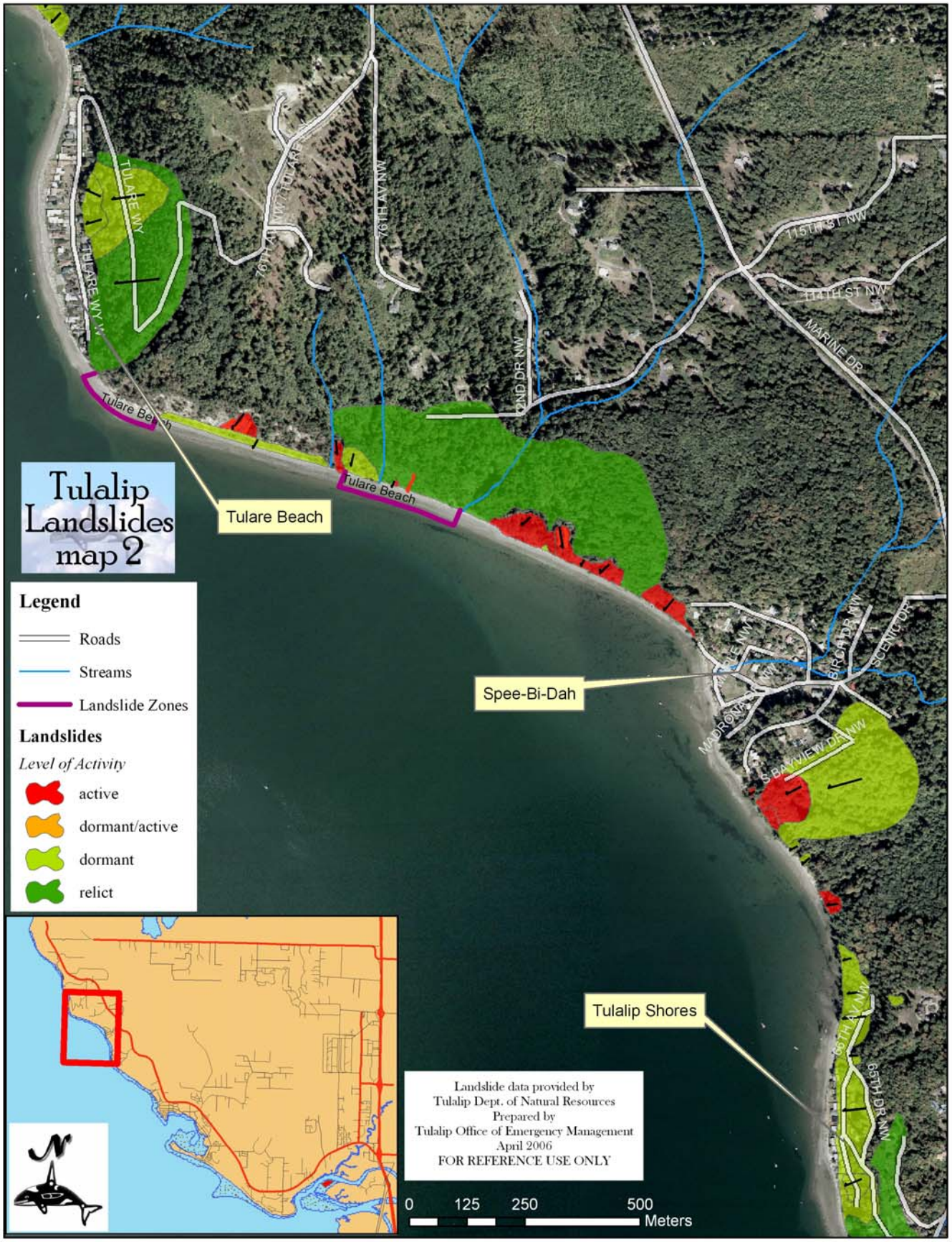

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Figure 4-23: Tulalip Landslides 3

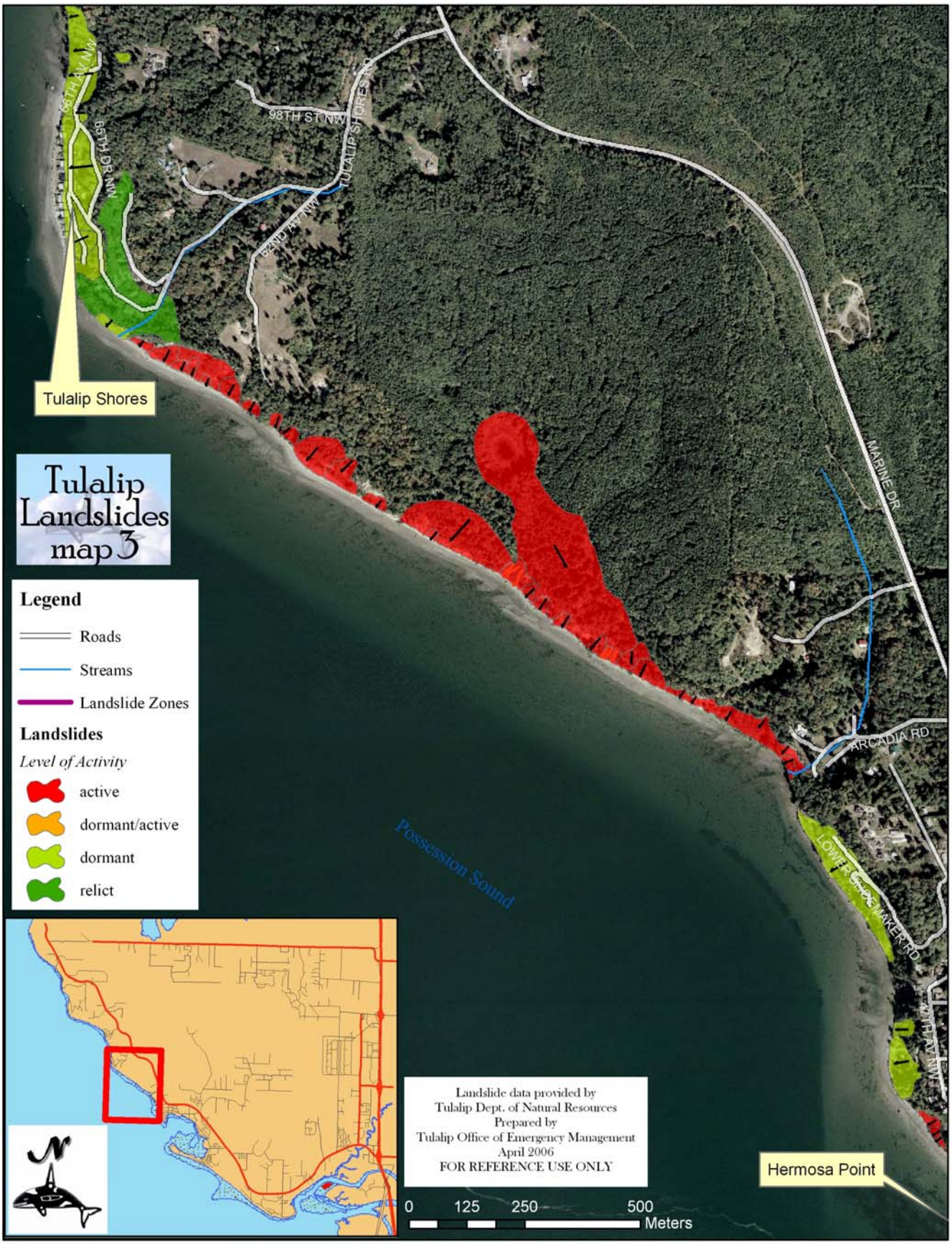

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Figure 4-24: Tulalip Landslides 4

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Figure 4-25: Tulalip Landslides 5

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Figure 4-26: Tulalip Landslides 6

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4.5. Severe Weather

Definitions

Blizzard: A storm with considerable falling and/or blowing snow combined with sustained winds or frequent gusts of 35 mph or greater that frequently reduces visibility to less than one-quarter mile. Blizzards typically are confined to the Columbia River Gorge and Northwest Washington near the Fraser River Valley of British Columbia.

Freezing Rain: This is the result of rain occurring when the temperature is below the freezing point. When this occurs the rain will freeze on impact and will result in a layer of glaze ice over everything it touches. Although the layer of glaze is generally quite thin it can measure up to one inch in depth. In a severe ice storm an evergreen tree measuring 20 meters high and 10 meters wide can be burdened with up to six tons of ice, creating a serious threat to power and telephone lines and transportation routes.

Puget Sound Convergence Zone (PSCZ): The PSCZ is a unique weather phenomenon of 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. Those updrafts can lead to convection and then rain showers or more active weather. The Convergence Zone's favorite spot tends to be an east-west line that extends over the central and south Snohomish County area (Lynnwood, Edmonds, and Everett are the prime spots). The Zone can move, depending on the strength of each wind component. If the south component becomes stronger, it will push the Zone further north, and vice versa.

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

Snowstorms: These are caused by a war between air of different temperatures and densities. This resultant low pressure system can cover thousands of square miles with snow. Heavy snow in western Washington is generally confined to the mountains with heavy accumulation in the lowlands uncommon. Some of the higher hills in Tulalip will also see snow.

Thunderstorms: This is the most common of severe weather systems. These are typically 25 kilometers in diameter and last 30 minutes from birth to growth through maturity to decay. Thunderstorms are underrated hazards. Lightning, which occurs with all thunderstorms, is a serious threat to human life nationwide. Heavy rains dumped in a small area over a very short time can lead to flash flooding. Strong winds, hail and tornadoes are also dangers associated with thunderstorms.

Tornadoes: Tornadoes are characterized by funnel clouds of varying sizes that generate winds as fast as 500 miles per hour. They can affect an area of ¼ to ¾ of a mile, with the path varying in width and length. Tornadoes can come from lines of cumulonimbus clouds or from a single storm cloud. They are measured using the Fujita Scale ranging from F0 to F6.

Windstorms: These are 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. Southern winds parallel to the Cascade Mountains are the strongest and most destructive winds. Windstorms tend to damage ridgelines that face into the winds.

General Background

The location of the State of Washington on the windward coast in mid-latitudes is such that climatic elements combine to produce a predominantly marine-type climate west of the Cascade Mountains, while east of the Cascades the climate possesses both continental and marine characteristics.

The state's climate is impacted by two significant factors:

- Mountain ranges: The Olympic Mountains and the Cascade Mountains affect rainfall. The first major release of rain occurs along the west slopes of the Olympics, and the second is along the west slopes of the Cascade Range. Additionally, the Cascades are a topographic and climatic barrier. Air warms and dries as it descends along the eastern slopes of the Cascades, resulting in near desert conditions in the lowest section of the Columbia Basin in eastern Washington. Another lifting of the air occurs as it flows eastward from the lowest elevations of the Columbia Basin toward the Rocky Mountains. This results in a gradual increase in precipitation in the higher elevations along the northern and eastern borders of the state.
- Location and intensity of semi-permanent high and low-pressure areas over the North Pacific Ocean: During the summer and fall, circulation of air around a high-pressure area over the North Pacific brings a prevailing westerly and northwesterly flow of comparatively dry, cool and stable air into the Pacific Northwest. As the air moves inland, it becomes warmer and drier, resulting in a dry season. In the winter and spring, the high pressure resides further south while low pressure prevails in the Northeast Pacific. Circulation of air around both pressure centers brings a prevailing southwesterly and westerly flow of mild, moist air into the Pacific Northwest. Condensation occurs as the air moves inland over the cooler land and rises along the windward slopes of the mountains. This results in a wet season beginning in late October or November, reaching a peak in winter, and gradually decreasing by late spring.

In interior valleys, measurable rainfall occurs on 150 days each year and on 190 days in the mountains and along the coast. Thunderstorms over the lower elevations occur up to 10 days each year and over the mountains up to 15 days.

During the wet season, rainfall is usually of light to moderate intensity and continuous over a period of time, rather than heavy downpours for brief periods; heavier intensities occur along the windward slopes of the mountains.

The strongest winds are generally from the south or southwest and occur during the fall and winter. In interior valleys, wind velocities reach 40 to 50 mph each winter, and 75 to

90 mph a few times every 50 years. The highest summer and lowest winter temperatures generally occur during periods of easterly winds.

During the coldest months, freezing drizzle occasionally occurs, as does a Chinook wind that produces a rapid rise in temperature. Chinook (a Native American word meaning "snow-eater") winds are warm, moist wind patterns originating in the Pacific Ocean during the winter that cool, and then rapidly warm as they pass over the western and eastern slopes of the Cascades and Rockies. On the Columbia Plateau they can cause drastic and rapid increases in temperature, which can also cause rapid snow melt and contribute to flooding.

During most of the year, the prevailing wind is from the southwest or west. The frequency of northeasterly winds is greatest in the fall and winter. Wind velocities ranging from four to 12 mph can be expected 60 to 70 percent of the time; 13 to 24 mph, 15 to 24 percent of the time; and 25 mph or higher, one to two percent of the time. The highest wind velocities are from the southwest or west and are frequently associated with rapidly moving weather systems. Extreme wind velocities can be expected to reach 50 mph at least once in two years; 60 to 70 mph once in 50 years; and 80 mph once in 100 years.

Hazard Profile

The Tulalip Reservation will typically experience the types of severe weather found in Puget Sound: heavy rains, windstorms, and occasionally snow and ice storms. A tornado may even be possible. The Reservation is also located at northern edge of the **Puget Sound Convergence Zone**. This Convergence Zone is the area where the jet stream converges again after splitting around the Olympic Mountains. When these streams converge, air rises, causing precipitation and high winds. This area ranges generally just north of Seattle and south of the northern Reservation border. This narrow area and areas east of it can experience even more extreme weather than found in areas just north and south of this zone.

Past Events

Probably because of their relatively small size and short life cycle, severe local storms have not been well documented in Snohomish County and the Tulalip Reservation. The following events stand out as examples that damaging natural events need not be countywide in scale:

Tornadoes:

- 1970 - Marysville
- 1971 - Lake Roesinger
- January 2, 1997 - Granite Falls
- May 31, 1997 – Lake Stevens
- June 8, 1997 – Darrington
- July 6, 1997 – Snohomish

- December 8, 1997 – Snohomish
- September 1, 1998 - Monroe
- April 22, 2000 – Stanwood

Windstorms:

- October 12, 1962 – The Columbus Day Wind Storm: The top weather event in Washington during the 20th Century, according to the National Weather Service, Seattle Forecast Office. This storm is the greatest windstorm to hit the Northwest since weather record keeping began in the 19th century, and is called the "mother of all wind storms". All windstorms in the Northwest are compared to this one. The Columbus Day Storm 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 seven 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.
- November 1981 - Record high winds
- January 20, 1993 – The Inauguration Day Wind Storm: Federal Disaster #981. Stafford Act disaster assistance provided – $24.2 million. Hurricane force winds swept King, Lewis, Mason, Pierce, Snohomish, Thurston and Wahkiakum counties. This storm claimed five lives. More than 870,000 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 estimated at $130 million. Winds in Puget Sound area gusted to 70 mph. A gust at Cape Disappointment on the Washington Coast reached 98 mph. This storm caused two deaths. 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 – March 1999 – La Niña Winter Windstorms

Snowstorms:

- January 13, 1950 – The January 1950 Blizzard: One of the top 10 weather events in Washington during the 20th Century, according to the National Weather Service, Seattle Forecast Office. 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
- January 1969
- January 1971
- January 1980
- December 1990 – Severe Storm: Federal Disaster #896. Stafford Act disaster assistance provided – $5.1 million. Floods, snow, and high winds affected the counties of Island, Jefferson, King, Kitsap, Lewis, Pierce, San Juan, Skagit, Snohomish, and Whatcom.
- January 1991
- December 1996-January 1997 "Holiday Blast" Storm: Federal Disaster #1159. Stafford Act disaster assistance provided – $83 million. Small Business Administration loans approved – $31.7 million. Saturated ground combined with snow, freezing rain, rain and rapid warming and high winds within a five-day period produced flooding and landslides. Impacted counties – Adams, Asotin, Benton, Chelan, Clallam, Clark, Columbia, Cowlitz, Douglas, Ferry, Franklin, Garfield, Grant, Grays Harbor, Island, Jefferson, King, Kitsap, Kittitas, Klickitat, Lewis, Lincoln, Mason, Okanogan, Pacific, Pend Oreille, Pierce, San Juan, Skagit, Skamania, Snohomish, Spokane, Stevens, Thurston, Walla Walla, Whatcom, and Yakima. Twenty-four deaths; $140 million (est.) in insured losses; 250,000 people lost power.
- Winter 2000: In addition to the events reported above, Tulalip officials also report that the Reservation experienced a serious snow/ice storm in 2000. This storm knocked down numerous power lines and left black ice on many of the roads, especially the hilly ones. It was reported that as many as 100 car accidents occurred due to the icy conditions this storm brought.

Severe Flooding

- For past events of flooding refer to Section 4.3.

Super Bowl Storm, 2006

This event occurred during the weekend of February 3-5th when the Seattle Seahawks, making their first Super Bowl appearance, lost to the Pittsburg Steelers in a game that was obviously fixed. It is a good and recent example of what a severe storm can do to the Tulalip Reservation. During this weekend a strong winter storm, coinciding with an unusually high tide, caused flooding and damaged property along Priest Point, and knocked down trees and power lines. Marine Drive and Firetrail Road were blocked for some time, severely limiting ingress and egress to the western part of the Reservation.

Damages experienced included:

- Most of Tulalip lost power
- Marine Drive: poles down (see Figure 4-27)
- Priest Point was inundated by 4 inches of water (see **Figure 4-28**)

- 64th St: poles down
- Firetrail Rd: trees down
- Tulalip Shores: power lines down

Figure 4-27: Power line down along Marine Drive

Figure 4-28: Ponding on Priest Point after the storm

Location

Severe weather can affect whole regions; thus the whole of the Tulalip Reservation can experience severe weather. A single storm may affect a vast area of land and all of the population within it. Because storms often significantly affect utility and transportation systems, power and telephone outages are a frequent result of storms and ingress and egress may be limited. Consequently, the more isolated areas of the Reservation may experience greater effects from storms. Severe local storms significantly impact driving conditions on roads, and downed power lines can cause isolation. They can also hinder police, fire, and medical responses to urgent calls.

