City and Borough of Wrangell

Multi-Jurisdictional Hazard Mitigation Plan

2020

Prepared by:

AECOM






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LIST OF ACRONYMS AND ABBREVIATIONS

AECOM	AECOM, Consultant, or Contractor
AVO	Alaska Volcano Observatory
CBW	City and Borough of Wrangell
CCTHITA	Central Council of the Tlingit and Haida Indian Tribes of Alaska
CFR	U.S. Code of Federal Regulations
DCCED	Department of Commerce, Community, and Economic Development
DCRA	Division of Community and Regional Affairs
DEC	Alaska Department of Environmental Conservation
DHS&EM	Division of Homeland Security and Emergency Management
DGGS	Alaska Division of Geological and Geophysical Survey
DMA 2000	Disaster Mitigation Act Of 2000
DOT/PF	Department of Transportation and Public Facilities
ENSO	El Niño/La Niña Southern Oscillation
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
ft	Feet
GI	Geophysical Institute
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HUD	Housing and Urban Development
IRA	Indian Reorganization Act
M	Magnitude
MAP	Mitigation Action Plan
MJHMP	Multi-Jurisdictional Hazard Mitigation Plan
mph	Miles Per Hour
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
SNAP	Scenarios Network for Alaska and Arctic Planning
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
UAF	University of Alaska Fairbanks
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geologic Survey
WCA	Wrangell Cooperative Association

1 INTRODUCTION

1.1 HAZARD MITIGATION PLANNING

As defined in Title 44 of the Code of Federal Regulations (CFR), Subpart M, Section 206.401, hazard mitigation is "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." As such, hazard mitigation is any work to minimize the impacts of any type of hazard event before it occurs. Hazard mitigation aims to reduce losses from future disasters. It is a process that identifies and profiles hazards, analyzes the people and facilities at risk, and develops mitigation actions to reduce or eliminate hazard risk. The implementation of the mitigation actions, which include short- and long-term strategies that may involve planning, policy changes, programs, projects, and other activities, is the end result of this process.

In recent years, local hazard mitigation planning has been driven by a federal law, known as the Disaster Mitigation Act of 2000 (DMA 2000). On October 30, 2000, Congress passed the DMA 2000 (Public Law 106-390), which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act) (Title 42 of the United States Code Section 5121 et seq.) by repealing the act's previous mitigation planning section (409) and replacing it with a new mitigation planning section (322). This new section emphasized the need for state, tribal, and local entities to closely coordinate mitigation planning and implementation efforts. This new section also provided the legal basis for the Federal Emergency Management Agency's (FEMA's) mitigation plan requirements for the Hazard Mitigation Assistance grant programs.

In recognition of tribal sovereignty and the government-to-government relationship that FEMA has with Indian Tribal governments, FEMA amended 44 CFR Part 201 at 72 Fed. Reg. 61720, on October 31, 2007, and again at 74 Fed. Reg. 47471, on September 16, 2009, to consolidate and clarify the requirements for Indian Tribal governments, to establish tribal mitigation plans separately from state and local mitigation plans, and finalize the mitigation planning rule.

Indian tribal governments with an approved Tribal Mitigation Plan in accordance with 44 CFR 201.7 may apply for assistance from FEMA as a grantee. If the Indian Tribal government coordinates with the State for review of their Tribal Mitigation Plan, then the Indian Tribal government also has the option to apply as a subgrantee through a state or another tribe. A grantee is an entity such as a state, territory, or Indian Tribal government to which a grant is awarded and that is accountable for the funds provided. A subgrantee is an entity, such as a community, local, or Indian Tribal government; state-recognized tribe; or a private non-profit organization to which a subgrant is awarded and that is accountable to the grantee for use of the funds provided.

If the Indian Tribal government is eligible as a grantee or subgrantee because it has an approved Tribal Mitigation Plan and has coordinated with the State for review, it can decide which option it wants to take on a case-by-case basis with respect to each Presidential Disaster Declaration, and for each grant program under a Declaration, but not on a project-by-project basis within a grant program. For example, an Indian Tribal government can participate as a subgrantee for Public Assistance, but as a grantee for the Hazard Mitigation Grant Program (HMGP) under the same Declaration. However, the Indian Tribal government would not be able to request grantee status under HMGP for one HMGP project, then request subgrantee status for another HMGP project under the same Declaration.

Under the Stafford Act and the National Flood Insurance Act, local, and tribal governments must have an approved, adopted hazard mitigation plan to meet the eligibility requirements for certain assistance types, which may differ depending on whether the local or Indian tribal government intends to apply as a grantee or subgrantee.

1.2 2020 MULTI-JURISDICTIONAL HAZARD MITIGATION PLAN SYNOPSIS

To meet the requirements of the DMA 2000, the City and Borough of Wrangell (CBW), the Wrangell Cooperative Association (WCA), and the Central Council of the Tlingit and Haida Indian Tribes of Alaska (CCTHITA) have prepared a Multi-Jurisdictional Mitigation Plan (MJHMP) (hereinafter referred to as the 2020 MJHMP) to assess risks posed by natural hazards and to develop a mitigation action plan for reducing the risks on Wrangell Island (Wrangell). This is an updated plan from the legacy 2009 hazard mitigation plan for the community.

The 2020 MJHMP is organized to follow FEMA's Local Mitigation Plan Review Tool, which demonstrates how local HMPs meet the DMA 2000 regulations. As such, specific planning elements of this review tool are in their appropriate plan sections.

The 2020 MJHMP structure has been updated to including the following sections:

- **Section 1 Introduction** defines what a hazard mitigation plan is, delineates federal requirements and authorities, and introduces the Hazard Mitigation Assistance program listing the various grant programs and their historical funding levels.
- **Section 2 Planning Process** provides an overview of the planning process, starting with the plan completion timeline. It identifies planning/advisory committee members and describes their involvement with the plan update process. It also details stakeholder outreach, public involvement and continued public involvement. It provides an overview of the existing plans and reports and how they were incorporated into the 2020 MJHMP, how the legacy plan was reviewed for the update, and lastly lays out a plan update method and schedule. Supporting planning process documentation is listed in Appendix A.
- **Section 3 Community Profile** provides a general history and background of Wrangell including historical trends for population and the demographic and economic conditions that have shaped the area. Finally, this section lists the critical facilities identified by the community that are included in this plan.
- **Section 4 Hazard Identification and Risk Assessment** describes each of the seven hazards addressed in this plan. Additionally, it includes impact (i.e., risk assessment) tables for the planning area, vulnerable populations and critical facilities in each hazard area. An overall summary description is also provided for each hazard.
- **Section 5 Mitigation Strategy** details Wrangell's capabilities (authorities, policies, programs and resources) available for hazard mitigation. Finally, it describes the mitigation strategy, which is the blueprint for how Wrangell will reduce its risks to hazards. The mitigation strategy is made up of three main components: mitigation goal(s); potential mitigation actions and projects; and a mitigation action plan.
- **Section 6 References** contains the sources cited in the document.
- **Section 7 Plan Adoption** contains a scanned copy of the adoption resolutions.

2 PLANNING PROCESS

Section 2 – Planning Process addresses Element A of the Local Mitigation Plan Regulation Checklist.

DMA 2000 requirements and implementing local and multi-jurisdictional governance regulations for describing the planning process include:

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element A: Planning Process
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))

DMA 2000 requirements and implementing Tribal governance regulations for describing the planning process include:

Regulation Checklist – 44 CFR 201.7 Tribal Mitigation Plans
Element A: Planning Process
A1. Does the plan document the planning process, including how it was prepared and who was involved in the process? [44 CFR § 201.7(c)(1)]
A2. Does the plan document an opportunity for public comment during the drafting stage and prior to plan approval, including a description of how the tribal government defined "public"? [44 CFR § 201.7(c)(1)(i)]
A3. Does the plan document, as appropriate, an opportunity for neighboring communities, tribal and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? [44 CFR § 201.7(c)(1)(ii)]
A4. Does the plan describe the review and incorporation of existing plans, studies, and reports? [44 CFR § 201.7(c)(1)(iii)]
A5. Does the plan include a discussion on how the planning process was integrated to the extent possible with other ongoing tribal planning efforts as well as other FEMA programs and initiatives? [44 CFR § 201.7(c)(1)(iv)]
A6. Does the plan include a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within the plan update cycle)? [44 CFR § 201.7(c)(4)(i)]
A7. Does the plan include a discussion of how the tribal government will continue public participation in the plan maintenance process? [44 CFR § 201.7(c)(4)(iv)]

2.1 OVERVIEW OF 2020 MJHMP PLANNING PROCESS

The planning process began on January 31, 2018 with a teleconference with Ms. Lisa Von Bargen, Borough Manager to explain how their community was selected by the Division of Homeland Security and

Emergency Management (DHS&EM) 2016 Pre-Disaster Mitigation Grant award. The staff of AECOM, the State's contractor, described the MJHMP development requirement to enable the community to qualify for Hazard Mitigation Grant Program grants and the overall MJHMP development process.

Ms. Von Bargen explained she desired a major update to their legacy Hazard Mitigation Plan (HMP) stating she was contacting prospective community planning team members to assist the community's efforts to identify available resources and capabilities for the 2020 MJHMP development. The planning team would assist AECOM by acting as an advocate for the planning process, assist with gathering information, and provide support during public participation opportunities.

The first community meeting and planning team work sessions occurred on November 27 to 29, 2018. The Assembly identified applicable resources and capabilities during the November 27 meeting. The planning team met on November 29 to discuss their hazards that create the most concern for the community.

The planning team then discussed the hazard impacts to their residential, critical facilities, and infrastructure various mitigation actions for potential future mitigation project funding.

In summary, the following five-step process took place from November 2018 through July 2019.

1. Organize resources: Members of the planning team identified resources, including staff, agencies, and local community members, who could provide technical expertise and historical information needed in the development of the hazard mitigation plan.
2. Monitor, evaluate, and update the plan: The planning team developed a process to ensure the plan was monitored to ensure it was used as intended while fulfilling community needs. The team then developed a process to evaluate the plan to compare how their decisions affected hazard impacts. They then outlined a method to share their successes with community members to encourage support for mitigation activities and to provide data for incorporating mitigation actions into existing planning mechanisms and to provide data for the plan's five-year update.
3. Assess risks: The planning team identified the hazards specific to the Wrangell area and with AECOM's assistance, developed the risk assessment for their identified hazards. The planning team reviewed the risk assessment, including the vulnerability analysis, prior to and during developing their 2018 mitigation strategy.
4. Assess capabilities: The planning team reviewed current administrative and technical, legal and regulatory, and fiscal capabilities to determine whether existing provisions and requirements adequately address relevant hazards.
5. Develop a mitigation strategy: After reviewing the risks posed by each hazard, the planning team developed a comprehensive range of potential mitigation goals and actions. Subsequently, the planning team identified and prioritized the actions for implementation.

Table 1 provides a timeline of the major planning tasks and milestones over the planning period.

Table 1. Hazard Mitigation Advisory Committee

Name	Department / Agency, Title	Contribution
Lisa Von Bargen	Borough Manager, CBW	Planning team lead, data input and MJHMP review.
Steve Prysunka	Mayor, CBW	Planning team member, data input and MJHMP review.
Patty Gilbert	Vice Mayor, CBW	Planning team member, data input and MJHMP review.
Carol Rushmore	Economic Development Director, CBW	Planning team member, data input and MJHMP review.

Table 1. Hazard Mitigation Advisory Committee

Name	Department / Agency, Title	Contribution
Rolland Howell	Public Works Director, CBW	Planning team member, data input and MJHMP review.
Amber Al-Haddad	Capital Facilities Director, CBW	Planning team member, data input and MJHMP review.
Tim Buness	Fire Chief, CBW	Planning team member, data input and MJHMP review.
Doug McCloskey	Police Chief, CBW	Planning team member, data input and MJHMP review.
Greg Meissner	Harbor Master, CBW	Planning team member, data input and MJHMP review.
Borough Assembly	Entire Membership, CBW	Planning team members, data input and MJHMP review.
Austin O'Brien	Acting Forest Service District Ranger, US Forest Service District (USFS)	Planning team members, data input and MJHMP review.
Esther Ashton	Tribal Administrator, WCA	Planning team member, Tribal data input and MJHMP review.
Richard Peterson	President, Central Council of the Tlingit and Haida Indian Tribes of Alaska	Planning team member, Tribal data input and MJHMP review.
Raymond Paddock	Environmental Manager/ MJHMP Contact, CCTHITA of Alaska	Planning team member, Tribal data input and MJHMP review.
Michael Sanders	Safety Officer, Southeast Alaska Regional Health Consortium	Agency Planning Participant
Kelly Isham	Emergency Management Planner, AECOM, Alaska	Contract planning team member, data acquisition, MJHMP development
Scott Simmons	Emergency Management Professional, AECOM, Alaska	Contract planning team lead. Responsible for MJHMP development, lead writer, project coordination.

2.2 OPPORTUNITIES FOR STAKEHOLDERS

On February 12, 2018, AECOM reached out to stakeholders about the 2020 MJHMP to invite them to participate in the planning process. Stakeholders included:

- US Bureau of Indian Affairs
- US Bureau of Land Management
- US Department of Housing and Urban Development (HUD)
- US Fish & Wildlife Service
- University of Alaska Fairbanks (UAF), Geophysical Institute (GI), Alaska Earthquake Information Center
- Alaska Native Tribal Health Consortium-Community Development
- Alaska Volcano Observatory (AVO)
- Association of Village Council Presidents

- Denali Commission
- Alaska Department of Environmental Conservation (DEC)
    - Division of Spill Prevention and Response
    - Village Safe Water
- Alaska Department of Transportation and Public Facilities (DOT/PF)
    - Central Region
    - North Region
    - Southcoast Region
- Alaska Department of Community, Commerce, and Economic Development (DCCED)
    - Division of Community Advocacy (DCRA)
- Alaska Department of Military and Veterans Affairs
    - Division of Homeland Security and Emergency Management (DHS&EM)
- U.S. Environmental Protection Agency (EPA)
- National Weather Service (NWS)
    - Northern Region
    - Southeast Region
    - Southcentral Region
- Natural Resources Conservation Service (NRCS)
- U.S. Department of Agriculture
- U.S. Department of Agriculture Division of Rural Development
- US Army Corps of Engineers (USACE)

All stakeholder documentation is included in Appendix A.

2.3 PUBLIC INVOLVEMENT

The CBW engaged the public in the plan update process through discussions at Borough Assembly and Tribal Council meetings and through distribution of newsletters (Appendix A). The newsletters and draft plan were posted on the community electronic bulletin board for review and comment.

The WCA and the CCTHITA of Alaska recognize any tribal member, Alaska Native, community resident, or employee as a "Public" member of the community. This assures that anyone within the community is eligible to attend and participate in tribal public meetings concerning hazard mitigation plan development and implementation activities. Table 2 provides the community's public involvement initiative.

Table 2. Public Involvement Mechanisms

Plans and Reports	Information to be Incorporated into the 2020 MJHMP
Newsletter #1 Distribution (Oct. 16, 2018)	The jurisdiction distributed their first newsletter introducing the upcoming planning activity. The newsletter encouraged the whole community to provide hazard and critical facility information. It was posted through Wrangell's offices, stores, and bulletin boards to enable the widest dissemination.

Table 2. Public Involvement Mechanisms

Plans and Reports	Information to be Incorporated into the 2020 MJHMP
Newsletter #2 Distribution (January 3, 2019)	The jurisdiction distributed their second newsletter describing the draft MJHMP's availability and presented potential projects for review. The newsletter encouraged the whole community to provide comments or input. It was posted at Wrangell area offices, stores, and bulletin boards, stores to enable the widest dissemination.
Agency Involvement Email (November 12, 2016)	Invited agencies to participate in mitigation planning effort and to review applicable newsletters located on the DHS&EM Local/Tribal All Hazard Mitigation Plan Development website at: http://ready.alaska.gov/plans/localhazmitplans
HMP Reviews Opportunities	The planning team reviewed each section during MJHMP development and final HMP review.
Public HMP Progress Notifications	Team members engaged their public during borough and tribal council meetings to encourage discussion concerning the 2020 MJHMP update's progress and about HMP review opportunities throughout the project.
Public Comments	The CBW planning team reviewed the initial draft MJHMP and posted comments received as of January 13, 2019 on the Planning and Zoning Commission's website for public review. Comments were available at: http://www.wrangell.com/planning/multi-jurisdictional-hazard-mitigation-plan. Notice for Public comments was posted during development and during the final draft HMP review period. Any comments received were reviewed and vetted by the Planning and Zoning Commission. Valid comments were included within the MJHMP before finalizing the plan.

WCA President worked with the CBW and WCA Tribal Council to review the legacy HMP and provide information throughout the 2020 MJHMP update planning process.

Public meeting notices were posted throughout the community (Offices, businesses, post office, public bulletin boards, etc.) announcing the November 27th Assembly Meeting's agenda; encouraging attendance and participate in the plan update process and the introductory newsletter was disseminated.

A planning team meeting was held in February 2019 to review legacy 2009 mitigation actions, determine their current status, and identify new mitigation actions identified based on the results of the risk assessment. A second newsletter was prepared and delivered on January 3, 2019 describing the process to date, presenting the newly identified and prioritized mitigation actions, and announcing the availability of the draft MJHMP for public review and comment.

The planning team held two meetings in February and March 2019 to review the draft MJHMP for accuracy – ensuring it meets borough and tribal needs. The Planning and Zoning Commission further reviewed a draft June 4, 2019 providing additional comments. No public comments were received.

2.4 LEGACY 2009 HMP REVIEW AND ANALYSIS

44 CFR requires communities to schedule multi-jurisdictional, local, and tribal HMP planning team meetings and teleconferences to review, discuss, and determine mitigation implementation accomplishments, track data relevance for future HMP update inclusion, and document recommendations for future HMP updates.

Wrangell's Legacy 2009 HMP document was revised to reflect the following format to meet newly identified regulatory requirements.

Section 1: Introduction

- Added entire new section explaining Wrangell's 2020 plan review and update planning processes.

Section 2: Planning Process

- Updated this section to reflect 2009 to 2020 changes to the public process including newsletters, public meetings and planning team composition.

Section 3: Community Profile

- Updated and expanded community information, including new census and state data.

Section 4: Hazard Identification and Risk Assessment

- Reviewed hazard identification and risk assessment for earthquake, flooding, severe weather and wildland fire adding 2009 to 2020 descriptions and data and new hazard impact data. The weather profile now addresses climate change as it pertains to changing patterns and impacts. However, other profiled natural hazards also include noted climate change impacts as appropriate, these modifications better meet Wrangell's needs.