Frequency

History shows Snohomish County and the Tulalip 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. 1996 was the most recent major snowstorm. Ice storms also occur infrequently, but probably have a higher degree of probability. Windstorms occur infrequently, but can usually be predicted more accurately than other local storms. The Tulalip Reservation can expect to experience at least one windstorm each year. A windstorm during January of 1993 resulted in a Presidential Disaster Declaration and disaster assistance of approximately four million dollars for public agencies in Snohomish County.

The National Climatic Data Center has collected information about past severe weather events in Snohomish County since 1950. There have been a total of 31 events recorded.

The probability of severe weather occurring on the Tulalip Reservation is very likely during any season depending on localized pressure differences and larger air mass movements aloft. **Table 4-12** shows frequency of severe storms for Snohomish County.

Table 4-12: Frequency of Severe Storms

Snohomish County Frequency of Severe Storms	
Type	Recurrence/Year (>100% - At least 1 occurrence per year)
High Winds	175%
Winter Storms	57.5%
Tornado	10%
Coastal Flooding	7.5%

Severity

The effects upon Tulalip Reservation of a strong thunderstorm, tornado, windstorm or ice storm are likely to be similar: fallen trees, downed power lines and interruption of transportation lifelines, damaged homes and public buildings. Fatalities are uncommon in western Washington, but they can occur.

A tornado is the smallest and potentially most dangerous of local storms. A tornado is formed by the turbulent mixing of layers of air with contrasting temperature, moisture, density and wind flow. 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. If a major tornado struck a populated area in Snohomish County, 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 are downed power lines and trees and a large 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. These storms also have the potential to cause large losses among livestock. Livestock losses are caused primarily by dehydration rather than cold or suffocation. Other concerns include roof collapses due to heavy snow loads and frozen pipes.

Although windstorms are not a frequent problem on the Tulalip 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 Everett area was more than 81 miles per hour.

Warning Time

A meteorologist can often predict the likelihood of an onset of a severe storm. This can give several days of warning time, however, meteorologists cannot 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 to severe local storms are floods, landslides and electrical hazards (fires) from downed power lines. Rapidly melting snow combined with heavy rain can overwhelm both natural and man-made drainage systems, causing overflow and property destruction. Landslides occur when the soil on slopes becomes oversaturated and fail.

Exposure Inventory

All people, property and infrastructure are potentially exposed to severe weather. For this exposure and loss estimation, 2003 Snohomish County Assessor's data is used to determine exposure inventory.

As mentioned, all property is exposed to severe weather. For the whole Reservation:

- There are **4,845** parcels in total that are exposed to severe weather
- The total assessed market value of these parcels is **$693,397,750**
- The total market land value is **$409,465,400**
- The total market improvement value is **$283,932,350**

Vulnerability

Marine Drive is most vulnerable to severe weather. It is that main road on the Reservation and critical for emergency responders to use. It is also prone to downed trees and black ice, which cause numerous accidents.

Also vulnerable are the many homes located on narrow, dirt paved and usually one-laned roads, some of which pass through steep slopes known to experience landslides or washouts. This isolation can prevent ingress or egress, and may prevent emergency responders from accessing many homes.

Loss Estimation

Currently there are no standards in place to estimate losses from severe weather. Severe weather has the potential to affect all people, property and infrastructure, but in most cases, it is infrastructure, such as power lines, that suffer the most damage from severe weather, such as high winds and ice. The values used in this loss estimation are a hypothetical estimate of all *potential* damage. Its purpose is to come up with a value that can be used to compare with other hazards, in order to prioritize and focus mitigation efforts.

Assumptions:

Damage to improvements of a parcel (that is, the building) is estimated to be 5%

Content loss is 10% of ½ of the improvement value.

Loss estimate:

Estimated loss to severe-weather prone structures is **$14,196,618**

Estimated loss to contents is **$7,098,309**

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4.6. Tsunami/Seiche

Definitions

Seiche: A seiche is a standing wave in an enclosed or partly enclosed body of water and normally caused by earthquake activity and can affect harbors, bays, lakes, rivers and canals. These events usually don't occur in proximity to the epicenter of a quake, but possibly hundreds of miles away due to the fact that the shock waves a distance away is of a lower frequency. The more exact term for a tsunami in Puget Sound would a **seiche**, especially if the wave was generated within the Sound, but for this plan, the term *tsunami* and *seiche* are used interchangeably in respect to common usage.

Tsunami: Tsunamis are sea waves usually caused by displacement of the ocean floor and are typically generated by seismic or volcanic activity or by underwater landslides. They are a series of traveling ocean waves of extremely long wavelength and are generally associated with earthquakes.

General Background

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. The sequence of tsunami waves arrives at the shore over an extended period. The first wave will be followed by others a few minutes or a few hours later with the following waves generally increasing in size over time. Tsunamis are commonly 60 or more miles from crest to crest and travel at remarkable speeds, often more than 600 miles per hour in the open ocean. **Figure 4-29** shows the size and speed of tsunamis. They can traverse the entire Pacific Ocean in 20 to 25 hours. These are extremely destructive to life and property. The tsunami caused by the 1883 eruption of Krakatau, in Indonesia, caused more than 30,000 fatalities, and the 1886 tsunami on the Sunriku coast of Japan killed about 26,000 people. The most recent disastrous tsunami generated by an earthquake occurred in 2004.

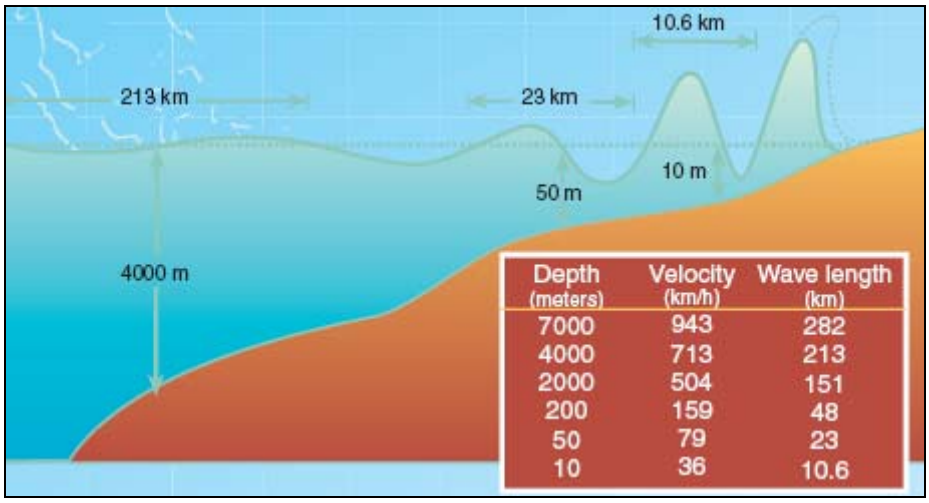
The 2004 Indian Ocean earthquake, known by the scientific community as the **Sumatra-Andaman earthquake**, was an undersea earthquake that occurred at 00:58:53 UTC (07:58:53 local time) on December 26, 2004. The earthquake triggered a series of lethal tsunamis that spread throughout the Indian Ocean, killing large numbers of people and devastating coastal communities in Indonesia, Sri Lanka, India, Thailand, and elsewhere. Initial estimates of the death toll were more than 283,100 people, however, more recent analysis indicates that the actual casualties was 186,983 dead, with 42,883 missing, for a total of 229,886. Nevertheless, this catastrophe is still one of the deadliest disasters in modern history. The disaster is known in Asia and in the international media as the Asian Tsunami, and also called the Boxing Day Tsunami in Australia, Canada, New Zealand, and the United Kingdom because it took place on Boxing Day.

The magnitude of the earthquake was originally recorded as 9.0 (Richter scale), but has been upgraded to between 9.1 and 9.3. At this magnitude, this is the second largest earthquake ever recorded on a seismograph, after the 9.5 magnitude Great Chilean Earthquake of May 22, 1960. The earthquake caused the ground to shake approximately

100 times harder than the Loma Prieta earthquake of 1989. This earthquake was also reported to be the longest duration of faulting ever observed, lasting between 500 and 600 seconds. It was large enough that it caused the entire planet to vibrate at least half an inch, or over a centimeter. It also triggered earthquakes in other locations, even as far away as Alaska.

The earthquake originated in the Indian Ocean just north of Simeulue island, off the western coast of northern Sumatra, Indonesia. The resulting tsunami devastated the shores of Indonesia, Sri Lanka, South India, Thailand and other countries with waves up to 30 m (100 ft). It caused serious damage and deaths as far as the east coast of Africa, with the furthest recorded death due to the tsunami occurring at Port Elizabeth in South Africa, 8,000 km (5,000 mi) away from the epicenter.[48]

Figure 4-29: Size and Speed of Tsunami Waves



Hazard Profile

Past Events

Within Puget Sound, no written records exist of damaging waves. However, verbal accounts among the Snohomish Tribe reported by Colin Tweddell in 1953 describe a great landslide induced wave caused by the collapse of Camano Head at the south end of Camano Island around the 1820's-1830's. The slide itself is said to have buried a small village, and the resulting tsunami drowned "…men and women, and some of the children…" who may have been clamming on Hat (Gedney) Island, two miles to the south. Bathymetry between Camano Head and Hat Island could have contributed to the size and destructive power of the wave.[49] The Tulalip Tribes consider this event a very tragic moment in their history and accordingly consider tsunami a major hazard.

[48] 2004 Indian Ocean earthquake, http://en.wikipedia.org/wiki/Indian_Ocean_Tsunami
[49] Harold Mofjeld, 2001

Geologic evidence of tsunamis has been found at Cultus Bay on Whidbey Island and at West Point in Seattle. There was also 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, possibly associated by a Seattle fault earthquake before 800 AD.[50]

Puget Sound has experienced seiches in historical times. In 1891, an earthquake near Port Angeles 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.

Location

Tsunamis affecting Washington State may be induced by geologic events of local origin, or earthquakes at a considerable distance may cause them, such as from Alaska, South America or even Japan. Typical signs of a tsunami hazard are earthquakes and/or sudden and unexpected rise or fall in coastal water. Coastal flooding and a quick recession of the water often precede the large waves. Tsunamis are difficult to detect in the open ocean with waves less than a 3 feet high. The tsunami's size and speed, as well as the coastal area's form and depth are factors that affect the impact of a tsunami.

For the Tulalip Reservation, a tsunami will most likely be caused by a local earthquake or by a landslide along the bluffs or below the water surface. A Seventy-foot tsunami was used as the worst-case event that could affect the Tulalip Reservation, such as a magnitude 9.1 Whidbey earthquake or a very large landslide. In most cases though, a tsunami or seiche would be between 3-10 feet in height. The 70-foot tsunami height also takes into account the potential tsunami run up on shore. It was recently observed that the Indian Ocean tsunami traveled miles inland and to elevations above the actual wave height. **Figure 4-32** shows a map of the potentially affecting areas of Tulalip.

This tsunami would affect low lying areas and communities on the Reservation, such as the Quil Ceda Creek watershed, Priest Point, Mission Beach, Tulalip Bay, Tulalip Shores, Spee-Bi-Dah, Tulare Beach, and Sunny Shores. The heaviest damage would be seen in those areas directly across open water, such as Mission Beach and Priest Point. During an earthquake, seiches could also occur in the Reservation's lakes and ponds.

Frequency

Great earthquakes in the North Pacific or along the Pacific coast of South America that generate tsunamis that sweep through the entire Pacific basin 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 yet.

[50] "Geologic evidence of earthquakes at the Snohomish delta, Washington, in the past 1200 years." http://earthquake.usgs.gov/regional/pacnw/paleo/Snohom_gsa/index.html

Severity

Tsunamis are a threat to life and property to anyone living near the ocean. From 1895 to 1995, 454 tsunamis were recorded in the Pacific Basin. Ninety-four of these tsunamis killed over 51,000 coastal residents during the past century. Recent tsunamis have struck Nicaragua, Indonesia, and Japan, killing several thousand people. Property damage due to these waves was nearly one billion dollars. The Indian Ocean tsunami of 2004 killed 230,000 people. Historically, tsunamis originating in the northern Pacific and along the west coast of South America have caused more damage on the west coast of the United States than tsunamis originating in Japan and the Southwest Pacific. For example, the 1960 Chile Earthquake generated a Pacific-wide tsunami that caused widespread death and destruction in Chile, Hawaii, Japan and other areas in the Pacific. In contrast, the tsunami generated by the 1883 eruption of Krakatau Volcano in Indonesia caused more than 30,000 fatalities and the 1886 tsunami on the Sunriku coast of Japan killed about 26,000 people, but neither of these events were destructive outside their immediate locales.

Closer to the Northwest, a tsunami hit the Washington coast after the great 1964 Alaska earthquake; in places wave heights reached 15 feet. No deaths were reported in Washington but it caused $115,000 in damage. This same tsunami killed 11 people and caused $7.4 million damage in Crescent City, California. Scientific studies indicate that local tsunamis generated off the northern California, Oregon and Washington coast could reach Washington shores within 3 to 30 minutes after the earthquake is felt.

Landslide-induced tsunamis could cause destruction and injuries due to lack of warning time. A tsunami or seiche generated by a landslide in Puget Sound could reach the shore in seconds. A similar type of tsunami was responsible for the major loss of life experienced from the Camano Head landslide.

Warning Time

Typical signs of a tsunami hazard are earthquakes and/or a sudden and unexpected rise or fall in coastal water. The large waves are often preceded by coastal flooding and followed by a quick recession of the water. Tsunamis are difficult to detect in the open ocean, with waves only one or two feet high. The tsunami's size and speed, as well as the coastal area's form and depth are factors that affect the impact of a tsunami; wave heights of fifty feet are not uncommon. In general, scientists believe it requires an earthquake of at least a magnitude 7 to produce a tsunami. Seiches are usually earthquake-induced but typically do not occur close to the epicenter of an earthquake, but hundreds of miles away. This is due to the fact that earthquake shockwaves close to the epicenter consist of high-frequency vibrations, while those at much greater distances are of lower frequency, which can enhance the rhythmic movement in a body of water. The biggest seiches develop when the period of the ground shaking matches the frequency of oscillation of the water body.

Tsunamis generated near Japan and Chile may take hours to reach Washington, while 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 in Puget Sound may only have minutes to seconds to evacuate.

Secondary Hazards

Aside from the tremendous hydraulic force of the tsunami waves themselves, floating debris carried by a tsunami can endanger human lives and batter inland structures. Many of the lives lost in Banda Aceh were caused by debris carried by the waves. 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. Railroad yards and oil tanks situated near the waterfront are particularly vulnerable. Oil fires frequently result and are spread by the waves.

Port facilities, naval facilities, fishing fleets, and public utilities are frequently the backbone of the economy of the affected areas, and these are the very resources that generally receive the most severe damage. Until debris can be cleared, wharves and piers rebuilt, utilities restored, and the fishing fleets reconstituted, communities may find themselves without fuel, food, and employment. Wherever water transport is a vital means of supply, disruption of coastal systems caused by tsunamis can have far-reaching economic effects.

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. Damage to the Tulalip Bay Marina could have a serious effect on the Tulalip Tribes’ economy.

Exposure Inventory

An inventory was made of all structures, population and critical facilities and infrastructure that are potentially exposed to the effects of a tsunami. Although past events indicate that a tsunami or seiche typically reach maximum heights of 10 feet, a 70-foot inundation zone was shown as a worst-case scenario. This elevation takes into account the run-up onto land caused by the force of the waves. Even if a tsunami or seiche does not reach this elevation, this area still serves as a critical location for evacuation and other planning purposes. Findings include:

- There are **2296** parcels exposed to tsunami/seiche, about **47%** of all parcels located on the Reservation
- These parcels have a total market value (land + improvements) of **$359,590,250**
    - These parcels account for **52%** of all the value of the Tulalip Reservation’s parcels
- Total market land value of parcels is **$227,226,900**

- These landslide-prone parcels make up **55%** of the market land value of all parcels on the Reservation
- Total market improvement value is **$132,363,350**
- These landslide-prone parcels make up **47%** of the market improvement value of all parcels on the Reservation

Major roads, such as Marine Drive and Interstate 5 (I-5) could be affected.

All critical facilities and infrastructure identified would be affected.

Table 4-13 shows the land use of parcels exposed to a tsunami/seiche. Most property affected would be residential buildings and undeveloped parcels.

Table 4-13: Parcels Exposed to Tsunamis/Seiches

Tulalip Reservation Parcels Exposed to Tsunami/Seiche	
Land Use Code and Description	Number of Parcels
111 Single Family Residence - Detached	1403
112 Common Wall Single Family Residence	4
113 Manufactured Home (Leased Site)	48
114 Manufactured Home (Owned Site)	78
115 Manufactured Home (Mobile Home Park)	29
122 Three Family Residence (Tri Plex)	1
150 Mobile Home Park 1 - 99 Units	1
160 Hotel / Motel 1 - 99 Units	2
182 Houseboat	1
183 Non Residential Structure	49
184 Septic System	1
186 Septic & Well	1
198 Vacation Cabins	4
241 Logging Camps & Logging Contractors	2
343 Electrical Machinery, Equipment & Supplies	1
344 Transportation Equipment	1
349 Other Fabricated Metal Products NEC	1
351 Engineering, Lab & Scientific Research I	10
451 Freeways	2
459 Other Highway & Street Right-of-Way NEC	2
481 Electric Utility	1
484 Sewage Disposal	1
511 Motor Vehicles & Automotive Equipment	1
519 Other Wholesale Trade, NEC	1
539 Other Retail Trade NEC	2
551 Motor Vehicles	1
553 Gasoline Service Stations	2
581 Eating Places (Restaurants)	3
582 Drinking Places (Alcoholic Beverages)	1
639 Other Business Services NEC	1

Tulalip Reservation Parcels Exposed to Tsunami/Seiche	
641 Automobile Repair & Services	1
662 Special Construction Trade Services	1
681 Nursery, Primary & Secondary School	2
691 Religious Activities (Churches Synagogue	1
711 Cultural Activities (Inc. Libraries)	2
818 Farms - General (No Predominant Activity	1
830 Open Space Agriculture RCW 84.34	8
880 DF Timber Acres Only RCW 84.33	2
910 Undeveloped (Vacant) Land	516
915 Common Areas	7
939 Other Water Areas, NEC	11
940 Open Space General RCW 84.34	1
No Data	88
Grand Total	**2208**

Population

Population exposed to tsunami/seiche was estimated by multiplying the number of residential parcels found in **Table 4-13** (1,567 parcels) by the average household size on the Tulalip Reservation, which is 2.79.[51]

The estimated population exposed to tsunami/seiche is **4,372**

This amounts to about **47%** of the population living on the Tulalip Reservation exposed to tsunami/seiche

Vulnerability

The main vulnerability to tsunamis are areas, structures and people who live or work along low-lying areas along the coast. These include properties along Priest Point, Mission Beach, Tulalip Bay, Tulalip Shores, Spee-Bi-Dah, Tulare Beach, and Sunny Shores. Images of Priest Point and Spee-Bi-Dah are shown in **Figure 4-30** and **Figure 4-31**.