Section 5: Mitigation Strategy

- Reviewed 2009 mitigation goals and actions and added new goals and actions for the 2020 MJHMP Mitigation Strategies' Mitigation Action Plan.

Section 6: References

- Revised to reflect 2020 update resources.

Section 7: Plan Adoption

- Provided new 2020 borough and tribal adoption resolutions.

Maintenance Requirement Completion Review

The planning team did not complete their designated annual HMP integration into other planning mechanisms, annual reviews, or other plan maintenance activities. Therefore, it became a primary consideration to update the legacy 2009 HMP to analyze borough and tribal changes as well as all hazards that have, or could potentially have, impacted the Wrangell area during the legacy HMP's five-year lifecycle.

All sections of the MJHMP were updated throughout the 2020 update's planning activity due to intermittent contractor and community staff availability. Table 3 categorizes planning team-identified HMP components that necessitated information update were not lost.

The 2020 MJHMP update process included inviting new and existing stakeholders to review the legacy 2009 HMP to determine what was accomplished versus what was intended to accomplish.

Table 3. Legacy HMP Review and Update Needs Determinations

2009 HMP Section	2009 HMP Items to be Updated	Status*	2009 HMP Identified items for Deletion	Newly Identified Items to be Added for HMP Compliance	New Action Commitment
Planning Process	• Planning process obligations successes • Planning team membership • Mitigation resource list • Continue public outreach initiatives • HMP integration initiatives into other planning mechanisms • Plan Maintenance Activities	NF: Complete annual HMP review NF: Integrate any legacy HMP components into other planning mechanisms or initiatives NF: Continue public involvement during five-year life cycle	• None	• Refine plan maintenance processes and responsibilities	• Planning team will begin to hold annual review meetings • Strive to integrate HMP initiatives into other planning mechanisms
Hazard Profile Update	• Update hazard profile and new event history • Profile newly identified hazard risks	NF: Update hazard profile and new event history	• Mitigation projects that were deleted or combined due to similarity	• Identify new hazards • Update hazards' impacts • Determine mitigation project status as: deleted, deferred, or combined • Develop new MAP	• Define new actions within the MAP
Risk Analysis and Vulnerability Assessment	• Asset inventory • Vulnerability analysis & summaries	NF: Identify development and land use changes	• None	• Develop asset inventory • Determine infrastructure vulnerabilities • Determine residential structure vulnerabilities • Identify repetitive loss properties as appropriate	• Fill data gaps • Locate scientific information to augment these data. • Delineate climate change impacts to infrastructure

Table 3. Legacy HMP Review and Update Needs Determinations

2009 HMP Section	2009 HMP Items to be Updated	Status*	2009 HMP Identified items for Deletion	Newly Identified Items to be Added for HMP Compliance	New Action Commitment
Mitigation Strategy	• Determine existing mitigation actions progress and current status • Define mitigation action implementation successes or barriers	NF: Did not track project implementation processes or progress	• Delete completed, combined, or deleted actions • Implemented & non-relevant mitigation actions	• Legacy (2009) HMP MAP initiatives' status • Identify new mitigation actions for newly identified hazard implementation • Develop community specific capability assessment(s)	• Annually review action's progress, status, and feasibility

* F: Fulfilled NF: Not Fulfilled

2.5 REVIEW AND INCORPORATION OF EXISTING PLANS AND REPORTS

The consultant reviewed existing relevant information to include in the 2020 MJHMP. Table 4 lists the plans and reports reviewed as well as information to be incorporated into the 2020 MJHMP.

Table 4. Existing Plans and Reports

Plans and Reports	Information to be Incorporated into the 2020 MJHMP
Wrangell Household Opinion Survey, 2009	Identified issues relevant to residents concerning quality of life, economic sustainability, waste accumulation and disposal recycling options, electric power intertie, and deepwater access location to boost industrial development and employment
Wrangell Water Front Economic Overview, 2014	Provided employment and other economic related data for plan inclusion
Waterfront Master Plan, 2015	Provided insight into future and planned development
Wrangell Community Profile, 2016	Provided community specific infrastructure and economic, information
Water Treatment Plant Upgrade Project Environmental Report, 2016 – 2017	Reviewed for pertinent geological information
Wrangell Borough Comprehensive Plan, 2010	Provided priorities for community, land use, historical information on mitigation, development goals
Wrangell Capitol Improvement Project List, 2016 - 2017	Provided critical facility funding information for risk assessment
Wrangell's History, (Wrangell website 2018)	Provided Wrangell area background information

Table 4. Existing Plans and Reports

Plans and Reports	Information to be Incorporated into the 2020 MJHMP
FEMA Map Service Center	Provided historic flood hazard area documents and maps
Wrangell Erosion Sediment Control Plan	Describes Wrangell area erosion concern areas
U.S. Army Corps of Engineers, Alaska Baseline Erosion Assessment, 2009	Defined the area's erosion impacts
U.S. Army Corps of Engineers, Floodplain Manager's Reports, Community Specific 2011	Defined the area's historical flood impacts
State of Alaska, Department of Commerce, Community and Economic Development Community Profile	Provided historical and demographic information
State of Alaska Hazard Mitigation Plan, 2013	Defined statewide hazards and their potential locational impacts

2.6 INTEGRATING THMP PRECEPTS INTO EXISTING PLANNING MECHANISMS

The Wrangell planning team did not integrate any legacy 2009 HMP components into other planning mechanisms; or initiatives during the legacy 2009 HMP's five-year lifecycle.

Like most Alaska communities there is continuous staff turnover. New leadership is in the process of working with Wrangell department leads to integrate MJHMP components into existing planning documents and procedural mechanisms.

Each planning team member ensures that the MJHMP, and in particular each Mitigation Action Plan's (MAP's) project or initiative, is incorporated into existing city or tribal planning mechanisms whenever possible. Once the MJHMP is community adopted and receives FEMA's final approval, each member of the planning team will undertake the following activities:

- Review community-specific regulatory tools to assess integrating MJHMP components. These regulatory tools are identified in Section 5.
- Work with pertinent community departments to increase MJHMP awareness and provide assistance with integrating the mitigation strategy (including the MAP) into relevant planning mechanisms.
- Responsible authorities will track their respective project or action's status and annually report their progress as well as their mitigation success, or failure.

Note: Implementing these requirements may require updating or amending specific planning mechanisms

Wrangell hosts various annual outreach activities annually which gives the Wrangell planning team opportunities to present MJHMP initiatives and philosophies to the public during these meetings. These activities provide platforms to facilitate public discussion and to explain the need to integrate MJHMP precepts into city and tribal planning initiatives. The most effective events include the annual Health Fair, Community Markets, Public School Science presentations or Senior Project presentations. A webpage of Information on Hazard Mitigation concerns will also be established on the City's website. The Borough also regularly uses social media to keep residents informed.

2.7 CONTINUED PUBLIC PARTICIPATION

The MJHMP was prepared as a collaborative effort with CBW, WCA, and the CCTHITA. The planning team will build upon previous hazard mitigation planning efforts and successes. CBW, WCA, and the CCTHITA will continue to use their respective planning teams, department staff meetings, and the Planning and Zoning Commission to monitor, review, and evaluate the MJHMP annually and update the plan as required.

A copy of the 2020 MJHMP will be kept at the CWB and the Central Council of the Tlingit and Haida Indian Tribes of Alaska offices and community electronic bulletin board. The Planning team will also notify residents of any changes or updates to the 2020 MJHMP, including mitigation projects identified in the plan as they are implemented on the city website.

The CBW, WCA, and the CCTHITA will strive to continue identifying opportunities to raise community awareness about the MJHMP and the hazards that affect the area. This effort may include attendance and provisions of materials and conducting annual surveys and questionnaires at City and Tribal-sponsored events, periodic presentations on the plan's progress to local officials and other community groups, or posting on social media about the plan and how it is being used in the city. Any public comments received regarding the MJHMP will be collected by the planning team leader who will include the information within the annual report for consideration during future MJHMP updates.

2.8 PLAN UPDATE AND MONITORING METHOD AND SCHEDULE

The CBW, WCA, and the CCTHITA commits to organizing their efforts to ensure that future HMP improvements and revisions occur in a well-managed, efficient, and coordinated manner. The planning team will follow these three process steps:

- **Annual Review Worksheets**: Every 12 months from plan adoption, the HMP planning lead will email each member of the planning team an Annual Review Worksheet to complete. As shown in Appendix B, the Annual Review Worksheet reflects the Local Mitigation Plan Review Tool and includes the following: planning process, hazard profile, risk assessment, and mitigation strategy. Each member of the advisory committee will email completed worksheets back to the HMP planning lead to review. The HMP planning lead will summarize these findings and email them out to the committee. If the HMP planning lead believes that the 2020 MJHMP needs to be updated based on the findings, then an invitation will be sent to planning team members to attend a formal HMP update meeting.
- **Mitigation Progress Project Reports**: Mitigation actions will be monitored and updated using the Mitigation Project Progress Report. During each annual review, each department or agency currently administering a mitigation project will submit a progress report to the HMP planning lead. For projects that are being funded by a FEMA mitigation grant, FEMA quarterly reports may be used as the preferred reporting tool. As shown in Appendix B, the progress report will discuss the current status of the mitigation project, including any changes made to the project, identify implementation problems, and describe appropriate strategies to overcome them.
- **Planning Team Roundtable**: On the fourth year of the update, the HMP planning lead will lead a tabletop exercise with the advisory committee to: collect the Annual Review Worksheet and any Mitigation Project Progress Reports and FEMA quarterly reports; determine hazards to be included in the 2025 MJHMP; develop a new work plan; and begin the plan update process.

The city and tribal councils will monitor the plan continually, evaluate the plan annually and update the plan every five years, or within 90 days of a presidentially declared disaster (if required), or as necessary to reflect changes in state or federal law.

Each authority identified in the MAP matrix will be responsible for implementing the MAP and determining whether their respective actions were effectively implemented.

The city and tribal councils will work together to appoint the most appropriate planning team leader, who will serve as the primary point-of-contact and will coordinate local efforts to monitor, evaluate, revise, and update MJHMP mitigation strategy actions' progress, status, and closure status.

2.9 TRIBAL OR NATIVE VILLAGE MITIGATION GRANT APPLICATION PROCESS CONSIDERATIONS

The Indian Reorganization Act (IRA) Tribes can potentially qualify to either apply for applicable grant funding as state sub-applicants; or apply directly to FEMA as eligible federally IRA tribal governments with sovereign authority working directly with government agencies.

Therefore, each eligible Tribe can determine which of the two following options will best fit their needs. These options are:

Option 1:

Each Tribe can submit grant applications through the State with no loss in Tribal governance authorities.

Each Tribe submits their mitigation grant applications to the State Hazard Mitigation Officer for initial State review. This option could potentially enable each Tribe to avoid paying future mitigation project grant funding match.

The State Hazard Mitigation Officer will then coordinate tribal applications within their grant review and prioritization process for potential approval and award. DHS&EM will review, prioritize, and award grants assigning their most current grant recipient cost share requirements to successful grant awardees.

Option 2:

Each eligible Tribe can submit mitigation grant applications directly to FEMA or other granting agencies as sovereign IRA tribal governments who maintain sovereign authority working directly with government agencies.

As an IRA tribe, the Tribal Councils submits their respective mitigation grant applications directly to FEMA with full knowledge that each Tribe will be responsible for providing any applicable programmatic project matching funds.

FEMA will review, prioritize, and award grants assigning their most current grant recipient cost share requirements to each successful grant awardee.

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3 COMMUNITY PROFILE

3.1 PLANNING AREA

The City and Borough of Wrangell and the Wrangell Cooperative Association are recognized governmental entities that are both located within and have authority within the same geographic area. For purposes of this Plan, the area includes the borough boundaries of the City and Borough of Wrangell.

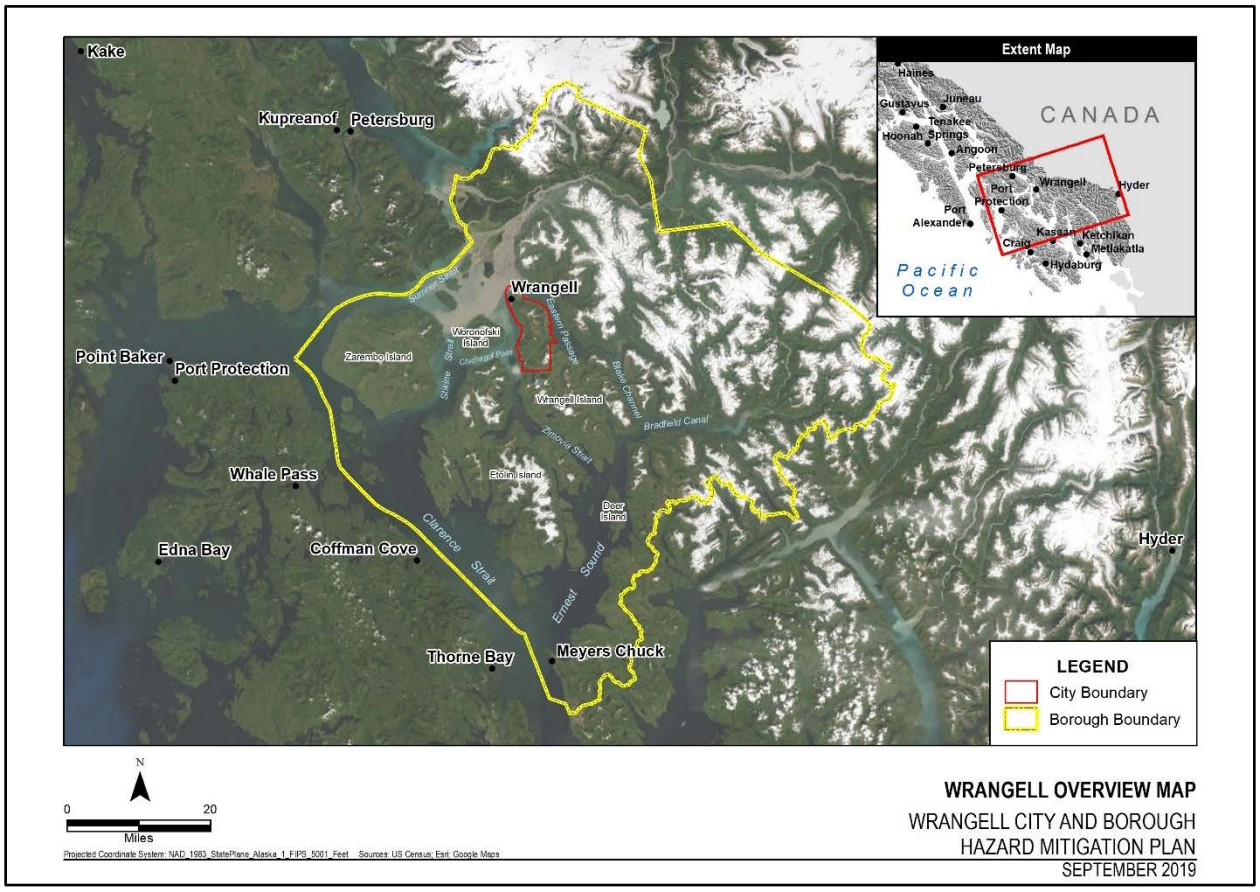

Figure 1. Wrangell Overview Map

The Wrangell Community Profile defines the city of Wrangell's location on Wrangell Island as being "located 90 miles north of Ketchikan in Southeast Alaska, near the mouth of the Stikine River. By air, Wrangell is approximately 1 hour 30 minutes (155 air miles) south from Juneau, and 3 hours from Anchorage and Seattle (just over 700 air miles each). The city of Wrangell is located on the northern tip of Wrangell Island" (Wrangell 2018). The following information is excerpted from the "History of Wrangell".

> *…Wrangell is the third oldest community in Alaska, and the second oldest community in Southeast, and the ONLY city in Alaska to be ruled by four nations and under three flags... Tlingit, Russia, England, and the United States*
>
> ***Since the last Ice Age***
>
> *A significant portion of the North American continent was buried under miles of glaciers during the last of the "Ice Age". However, recent archaeological and paleontological evidence indicates that at least a portion of Southeast Alaska, the outer coast, may have been ice-free during the late Pleistocene. Three archaeological sites within the Tongass National Forest have been reliably*

dated in excess of 9,000 years BP: Hidden Falls at approximately 9860 BP; Groundhog Bay at approximately 10,180 years BP and On-Your-Knees Cave, with rare human remains, at approximately 9730 BP.

The Tlingits

Tlingit influence in Southeast is well documented in the literature. The Tlingit migration stories describe the early migration of the Tlingit through the Canadian interior, the discovery of "the hole in the ice", and the subsequent discovery of the "land of plenty" when a couple was brave enough to explore where the hole led to. Local Wrangell Tlingits believe the hole in the ice was in fact the Stikine River corridor, perhaps a river beneath the glacier that led from the Canadian interior to a series of lush island along the coast of Southeast Alaska during the last of the "Ice Age".

Subsequent movement into the area by the Haida and Tsimshian impacted the Tlingits and brought competing interests for the resources. Disputes over resources are commonly described in ethnographic accounts, along with descriptions of the Stikine Tlingits as fierce warriors who were able and willing to fight against their neighbors. Tlingits were equally well known as seasoned negotiators and traders. Trade networks from Southeast extended into the interior of Canada and up the Copper River and beyond. George Vancouver was the first recorded white man to come to the Wrangell area. He came in 1793, while on a survey expedition and just missed discovering the nearby Stikine River. Captain Cleveland visited the "Village of Steeken" on April 16, 1799, where he did some fur trading with the Indians.