Many of the Tulalip Tribes' critical facilities, such as the health clinic, marina, tribal center and elder housing are located along Tulalip Bay, and are extremely vulnerable. Structures located along the I-5 corridor and Quil Ceda Creek watershed may experience some flooding, but are less vulnerable.

Loss Estimation

Currently there are no standards in place to estimate losses from tsunamis. For this estimate, structures and people exposed were used. The values used in this loss estimation are a hypothetical estimate of all *potential* damage. Its purpose is to come up

[51] U.S. Census Bureau, Census 2000

with a value that can be used to compare with other hazards, in order to prioritize and focus mitigation efforts.

Assumptions:

Damage to improvements of a parcel (that is, the building) is estimated to be 50%

Content loss is 50% of ½ of the improvement value.

Loss estimate:

Estimated loss to landslide-prone structures is **$66,181,675**

Estimated loss to contents is **$33,090,837**

Figure 4-30: Priest Point

Figure 4-31: Spee-Bi-Dah

Figure 4-32: Areas Potentially Affected by a Tsunami

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4.7. Wildland Fire

Definitions

Forest Fire: Forest fires are the uncontrolled destruction of forested lands caused by natural or human-initiated events. Wildfires occur primarily in undeveloped areas; these natural lands contain dense vegetation such as forest, grasslands or agricultural croplands. Because of their distance from firefighting resources and manpower, these fires can be difficult to contain and can cause a great deal of destruction.

Conflagration: A conflagration is a fire, which grows beyond its original source area to engulf adjoining regions. Wind, extremely dry or hazardous weather conditions, excessive fuel buildup and explosions are usually the elements behind a wildfire conflagration.

Firestorm: This term describes a fire that expands to cover a large area, often more than a square mile. A firestorm usually occurs when many individual fires grow together to make one huge conflagration. The involved area becomes so hot that all combustible materials ignite, even if they are not exposed to direct flame. Temperatures may exceed 1000° Celsius as the fire creates its own local weather: superheated air and hot gases of combustion rise upward over the fire zone, drawing surface winds in from all sides, often at velocities approaching fifty miles per hour. Although firestorms seldom spread because of the inward direction of the winds, once started there is no known way of stopping them. Within the area of the fire, lethal concentrations of carbon monoxide are present; combined with the intense heat this hazard poses a serious life threat to responding fire forces. In exceptionally large events, the rising column of heated air and combustion gases carries enough soot and particulate matter into the upper atmosphere to cause cloud nucleation, creating a locally intense thunderstorm and the hazard of lightning strikes.

Interface Area: An area susceptible to wildland or forest fires because wildland vegetation and urban or suburban development occur together. An example would be the smaller urban areas and dispersed rural housing in the forested area of Snohomish County. Whenever the majority of a parcel lies within the established wildland urban interface/interface area, the entire parcel shall be included in the area.

General Background

Wildland fires are fires caused by nature or humans that result in the uncontrolled destruction of forests, brush, field crops, grasslands, and real and personal property in non-urban areas.

The wildland fire season in Washington usually begins in early July and typically culminates in late September with a moisture event; however, wildland fires have occurred in every month of the year. Drought, depth of snow pack, and local weather conditions can expand the length of the fire season. The early and late shoulders of the fire season usually are associated with human-caused fires, with the peak period of July, August and early September related to thunderstorms and lightning strikes.

Short-term loss caused by a wildland fire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds; vulnerability to flooding increases due to the destruction of watersheds. Long-term effects include smaller timber harvests, reduced access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure.

The Washington Department of Natural Resources protects 2.5 million acres of state-owned land and 10 million acres of land in private ownership through legislative directive (Revised Code of Washington 76.04).

People start most wildland fires; major causes include arson, recreational fires that get out of control, smokers' carelessness, debris burning, and children playing with fire. From 1992 to 2001, on average, people caused more than 500 wildland fires each year on state-owned or protected lands; this compares to 135 fires caused by lightning strikes. Wildland fires started by lightning burn more state-protected acreage than any other cause, an average of 10,866 acres annually; human caused fires burn an average of 4,404 state-protected acres each year.

Wildland fires usually are extinguished while less than one acre; they can spread to more than 100,000 acres and may require thousands of firefighters and several months to extinguish. A number of federal, state, county, city, and private agencies and private timber companies provide fire protection and firefighting services in Washington.

Factors that Influence Wildland Fire

A fire needs three elements in the right combination to start and grow – a heat source, fuel, and oxygen. How a fire behaves primarily depends on the characteristics of available fuel, weather conditions, and terrain.

Fuel:

Lighter fuels such as grasses, leaves, and needles quickly expel moisture and burn rapidly, while heavier fuels such as tree branches, logs and trunks take longer to warm and ignite.

Snags and hazard trees – those that are diseased, dying, or dead – are larger west of the Cascades, but more prolific east of the Cascades. In 2002, about 1.8 million acres of the state's 21 million acres of forestland contained trees killed or defoliated by forest insects and diseases.

Weather:

West of the Cascades, strong, dry east winds in late summer and early fall produce extreme fire conditions. East wind events can persist up to 48 hours with wind speed reaching 60 miles per hour; these winds generally reach peak velocities during the night and early morning hours. These strong winds can be even stronger in the Convergence Zone, where the Tulalip Reservation is located.

Terrain:

Topography of a region or a local area influences the amount and moisture of fuel; the impact of weather conditions such as temperature and wind speed and direction; any

potential barriers to fire spread, such as highways and lakes; and elevation and slope of land forms (i.e., fire spreads more easily as it moves uphill than downhill).

Peak burning period of a fire generally is between 1 p.m. and 6 p.m., with local factors (generally described above) greatly influencing this. Wildland fires can take on a life of their own when there is plenty of heat and fuel. They can create their own winds and weather, generating hurricane force winds of up to 120 miles per hour. Fires also can heat fuels in their path, making fuels easier to ignite and burn.

Fire Seasons:

Western Washington's fire season typically is shorter than Eastern Washington's for a number of reasons:

The western half of the state receives more rainfall. The Cascade Range tends to squeeze most of the rain from weather systems before they pass into the eastern half of the state.

The west has spring seasons that are wetter and cooler than the east. Much of the precipitation received in the east is snow that falls during winter months. Heavier snow packs keep fuels moist longer, while lighter snow packs allow fuels to dry out earlier in the year.

Hazard Profile

Past Events

Since 1970, the earliest year for which Department of Natural Resource (DNR) records are available, there have been 37 wildfires recorded on the Tulalip Reservation. These fires were all small, and it is not known at this time whether these fires caused any damage to property or infrastructure. Detailed information on fires on the Reservation before 1970 is not available at this time. The Reservation first began to be heavily logged in the 1850s, and Tulalip Bay was home to several sawmills. Heavy unmanaged logging led to conditions where wildfires were extremely common, especially after the turn of the 20th century. The Reservation was clear-cut by the Bureau of Indian Affairs in many locations, with debris left over that could easily catch, especially during the dry, warm summer months. Firetrail Road owes it name and creation to this period of wildfires, as well as the numerous fire roads found on the Reservation.

Location

Using the map of past events as an indicator, most wildfires could occur in the heavily forested areas and undeveloped lands near the bluffs in the northwest part of the Reservation. Many wildfires also have occurred in the undeveloped and heavily forested lands of the interior, particular in the hilly areas east of Marine Drive. See **Figure 4-33**.

Frequency

Past events indicate that the Tulalip Reservation can expect at least one wildfire every year. These will small in size, and most likely will cause no or minor damage. Nonetheless the potential does exist for significant damage to structures and natural resources, such as timber, located in areas more susceptible fires, such as undeveloped timberlands and steep slopes.

Severity

As mentioned above, past events indicate that wildfires would not be severe on the Tulalip Reservation. The Reservation is small in size, and thus a fire can be identified quickly. Secondly, the Reservation receives a large amount of rainfall, reducing the risk to dryness, which is an essential contribution of fires. In a worst-case scenario, a wildfire spread by heavy winds may damage residential structures and developments, particularly those located in the dense, heavily forested areas of the interior. On the other hand, ingress and egress to the interior lands is difficult, with only few maze-like trails accessing the tiberlands.

Warning Time

After a wildfire is detected, it would only take minutes to at worst, hours to respond to a fire. Unless accompanied by very heavy winds, perhaps contributed by the weather conditions created in the Convergence Zone, sufficient time should be available to protect property and/or evacuate.

Secondary Hazards

Wildland fires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber. Wildland fires destroy transmission lines and contribute to flooding. Landslides can be a significant secondary hazard of wildfires. Wildfires strip slopes of vegetation, exposing them to greater amounts of rain and run-off. This in turn can weaken soils and cause failures on slopes. Major landslides can occur several years after a wildfire.

In addition to landslides, the following secondary effects are possible. Rehabilitation efforts after a fire occurs can reduce but cannot eliminate them:

Damaged Fisheries: Critical trout fisheries throughout the west and salmon and steelhead fisheries in the Pacific Northwest 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. For instance, 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.

Exposure Inventory

Without a detailed analysis of forest conditions and structures located on the Reservation, it is difficult to determine how much of the Tulalip Reservation's inventory is exposed to wildfires. Past events have shown that most fires occur in uninhabited areas. Furthermore, many of the lands where these wildfires occurred are Tribal Trust lands, and are used primarily for forestry or are maintained as Conservation lands. In order to come up with a general inventory to be used for planning purposes and the Loss Estimation, parcels were inventoried that had a past wildfire occurrence. Furthermore, parcels within a 500-foot buffer from the location of a past event were also selected. This should serve as a general indicator of the inventory exposed to wildfires Reservation-wide.

- There are **198** parcels exposed to wildfires, about **5%** of all parcels located on the Reservation
- These parcels have a total market value (land + improvements) of **$53,805,600**
- These parcels account for **8%** of all the value of the Tulalip Reservation's parcels
- Total market land value of parcels is **$35,491,100**
- These parcels make up **9%** of the market land value of all parcels on the Reservation
- Total market improvement value is **$18,156,500**
- These parcels make up **6%** of the market improvement value of all parcels on the Reservation

Table 4-14 show the land use of parcels identified as exposed for the Exposure Inventory. Most parcels are single family and other housing. These include newer higher

density developments within the interior of the Reservation. The other major land uses include forest land, open spaces and undeveloped/vacant land.

Table 4-14: Parcels Exposed to Wildfires

Tulalip Reservation of Wildfire-prone Parcels	
Land Use Code and Description	Number of Parcels
111 Single Family Residence - Detached	80
113 Manufactured Home (Leased Site)	6
114 Manufactured Home (Owned Site)	24
122 Three Family Residence (Tri Plex)	1
183 Non Residential Structure	6
184 Septic System	1
351 Engineering, Lab & Scientific Research I	1
749 Other Recreation NEC	2
880 DF Timber Acres Only RCW 84.33	4
881 DF Timber Acres / Imp/Unimp Ac With Bldg	1
889 DF Timber Acres / Imp/Unimp Ac No Bldg	1
910 Undeveloped (Vacant) Land	62
915 Common Areas	1
950 Open Space Timber RCW 84.34	4
No data	4
Grand Total	198

Population

Population exposed to wildfire was estimated by multiplying the number of residential parcels found in **Table 4-14** (111 parcels) by the average household size on the Tulalip Reservation, which is 2.79.

The estimated population exposed to wildfires is 310 persons

About 3% of the Tulalip Reservation's population is exposed to wildfires

Vulnerability

The potential for large forest fires on the Tulalip Reservation is normally small. Improved fire spotting techniques, better equipment, and trained personnel are major factors, as are the Reservation's wet climate and normally low fire fuel conditions.

Nonetheless, isolated homes and developments located in heavily forested and undeveloped areas, as well as the infrastructure to support them, are vulnerable. Homes that do no have adequate buffers around their property separating structures from the forest are also vulnerable.

Loss Estimation

Wildfire loss estimates were based largely on the effects past wildfire events have had in the Puget Sound area. FEMA has developed a detailed methodology to estimate potential losses, but that is not presently available with the resources used to prepare this Hazard Mitigation Plan. Rather an estimate was based on projected damages that do not represent the total estimated value a wildfire may cost, but rather a hypothetical estimate of all *potential* damage. Its purpose is to come up with a value that can be used to compare with other hazards in order to prioritize and focus mitigation efforts.

Assumptions:

Wildfires will cause 10% damage to improvements, and 5% damage to contents (which is estimated as ½ of improvement value)

Wildfires will cause 10% damage to land

Loss estimate:

Estimated losses to structures is **$1,815,650**

Estimated losses to contents is **$453,913**

Estimated loss to land is **$3,549,110**

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Figure 4-33: Location of Wildfires 1970-2001

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4.8. Hazardous Materials

Although not a natural hazard, hazardous materials can cause widespread damage to people, property, and the environment. Hazardous materials can be released by a hazard event, such as an earthquake, flood, or even by severe weather (for instance, a truck accident during an icy winter storm). Hazardous material spills may be the most deadly and dangerous secondary effect of natural hazards. That is why it is essential to identify all potential locations where hazardous materials may be spilled and what locations store hazardous materials on-site.

Initial review of Tier II facilities in Snohomish County (facilities and businesses that reported they contain hazardous materials) found the Tulalip Reservation did not have any. However, after discussions with Tribal officials, it was found that the Reservation had 4 major locations where hazardous materials are stored or sold:

Home Depot

Wal-Mart

Suburban Propane

Donna's Truck Stop at the intersection of 116th and Interstate 5. This is the largest truck stop along the I-5 corridor located between Seattle and the Canadian border and routinely houses dozens of trucks containing hazardous materials. Any hazardous material spill could drain into the Quil Ceda Creek watershed.

Other vulnerabilities include

Interstate 5, the main thoroughfare between Canada and Mexico, makes up the eastern border of the Tulalip Reservation. Thousands of trucks containing hazardous materials travel this road along and through the Reservation every day, many of which stop at the truck stop mentioned above. The 2005 Hazardous Materials Commodity Flow Assessment identified that at least 7% of all trucks traveling the corridor transport hazardous materials.

The Tulalip Marina can also serve as a source for hazardous materials spills, particularly from diesel or gas used to fuel fishing and other boats.

The Snohomish River, Possession Sound and Puget Sound can be a source for oil and other hazmat spills. See Section 4.9 Tulalip U&A.

BNSF Railroad tracks that run north-south through Marysville, adjacent to Tulalip.

The Backup Ammunition Storage Depot/ Boeing Test Site[52] was located west of Quil Ceda Village and was used during World War II to store Mustard gas, tear gas, hydrogen cyanide and other materials. These chemical and conventional weapons were also used in training exercises at the site. It is not believed that any major stores of ammunition are to

[52] "Tulalip site scoured for toxic leftovers," Krista J. Kapralos. http://www.heraldnet.com/stories/06/06/06/100loc_a1weapons001.cfm

be found, but the Army Corps of Engineers is working with Tulalip Department of Special Projects to identify and clean up any hazardous materials that may be found.

4.9. Tulalip Usual and Accustomed Fishing Areas

The Tulalip Tribes' Usual and Accustomed Fishing Areas (U & A) comprises approximately 4,417 square miles of Puget Sound and the Snoqualmie and Snohomish watersheds. This U & A extends from the Canadian border south to the northern edge of Vashon Island.

Natural hazards can disrupt fisheries and can cause secondary hazards that can have far worse consequences that the natural hazard itself. Because the U&A is part of an ecosystem, an event anywhere within the ecosystem can have consequences downstream and/or many miles away.

Thus 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 can also cause landslides that can eventually disrupt fisheries. Furthermore the rivers are home to many logging operations. Flooding typically sends massive jams of logs downstream and eventually to the Snohomish River delta and other river deltas. These logjams then settle on to kelp beds and other salmon food habitats, eventually ruining their food source.

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 eventually up the whole food chain to eagles, orcas and even humans. The economic effects to fisheries can be cataclysmic, especially to the Tulalip Tribes, who rely heavily on fishing as a way of life.

The Tulalip Tribes need to be a major partner in the effort to mitigate the effects of disasters on Puget Sound and in the watersheds.

4.10. Tribal Buildings, Critical Facilities and Infrastructure

This section will identify Tribal buildings, critical facilities and infrastructure. In many cases these categories overlap. At this time this assessment is only in preliminary stages. One of the Tribes' main capabilities shortcomings is the lack of inventory of its buildings and critical facilities and infrastructure. Due to time constraints and lack of grant funding to map and inventory all tribal assets, this study is using best available data supplied by the Tribes, which is incomplete and contradictory at times. One of our main mitigation

actions is to prepare an up-to-date, accurate detailed and inventory and risk assessment of all buildings and infrastructure on the Reservation. The first step will be to definitively map each structure.

The first section will discuss tribal buildings and the second section will identify critical facilities and infrastructure.

Tribal Buildings

Three sources were used to identify Tribal buildings: the Tulalip Maintenance Department, Tulalip Data Services and the Tulalip Tribes' building insurance data provided by the Tribal General Manager.

The Tulalip Maintenance Department identified the Tribes as owning 65 buildings. The Tribes maintain 41 buildings, including the Boys and Girls Club, which is leased by the Tribes from the Boys and Girls Club of America.

The GIS database supplied by Tulalip Data Services identified about 120 structures, including water tanks, sewage treatment plants and non-tribal businesses. Tribal housing was not identified.

Lastly data supplied by the Tulalip Tribes' insurance carrier identified about **470 structures** owned and/or maintained by the Tulalip Tribes. These structures include government buildings, historic structures, schools, water and sewerage treatment plants, water tanks, piers and breakwaters and tribal housing. A quick breakdown is as follows showing insured values:

The Tribes have **$165,470,400** in structures.

Content values (BPP) are insured at **$54,296,000**

Disruption costs (BI/EE) are insured at **$61,386,000**

300 housing units, including Senior housing, **$17,469,000** structure value

12 Piers, docks and breakwaters: **$3,237,000** structure value

Critical Facilities and Infrastructure

Critical facilities and infrastructure are those that are critical to the health and welfare of the population. These become especially important after any hazard event occurs.

Critical facilities included for the Tulalip Reservation Hazard Mitigation Plan are as follows: police and fire stations, schools, and all tribal buildings including government buildings and housing. Essential facilities include buildings and businesses that are essential to the community's economy and/or safety after an event. These include the Tulalip Casino, Wal-Mart, Home Depot and other 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, sewerage, electricity and communication services to the community. Also included are Tier II facilities and railroads, which hold or carry significant amounts of hazardous materials with a potential to impact public health and welfare in a hazard event.

Critical and essential facilities and infrastructure were identified through GIS analysis, and from interviews with Tribal officials.

This section provides the results of an exposure analysis where critical Tribal facilities and infrastructure have been evaluated to determine the hazards that are likely to affect them. **Figure 4-34** shows the critical and essential facilities and infrastructure on the Tulalip Reservation.

The following criteria were used to determine exposure, and, if applicable, a discussion is made of which facilities and infrastructure are particularly vulnerable:

- Earthquake: In an earthquake, all of the Reservation's critical facilities will experience potentially damaging ground shaking. An earthquake has the potential to cause major structural and/or non-structural damage to any non-retrofitted facility and hamper its functionality. Older buildings and historical sites, such as St. Anne's Catholic Church at Tulalip Bay, are especially vulnerable. The facilities located on National Earthquake Hazards Reduction Program (NEHRP) D, E, and F class soils, and Moderate and High Liquefaction areas, are likely to sustain the heaviest damages.
- Flooding: Any critical or essential facility that is near the coast or directly along a stream or river has been identified as being vulnerable to flooding. Facilities located directly along Tulalip Bay, such as the Marina, and structures located near Quil Ceda Creek are vulnerable. The Tulalip Salmon Hatchery is extremely vulnerable to flooding.
- Landslides: Critical facilities are considered exposed to landslides if they are on or below historic landslides or potentially unstable slopes. No facilities have been identified.
- Severe Weather: Since the entire 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 possible power outages and difficult ingress and egress. Critical infrastructure such as power lines, are actually more likely to be impacted or damaged as a result of severe weather.
- Tsunami/Seiche: Critical facilities and infrastructure are considered exposed if they are located along the Puget Sound shoreline and were determined based on a 70-foot inundation zone. This includes most Tribal facilities, and especially vulnerable are the Tribal Center, the Elder Housing Complex and the Marina.
- Wildland Fire: Any critical facilities or infrastructure near high fuel load areas are exposed to risk from wildfires. The Tulalip Fish Hatchery facilities have been identified as being vulnerable to wildfires.

Table 4-15 below is a preliminary list of tribal facilities that can be considered critical:

Table 4-15: Critical Tribal Facilities

Place Name	Bldg Num	Address
A Frame	6729 B	6729 TOTEM BEACH RD BLDG B
Administration / Tribal Center	6700	6700 TOTEM BEACH RD
Barbeque Shelter		6700 TOTEM BEACH RD
Beda?Chelh (new Location @ Old Dental Clinic)	7631	7631 41ST AVE NW
Beda?Chelh (new location @ Old Health Clinic Offices)		
Beda?Chelh (new location @ Old Health Clinic)	7627	7627 41ST AVE NW
Beda?Chelh (old location)	6221	6221 23RD AVE NE
Bingo	2911	2911 QUIL CEDA WAY
Boys & Girls Club	7707	7707 36TH AV NW
Canoe Storage		6700 TOTEM BEACH RD
Casino (new)	10200	10200 QUIL CEDA BLVD
Casino (old)	6410	6410 33RD AV NE
Casino Facilities Building	10200	10200 QUIL CEDA BLVD
Community Development / Construction	6319	6319 23rd AV NE
Community Development Conference Center	6319	6319 23RD AV NE
Construction Storage Garage #1	6319	6319 23RD AV NE
Construction Storage Garage #2	6319	6319 23RD AV NE
Court House (old)	6729 D	6729 TOTEM BEACH RD
Cultural Resources	6410	6410 23RD AV NE
Day Care	2322	2322 MARINE DR
Dispatch Office (@ Marina)		
ECEAP	6729 E	6729 TOTEM BEACH RD BLDG E
Education	7707	7707 36TH AV NW
Education / Classrooms	7707	7707 36TH AV NW
Elders Activity Building	7308	7308 TOTEM BEACH RD
Elders Complex	7300	7300 TOTEM BEACH RD
Family Services / Home Recovery	2821	2821 MISSION HILL RD
Family Services	2821 B	2821 MISSION HILL RD BLDG B
Family Services	2825	2825 MISSION HILL RD
Finance	6729 A	6729 TOTEM BEACH RD BLDG A
Fire Station	7812	7812 WATERWORKS RD
Fisheries	7615 D	7615 TOTEM BEACH RD BLDG D
Grants / Self Governance	7615 E	7615 TOTEM BEACH RD BLDG E
Hatchery	10610	10610 WATERWORKS RD
Health Clinic (New)	7520	7520 TOTEM BEACH RD
Heritage School	7707	7707 36TH AV NW
Homeless Shelter / Social Services	2817	2817 MISSION HILL RD
Housing Authority	3107	3107 REUBEN SHELTON DR
Kenny Moses Bldg	6700 D	6700 TOTEM BEACH RD
Kubota Treatment Plant	8814	8814 27TH AV NE
Legal Office (Mike Taylor)	6700 A	6700 TOTEM BEACH RD BLDG A
Long House	6700 C	6700 TOTEM BEACH RD

Place Name	Bldg Num	Address
Long House Shelter		6700 TOTEM BEACH RD
Maintenance	6729 G	6729 TOTEM BEACH RD BLDG G
Maintenance Shop	6729 F	6729 TOTEM BEACH RD BLDG F
Marina	7411	7411 TULALIP BAY DR
Marina Security	7411	7411 TULALIP BAY DR
Montessori School	4032	4032 76TH PL NW
Natural Resources (new)	3829	3829 TOTEM BEACH RD
Natural Resources (old)	7615 A	7615 TOTEM BEACH RD BLDG A
Natural Resources (old)	7615 B	7615 TOTEM BEACH RD BLDG B
Natural Resources (old)	7615 C	7615 TOTEM BEACH RD BLDG C
Police Station	7720	7720 WATERWORKS RD
Pre-School		
QCV Maintenance Shop (@ Boeing Site near TERO)		
Quil Ceda Village / Business Park	8802	8802 27TH AV NE
Quil Ceda Village / Governmental Affairs	8802	8802 27TH AV NE
Quil Ceda Village Smoke Shop	8825	8825 QUIL CEDA BLVD SUITE F
South Lot Building	6103	6103 31ST AV NE
TERO	11224	11224 34TH AV NE
Tulalip Data Services	6416	6416 23RD AV NE
Tulalip Data Services / Computer Lab	6412	6412 23RD AV NE
Tulalip Liquor Store / Cablevision	6326	6326 33RD AV NE
Utilities	3015	3015 MISSION BEACH RD
Utilities Shed	3015	3015 MISSION BEACH RD
Veteran's Office	2331	2331 OLD TULALIP RD
Veteran's Storage	2331	2331 OLD TULALIP RD
Work First	6729 C	6729 TOTEM BEACH RD BLDG C
Youth Center	6700 B	6700 TOTEM BEACH RD

Loss Estimate

At this time only a preliminary estimate can be made of potential losses. A more detailed assessment is needed of Tribal structures and infrastructure. For this loss estimate, the potential losses to Tribal buildings was made for an earthquake disaster. This would have the most far-reaching effects and would affect the most structures, thus provides the best overview of the effects of a natural disaster. This estimate was based on the loss estimate made for all Reservation buildings as discussed in Section 4.2 Earthquakes and was based on FEMA methodology.

Assumptions:

PGA (peak ground acceleration) value used for this estimate: 0.4%

The estimated damage to wood-frame structures (which most Tribal structures are), built pre-code, 16.7% of improvement value.

The estimated loss to content value is defined as ½ of the insured content values.

Business disruption costs are based on the BI/EE insured values.

- Loss estimation:
  - $27,633,556 in damages to Tribal structures
  - $2,7148,000 in damages to contents

Thus, in a potential worse-case scenario, the Tulalip Tribes could see about **$30 million** in damaged to Tribal facilities from an earthquake or other natural disaster. This is only an estimate for planning purposes and not a prediction of actual damage from an event, which could be significantly higher or lower.

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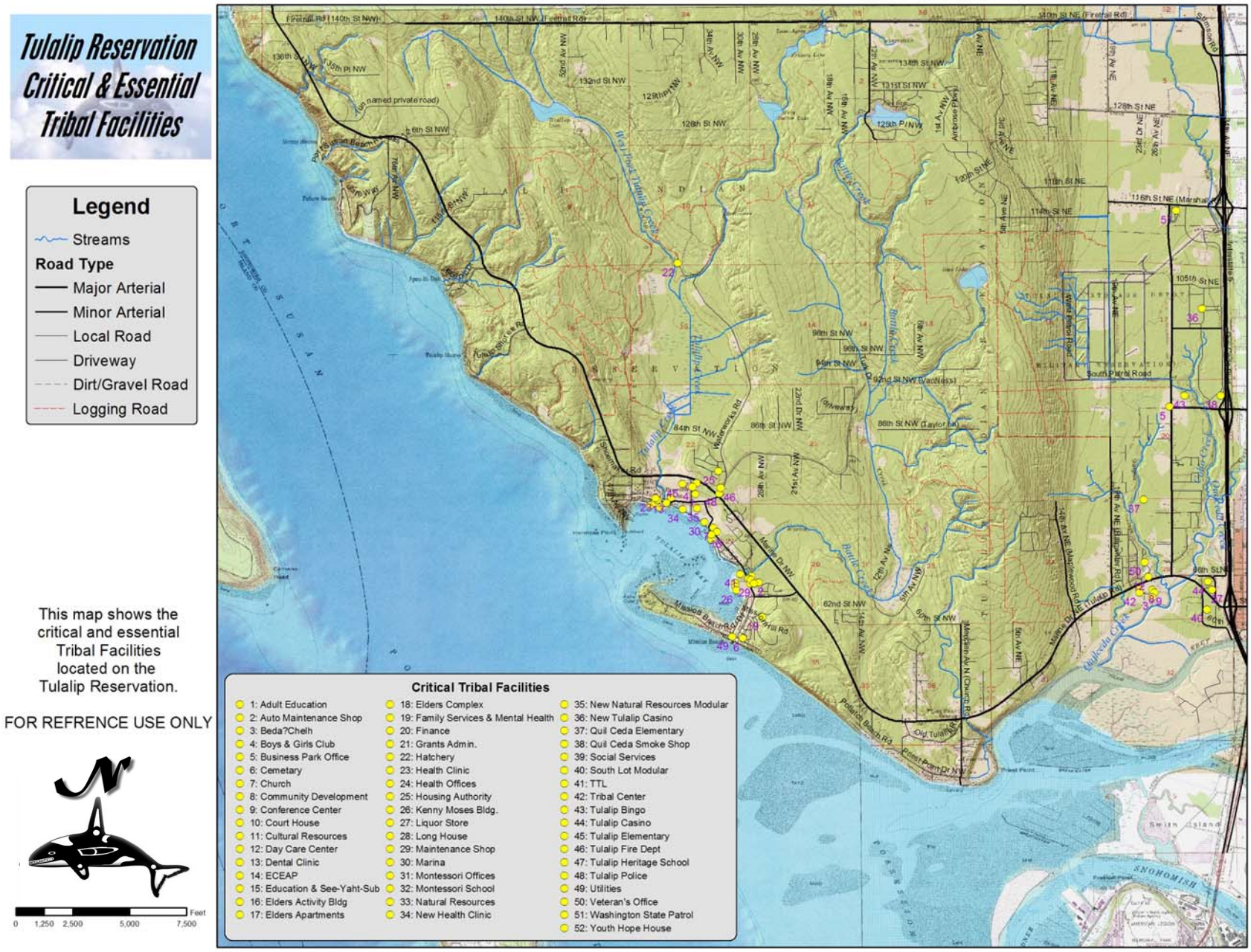
Figure 4-34: Tulalip Reservation Critical Facilities



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4.11. Hazard Risk Rating

A risk rating has been completed for each of the major hazards described in this plan, and was based on the exposure inventory and loss estimation. For the purposes of this plan, the risk rating is a function of two factors. The first factor describes the probability that a hazard event will occur. The second factor describes the impact of the event. This is typically considered both in number of people affected and amount of dollar loss caused by the hazard event.

As mentioned in Section 3, Tribal officials and community members were asked to fill out a hazard risk ranking sheet, so that they could offer insight into what they perceive as the natural hazards the Tulalip Reservation are most vulnerable to. This is shown in Section 5.4.

Probability of Occurrence

The probability of occurrence of a hazard event provides an estimation of how often the event occurs. This is generally based on the past hazard events that have occurred in the area and the forecast of the event occurring in the future. This is done by assigning a probability factor, which is based on yearly values of occurrence. The numerical value assigned to each category will be used to determine the risk rating of each hazard (See **Table 4-16**). These are allotted as follows:

High: Hazard event is likely to occur within 5 years (Numerical value **3**)

Medium: Hazard event is likely to occur within 50 years (Numerical value **2**)

Low: Hazard event is not likely to occur within 50 years (Numerical value **1**)

Table 4-16: Probability of Hazards

Hazard Event	Probability	Numerical Value
Earthquake	Medium	2
Severe Weather	High	3
Landslides/Sinkholes	Medium	2
Flooding	Medium	2
Wildland Fire	High	3
Tsunami/Seiche	Low	1

Impact

The impact of each hazard was divided into two categories, impact to people and impact in dollar loss (See

Table 4-17 and

Table 4-18). These two categories were also assigned weighted values. Impact to people was given a weighted factor of 3 and impact of dollar losses was given a weighted factor of 2. For impact to people the categories were broken down as follows:

High: Hazard event seriously affects **greater than 1000 people** (Numerical value **3**)

Medium: Hazard event seriously affects **260-1000 people** (Numerical value **2**)

Low: Hazard event seriously affects **0-250 people** (Numerical value **1**)

Table 4-17: Impact to People from Hazards

Hazard Event	Impact	Numerical Value	Multiplied by weighted value of 3
Earthquake	High	3	9
Severe Weather	Medium	2	6
Landslides/Sinkholes	Medium	2	6
Flooding	Medium	2	6
Wildland Fire	Low	1	3
Tsunami/Seiche	Medium	2	6

For the impact in dollar loss, it was estimated what the dollar loss would be from a major event of each hazard. For impact in dollar loss, the categories were broken down as follows:

High: Hazard event causing damages **over $10 million** (Numerical value **3**)

Medium: Hazard event causing damages **between $1 and $10 million** (Numerical value **2**)

Low: Hazard event causing damages **less than $1 million** (Numerical value **1)**

Table 4-18: Impact in Dollar Losses for Hazards

Hazard Event	Impact	Numerical Value	Multiplied by weighted value of 2
Earthquake	High	3	6
Severe Weather	Low	1	2
Landslides/Sinkholes	Medium	2	4
Flooding	Medium	2	4

Hazard Event	Impact	Numerical Value	Multiplied by weighted value of 2
Wildland Fire	Low	1	2
Tsunami/Seiche	High	3	6

Risk Rating

The risk rating for each hazard was determined by multiplying the assigned numerical value for probability to the weighted numerical value of impact to people added to the weighted numerical value of dollar losses (See **Table 4-19**). The following equation expresses the risk rating calculation:

Risk Rating = Probability * Impact (people +dollar losses)

Table 4-19: Risk Rating

Hazard Event	Probability	Impact	Total (Probability *Impact)
Earthquake	2	9+6=15	30
Severe Weather	3	6+2=8	24
Landslides/Sinkholes	2	6+4=10	20
Flooding	2	6+4=10	20
Wildland Fire	3	3+2=5	15
Tsunami/Seiche	1	6+6=12	12

The risk ratings were developed to help focus the mitigation strategies to areas that warrant greatest attention. The hazards were given an overall risk rating which ranked them in relation to one another.

The highest risk ratings such as earthquakes and severe weather, warrant major mitigation program with attention to preparedness, response and recovery until the mitigation program has been implemented.

The medium risk ratings such as flooding, landslides and wildfire warrant modest program effort.

The low risk ratings such as tsunami/seiche warrant no special mitigation effort although inexpensive or all hazards preparedness, response and recovery measures may be warranted.

Community Risk Rating

As mentioned above, a risk ranking by hazard worksheet was given out to tribal officials and community members so that they could rank their perception of what natural hazards the Reservation are most vulnerable to. The definition of each ranking is shown below. **Table 4-20** shows the results of the survey. Tribal officials and community members perceived the Reservation to be most vulnerable to Severe Weather and Earthquakes.

High: The risk is significant enough to warrant **major program effort** to prepare for, respond to, recover from and mitigate against this hazard. This hazard should be a major focus of the Tulalip Tribes' emergency management program.

Medium: The risk is significant enough to warrant **modest program effort** to prepare for, respond to, recover from and mitigate against this hazard. This hazard should be included in the Tulalip Tribes' emergency management program.

Low: The risk is such as to warrant **no special effort** to prepare for, respond to, recover from or mitigate against this hazard. This hazard need not be specifically addressed in the Tulalip Tribes' emergency management program except as generally dealt with during hazard awareness training.

Table 4-20: Community Risk Ranking

Community Risk Rating				
	Number of Responses			
hazard event	High (3 points)	Medium (2 Points)	Low (1 point)	**Risk Rating**
Severe Weather	17	10	0	**71**
Earthquake	15	12	1	**70**
Wildland Fire	9	11	8	**57**
Landslides	6	15	8	**56**
Flooding	7	10	10	**51**
Tsunami/Seiche	5	6	15	**42**
Volcano	1	8	17	**34**

5. Mitigation Strategy

This section provides the blueprint for the Tulalip Tribes to reduce potential losses from the natural hazards identified in the Risk Assessment found in Chapter 4. The format of this chapter is as follows:

Section 5.1 will describe the Goals and Objectives the Tulalip Tribes have formulated to guide the selection of mitigation strategies.

Section 5.2 is an assessment of the Tulalip Tribes' pre-and post-disaster capabilities.

Section 5.3 identifies, evaluates and prioritizes the mitigation strategies the Tulalip Tribes is pursuing, including actions identified during the previous local-level planning process.