Under the Russian Flag

It wasn't until the early 1800's that the Native Alaskans were visited by outside forces. Lt. Dionysius Zarembo, commander of the Russian-American Company ship Chichagof, landed at present day Wrangell in 1833. Wrangell started in 1834 as the Russian Redoubt St. Dionysus. The Russians established the Fort in order to preserve their interests in the region. Both the Spanish and English had also been carefully scouting the extent of Russian settlement with an eye towards occupation themselves

Stikine Tlingit Chief Shakes V, recognized some advantages of cooperation with the Russians, and moved the Tlingit village from its former site at "old town" to Shakes Island in the heart of the current city of Wrangell to be near the Russian Redoubt. Aleuts, Eskimos and Interior Athabaskans were brought to Southeast as sea otter hunters for the Russian companies…

In June of 1834, shortly after the Russian Redoubt was completed, Peter Sheen Ogden with eight officers, and 80 plus Hudson Bay Company employees, supplies and trading goods, sailed north to establish a post on the Stikine River… the Hudson Bay ship neared Redoubt St. Dionysius, Lt. Zarembo refused to allow them to anchor and ordered the ship to leave at once. Ogden protested to the Chief Russian in Sitka, Baron von Wrangel, saying that the British had as much right as the Russians to trade for fur on the Stikine…

Under the British Flag

Ogden went to Vancouver and talked with Dr. John McLoughlin who was in charge of all Hudson Bay Company posts on the Pacific Coast. The two men agreed that the Russian government should pay the Hudson Bay Company for the furs they had been denied from the Stikine Valley. Dr. McLoughlin prepared a claim for his company of 21,150 pounds, 10 shillings, sterling seeking reimbursement by the Russian government. A settlement was reached and the Hudson Bay Company withdrew its claim in exchange for a lease to the Alaskan mainland from Portland Canal to Cape Spencer. … On May 30, 1840, the Hudson Bay Company ship Beaver reached Fort Dionysius. The Russian flag was lowered and the British flag raised. The fort was renamed Fort Stikine. John McLoughlin Jr. was made commander of the fort. Eighteen Hudson Bay Company men were left to gather the furs and defend Fort Stikine... Soon after the transfer of Fort Stikine to the British, there were several failed attempts by the Tlingits to capture the fort. The Hudson Bay

Company leased the fur lands of the Stikine area for more than 20 years and continued to operate the fort until the purchase of Alaska from Russia in 1867 by the United States.

Under the American Flag

The 1867 purchase of Alaska from Russia was known as "Seward's Folly" after William H. Seward, The Secretary of Interior. Most in the federal government believed Alaska was nothing but ice, snow and glaciers, with little value other than for the exported furs. Gold, however, had been discovered on the Stikine River in 1861. There were three Gold Rushes in and around Wrangell. The first one occurred when a man named Buck Choquette found gold on the Stikine River in 1861 on what is now call Buck's Bar. Buck Choquette was a Hudson Bay company employee. He was the first white man to find gold. Until Skagway came into existence, Wrangell served as the trade center for all the gold rushes, offering access to the Klondike fields through the Stikine River corridor and then on into the interior to the Yukon River. At one point over 10,000 persons were in Wrangell at one time, waiting for supplies and transportation up the Stikine. To put that into perspective, Wrangell has a current population of 2300 people! A number of buildings from this time period still exist in Wrangell.

In 1868 a military post was established and a new fort was built in Wrangell at a cost of $26,000. The American's named the fort after Baron von Wrangel of the Russian-American Company. The fort, located where the present day post office is, was composed of a stockade with narrow gun holes and several block houses. Inside the walls were barracks, officers' quarters, and supply sheds made of logs. South of the fort was the Tlingit village of about 35 houses and 500 inhabitants. The Fort Wrangell Post Office was established in 1869. The fort was abandoned in 1877.

Not long after the purchase of Alaska, the fishing industry got its start with the establishment of several canneries throughout Southeast. The canneries were responsible for the eventual development of the large fish traps at stream mouths that dramatically impacted the salmon runs. These traps were later outlawed, but had serious impacts to the local economies, particularly the Tlingit groups who had traditionally procured their subsistence resources from these streams… The second gold rush started in 1872 when two prospectors named Thibert and McCullough came to Wrangell with gold they found at Dease Lake in the Cassiar country in Canada. Then, when gold was discovered in the Klondike, Wrangell became a mining center for the third time. Thousands of people went up the Stikine in 1898 to travel the Teslin Trail to the Klondike. During the 1898 gold rush, famed Marshall Wyatt Earp spent 10 days as Wrangell's marshall. He declined to become a full-time town marshall since he was on his way, with his wife, to strike his fortune in the Klondike. Some locals jokingly claim that "Wrangell was too wild for Wyatt!"

An 1898 issue of the Stikine River Journal gives an excellent picture of the rapid growth of Wrangell during the gold rush when it lists the stores in town. Included on the list are two sawmills, one cigar factory, two manufacturing jewelers, one fish cannery, three tin shops, two blacksmith shops, several carpenter and cabinet shops, one ship yard, about ten laundries, one plumbing shop, one copper shop, two breweries, two newspapers, and numerous lodging houses and restaurants. Most of the shops were false front buildings clustered along both sides of Front Street. In 1898, Front Street was constructed of boards placed on pilings over the water. Today, the downtown area is built on gravel fill and still has the false front look of the gold rush days. Unfortunately, two devastating fires, one in 1906 and the other in 1952, destroyed most of the historic buildings...

Missionaries came during the early 1870's establishing the first Presbyterian and Catholic churches and schools. Noted naturalist John Muir spent quite a lot of time in Wrangell in the 1880's, staging many of his explorations of southeast Alaska out of Wrangell… Wrangell continued developing as a town and Wrangell incorporated as a city in 1903...

In 1902, the creation of the Alexander Archipelago Forest Reserve and its subsequent transformation into the Tongass National Forest five years later, set in motion a series of events which eventually led to Southeast Alaska's and Wrangell's largest, employers during the mid to late

1900's - the wood and fiber companies. As with other southeast communities, Wrangell's primary economic base became fishing and timber...

…In 1912 the Alaska Native Brotherhood (ANB) was created, thus forming a solid political group whose aim was to achieve political equality for the Native Alaskans. In 1924, successful arguments led to the Natives receiving citizenship and the right to vote. The ANB and Alaska Native Sisterhood further exercised their political power by successfully lobbying the federal Bureau of Indian Affairs to build the first Native boarding school, the Wrangell Institute, in Wrangell in 1932...

There were two salmon canneries within the City limits of Wrangell in 1929 as well as two shrimp and crab canneries that employed over 150 people. Fur farming was also very important in the Wrangell area. Wrangell and surrounding islands had fox, mink, beaver, marten and muskrat farms. During the 1920's to present day, Wrangell continues to be a center for mining, serving as a supply area for the gold fields of the Cassiar Country in Canada. On August 14, 1920, the first airplanes ever to come to Wrangell appeared and landed on Sergief Island at the mouth of the Stikine River. The four World War I DeHavilland bi-planes were on a round-trip flight from New York to Nome. Wrangell has survived two fires which destroyed the downtown areas, has survived the boom and bust cycles of the gold rushes, the fishing industry and timber history.... (CBW 2018)

3.2 POPULATION, LAND USE AND DEVELOPMENT TRENDS

Prior to 2010, the U.S. Census figures were for the City of Wrangell, only. In May of 2008, the City was dissolved, and the City and Borough of Wrangell was incorporated with expanded boundaries, therefore current population data for the expanded Borough boundaries only goes back to 2010. Wrangell's 2015 Waterfront Master Plan provided data that shows the community's population spanning from 1997 through 2017 to fill in the gaps.

Figure 2 portrays population decreased from a high of 2,560 in 1998 declining steadily to a low of 2,232 in 2006. As described in the Wrangell Waterfront Master Plan, "…the Alaska Pulp Company sawmill closed and salmon prices tumbled in the 1990's, the local economy was devastated. Between 1994 and 2006, the population of the community fell by 18 percent (losing more than 500 residents)."

The population has been growing to 2,456 in 2017 which is only slightly more than Wrangell's 2000 population of 2,448.

2018 U.S. Census estimated 2,503 residents, of which the median age was 48.8 indicating a middle-aged population. The City and Borough's population is expected to continue slow growth with an upward trend for the foreseeable future. Over half of current population is between 25 and 64 years of age.

72.5 percent of the current population is reported as white, with 16.2 percent having an American Indian or Alaska Native heritage. The male and female composition is approximately 52.4 and 47.6 percent respectively. The 2017 Census estimate revealed that there are 1,053 households with the average household having approximately 2.2 individuals. The most recent 2017 DCCED certified population is 2,387.

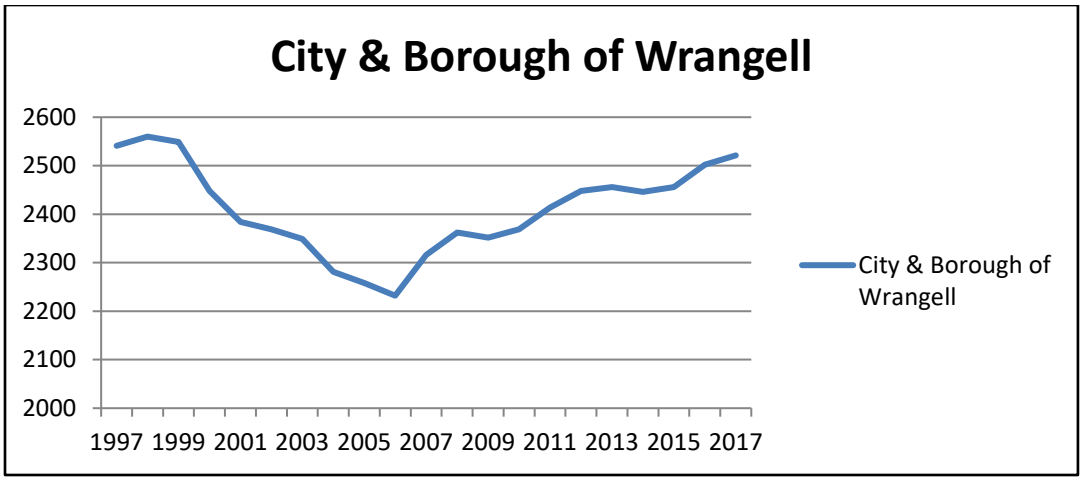

Figure 2. City and Borough of Wrangell's Historic Population

Population data for City and Borough of Wrangell were obtained from the 2017 U.S. Census and the DCCED certified Population. The U.S. Census estimated the City and Borough of Wrangell total population for 2018 as 2,503 and the 2017 DCCED certified population data of 2,426 (Table 5).