Section 5.4 identifies current and potential sources of Federal, State, Tribal, local and private funding to implement mitigation activities.

5.1. Goals and Objectives

This section defines the general outcomes that can be expected as a result of successful implementation of this plan. Plan goals are broad statements describing the principles that guide the actions suggested in this document. Plan objectives are more targeted statements that define strategies and implementation steps to attain the goals. The plan goals and objectives below were developed based on the outcome of numerous planning meetings, the Risk Assessment and the goals and objectives defined in the Tulalip Tribes Comprehensive Plan and the Tulalip Tribes Comprehensive Emergency Management Plan.

For this planning effort, the goals and objectives found in the local mitigation plan were refocused to better reflect the overall goals and objectives of the Tulalip Tribes that otherwise were not explicitly defined or articulated elsewhere or in previous planning efforts.

Goals and objectives:

1. Protect people, property and the natural environment
    - Purchase hazard-prone areas for conservation and risk reduction
    - Buy-out or relocate structures located in high-risk hazard areas
    - Encourage low impact development through land-use regulations
2. Ensure continuity of critical economic and public facilities and infrastructure
    - Support redundancy of critical government functions
    - Retrofit or build to highest standards, critical facilities and infrastructure
3. Promote and protect Tribal sovereignty and identity
    - Increase mitigation and emergency management capabilities for the Tulalip Tribes and Quil Ceda Village
    - Enable the Tulalip Tribes to be self-sufficient for at least 72 hours after a disaster
4. Increase public awareness of natural hazards and involvement in hazards planning
    - Encourage organizations, businesses, and local governmental agencies within community and region to develop partnerships
    - Implement hazard awareness, preparedness and reduction programs

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5.2. Capability Assessment

This section will discuss the pre- and post-disaster hazard management policies, programs, and mitigation capabilities of the Tulalip Tribes. This discussion will include an evaluation of Tulalip Tribal laws, regulations, policies, and programs that are related to hazard mitigation and to development activity in hazard-prone areas. Funding capabilities for hazard mitigation projects are also discussed. The local capability assessment includes a general description of the capabilities of Tulalip's local jurisdiction, Quil Ceda Village.

Tribal Capabilities

Currently the Tulalip Tribes' capabilities are limited. Nonetheless a framework is in place to expand these.

Planning

Tulalip Tribes Local Hazard Mitigation Plan

The 2004 Tulalip Tribes Local-level Hazard Mitigation Plan was prepared as part of a nationwide effort involving states, local communities and tribes, and is intended to inform the Tulalip community about the disastrous effects natural hazards, such as earthquakes, floods and severe weather, can have on their property and families.

The plan meets the requirements of the Disaster Mitigation Act of 2000 (DMA 2000) and makes the Tulalip Tribes eligible for pre- and post-hazard mitigation grant funding, which can potentially make the Tulalip Reservation more resilient to the damaging effects of natural hazards. This plan was developed as a local level plan under the State of Washington Hazard Mitigation Plan.

Tulalip Tribes State-level Hazard Mitigation Plan

The 2006 Tulalip Tribes State-Level Hazard Mitigation Plan is a revision/update of the 2004 local-level. As sovereign nations, Indian tribes are encouraged to develop their own state-level hazard mitigation plans in order to deal directly with FEMA for disaster planning and response. It was prepared as part of the ongoing nationwide effort involving states, local communities and tribes, and is intended to inform the Tulalip Tribal community about the disastrous effects natural hazards, such as earthquakes, floods and severe weather, can have on their property and families.

The plan meets the requirements of the Disaster Mitigation Act of 2000 (DMA 2000) and makes the Tulalip Tribes eligible for pre- and post-hazard mitigation grant funding directly from FEMA, which can potentially make the Tulalip Reservation more resilient to the damaging effects of natural hazards.

Tulalip Tribes Comprehensive Plan, 1994

The 1994 Tulalip Tribes Comprehensive Plan discusses Sensitive Lands in Chapter 6, and stresses the needs for higher regulatory standards within said lands. Chapter 13 discusses the goals and objectives that will protect and maintain sensitive lands and limit development. Appended to the Tulalip Comprehensive Plan is the Tulalip Tribes Interim Sensitive Lands Development Policy. Currently the Comprehensive Plan is being revised and updated for 2006.

Tulalip Tribes Comprehensive Emergency Management Plan

Emergency management is a system that through organized analysis, planning, decision-making, and assigning of resources will help prevent, prepare for, respond to and recover from the effects of all- hazards within the Tulalip Reservation**.**

The Tulalip Tribal government has the responsibility for protecting life, property and environment threatened by natural or manmade disasters. Tribal emergency responders provide services such as rescue and medical treatment of the injured, evacuation of Tribal members at risk, initial isolation of an area, and identification of hazard. Tribal responders also notify other local, state, Tribal, and Federal agencies per applicable laws, regulations, plans and mutual aid agreements. The Tulalip Tribes Comprehensive Emergency Management Plan provides a decision-making management system that facilitates Tribal involvement for multi-agency and multi-jurisdictional response to natural or technological disasters. The Tulalip Tribes Comprehensive Emergency Management Plan recognizes and adapts to each agency's authority and responsibility.

When a natural disaster or man caused disaster requires an emergency response, a tiered response flow typically occurs. The general order of the tiered response is as follows:

1. Tulalip Tribal First Responders
2. Local first responders from the surrounding area (including the public and private sector resources)
3. Regional first responders
4. State responders
5. Federal responders

A Federal response is likely for complex and/or widespread natural hazard or human caused disaster incidents in situations when the incident exceeds the level of response available from state, local and Tribal agencies, or at the request of the Tulalip Tribes. Federal response capabilities include providing immediate response resources, access to funds and response coordination, and addressing federal interests. The Tulalip Tribes may request State and Federal resources by following established procedures set forth in this document.

2005 Hazardous Materials Commodity Flow Assessment

This study was conducted by Washington State University's Department of Political Science & Criminal Justice. It was a joint project with the Lummi Nation. Its purpose was to identify

hazardous materials located on the Tulalip Reservation and haz-mat that is transported to and through the Reservation.

Regulations

Tulalip Zoning Ordinance, Ordinance No. 80

The Tulalip Zoning Ordinance, Ordinance No. 80, Section 23 regulates development in environmentally sensitive lands. These regulations include buffers around streams and wetlands to protect the environment and prevent damage to property. Steep slopes are also regulated. Section 25.2 discusses regulations in regards to hydraulic projects. Section 4.3, Conformity with Uniform Codes, mandates that all structures on the Tulalip Indian Reservation shall be built consistent with the most recent editions of the Uniform Building Code (UBC), Uniform Fire Code, and the Uniform Plumbing Code.

Tulalip Tidelands Management Policies, Ordinance No. 129

The Puget Sound shoreline is one of the most important physical features of the Tulalip Reservation to the Tulalip Tribes of Washington, its members, and non-tribal residents. The shoreline is where many ancestral settlements and burial sites are located and where Tribal fishing, gathering, cultural activities, and recreation continue to this day.

The Tulalip Reservation includes all tidelands within its borders. Tribal people have depended on the shoreline to such an extent that the tidelands were not allotted to individual Tribal members by the Federal government and the tidelands, together with all of Tulalip Bay, are reserved for the use and benefit of the Tribes.

Fish and shellfish resources are of central importance to the economy, culture, subsistence, and identity of Tribal members. The right to harvest these resources is secured for the exclusive use of the Tribes under the Treaty of Point Elliott. The tidelands of the Reservation provide essential habitat and food for these Tribal resources. Protection of these Tidelands is essential to preserve the use of the reservation as a homeland for the Tulalip people and preserve its use for Treaty fishing activities.

A great deal of development has occurred along the Reservation shoreline over the years. The shoreline is studded with marinas, parking lots, public buildings, houses, cabins, docks, bulkheads, and beach access stairways. Unfortunately, this development has had negative impacts on shorelines on the Reservation and throughout Puget Sound.

Water quality has decreased dramatically as pollutants make their way into Puget Sound from roads, homes, parking lots, septic systems and other forms of development. Fish populations, including salmon, herring, bottom fish, and many others, have declined. Shellfish beds have been closed for public health reasons. Tribal fish and shellfish resources and habitat have been severely degraded by the numerous bulkheads and other physical alterations to the shoreline. Docks, pilings and buoys have interfered with tribal net fisheries. Information from the Tulalip Natural Resources Department shows that there are approximately 73 docks and piers and 124

mooring buoys along the Reservation shoreline while there are less than 15 private docks and buoys along the rest of Snohomish County's shoreline, excluding Everett. Many of these private structures and uses are located on tribally owned tidelands without permission or compensation to the Tribes. The Tribes and its members are increasingly prevented from gaining access to the tidelands reserved for their use.

The impacts of bulkheads are of particular concern. Their negative impacts to fish and shellfish resources and their habitat are well documented and include:

> Increased beach erosion, loss of beach sediments, and lowering of the beach due to the reflection of wave energy off of hard bulkheads back onto the beach.
>
> "Beach starvation", which is the loss of beach sand and sediment that occurs when bulkheads block the supply of sediment that erodes from the bluff. The fine sediments tend to be lost, which translates into less habitat for the creatures that are prey for juvenile fish.
>
> Loss of plants and shade, which are important to fish habitat, as bank vegetation is removed when bulkheads are built.

The environmental effects and impacts of bulkheads and supporting literature are documented in a Supplemental Final Environmental Impact Statement (SFEIS) prepared by the State of Washington Department of Ecology in December 2003 for the recently adopted revisions to the state's Shoreline Master Program Guidelines (SMPG). The SFEIS contains a lengthy bibliography that includes scientific literature regarding bulkheads and their effects. The revisions to the SMPG include measures to protect against the environmental effects and impacts of bulkheads that are reflective of those contained in these policies. Bulkheads are generally built with the intention of preventing or reducing bluff erosion on shoreline properties since many people have the perception that wave action is responsible for the erosion. The erosion and landslides are often actually due to drainage problems and soil conditions at the top of the bluff or the actions of property owners, such as the removal of trees and native vegetation. The Tulalip Tribes through its Fisheries, Community Development and Natural Resources Departments have collected reference lists on the subject of the adverse effects of bulkheads on fish and shellfish resources, on fish habitat, and on other treaty protected rights of Tulalip Indians. In addition to being plainly observable over time, the adverse effects are clearly documented and the results of these studies are transferable to the shorelines of the Tulalip Reservation. The Tulalip Reservation is one of the few areas in Snohomish and King Counties where there is some remaining Puget Sound shoreline that has not been modified with shoreline structures. A November 22, 2002 Seattle Post Intelligencer article reported, based on information from the state Department of Natural Resources, that 72% of the shoreline in Snohomish and King Counties has been modified by the construction of bulkheads, docks, piers, boat ramps, and boat slips. Snohomish County GIS maps show that, despite several long stretches of nearly unbroken bulkheads, there is a substantial amount of natural beach left on the Reservation. Information from the Tribe’s Natural Resources Department indicates approximately 45% of the Reservation shoreline has been "armored" with bulkheads. Although Section 23.8 of Zoning Ordinance No. 80 regulates bulkheads, docks, stairways, and other shoreline structures, Tribal staff has not been satisfied that it adequately address the impacts of shoreline development stated

above. There has been ongoing demand by a number of departments to revise or expand the Tribe's requirements. It has also been pointed out that there are a number of feasible alternatives to bulkheads including vegetation management, drainage and groundwater control, replenishing scoured beaches with sand, and anchoring drift logs to the beach.

Additionally, Tribal staff has expressed concern over the need to protect Tribal property interests by requiring leases for private structures constructed on Tribal tidelands. While in the past Tribal tidelands were leased to private parties for a variety of uses, this practice has fallen out of use. Now there are numerous private structures located on Tribal tidelands that are not currently, or may have never been, leased from the Tribes. In light of this situation, the Board of Directors' Business Committee asked Tribal staff, on April 2, 2003, to prepare new policies regarding tidelands development regulation, and leases, have them reviewed by the Planning Commission, and return them to the Board for their consideration. A staff team representing the Community Development, Legal, Environmental, Fisheries, Fish and Wildlife Enforcement, Leasing, and Forestry Departments has participated in the preparation of the draft Tidelands Management Policies. The purpose of the policies is to establish management requirements for the development regulation, and leasing of that portion of tribally owned tidelands included within the definition of "Tidelands" in Part IV of these policies. The policies lay the groundwork for legislative and policy reform on issues affecting Tribal tidelands. The "implementation measures" included with the policies will guide future modifications to land use controls, leasing practices, intergovernmental coordination, and the regulation, enforcement, protection and conservation of Tribal tidelands. Ultimately, the Tribes will also prepare a more detailed, comprehensive shoreline management plan, regulating the use and development of the Reservation shorelines, as called for in the future implementation measures.

Agencies and programs

Tulalip Office of Emergency Management

The purpose of the Tulalip Tribes Office of Emergency Management is to provide:

- A leadership role in facilitating and coordinating a regional approach to emergency planning and response on the Tulalip Reservation and surrounding communities.
- Guidance and coordination in the planning, mitigation, response, and recovery efforts of the Tulalip Reservation before, during, and after an emergency or disaster.
- Acquire, allocate and coordinate the appropriate resources in response to emergencies of disasters.

Tulalip OEM assists with environmental and hazards planning, Department of Homeland Security and FEMA grant writing, disaster relief training and NIMS compliance training. The Tulalip OEM also is a leading partner in the Northwest Tribal Emergency Management Council.

Tulalip Police Department

Mission Statement:

The Tulalip Tribal Police Services constitutes an organization whose very existence is justified solely on the basis of service to the Tribal members and Tulalip Tribal Community. Although tribal police services regulations provide a working pattern, our official activity must not be confined within their limits. Actually, that portion of police service dealing with real criminals is only a small part of our overall responsibility. The greater percentage of our time and energy is expended on non-criminal service functions and in dealing with law abiding tribal members and citizens of the reservation community.

We should consider it our duty and privileges to not only protect our tribal members and reservation citizens from crime, but also to protect and defend the rights guaranteed under the Tulalip Tribes Constitution. It may be said that matters of civil law are not a basic police responsibility and, within reasonable limits, we should attempt to avoid becoming entangled in them.

However, many situations can best be served only when we assist in such matters. Our broad philosophy must embrace whole- hearted determination to protect and support individual rights, while at all times providing for the security of persons and property in the Tulalip Tribal community. In meeting this objective, it is our duty to operate as a tribal public service organization.

It is the mission of the tribal police services is to support, through our words, deeds and actions the visions of the Tulalip Tribes, the tribal constitution, the tribal council, the tribal members, the tribal elders, the tribal youth, and honor the customs and heritage of the tribe and to support the treaties and sovereignty of the tribe.

Tulalip Fire Department (Snohomish County Fire District 15)

This facility is located at 7812 Waterworks Road near Tulalip Bay and is responsible for providing protection to the western part of the Tulalip Reservation. Although not a Tribal department, the Tulalip Fire Department provides critical capabilities for Tribal Emergency services.

Marysville Fire District (Snohomish County Fire District 12)

This district is headquartered at 1635 Grove Street in Marysville, Washington and provides services to Quil Ceda Village and the eastern part of the Tulalip Reservation.

Tulalip Health Clinic

The new Tulalip health clinic opened in August of 2003. This new and expanded space offers state-of-the-art health services to tribal members. The new clinic will allow us to build on our existing programs and provide new opportunities.
The mission of our Health and Social Services Department is to provide a premier integrated healthcare delivery system that is culturally relevant and addresses the physical, mental, spiritual, and emotional needs of all Tulalip Tribal Members.

The Health Clinic will be able to provide immediate assistance to those injured immediately following a natural disaster.

Tulalip Office of Community Development

The Tulalip Office of Community Development is responsible for developing land use and zoning regulations for the Tulalip Tribes. They also play a critical role in developing regulations related to hazards mitigation, such as critical areas ordinances and regulations, such as the newly adopted Tidelands Management Policy.

The Office of Community Development recently commissioned a study entitled "Engineering Geologic Evaluation, Mission Beach Heights Slopes" regarding the landslide prone bluffs located above and below homes on Mission Beach Heights.

see-yaht-sub/Communications

The See-yaht-sub is the Tulalip Tribes community newspaper. They can provide information on natural hazards including awareness and preparedness. The Tulalip Tribes also own and operates a cable TV service and can provide emergency/disaster information.

Tulalip Natural Resources

The Tulalip's predecessor tribes were among the signers of the Treaty of Point Elliot made with the United States in 1855. In this treaty the tribes gave up thousands of square miles of land in exchange for a small amount of money and permanent protection from the United States government. The treaties also specified that the the tribes retained fishing and hunting rights. The federal court has interpreted the nature and extent of those retained rights, and ruled that the tribes, along with the State of Washington, have comanagement responsibility and authority over fish and wildlife resources. The mission of the Tulalip Natural Resources program is to carry out the tribes' comanagement responsibilities in a manner consistent with treaty rights as well as protection and perpetuation of the resources upon which the people have depended for over ten thousand years.
Projects Natural Resources are working on related to hazards mitigation include the **Qwuloolt Estuary Restoration**[53] and mapping of active and historic landslide locations along the Tulalip coastline.

Northwest Tribal Emergency Management Council

Led by efforts of the Tulalip Tribes, the eight tribes of Washington State Homeland Security Region 1 (a region composing Snohomish, Skagit, Whatcom, Island and San Juan Counties) formed the Northwest Tribal Emergency Management Council (NWTEMC) to address homeland security and emergency management issues each tribe faces.

[53] Qwuloolt Estuary Restoration, http://www.tulalip.nsn.us/~qwuloolt/index.html

The development of the Northwest Tribal Emergency Management Council not only better prepares Tribal entities for emergency incidents, but will also provide more opportunities for the tribes to work collaboratively to assist one another in meeting the mandates of related emergency management programs and foster partnerships with their neighboring counties and municipalities. The Department of Homeland Security's guidance identifies tribal entities as key stakeholders in partnerships with state, local and private sectors.

The tribes that make up the Tribal Emergency Management Council are:

- Lummi
- Nooksack
- Samish
- Sauk-Suiattle
- Stillaguamish
- Swinomish
- Tulalip
- Upper Skagit

Disaster Relief Training

Sponsored by Tulalip Office of Emergency Management and Tulalip TERO (Tribal Employment Rights Office), this program will allow tribal members to be able to assist in disaster relief efforts for the Tulalip Tribes and at any disaster location nationally.