Table 5. Estimated Population and Building Inventory

Population[1]		Residential Buildings	
2018 Census	DCCED 2017 Data	Total Building Count	Total Value of Buildings
2,503	2,426	1,454	[1]US Census $282,076,000 [2]Adjusted for CBW: $399,850,000

[1]U.S. Census 2018 estimated City and Borough of Wrangell population data. US Census listed median housing value at $940,000

[2]The project team determined that the average single-family residential structural replacement cost is $275,000

The 2017 U.S. Census estimates the City and Borough of Wrangell's current residential structure value as $183,300.

However, the planning team stated that residential replacement values are generally understated because replacement costs exceed U.S. Census structure value estimates due to material purchasing, barge or airplane delivery, construction, and labor costs in rural Alaska. The planning team estimates an average 1,200 square foot residential structure costs $275,000. A total of 1,454 single-family residential buildings were considered in this analysis.

3.2.1 Land Use

The 2010 Wrangell Comprehensive Plan defines their land ownership and current land use designations. Since 2010, the Borough has completed its municipal entitlement selection and acquired an additional 9,006 acres from the State of Alaska.

The City and Borough of Wrangell encompasses 2,582 square miles of land and 883 square miles of water. The federal government is by far the largest landowner in the borough, followed by the State of Alaska (including Alaska Mental Health Trust), the City and Borough of Wrangell and a variety of individual and corporate private sector land owners (CBW 2010).

There are just under 41,000 acres of State uplands in the Borough. Approximately 25,000 acres of State land are designated in a manner eligible for municipal selection (CBW 2010).

In 2008, a local election was held to decide whether to dissolve the City of Wrangell and incorporate as the unified City and Borough of Wrangell, that would include the communities of Meyers Chuck, Union Bay, Thoms Place, Olive Cove and Farm Island and stretch from Cleveland Peninsula on the south end to the Stikine River on the north, and Zarembo and Etolin Islands on the west. Two thirds (64 percent) of the area's residents voted in favor of this proposal and on May 30, 2008, the City and Borough of Wrangell was incorporated. The area and extent of the new borough reflects the long standing connection between Wrangell, its Tlingit territory, and the surrounding land and water; minerals and gravel are extracted from the Stikine and brought into Wrangell, fish caught in surrounding waters are processed in local plants, logs harvested from Etolin, Zarembo and Shrubby Islands and other areas supported the Wrangell mills, residents of the remote areas use Wrangell as a transportation and supply hub, and visitors to Wrangell often travel to the rest of Wrangell Island, the Stikine River and Anan Wildlife Observatory (CBW 2010).

Often the co-located tribe and city share the same land boundaries and infrastructure. However, the regional Alaska Native Corporations typically manage the sub-surface rights and sometimes the surface use rights. The regional corporations provide lands to their tribal members for home sites, tribal offices, and other needs. Villages may have historically used lands outside their joint community as seasonal-use land for subsistence hunting/fishing/gathering purposes. These subsistence lands are often traditional use areas, and many times are on public lands. Traditional use lands do not have definitive or set boundaries and are seldom improved. Therefore, undeveloped lands are not eligible for programmatic mitigation funding except what is essential for protecting critically threatened facilities.

3.2.2 Development Trends

The City and Borough of Wrangell continually seeks to maintain and upgrade their aging infrastructure.

The CBW, WCA, and the CCTHITA have few known hazard areas because there is no actual hard data about such areas. The community has become aware of a few ground failure - principally landslide sites, and flood hazard areas. Wrangell learned of their potential landslide locations after development occurred in area.

Wrangell has FEMA Flood Insurance Rate Maps developed in 1982. However, Wrangell no longer participates in the National Flood Insurance Program (NFIP). The maps define Wrangell's flood zoned areas. Most of their flood hazard areas are in flood velocity zones near the coastline.

The borough provides developers or those desiring to develop in the floodway flood construction guidance documents, such as flood insurance construction requirements, and construction guidelines before any development occurs. If they are seeking to fill, they are provided all the flood insurance documentation and development guidelines to assure they know what is required. There are only a few homes that were built on fill or in the V zone.

The 10-year Wrangell Comprehensive Plan explains the borough's growth initiatives to guide development away from known hazard impact areas such as requiring building permits.

4 HAZARD IDENTIFICATION AND RISK ASSESSMENT

Section 4 – Hazard Identification and Risk Assessment addresses Element B of the Local and Tribal Mitigation Plan Regulation Checklist.

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element B: Hazard Identification and Risk Assessment
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement § 201.6(c)(2)(ii))
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement § 201.6(c)(2)(i))
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))
Regulation Checklist – 44 CFR 201.7 Tribal Mitigation Plans
Element B: Hazard Identification and Risk Assessment
B1. Does the plan include a description of the type, location, and extent of all natural hazards that can affect the tribal planning area? [44 CFR § 201.7(c)(2)(i)]
B2. Does the plan include information on previous occurrences of hazard events and on the probability of future hazard events for the tribal planning area? [44 CFR § 201.7(c)(2)(i)]
B3. Does the plan include a description of each identified hazard's impact as well as an overall summary of the vulnerability of the tribal planning area? [44 CFR § 201.7(c)(2)(ii)]

For the 2020 MJHMP, the planning lead worked with the local planning team to review the State of Alaska identified hazards for the geography. The team evaluated and screened these potential hazards based on a range of factors, including prior knowledge or perception of their threat, the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected information availability for each hazard. The planning team determined that the following seven hazards: earthquake, flood and erosion, ground failure, tsunami and seiche, volcanic ash, weather, and wildland fire posed the greatest threat to the Wrangell area and are profiled in this plan.

Table 6. Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Earthquake	Yes	Periodic, unpredictable occurrences. The Wrangell area experienced minor shaking from the 1964 Good Friday Earthquake and aftershocks along with earthquakes occurring off the coast of Prince of Wales Island. The Wrangell area has experienced 48 earthquakes M4.2 and below since the legacy 2009 HMP was implemented.
Erosion/Flood (Coastal surge resultant erosive scour damages)	Yes	There is potential for coastal storm surge flooding exacerbated by high wind, high tides, and rising sea level. Wrangell does not have an entire community storm drainage system. Existing location drainage capacity could be insufficient or culverts could clog and back-up. Many drains go directly into sewer systems. Heavy rain

Table 6. Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
		could cause pump failure due to stress and too much water cause great concern.
Ground Failure (Landslide/Debris Flow, Permafrost, Subsidence)	Yes	Ground Failure occurs throughout Alaska from avalanches, landslides, melting permafrost, ground subsidence and sink holes. In Wrangell there is a potential for landslides and small avalanches, and subsidence impacts.
Severe Weather (Cold, Drought, Rain, Snow, Wind, etc.)	Yes	Severe weather impacts the community with climate change/global warming and changing El Niño/La Niña Southern Oscillation (ENSO) patterns generating increasingly severe weather events such as winter storms, heavy or freezing rain, thunderstorms and with subsequent secondary hazards such as riverine or coastal storm surge floods, landslides, snow, and wind; and heat and drought more recently from lack of precipitation.
Tsunami (Seiche)	Yes	Wrangell is located at the confluence of three straits, the Stikine, Zimovia, and the Eastern Passage. There have been minor historical tsunami events that caused minor increased (1-foot) tidal run-up.
Volcano	Yes	Distant volcano generated ash has historically extended to beyond the Wrangell area from very distant volcanoes. Such an event could prevent essential goods delivery to Wrangell's remote island location for an extended period.
Wildland Fire	Yes	The community and the surrounding forest area become very dry in summer months when extreme heat, cause very dry drought conditions. These conditions have historically fueled lightening and human carelessness as fire ignition sources throughout the Wrangell area.

Hazard identification consists of describing the nature of the hazard, disaster history, location, extent/severity, and probability of future events. Hazard identification profiles have been developed for each of the five hazards addressed in the MJHMP. Additionally, impact (i.e., risk assessment) tables have been created for each hazard. Overall summary descriptions have been developed as well.

The specific hazards selected by the planning team for profiling have been examined in a methodical manner based on the following factors:

- Nature (Type)
  - Potential climate change impacts are primarily discussed in the Severe Weather hazard profile but are also identified where deemed appropriate within each hazard profile.
- Location
- History (Previous Occurrences)
- Extent (to include magnitude, severity and impact)
- Recurrence Probability

Each hazard is assigned a rating based on the following criteria for magnitude/severity (Table 7) and future recurrence probability (Table 8).

Estimating magnitude and severity are determined based on historic events using the criteria identified in the following tables.

Table 7. Hazard Magnitude/Severity Criteria

Magnitude / Severity	Criteria
4 - Catastrophic	• Multiple deaths. • Complete shutdown of facilities for 30 or more days. • More than 50 percent (%) of property is severely damaged.
3 - Critical	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least two weeks. • More than 25% of property is severely damaged.
2 - Limited	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than one week. • More than 10%of property is severely damaged.
1 - Negligible	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10% of property is severely damaged.