National Incident Management System (NIMS) compliance training

The Tulalip Office of Emergency Management is coordinating the training of all tribal police officers, department heads, Board members and relevant staff in the National Incident Management System so they are compliant with NIMS.

Local Capabilities (Quil Ceda Village)

The Consolidated Borough of Quil Ceda Village, commonly called Quil Ceda Village, is a thriving municipal and corporate body of the Tulalip Tribes. It was established in 2002 and is located along I-5. The tribal capabilities discussed in the previous section also apply to Quil Ceda Village. At this time, Quil Ceda Village does not have any specific capabilities that relate to hazard management, although there are plans in place to implement local capabilities. The first steps to implementing local capabilities will be to establish a Quil Ceda Village Office of Emergency Management and to prepare a local level hazard mitigation plan for the Village.

5.3. Mitigation Actions and Activities

The local level Tulalip Reservation Hazard Mitigation Plan identified 11 actions and activities to mitigate the effect of natural hazards within the Tulalip Reservation. The next section will briefly review those actions and activities and give an update on their implementation. The section after that will identify the mitigation actions and activities that may be implemented over the next few years, if funding becomes available.

Previous Mitigation Actions and Activities

During the beginning of the planning process for the State-level hazard mitigation, the previous mitigation actions were evaluated for implementation. It was found that 9 of the 11 actions were either implemented or were on-going.

M-1: Create a full time position in the Tulalip Tribes for an Emergency Management Coordinator.

Status: Implemented. A position was created after the local plan was adopted and is currently being funded through 2006.

M-2: Create a community-wide comprehensive education program to educate the public, private and business sectors about hazards and hazard mitigation.

Status: Ongoing. This activity is one of the main duties of the Emergency Management Coordinator.

M-3: Create and maintain partnerships with all entities that impact the Tulalip Tribes to ensure that critical facilities and infrastructure are retrofitted or built to standards that make them less vulnerable in a hazard event.

Status: Ongoing. More work needs to be done to involve private businesses and forge partnerships with other communities.

M-4: Create and maintain partnerships with all entities that impact the Tulalip Tribes to implement non-structural retrofitting in Tribal households, facilities and businesses.

Status: Ongoing

M-5: Identify critical community facilities and infrastructure that are without back-up power generators.

Status: Ongoing. One of the main tasks of the Tribal-level plan is to identify said facilities.

M-6: Assure that the public is informed of the necessity of maintaining a 3-day supply of food and water, along with basic first aid and medical supplies.

Status: Ongoing

M-7: Improve\expand storm water drainage, dams, detention and retention system capabilities.

Status: This action has not been implemented at this time.

M-8: Promote use of new technology in hazard mitigation and emergency preparedness.

Status: Ongoing

M-9: Institute low-impact development regulations for new developments as well as re-development projects..

Status: This action has not been implemented at this time. This project will be merged into the new mitigation activity, T-8.

M-10: Assess the Tulalip Tribes evacuation and primary response routes.

Status: This action has not been implemented at this time.

M-11: Utilize Geographic Information Systems (GIS) in decision-making processes.

Status: Ongoing. The Tulalip OEM has been working closely with Tulalip Data Services and Tulalip GIS to assess critical facilities and to map hazards.

Proposed Mitigation Actions and Activities

This section will detail the proposed mitigation actions and activities that were identified during the current planning process. Previous mitigation actions and activities that have not been implemented or are on-going will also be discussed. The proposed mitigation actions and activities are:

T-1: Develop a local Hazard Mitigation Plan for Quil Ceda Village

T-2: Assessments and mapping of critical facilities and infrastructure

T-3: Seismically retrofit and install back-up generators for the Tribal Center, Kenny Moses Building and the Quil Ceda Casino

T-4: Buy-out of landslide, flood and tsunami prone properties at Priest Point, and other coastal locations

T-5: Relocate homes located on the bluff at Hermosa Point

T-6: Have Tulalip become a StormReady community

T-7: Have Tulalip become a TsunamiReady community

T-8: Have Tulalip become a Firewise community

T-9: Implement higher regulatory standards for hazard prone and environmentally sensitive areas using best available science.

T-10: Join the National Flood Insurance Program (NFIP)

These mitigation activities were ranked and prioritized through meetings with Tribal officials and staff. They were ranked by need and technical and fiscal feasibility. As the specific mitigation projects for buy-out and retrofitting are further defined, the FEMA Benefit-Cost Analysis software will be used to rank said projects for feasibility.

The format and explanation of each mitigation measure is shown below:

T-1: The mitigation action or activity is shown here. "T" stands for Tribal. These actions are proposed in the Tulalip Tribal-level Plan. Previous mitigation actions identified in the local-level plan are referred to as M-1, M-2 etc.

Problem/Opportunity: This describes either a problem or possible opportunity to reduce risk.

Implementation Strategy: Each mitigation strategy includes ideas to implement and accomplish the specific project.

Lead Agency: This is the agency or agencies that will organize resources, find appropriate funding or oversee project implementation, monitoring and evaluation.

Funding Options: This offers suggestions on potential financial resources for implementing the mitigation strategy. This includes funding from government agencies as well as various different types of grants.

Implementation Cost: This is the approximate amount that the strategy will cost to implement.

Timeline: This estimates the amount of time it will take to begin implementation of each strategy. Under timeline there are three categories, short term, long term and ongoing.

- Short Term: the mitigation strategy will be implemented in years 1 to 2.
- Long Term: the mitigation strategy will be implemented in years 3 to 5.
- Ongoing: the mitigation strategy will be implemented in years 1 to 5 and will continue into the future indefinitely.

Associated Hazards: Each mitigation strategy is related to one or more of the hazards that could affect Tulalip.

Related Goals: Each mitigation strategy is related to a Goal listed in Section 5.1.

Mitigation actions and activities:

T-1: Develop a local Hazard Mitigation Plan for Quil Ceda Village

Problem/Opportunity: Quil Ceda Village is a corporate municipality within the Tulalip Reservation. It is also the heart of the Tulalip's economy and part of the basic economy of the region, employing residents from surrounding communities and financing Tribal and county programs and initiatives. In the event of disaster, losing these businesses, even for a few hours or days, would cause an economic domino effect that would ultimately affect the Tulalip's well-being and safety as well as the region's. Continuity of the area's basic economy is essential to the Tribe's ability to responds and recover from a hazard event, natural or otherwise. Thus it is imperative that the Quil Ceda Village develop a hazard mitigation plan so to minimize potential losses to and disruptions of the local economy, and to protect the well-being of those who work, live and patronize the Village.

Implementation Strategy: A PDM planning grant will be prepared in order to hire a consultant/staff person to prepare the plan. The Tulalip Tribes will supply staff time for

meetings, coordination and administration of the grant and planning process as part of its cost share.

Lead Agency: The Tulalip Office of Emergency Management will be the lead agency in preparing the grant. The Tulalip OEM and the Quil Ceda OEM will share the lead in developing the plan.

Funding Options: Pre-Disaster Mitigation Program planning grant funds will be used to hire a consultant with expertise in Tribal mitigation plan. The Tribe's cost share will come from the Tulalip Operating Budget.

Implementation Cost: $46,000

Timeline: Short-term

Associated Hazards: All

Related Goals: Goals 1, 2, 3, 4

T-2: Assessments and mapping of critical facilities and infrastructure

Problem/Opportunity: Better mapping and assessments of critical facilities and infrastructure, especially those that have cultural and economic value, are needed for the Tulalip Tribes. This effort has been on-going, but more needs to be done. The Tulalip Tribes envision making the Tulalip Reservation a national leader in the mapping and assessment of critical facilities and infrastructure and plan to do so through continued planning efforts, such as the Quil Ceda Village Hazard Mitigation Plan.

Implementation Strategy: A PDM planning grant for the Quil Ceda Village as well as future grants for plan updates will be used to implement this. Also Tulalip Data Services and Tulalip Community Development will be part of this effort and will contribute on-going staff time.

Lead Agency: Tulalip OEM and Quil Ceda OEM with Tulalip Data Services/GIS

Funding Options: PDM grants, Homeland Security grants, Tulalip Operating Budget

Implementation Cost: At least $6,000 for Quil Ceda Village.

Timeline: Short-term and ongoing

Associated Hazards: all

Related Goals: Goals 1, 2, 3, 4

T-3: Seismically retrofit and install back-up generators for the Tribal Center, Kenny Moses Building and the Quil Ceda Casino

Problem/Opportunity: Many of Tribe's most critical facilities lack the structural integrity to withstand a major event, particularly an earthquake. Furthermore they do not have the ability to maintain operations after an event. The loss of power can occur easily in a rural area like the Tulalip Reservation. Thus it is essential that these facilities are seismically retrofitted and have back-up power to withstand and continue operations after a major event. So far 3 facilities have been identified and prioritized as needing seismic retrofitting and back-up generators: the Kenny

Moses Building, the Tribal Center, and the Quil Ceda Casino, all older structures built before building codes were in place.

Implementation Strategy: An estimate will be made of the costs to implement this strategy. A benefit-cost analysis will be conducted for feasibility. Then a PDM project grant will be applied for to FEMA in order to help secure funding.

Lead Agency: Tulalip OEM, Tulalip Building Maintenance

Funding Options: PDM Grant Funding, Tulalip Operating Budget

Implementation Cost: n/a

Timeline: Ongoing, as funds become available

Associated Hazards: All

Related Goals: Goals 1, 2

T-4: Buy-out of landslide, flood and tsunami prone properties at Priest Point, and other coastal locations

Problem/Opportunity: The topography of Tulalip creates an extremely dangerous situation for many residents living along the coast. Unregulated development has led to many small communities being created along the small edge of land between Possession Sound and the steep landslide-prone bluffs that may reach up to 300 feet in height. In order to protect from landslides or the onslaught of waves generated by severe storms, many residents have taken it upon themselves to protect their property by building bulkheads or shoring up steep slopes.

Nonetheless these measures typically are only short term in effect and can disastrously affect the natural ecosystem, especially salmon habitat. Destruction of salmon habitat can mean the loss of livelihood and cultural identity for the Tulalip Tribes, many of whose members rely on fishing as a way of life.

Buy-out of hazard-prone properties along the Tulalip coast is the prime long-term focus of Tulalip hazard mitigation efforts. Not only will buy-out eliminate the potential loss of life and property, as well as the need for federal and local recovery aid, but it will also help protect and restore the natural environment such as salmon habitat which is essential to the Tulalip Tribes identity and livelihood.

Implementation Strategy: Close collaboration amongst the Tulalip agencies and local homeowners will identify which properties to prioritize for buy-out. The Tulalip OEM will prepare project grants, if applicable, each year in order to purchase property.

Lead Agency: Tulalip OEM, Tulalip Natural Resources, Tulalip Community Development

Funding Options: FEMA PDM grant funding is expected to provide much of the financing.

Implementation Cost: This information is not available at this time, but is expected to be in the millions of dollars.

Timeline: Ongoing

Associated Hazards: Landslides, Tsunamis, Severe Weather, Coastal Flooding, Earthquakes

Related Goals: Goals 1, 4

T-5: Relocate homes located on the bluff at Hermosa Point

Problem/Opportunity: Many homes on Hermosa Point are located at the top edge of a steep and rapidly eroding bluff. These homes are owned by tribal members who depend on the lease income these homes generate. Removal of the homes would mean loss of income for tribal members. Thus the best alternative would be to relocate the vulnerable homes away from cliff, either onto safer locations on the same property or to nearby, undeveloped lots.

Implementation Strategy: Close collaboration amongst the Tulalip agencies and local homeowners will identify which properties to prioritize for relocation. The Tulalip OEM will prepare project grants, if applicable, each year in order to relocate homes.

Lead Agency: Tulalip OEM, Tulalip Natural Resources, Tulalip Community Development

Funding Options: FEMA PDM grant funding is expected to provide much of the financing.

Implementation Cost: This information is not available at this time, but is expected to be in the hundreds of thousands of dollars.

Timeline: Ongoing

Associated Hazards: Landslides, Earthquakes

Related Goals: Goals 1, 4

T-6: Have Tulalip become a StormReady community

Problem/Opportunity: NOAA's StormReady program is a great opportunity to make Tulalip safer from severe storms while also making the community more aware of the effects storms can have on property and lives. StormReady communities are better prepared to save lives from the onslaught of severe weather through better planning, education, and awareness. No community is storm proof, but StormReady can help communities save lives.

Implementation Strategy: Detailed information on joining the program can be found at NOAA's website: http://www.stormready.noaa.gov/

Lead Agency: Tulalip and Quil Ceda OEM

Funding Options: Tulalip Operating Budget, other grants

Implementation Cost: Staff time

Timeline: The program will be implemented short-term and will be on-going.

Associated Hazards: Severe Weather, Coastal Flooding, Tsunamis

Related Goals: Goals 1, 2, 3, 4

T-7: Have Tulalip become a TsunamiReady community

Problem/Opportunity: NOAA's TsunamiReady program is part of its StormReady program and is a great opportunity to make Tulalip safer and more prepared from the effects of tsunamis, which although extremely rare, can have disastrous effects. TsunamiReady communities are better prepared to save lives from the onslaught of tsunamis through better planning, education, and awareness. No community can prevent tsunamis, but TsunamiReady can help communities save lives.

Implementation Strategy: Detailed information on joining the program can be found at NOAA's website: http://www.stormready.noaa.gov/tsunamiready/index.htm.

Lead Agency: Tulalip and Quil Ceda OEM

Funding Options: Tulalip Operating Budget, other grants

Implementation Cost: Staff time

Timeline: The program will be implemented short-term and will be on-going.

Associated Hazards: Severe Weather, Coastal Flooding, Tsunamis

Related Goals: Goals 1, 2, 3, 4

T-8: Have Tulalip become a Firewise community

Problem/Opportunity: The mitigation planning effort has identified that much of the interior of the Tulalip Reservation is undeveloped forest. During dry conditions, especially during the summer, a wildfire can develop, either from storms or by careless human behavior. Due to limited access into the forest areas, a small fire can easily grow and spread unchecked into the residential developments surrounding the interior Tulalip area. Joining Firewise can make the community more aware of the potential hazard and to develop and implement mitigation efforts to reduce risk.

Implementation Strategy: A staff person from the Tulalip OEM and/or Community Development will be responsible for reviewing material on Firewise.org and working with the local fire department and community to implement mitigation measures.

Lead Agency: Tulalip OEM, Community Development and Tulalip Fire Dept.

Funding Options: Tulalip Operating Budget, other grants as they become available

Implementation Cost: None

Timeline: Ongoing

Associated Hazards: Wildfire

Related Goals: Goals 1, 2, 3, 4

T-9: Implement higher regulatory standards for hazard prone and environmentally sensitive areas using best available science

Problem/Opportunity: Due to complicated and contradictory jurisdictional issues, the area of the Tulalip Reservation has lacked adequate regulations in order to prevent development in

hazard-prone areas and protect environmentally and culturally sensitive areas. Thus as a mitigation action, it is necessary that the Tulalip Tribes implement higher regulatory standards in order to protect sensitive habit and protect life and property.

Implementation Strategy: Tulalip Community Development will work with Tulalip and Quil Ceda OEMs in order to develop higher regulatory standards that can be offered for approval by the Tulalip Planning Commission.

Lead Agency: Tulalip Community Development

Funding Options: Tulalip Operating Budget

Implementation Cost: Unknown at this time. Generally it will be the cost of staff to draft and implement regulations.

Timeline: Ongoing

Associated Hazards: all

Related Goals: Goals 1, 2, 3, 4

T-10: Join the National Flood Insurance Program (NFIP)

Problem/Opportunity: The Tulalip Tribes currently does not have Flood Insurance Rate Maps (FIRMs) prepared for its Reservation, so there is no clear understanding of how flooding could affect the Reservation. Past events have shown however that Tulalip Creek and well as some of the lakes/ponds have a tendency to overtop during severe conditions. Furthermore severe storms cause damage every year to low-lying structures along the coast. Thus the Tulalip Tribes find it imperative that these vulnerable areas are definitively identified so appropriate actions can be taken to protect vulnerable structures and facilities.

Implementation Strategy: As FIRMs are prepared for Tulalip and Snohomish County, the Tulalip Tribes will focus on implementing NFIP requirements in order to join the program.

Lead Agency: The Tulalip Office of Emergency Management as well as the Office of Community Development will take a lead in implementing this measure.

Funding Options: Tulalip Operating Budget

Implementation Cost: Staff time

Timeline: Ongoing, especially as mapping is completed

Associated Hazards: Flooding, severe weather

Related Goals: Goal 1, 2, 3, 4

Ongoing activities and actions:

M-2: Create a community wide comprehensive education program to educate the public, private and business sectors about hazards and hazard mitigation.

Problem/Opportunity: One of the most important elements to mitigation is awareness. The general public is often unaware of the risk of hazards and what actions to take during a disaster event. Public awareness programs can provide information about mitigation measures for different hazards as well as preparedness, response and recovery measures after a disaster event. During and after a hazard event, emergency responders may be either overwhelmed with emergency calls or unable to access some residents. This means that it is important that individual households and local businesses are prepared for an event and have the ability to support themselves for a period of time while emergency responders deal with more immediate and life-threatening situations.

Implementation Strategy: The education program should be an ongoing program that is devoted to increasing the public's awareness of what hazards affect Tulalip and what can be done to mitigate these hazards and their effects. Following a disaster event, there should be extra efforts to provide the public with information about disaster preparedness and mitigation measures. Generally, the public is very receptive to this type of information at this time. The Emergency Management Coordinator could implement this strategy. Some of the measures that should be taken to educate the public are:

- Evaluate success of current public education efforts.
- Develop and index a mitigation/preparedness packet for the public and for the media for each type of hazard affecting Tulalip.
- Draft a campaign strategy to effectively distribute information about hazards and hazard mitigation.
- Create a link on the Tulalip Tribes web page that is specifically devoted to providing current information about hazards and hazard mitigation. This would include static information about existing hazards and up-to-date information on disaster events affecting Tulalip. For example, there could be information about what to do during an earthquake.
- Develop and implement workshops and training programs that address specific issues related to the hazards affecting Tulalip. An example would be providing a workshop on how to non-structurally retrofit buildings in order to minimize loss from an earthquake.