Similar to estimating magnitude and severity, probability is determined based on historic events, using Table 7 identified criteria, to provide estimated future event recurrence likelihood.

Table 8. Hazard Recurrence Probability Criteria

Probability	Criteria
4 - Highly Likely	• Event is probable within the calendar year. • Event has up to 1 in 1 year chance of occurring (1/1=100 percent [%]). • History of events is greater than 33% likely per year. • Event is "Highly Likely" to occur.
3 - Likely	• Event is probable within the next three years. • Event has up to 1 in 3 years chance of occurring (1/3=33%). • History of events is greater than 20% but less than or equal to 33% likely per year. • Event is "Likely" to occur.
2 - Possible	• Event is probable within the next five years. • Event has up to 1 in 5 years chance of occurring (1/5=20%). • History of events is greater than 10% but less than or equal to 20% likely per year. • Event could "Possibly" occur.
1 - Unlikely	• Event is possible within the next ten years. • Event has up to 1 in 10 years chance of occurring (1/10=10%). • History of events is less than or equal to 10% likely per year. • Event is "Unlikely" but is possible to occur.

The hazards profiled for Wrangell are presented throughout the remainder of this section. The presentation order does not signify their importance or risk level.

The Census Designated Place boundary was used for the geographic area. Percentages for erosion and tsunami were calculated by dividing the acreages of the overlapping tsunami (100 feet from shoreline) or erosion (0.5 mile from shoreline) buffer with the geographic area.

Percent of population was performed similarly, but by selecting the number of critical infrastructure buildings that were given an occupancy count by the community that overlap with the erosion or tsunami buffers.

Building stock was determined by digitizing buildings/structures using map sheets for the community and publicly available imagery. These were then selected by finding those that overlapped with the erosion or tsunami buffers.

Critical infrastructure was selected by finding those that overlapped with the erosion or tsunami buffers.

4.1 EARTHQUAKE

4.1.1 Nature

An earthquake is a sudden motion or trembling caused by a release of strain accumulated in or along the edge of the earth's tectonic plates. The effects of an earthquake can be felt far beyond the site of its occurrence. Earthquakes usually occur without warning and after only a few seconds can cause massive damage and extensive casualties. The most common effect of earthquakes is ground motion, or the vibration or shaking of the ground during an earthquake.

Ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. An earthquake causes waves in the earth's interior (i.e., seismic waves) and along the earth's surface (i.e., surface waves). Two kinds of seismic waves occur: primary waves are longitudinal or compressional waves similar in character to sound waves that cause back and forth oscillation along the direction of travel (vertical motion), and secondary waves, also known as shear waves, are slower than primary waves and cause structures to vibrate from side to side (horizontal motion). There are also two types of surface waves: Raleigh waves and Love waves. These waves travel more slowly and typically are significantly less damaging than seismic waves.

In addition to ground motion, several secondary natural hazards can occur from earthquakes such as:

- **Surface Faulting** is the differential movement of two sides of a fault at the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., up to 20 feet [ft]), as can the length of the surface rupture (e.g., up to 200 miles). Surface faulting can cause severe damage to linear structures, including railways, highways, pipelines, and tunnels.
- **Liquefaction** occurs when seismic waves pass through saturated granular soil, distorting its granular structure, and causing some of the empty spaces between granules to collapse. Pore water pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Liquefaction causes lateral spreads (horizontal movements of commonly 10 to 15 ft, but up to 100 ft), flow failures (massive flows of soil, typically hundreds of ft, but up to 12 miles), and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property.
- **Landslides/Debris Flows** occur as a result of horizontal seismic inertia forces induced in the slopes by the ground shaking. The most common earthquake-induced landslides include shallow, disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes totally saturated with water. Once the soil liquefies, it loses the ability to hold together and can flow downhill at very high speeds, taking vegetation and/or structures with it. Slide risks increase after an earthquake during a wet winter.

The severity of an earthquake can be expressed in terms of intensity and magnitude. Intensity is based on the damage and observed effects on people and the natural and built environment. It varies from place to place depending on the location with respect to the earthquake epicenter, which is the point on the earth's surface that is directly above where the earthquake occurred. The severity of intensity generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. The scale most often used in the U.S. to measure intensity is the Modified Mercalli Intensity Scale. The Modified Mercalli Intensity Scale consists of 10 increasing levels of shaking intensity that range from "Not Felt" (imperceptible) to "Extreme" (catastrophic) destruction. Peak ground acceleration is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location. Peak ground acceleration can be measured as acceleration due to gravity.

4.1.2 Location

The entire geographic area of Alaska is prone to earthquake effects. The USGS earthquake catalog indicates Wrangell earthquakes magnitude (M) averaged M2.9 since 1973. These data should be fairly accurate since state installed a seismometer (equipment that measures the direction, intensity, and duration of earthquakes by measuring actual ground movement in close proximity to Wrangell Shoemaker Bay.

Figure 3 shows an extracted portion of the Neotectonic Map of Alaska depicting Wrangell's relatively close proximity to known earthquake faults (DGGS 1994).

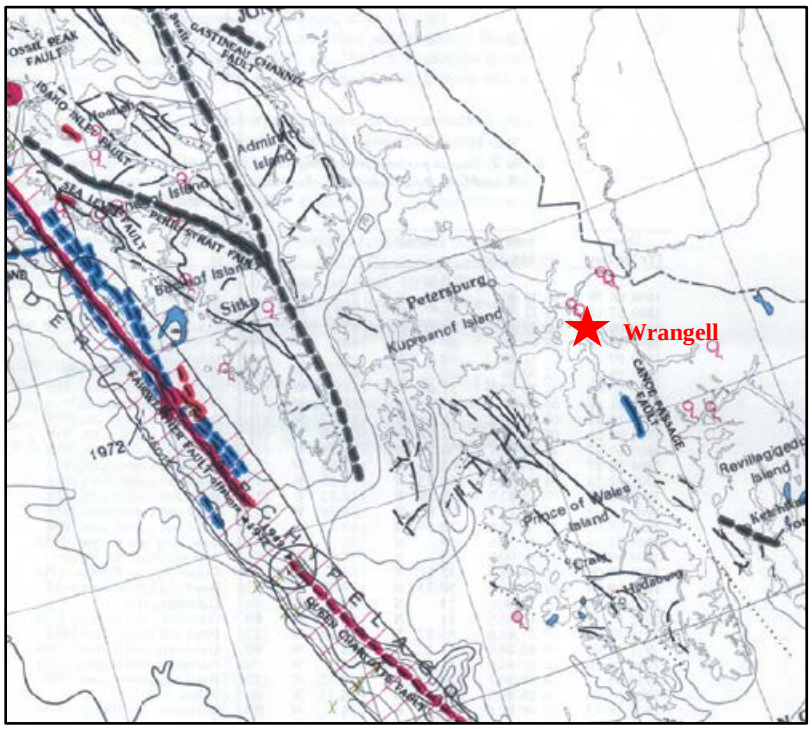

Figure 3. Neotectonic Map of Alaska, Wrangell Area

4.1.3 History

Accurate seismology for Alaska is relatively young with historic data beginning in 1973 for most locations. Therefore, data is limited for acquiring long-term earthquake event data. The MJHMP's Alaska earthquake information is based on best available data; obtained from the U.S. Geological Survey (USGS) and the State of Alaska, UAF Geophysical Institute's archives. Research included searching the USGS earthquake database for events since the legacy 2009 HMP was implemented to present; none of which exceeded M4.2 located within 100 miles of Wrangell.

The 1995 "Overview of Environmental and Hydrogeologic Conditions at Wrangell, Alaska," USGS, Open File Report 95-344 prepared for the Federal Aviation Administration describes the Wrangell area seismically relevant location:

> *The bedrock on Wrangell Island consists of sedimentary and intrusive rocks of Cretaceous age. The sedimentary rocks consist of marine gray wacke, mudstone, and minor amounts of limestone. Other rock types on the island include andesitic to basaltic volcanic rocks.*
>
> *Wrangell Island lies within the circum-Pacific seismic belt that rims the north Pacific Ocean. The area is traversed by the Chatham Strait Fault, the Fairweather Fault, and numerous smaller faults. In recent years, several earthquakes with Richter scale magnitudes greater than 7 have been recorded along these fault systems.*

Current Wrangell area earthquake information is based on best available data; obtained from the USGS and the State of Alaska, UAF Geophysical Institute's archives. Research included searching the USGS earthquake database for events spanning from 1973 to present. Of the 48 events that have occurred since the legacy 2009 HMP was implemented, none exceeded M4.2 located within 109 miles of Wrangell.

The planning team determined that based on available recorded data, Wrangell has a minor to moderate concern for earthquake damages as they have not experienced damaging impacts from their historical earthquake events and only need to be concerned with earthquakes with a magnitude >M5.0 (Table 9).