Lead Agency: Tulalip OEM

Funding Options: Tulalip Operating Budget, Emergency Management Performance Grant (EMPG), Hazards Mitigation Grant Program (HGMP), Pre-Disaster Mitigation Program

Implementation Cost: The initial cost would be about $50, 000 and would include the material assembly, printing and distribution. The continuing cost would be about $20,000 per year and would include development and implementation of workshops and training programs. Included in this cost would be mitigation strategies M-2, M-3, M-4, M-6

Timeline: Ongoing

Associated Hazards: All Hazards

Related Goals: Goal 1, 2, 3, 4

M-3: Create and maintain partnerships with all agencies that impact the Tulalip Tribes to ensure that critical facilities and infrastructure are retrofitted or built to standards that make them less vulnerable in a hazard event.

Problem/Opportunity: Critical facilities and infrastructure in Tulalip may be at risk to failure during or after an event. There are methods of retrofitting or building to a certain standard that will reduce the risk of failure.

Implementation Strategy: The Emergency Management Coordinator could implement this strategy.

- Develop a contact at each of the agencies that impact the Tulalip Tribes so that the Tulalip Tribes can stay updated about what is being done to reduce risk.
- Jointly analyze high-risk areas and develop mitigation strategies that address the risk. Initial focus should be given to critical facilities and infrastructure in NEHRP D and E soils.
- Maintain contact and work with agencies to ensure that the critical facilities and infrastructure are retrofitted or built to standards that make them less vulnerable in a hazard event.

Lead Agency: Tulalip Office of Emergency Management

Funding Options: Tulalip Operating Budget

Implementation Cost: No significant additional cost for Tulalip

Timeline: Ongoing

Associated Hazards: All Hazards

Related Goals: Goals 1, 2, 4

M-4: Create and maintain partnerships with all agencies that impact the Tulalip Tribes to implement non-structural retrofitting in Tribal households, facilities and businesses.

Problem/Opportunity: Most injury and business loss is due to non-structural damage such as toppling shelves and hazardous material spills. These are largely preventable through relatively simple, non-structural measures.

Implementation Strategy: Provide information and\or training about how to implement non-structural retrofitting. The Emergency Management Coordinator could implement this strategy.

- Coordinate assessments of non-structural hazards for Tribal facilities.
- Prioritize the order by which Tribal facilities should be non-structurally retrofitted.
- Provide education and training about non-structural hazards and non-structural retrofitting for critical facilities, schools, health care facilities, residences and businesses. Initial focus should be given to facilities on NEHRP D and E Soils.
- Apply for grants that could provide funding for non-structural retrofitting.

Lead Agency: Tulalip OEM, Tulalip Utilities Department, Tulalip Buildings Maintenance

Funding Options: Tulalip Operating Budget

Implementation Cost: For non-structural assessment and non-structural retrofitting of Tulalip Tribes facilities the cost would be about $25,000. The education and training component is included in the cost of M-2.

Timeline: Ongoing

Associated Hazards: Earthquakes

Related Goals: Goals 2, 4

M-5: Identify critical community facilities and infrastructure that are without back up power generators.

Problem/Opportunity: Hazard events frequently cause power outages and create disruptions to the operation of important community facilities. In past cases, the Tulalip Tribe's operations have been disrupted or unable to function as necessary. It is especially important that facilities designated as emergency shelters have back up power generators. Back up power generators supply the needed resources to maintain operations until the power supply is restored.

Implementation Strategy: The Emergency Management Coordinator could implement this strategy.

- Identify critical Tulalip Tribes facilities that currently do not have back up power capacity.
- Prioritize the list of critical Tulalip Tribes facilities that do not have back up power capacity by which facilities are most important in maintaining the critical functions of Tulalip.
- Acquire a source of back up power sufficient to maintain necessary operations for these Tulalip Tribes facilities using the prioritization list.
- Provide information on the importance of a back up power source.
- Work with utility providers as a possible funding source.

Lead Agency: Tulalip Utilities Department

Funding Options: Tulalip Operating Budget, PDM grants

Implementation Cost: For the assessment, there is no significant additional cost for Tulalip. There is no way to determine the cost for acquisition of back up generators until it is determined how many facilities need back up power generators.

Timeline: Ongoing

Associated Hazards: All Hazards

Related Goals: Goal 2

M-6: Assure that the public is informed of the necessity of maintaining a 3-day supply of food and water, along with basic first aid and medical supplies.

Problem/Opportunity: During and after a hazard event, emergency responders may be either overwhelmed with emergency calls or unable to access some residents. It is important that individual households are prepared for a period of self-sufficiency while responders deal with more immediate and life-threatening situations. Assuring that the public is informed of the necessity of maintaining a 3-day supply is a preparedness measure that must be implemented until mitigation measures can be implemented that appropriately address the issue of isolation.

Implementation Strategy: Educate the public about the necessity of maintaining a 3-day supply for emergencies. The Emergency Management Coordinator could implement this strategy. Some important elements of maintaining a 3-day supply are:

- A three-gallon supply of water per person stored in sealed, unbreakable containers.
- A supply of non-perishable packaged or canned food and a non-electric can opener.
- A first aid kit and prescription medications.
- A battery-powered radio, flashlight and plenty of extra batteries.
- To implement this program refer to M-2 and M-8, which describes the methodology of how to distribute information community wide.

Lead Agency: Tulalip OEM

Funding Options: Tulalip Operating Budget, Emergency Management Performance Grant (EMPG)

Implementation Cost: Included in M-2 an M-8

Timeline: Ongoing

Associated Hazards: All Hazards

Related Goals: Goals 1, 2, 3, 4

M-7: Improve\expand storm water drainage, dams, detention and retention system capabilities.

Problem/Opportunity: Flooding in Tulalip is related to inadequate capacity in the water system and the large amount of impervious surfaces in the highly developed areas. During and after heavy rains there has been flooding of roadways, yards and driveways and several structures.

Implementation Strategy:

- Analyze reports of flooding from past years and determine problem areas.
- Determine if drainage, dams, detention and retention system capabilities are adequate in these areas.
- Prioritize areas that need the drainage, dams, detention and retention system capabilities expanded.
- Begin expanding the drainage, dams, detention and retention system capabilities in the order of prioritization.

Lead Agency: Tulalip Utilities Department

Funding Options: Tulalip Capital Improvement Budget, Hazards Mitigation Grant Program (HGMP), Pre-Disaster Mitigation Program

Implementation Cost: No significant additional cost for the analysis. Expansion costs cannot be determined until the analysis is completed.

Timeline: Long Term

Associated Hazards: Flooding

Related Goals: Goals 1, 2

M-8: Promote use of new technology in hazard mitigation and emergency preparedness

Problem/Opportunity: One of the most important elements to mitigation and emergency preparedness is awareness. The general public, as well as critical operations personnel, are often unaware of the risk of hazards and what actions to take during a disaster event. Public awareness programs can provide information about mitigation measures for different hazards as well as preparedness, response and recovery measures after a disaster event. The use of current technologies can help with the distribution of crucial information in a more organized and expeditious manner.

Implementation Strategy: The Emergency Management Coordinator could implement this strategy.

- Develop a partnership with the Tulalip Data Services for the purpose of distributing crucial information on the Tulalip Tribes website.
- Develop and promote the use of the Internet and video technologies for providing training opportunities to the community, as well as critical operations personnel.

Lead Agency: Tulalip Data Services, Tulalip OEM

Funding Options: Tulalip Operating Budget

Implementation Cost: There is no significant additional cost for Tulalip.

Timeline: Ongoing

Associated Hazards: All Hazards

Related Goals: Goals 1, 3

M-9: Institute low impact development regulations for new developments as well as re-development projects.

Problem/Opportunity: Impervious surfaces, such as sidewalks, driveways, or foundations, do not allow water to filter through the ground but instead drain it quickly into storm water conveyance systems. This situation increases the risk of flooding and adds sediment and toxins to runoff. Low impact development has the potential to alleviate these adverse impacts through the creation of appropriately placed green space, landscaping, grading, streetscapes, roads and parking lots. Low impact development can achieve multi-functional objectives and help to reduce storm water impacts and provide and maintain the beneficial hydrologic functions of a natural drainage system.

Implementation Strategy: Develop Tribal regulations and guidelines that implement low impact development objectives to:

- Minimize impacts to the extent practicable by reducing imperviousness, conserving natural resources and ecosystems, maintaining natural drainage courses, reducing the use of pipes and minimizing clearing/grading.
- Recreate detention and retention storage so that water is dispersed and evenly distributed throughout a site. This can be done with the use of open swales, gentler slopes, depressions, storage rain gardens (bio-retention), water use (rain barrels) and others.
- Strategically route water flows to maintain pre-development drainage times.
- Provide effective public education and socioeconomic incentives to ensure property owners use effective pollution prevention measures and maintain water management measures.

Lead Agency: Tulalip Community Development

Funding Options: Tulalip Operating Budget**,** Tulalip Capital Improvement Budget

Implementation Cost: No significant additional cost to Tulalip.

Timeline: Ongoing

Associated Hazards: Flooding

Related Goals: Goals 1, 2, 3, 4

M-10: Assess the Tulalip Tribes evacuation and primary response routes.

Problem/Opportunity: The Tulalip Tribes Comprehensive Emergency Management Plan (CEMP) identifies evacuation and primary response routes. Some of the same roads are used and may cause problems in the event of a disaster. An analysis of other potential routes is needed to ensure that traffic congestion does not impede response efforts during or after a disaster. Additional work may need to be done to roads so that they can serve as an evacuation or primary response route. The Emergency Management Coordinator outlined in M-1 could implement this strategy.

Implementation Strategy:

- Reassess the Tulalip Tribes evacuation and primary response routes.
- Develop new routes where necessary.

Lead Agency: Tulalip Police Department

Funding Options: Tulalip Operating Budget

Implementation Cost: No significant additional cost for Tulalip

Timeline: Short Term

Associated Hazards: All Hazards

Related Goals: Goal 2

M-11: Utilize Geographic Information Systems (GIS) in decision-making processes.

Problem/Opportunity: GIS offers a quick and comprehensive tool to identify problems and opportunities.

Implementation Strategy: Utilize GIS software to aid in reducing risk from hazard. This would include educating decision makers about how hazards can be analyzed using GIS. Some of the functions GIS can be used for include:

- Determination of areas of high risk, exposure, coding, retrofitting, and education priorities.
- Mapping and preparing risk assessments for critical facilities and infrastructure
- Planning for road network and utility network expansions.
- Evaluating the risk to existing and new developments.
- Update and maintain data so that there is consistency and data coordination among all Tulalip Tribes departments.

Lead Agency: Tulalip Community Development, Tulalip Data Services, Tulalip OEM

Funding Options: Tulalip Operating Budget

Implementation Cost: The additional cost for the printer, software, GPS equipment and training would be $40,000.

Timeline: Ongoing

Associated Hazards: All Hazards

Related Goals: Goals 1, 2, 4

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	Mitigation Strategy	Associated Hazards							Timeline	Lead Agency	Implementation Costs	Funding Options	Plan Goals Addressed			
		Earthquakes	Floods	Landslides	Severe Weather	Tsunami/Seiche	Wildland Fire	Hazardous Materials					Goal 1: Protect People, Property and the Natural Environment	Goal 2: Ensure continuity of critical economic and public facilities and infrastructure	Goal 3: Promote and protect Tribal sovereignty and identity	Goal 4: Increase public awareness of natural hazards and involvement in hazards planning
T-1	Develop a local Hazard Mitigation Plan for Quil Ceda Village	✓	✓	✓	✓	✓	✓	✓	Short-term	Tulalip/ Quil Ceda OEM	$46,000	FEMA PDM, Tulalip Operating Budget	✓	✓	✓	✓
T-2	Assessments and mapping of critical facilities and infrastructure	✓	✓	✓	✓	✓	✓	✓	On-going	Tulalip OEM, Tulalip TDS	$6,000-20,000	PDM grants, Homeland security grants, Tulalip Operating Budget	✓	✓	✓	✓
T-3	Seismically retrofit and install back-up generators for the Tribal Center, Kenny Moses Building and the Quil Ceda Casino	✓			✓				On-going, as funds become available	Tulalip OEM, Tulalip Building Maintenance	n/a	PDM grant funding, Tulalip Operating budget	✓	✓		
T-4	Buy-out of landslide, flood and tsunami prone properties at Priest Point, and other coastal locations	✓	✓	✓		✓			On-going	Tulalip OEM, Natural Resources, Community Development	$1 Million +	PDM grant funding, Tulalip Operating Budget	✓			✓
T-5	Relocate homes located on the bluff at Hermosa Point	✓		✓					On-going	Tulalip OEM, Natural Resources, Community Development	$100 K +	PDM grant funding, Tulalip Operating Budget	✓			✓
T-6	Have Tulalip become a StormReady community				✓				On-going	Tulalip/Quil Ceda OEM	Staff time	EMPG, Tulalip Operating Budget	✓	✓	✓	✓
T-7	Have Tulalip become a TsunamiReady community					✓			On-going	Tulalip/Quil Ceda OEM	Staff time	EMPG, Tulalip Operating Budget	✓	✓	✓	✓
T-8	Have Tulalip become a Firewise community						✓		On-going	Tulalip OEM, Tulalip Fire Dept.	Staff time	EMPG, Tulalip Operating Budget	✓	✓	✓	✓

Mitigation Strategy		Associated Hazards							Timeline	Lead Agency	Implementation Costs	Funding Options	Plan Goals Addressed			
		Earthquakes	Floods	Landslides	Severe Weather	Tsunami/Seiche	Wildland Fire	Hazardous Materials					Goal 1: Protect People, Property and the Natural Environment	Goal 2: Ensure continuity of critical economic and public facilities and infrastructure	Goal 3: Promote and protect Tribal sovereignty and identity	Goal 4: Increase public awareness of natural hazards and involvement in hazards planning
T-9	Implement higher regulatory standards for hazard prone and environmentally sensitive areas using best available science	✓	✓	✓	✓	✓	✓	✓	On-going	Tulalip Community Development	Staff time	Tulalip Operating Budget	✓	✓	✓	✓
T-10	Join the National Flood Insurance Program (NFIP)		✓			✓			On-going	Tulalip OEM, Community Development	Staff time	EMPG, Tulalip Operating Budget	✓	✓	✓	✓
	Previous Mitigation Actions:															
M-2	Create a community wide comprehensive education program to educate the public, private and business sectors about hazards and hazard mitigation.	✓	✓	✓	✓	✓	✓	✓	Ongoing	Tulalip OEM	Staff time	Tulalip Operating Budget, EMPG, HGMP	✓	✓	✓	✓
M-3	Create and maintain partnerships with all entities that impact the Tulalip Tribes to ensure that critical facilities and infrastructure are retrofitted or built to standards that make them less vulnerable in a hazard event.	✓	✓	✓	✓	✓	✓	✓	Ongoing	Tulalip OEM	Staff time	Tulalip Operating Budget	✓	✓		✓

Mitigation Strategy		Associated Hazards							Timeline	Lead Agency	Implementation Costs	Funding Options	Plan Goals Addressed			
		Earthquakes	Floods	Landslides	Severe Weather	Tsunami/Seiche	Wildland Fire	Hazardous Materials					Goal 1: Protect People, Property and the Natural Environment	Goal 2: Ensure continuity of critical economic and public facilities and infrastructure	Goal 3: Promote and protect Tribal sovereignty and identity	Goal 4: Increase public awareness of natural hazards and involvement in hazards planning
M-4	Create and maintain partnerships with all entities that impact the Tulalip Tribes to implement non-structural retrofitting in Tribal households, facilities and businesses.	✓							Long Term	Tulalip Tribes OEM	Staff time	Tulalip Operating Budget		✓		✓
M-5	Identify critical community facilities and infrastructure that are without back up power generators.	✓			✓				Ongoing	Public Works Department	Staff time	Tulalip Operating Budget		✓		
M-6	Assure that the public is informed of the necessity of maintaining a 3-day supply of food and water, along with basic first aid and medical supplies.	✓	✓	✓	✓	✓	✓	✓	Short Term	Tulalip OEM	Staff time	Tulalip Operating Budget	✓	✓	✓	✓
M-7	Improve\expand storm water drainage, dams, detention and retention system capabilities.	✓	✓	✓	✓	✓	✓	✓	Ongoing	Public Works	Staff time	Tulalip Operating Budget	✓	✓		
M-8	Promote use of new technology in hazard mitigation and emergency preparedness	✓	✓	✓	✓	✓	✓	✓	Ongoing	Tulalip TDS	Staff time	Tulalip Operating Budget, EMPG	✓		✓	
M-9	Institute low impact development regulations for new developments as well as re-development projects.	✓			✓	✓	✓	✓	Long Term	Community Development	Staff time	DHS/FEMA, Tulalip Operating Budget	✓	✓	✓	✓

Mitigation Strategy		Associated Hazards							Timeline	Lead Agency	Implementation Costs	Funding Options	Plan Goals Addressed			
		Earthquakes	Floods	Landslides	Severe Weather	Tsunami/Seiche	Wildland Fire	Hazardous Materials					Goal 1: Protect People, Property and the Natural Environment	Goal 2: Ensure continuity of critical economic and public facilities and infrastructure	Goal 3: Promote and protect Tribal sovereignty and identity	Goal 4: Increase public awareness of natural hazards and involvement in hazards planning
M-10	Assess the Tulalip Tribes evacuation and primary response routes.	✓	✓	✓	✓	✓	✓	✓	Long Term	Tulalip Tribal Police, Tulalip Fire Dept.	Staff time	EMPG, Tulalip Operating Budget		✓		
M-11	Utilize Geographic Information Systems (GIS) in decision-making processes.	✓	✓	✓	✓	✓	✓	✓	Short Term	Tulalip TDS	Staff time	Tulalip Operating Budget	✓	✓		✓

5.4. Current and 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 Section 5.3. Due to the Tulalip's situation as a sovereign Indian reservation with a limited revenue base, most funding to implement mitigation measures will come from the federal government through grant programs. Limited funding is also possible from the State of Washington and Snohomish County as well as matching funds for grants from the Tulalip Tribes.

Federal

Below are listed the primary federal programs and agencies that can potentially fund mitigation actions and planning. Additional programs and agencies can also be found in the capability assessment and in Appendix C, Sources of Funding.

Pre-Disaster Mitigation Program, which provides funds to develop mitigation plans and implement mitigation projects, is administered by FEMA (by submitting a state level plan, the Tulalip Tribes will qualify as a direct grantee);

Hazard Mitigation Grant Program, which provides post-disaster funds for hazard reduction projects (e.g., elevation, relocation, or buyout of structures), is administered by FEMA and the Washington State Emergency Management Division (because the Tulalip Tribes also has an approved local level plan, it is also eligible to apply to the State for assistance);

Flood Control Assistance Account Program, which 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), is administered by the Washington State Department of Ecology (Ecology);

Flood Mitigation Assistance Program, which provides funds for flood mitigation on buildings that carry flood insurance and have been damaged by floods, is administered by FEMA;

Department of Homeland Security funding, in addition to FEMA programs;

U.S. Fire Administration, which provides wildfire program funds;

Environmental Protection Agency, which could provide funds for projects with dual hazard mitigation and environmental protection goals as well as updates to this HMP and related planning efforts such as spill prevention and response planning;

Indian Health Service, which could provide funds for hazard mitigation projects that address public health and safety;

Rural Development Agency, USDA, which provides loan and grant funds for housing assistance, business assistance, community development, and emergency community water and wastewater assistance in areas covered by a federal disaster declaration;

Community Development Block Grant, which provides funds for a variety of community development projects, is administered by the Department of Housing and Urban Development;

Small Business Administration Loans, which help businesses recover from disaster damages, is administered by the Small Business Administration; and

Bureau of Indian Affairs, which provides funds to support tribal activities.

Tribal

The Tulalip Tribes is fully committed to the public safety and welfare of its residents and tribal members and to the goals of the Tulalip Hazard Mitigation Plan. The Tribe has only limited resources though to devote to mitigation planning. Tribal Funding sources generally come from the revenue generated by tribally owned businesses, such as the Quil Ceda and Tulalip Casinos, the Tulalip bingo hall, and from the leasing of trust land to businesses and home owners.

Nonetheless the Tribes may be willing to match grant funding, either through direct monies or through the allocation of resources, such as labor and expertise, in order to implement the actions discussed in this plan.

State/Local

In some cases, funding may be available from the State of Washington and/or Snohomish 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 Tulalip tribes is currently building relationships with the state of Washington, its departments and Snohomish County, as well as local communities, in order to develop partnerships to implement mitigation measures that are regional in scale.

Private

No potential funding from the private sector is currently identified. Nonetheless local businesses and residents located within the Tulalip Reservation will be encouraged to participate and contribute to the mitigation effort.

6. Coordination of Local Mitigation Planning

The consolidated borough of Quil Ceda Village is the only local jurisdiction within the Tulalip Reservation. Nonetheless the Tulalip Tribes will work with other local agencies and jurisdictions, such as the Marysville School District and the Tulalip Fire Department in helping to implement the mitigation actions described in Section 5 and in preparing and coordinating their own mitigation planning activities. The following sections will describe how the Tulalip Tribes will support the development of the Quil Ceda Village Hazard Mitigation Plan, and other local mitigation plans, if applicable. Furthermore the process to integrate the local plan and evaluate and prioritize local mitigation actions using a FEMA approved benefit-cost analysis will be described.

6.1. Local Funding and Technical Assistance

The Tulalip Office of Emergency Management (OEM) will be the lead agency in the coordination of developing mitigation planning for the Quil Ceda Village (QCV) and other local agencies within the Tulalip Reservation.

The Tulalip Office of Emergency Management can provide various types of assistance to local agencies, businesses, or individuals that are trying to identify appropriate mitigation measures for their facilities and homes. These include providing current hazard vulnerability estimates and technical information, improving communications between local organizations and hazard-related agencies, and coordinating hazard mitigation training. In addition, the Tulalip OEM can provide public education materials or presentations to organizations or residents on the Reservation. The Tulalip OEM will proactively identify appropriate mitigation measures and present them to local agencies, businesses, and/or individuals.

The Tulalip Tribes currently has limited funds to provide direct funding of mitigation measures to local agencies and jurisdictions. However, the Tulalip Tribes Board of Directors, through the Tulalip OEM, can apply for and pass on funds from outside sources to local entities and/or implement activities that directly or indirectly help local organizations, businesses, and/or individuals implement mitigation measures.

With adoption and approval of the Tulalip Tribal-level Hazard Mitigation Plan, the Tulalip OEM will apply for a pre-disaster mitigation grant in order for the Quil Ceda Village OEM to develop its own local mitigation plan.

6.2. Local Plan Integration Process

The Tulalip Office of Emergency Management will work closely with the Quil Ceda Village OEM to ensure that the QCV Hazard Mitigation Plan is consistent with the goals of the Tulalip Tribes Tribal-level Hazard mitigation and that local mitigation actions and

strategies do not contradict those of the Tribal-level plan. The Tulalip OEM will also ensure that the QCV HMP fulfills all FEMA requirements for successful approval. Efforts to ensure that integration of local planning is successful will include:

- Frequent meetings between the Tulalip and QCV OEMs, especially during the planning process.
- The Tulalip OEM will share all available resources to the QCV OEM, such as staff assistance, technical assistance and expertise and the use of computers, printers and software that will lead to the successful adoption and implementation of the local mitigation plan.
- The Tulalip OEM will share all available hazard data, plans, and maps and will coordinate with other agencies, including those outside the Reservation in order to collect and disseminate relevant information.
- The Tulalip OEM will work closely with the QCV OEM in order to better map and develop risk assessments for critical facilities and infrastructure.
- The Tulalip OEM will help review the QCV mitigation plan at least once a year as part of the implementation and monitoring process.
- The Tulalip OEM will assist the QCV OEM at least once every five years in order to update the local plan.

6.3. Local Assistance Prioritization Criteria

With only one local jurisdiction, the Tulalip Tribes will not have to prioritize among local jurisdictions' grant applications for planning and projects. However, in order to use its limited resources and funding most efficiently and effectively, the Tulalip Tribes will require that the Quil Ceda Village prioritize areas and critical facilities and infrastructure most vulnerable to hazards and the projects that are most appropriate and effective in mitigating those hazards.

In general, the following criteria will be used to prioritize mitigation actions and to seek potential funding for projects:

- Projects that provide the greatest enhancement to public health and safety;
- Projects in which the benefits are maximized according to a benefit-cost review of proposed projects and their associated costs;
- Agencies and facilities with or projects that address the highest risks of hazard damage;
- Projects that involve repetitive loss properties; and
- Projects that address the most intense development pressures.

The Tulalip OEM will develop a ranking system that weights various factors and provides a relative score that reflects the importance of a project to the Tulalip Tribes and the residents of the Reservation. The Tulalip OEM and QCV OEM will use these scores to rank proposed mitigation projects and to prioritize mitigation activities for action. The ranking system will include the following criteria:

- Reduction of threats to public health and safety;
- Reduction of potential structural damages;
- Reduction of potential economic losses;
- Effects on environmental and cultural resources;
- Degree of support for the Tulalip Tribes goals and objectives; and
- The benefit/cost ratio of the project.

Since most hazard mitigation funding from federal and state sources requires a benefit/cost ratio greater than one, this ratio will be an important factor in the assessment of projects. Unless a project involves overriding public health and safety or cultural factors, the Tulalip OEM will only consider projects in which project benefits at least exceed project costs. In seeking to maximize public benefits, the Tulalip OEM and/or the QCV OEM will acquire the information and/or assistance necessary to determine the best possible benefit-cost ratio for high priority projects before submitting applications for these projects to funding agencies. Projects that are recommended for funding will be those that best document their ability to reduce future impacts of natural disasters as well as demonstrate cost effectiveness through a benefit-cost review.
It is planned that the FEMA Benefit-Cost Analysis Toolkit will be utilized for this analysis.

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7. Plan Maintenance Process

The federal hazard mitigation planning regulations (44 CFR 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 three 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 Tulalip Tribes Tribal-level Hazard Mitigation Plan is a living document that is intended to provide a guide for hazard mitigation to the Tulalip Tribes. The Plan can be revised more frequently than 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 Tulalip Tribes' method and schedule for monitoring, evaluating, and updating the HMP and for monitoring the progress of mitigation actions.

7.1. Responsibility for Plan Maintenance

The Tulalip Board of Directors has final authority and responsibility over the Tulalip Hazard Mitigation Plan. Responsibility for plan maintenance and coordinating implementation of mitigation measures will be delegated to the Tulalip Office of Emergency Management. The Tulalip OEM will also be responsible for annual progress reports to the Tulalip Board of Directors and for the three-year update to be submitted to the Board and subsequently to FEMA for approval.

7.2. Monitoring, Evaluating and Updating the Plan

The Tulalip OEM will review this HMP annually and will update the HMP every three years. Annual reviews will identify progress made on the implementation of mitigation measures and projects. Annual reviews will also assess the impacts of disasters in the Reservation region to determine whether the HMP should be revised based on the new information. The annual review will occur during the last quarter of each calendar year to coincide with the tribal fiscal year and to prepare for PDM grant deadlines.

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

- Examine and revise the Hazard Risk Assessment as necessary to ensure that it describes the current understanding of hazard risks;
- Examine progress on and determine the effectiveness of the mitigation actions and projects recommended in this HMP;
- Identify implementation problems (technical, political, legal, and financial) and develop recommendations to overcome them;
- Recommend ways to increase participation by Tulalip Tribes departments and to improve coordination with other jurisdictions and agencies; and
- Review and, if desirable, revise the Tulalip HMP Action Plan.

The updated HMP will be presented to the Tulalip Board of Directors for approval and adoption before it is submitted to FEMA for re-approval.

7.3. Monitoring Progress of Mitigation Actions

The Tulalip Tribes Office of Emergency will frequently review progress on the implementation of mitigation actions. The Tulalip OEM will also meet with representatives from Tribal Departments to discuss progress of mitigation activities. The implementation of all short-term mitigation actions will be monitored by the Tulalip OEM 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 for the future 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 Tulalip OEM. As described in the previous section, progress on mitigation actions will be described in an annual report to Tulalip Board of Directors and in the three-year update of the Hazard Mitigation Plan.

In addition to the work products described in approved work plans for projects funded by the Pre-Disaster Mitigation Program, the Hazard Mitigation Grant Program, the Flood Mitigation Assistance Program, or other grant programs, quarterly or semi-annual (depending on reporting requirements of funding agencies) performance reports that identify accomplishments toward completing the work plan commitments, a discussion of the work performed for all work plan components, a discussion of any existing or potential problem areas that could affect project completion, budget status, and planned activities for the subsequent quarter will be submitted to the funding agency by the assigned Tulalip Project Officer. The agency-specific final grant closeout documents will also be prepared by the Tulalip Project Officer at the conclusion of the performance period and submitted to the funding agency.

8. References

General

Snohomish County Community Transit, Tulalip bus routes 221 & 222. http://www.commtrans.org/

Tulalip Tribes web site. http://www.tulaliptribes-nsn.gov/

Washington State Hazard Mitigation Plan, 2004. http://emd.wa.gov/6-mrr/mit-rec/mit/mit-pubs-forms/hazmit-plan/hazmit-plan-idx.htm

Flood

-USGS streamflow data for Washington, as of 2004

http://wa.water.usgs.gov/data/realtime/adr/2004/

"Water Resources of the Tulalip Indian Reservation and Adjacent Area, Snohomish County, Washington, 2001-03" . Prepared in cooperation with the Tulalip Tribes
By Lonna M. Frans and David L. Kresch, U.S. GEOLOGICAL SURVEY
Scientific Investigations Report 2004-5166
http://pubs.usgs.gov/sir/2004/5166/

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Appendix A Resolution Adopting Plan

THE TULALIP TRIBES
Resolution No. 2006- 221

WHEREAS the Board of Directors is the governing body of the Tulalip Tribes under the Constitution and Bylaws of the Tribe approved by the United States Commissioners of Indian Affairs and the Secretary of Interior on January 24, 1936, Pursuant to the Act of June 18, 1934 (48 Stat. 984, 25 U.S.C & 476); and

WHEREAS, the Tulalip Tribes has a duty to create a "Tulalip Tribes Hazard Mitigation Plan" as required by Federal Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390) commonly known as the "2000 Stafford Act" which was approved by Congress on October 10, 2000; and

WHEREAS, the Tulalip Tribes has the need to permanently eliminate or reduce the long-term risk to human life and property from natural and human caused hazards; and

WHEREAS, the Tulalip Tribes Hazard Mitigation Plan falls under the jurisdiction of the Tulalip Tribes Board of Directors. The Tulalip Tribes Board of Directors will provide oversight to emergency management activities and those ordinances, resolutions, contracts, rules and regulations that are necessary for emergency management (The Tulalip Tribes Comprehensive Emergency Management Plan 2005).

NOW THEREFORE BE IT ENACTED by the Board of Directors of the Tulalip Tribes, to support the request for the adoption of the "The Tulalip Tribes State-Level Hazard Mitigation Plan" as written.

ADOPTED by the Board of Directors of the Tulalip Tribes of Washington at a regular meeting assembled on the 11 of August, 2006, with a quorum present by a vote of 5 for and 0 against.

THE TULALIP TRIBES OF WASHINGTON

Stanley G. Jones Sr., Chairman

ATTEST:

Marie Zackuse, Secretary

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Appendix B Pre-Adoption Letter from FEMA

U.S. Department of Homeland Security
Region X
130 228th Street, SW
Bothell, WA 98021-9796

FEMA

June 7, 2006

Lynda Harvey, Director
Office of Emergency Management
Tulalip Tribes
7720 Waterworks Road
Tulalip, Washington 98271

Dear Ms. Harvey:

As requested, I have completed a pre-adoption review of the **Tulalip Tribes Hazard Mitigation Plan, dated April 2006**. The plan successfully contains the required criteria for a State Standard Hazard Mitigation Plan, excluding the adoption, as outlined in 44 CFR Part 201. The plan review worksheet is enclosed. This letter serves as our commitment to approve the plan upon receiving documentation of the plan's adoption by the Tribal Council.

The plan will not be approved by the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) until it is adopted. The Tulalip Tribes will not be eligible for pre-disaster mitigation project grants nor certain forms of federal disaster recovery assistance (e.g., Public Assistance Program's post-disaster reconstruction grants) until the plan is formally approved by FEMA.

Please contact me at 425.487.4700 with any questions.

Sincerely,

Sharon Loper

Sharon Loper
Hazard Mitigation Plans Manager

Enclosure

SL:gb

www.fema.gov

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Appendix C Sources of Funding[54]

Catalog of Federal Disaster Assistance (CFDA) numbers are provided to help you find additional information on the CFDA website.

Disaster-Specific Assistance Programs

- Community Disaster Loan Program
  (CDFA Number: 97.03)
  Provides funds to any eligible jurisdiction in a designated disaster area that has suffered a substantial loss of tax and other revenue.
  (Localities)

- Fire Management Assistance Grant Program
  (CDFA Number: 97.046)
  Assistance for the mitigation, management, and control of fires on publicly or privately owned forests or grasslands, which threaten such destruction as would constitute a major disaster.
  (States, local and tribal governments)

- Hazard Mitigation Grant Program
  (CDFA Number: 97.039)
  Provides grants to States and local governments to implement long-term hazard mitigation measures after a major disaster declaration.
  (States, localities and tribal governments; certain private-nonprofit organizations or institutions; authorized tribal organizations; and Alaska native villages or organizations via states)

- Public Assistance Grant Program
  (CDFA Number: 97.036)
  Provides assistance to alleviate suffering and hardship resulting from major disasters or emergencies declared by the President.
  (States, localities, tribal governments and private-nonprofit organizations via states)

- Reimbursement for Firefighting on Federal Property
  (CDFA Number: 97.016)
  Provides reimbursement only for direct costs and losses over and above normal operating costs.
  (States, localities, tribal governments and fire departments)

[54] http://www.fema.gov/government/grant/government.shtm

Hazard-Related Grants and Assistance Programs

- Community Assistance Program, State Support Services Element (CAP-SSSE)
  (CDFA Number: 97.023)
  Provides funding to States to provide technical assistance to communities in the National Flood Insurance Program (NFIP) and to evaluate community performance in implementing NFIP floodplain management activities.
  (States)

- Flood Mitigation Assistance Program
  (CDFA Number: 97.029)
  Provides funding to assist States and communities in implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP.
  (States and localities)

- National Dam Safety Program
  (CDFA Number: 97.041)
  Provides financial assistance to the states for strengthening their dam safety programs.
  (States)

- National Earthquake Hazards Reduction Program (NEHRP)
  (CDFA Number: 97.082)
  Provides financial assistance to the states for strengthening their dam safety programs.
  (States)

- National Flood Insurance Program
  (CDFA Number: 97.022)
  Enables property owners in participating communities to purchase insurance as a protection against flood losses in exchange for State and community floodplain management regulations that reduce future flood damages.
  (States, localities, and individuals)

- Pre-Disaster Mitigation Program
  (CDFA Numbers: 97.017)
  Provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event.
  (States, localities and tribal governments)

- Repetitive Flood Claims Program
  (CDFA Number: 97.092)
  Provides funding to States and communities to reduce or eliminate the long-term risk of flood damage to structures insurede under the NFIP that have had one or more claims for flood damages, and that can not meet the requirements of the Flood Mitigation Assistance (FMA) program for either cost share or capacity to

manage the activities.
(States and localities)

Non-Disaster Programs

- Chemical Stockpile Emergency Preparedness Program
(CDFA Number: 97.040)
Improves preparedness to protect the people of certain communities in the unlikely event of an accident involving this country's stockpiles of obsolete chemical munitions.
(States, localities and tribal governments)

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
(PDF - 129KB) (TXT - 8KB)
(CDFA Numbers: 97.02, 97.021)
Supports programs designed to improve capabilities associated with oil and hazardous materials emergency planning and exercising.
(States, localities and tribal governments, U.S. territories, state emergency response committee's (SERCs) and LEPCs)

- Cooperating Technical Partners
(CDFA Number: 97.045)
Provides technical assistance, training, and/or data to support flood hazard data development activities.
(States, localities, tribal governments)

- Emergency Food and Shelter Program
(CDFA Number: 97.024)
Supplements the work of local social service organizations within the United States, both private and governmental, to help people in need of emergency assistance.
(Private-Nonprofit community and government organizations)

- Map Modernization Management Support
(CDFA Number: 97.070)
Provides funding to supplement, not supplant, ongoing flood hazard mapping management efforts by the local, regional, or State agencies.
(States and localities)

- Superfund Amendments and Reauthorization Act
Provides funding for training in emergency planning, preparedness, mitigation, response, and recovery capabilities associated with hazardous chemicals.
(Public officials, fire and police personnel, medical personnel, first responders, and other tribal response and planning personnel.

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