Table 9. Wrangell Historic Earthquakes Since 2009

Date	Latitude	Longitude	Depth	Magnitude	Location
5/22/2017	57.7093	-132.5577	5	2.7	102km NNE of Petersburg, AK
3/24/2017	57.7328	-132.4347	1	2.5	107km NNE of Petersburg, AK
1/26/2017	57.6921	-132.3284	10	2.8	105km NNE of Petersburg, AK
1/26/2017	57.7187	-132.4169	1	3.1	106km NNE of Petersburg, AK
11/14/2016	57.8586	-133.0732	1	2.5	93km ESE of Juneau, AK
10/26/2016	57.4371	-132.936	1	2.5	69km N of Petersburg, AK
9/5/2016	57.882	-133.124	7.98	2.8	89km ESE of Juneau, AK
6/10/2016	57.7006	-132.4483	5	2.9	103km NNE of Petersburg, AK
5/12/2016	56.0847	-130.2367	1	3.1	22km NW of Hyder, AK
11/18/2015	57.2359	-132.908	1	2.8	47km N of Petersburg, AK
9/11/2015	55.8863	-129.9554	10.52	2.8	5km SE of Hyder, AK
7/9/2015	57.8727	-133.0582	1	2.7	93km ESE of Juneau, AK
3/29/2015	57.436	-132.592	1	2.5	72km NNE of Petersburg, AK
3/14/2015	57.479	-132.525	1	2.8	78km NNE of Petersburg, AK
10/20/2014	57.369	-132.7648	1	3.4	63km N of Petersburg, AK
9/13/2014	55.842	-130.0933	1	2.9	9km SSW of Hyder, AK
3/2/2014	57.878	-132.035	1	3.3	130km NNE of Petersburg, AK
11/6/2013	55.715	-134.837	14.9	3.3	109km WNW of Craig, AK
5/27/2013	55.571	-134.486	5	3.2	Southeastern AK
4/29/2013	56.324	-131.232	5	4.2	70km E of Wrangell, AK
4/14/2013	57.333	-132.862	5	2.7	Southeastern AK
1/5/2013	55.775	-134.79	10	2.9	Southeastern AK
1/5/2013	56.169	-134.84	0.1	2.5	Southeastern AK
1/5/2013	55.83	-134.671	10	2.7	Southeastern AK
1/5/2013	55.5	-134.546	10	2.8	Southeastern AK
1/5/2013	56.115	-135.131	4.4	3.8	Southeastern AK
1/5/2013	55.583	-134.677	10	2.7	Southeastern AK
1/5/2013	55.945	-135.047	10	4	Off the Coast of Southeastern AK
1/6/2012	57.19	-131.94	1	3.5	British Columbia, Canada
12/25/2011	57.693	-132.132	20.5	3.1	Southeastern AK
4/27/2011	56.508	-134.999	1	2.9	Southeastern AK
4/6/2011	58.0041	-133.0047	0	2.8	Southeastern AK
12/8/2010	56.5504	-134.4532	8.4	2.8	Southeastern AK
11/9/2010	57.7858	-133.2808	0	2.7	Southeastern AK
9/20/2010	56.8598	-134.6434	16.6	3.4	Southeastern AK
6/16/2010	56.7291	-132.345	13.5	2.6	Southeastern AK
4/9/2010	57.413	-132.823	10	2.6	Southeastern AK
4/6/2010	55.2797	-133.5611	17.8	3.3	Southeastern AK

11/9/2009	57.699	-132.497	1	3.5	Southeastern AK
11/9/2009	54.979	-132.744	15	2.8	Dixon Entrance Region, USA-Canada
11/8/2009	54.93	-132.655	10	2.6	Dixon Entrance Region, USA -Canada
11/8/2009	54.94	-132.662	25	2.6	Dixon Entrance Region, USA -Canada
11/8/2009	54.929	-132.785	10	2.8	Dixon Entrance Region, USA -Canada
11/8/2009	54.97	-132.891	19.2	2.8	Dixon Entrance Region, USA -Canada
11/8/2009	54.95	-132.508	10	2.5	Dixon Entrance Region, USA -Canada
11/8/2009	54.945	-132.789	14.9	4.2	Dixon Entrance Region, USA -Canada
11/8/2009	54.91	-132.651	10	3.2	Dixon Entrance Region, USA -Canada
1/8/2009	56.539	-134.637	18.7	3.1	Southeastern AK

Source: USGS 2018

4.1.4 Extent/Impact

Extent

Based on historic earthquake events and the criteria identified in Table 7, the magnitude and severity of earthquake impacts in the Wrangell area are considered "Limited" with potential injuries and/or illnesses that do not result in permanent disability; critical facilities could expect to be shut-down for more than two weeks; and more than 10 percent of property is severely damaged with limited long-term damage to transportation, infrastructure, or the economy.

Impact

Impacts to the community such as significant ground movement that may result in infrastructure damage could occur based on the magnitude or intensity. The community's water supply is supplied by two surface reservoirs behind aging earthen dams. Minor shaking has been felt based during past events. Impacts to future populations, residences, critical facilities, and infrastructure could be severe if a high magnitude earthquake were to occur.

The current USGS seismicity model for Alaska was developed in 2007. Figure 4 shows the peak ground acceleration values for a 7.56 percent probability of exceedance in 50 years. Wrangell falls within the moderate perceived shaking, and moderate range for perceived damages.

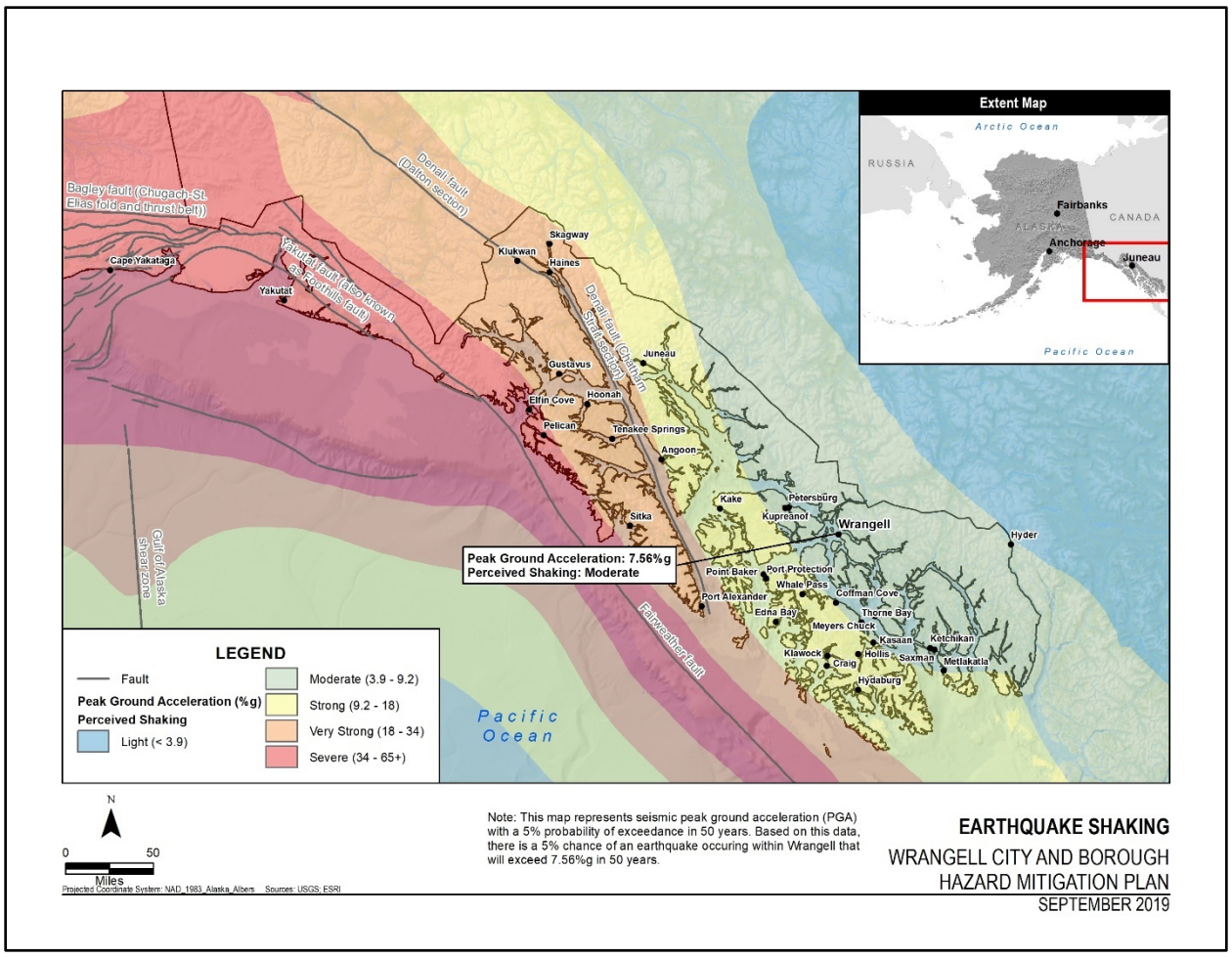

Figure 4. Wrangell Earthquake Perception Map

4.1.5 Recurrence Probability

Wrangell's historic earthquake history indicates the community could experience a M5.0 or greater earthquake. However, an event of that magnitude could be 250 miles distant from the Wrangell area. While it is not possible to predict when an earthquake will occur, the USGS has conducted Probabilistic Seismic Hazard Analyses for the state. This modeling effort incorporates what is known about Alaska's active faults and current and past seismicity to depict community usable recurrence probability maps.

> *The hazard maps depict the peak ground accelerations expected at a point with 10%, 5%, and 2% exceedance probabilities in 50 years. A useful way to think about these exceedance probabilities is that a 10% chance in 50 years means that statistically this earthquake happens on average every 500 years. A 5% chance in 50 years means that statistically this kind of earthquake happens every 1000 years. A 2% chance in 50 years, is the rare, large earthquake, and statistically it happens on average every 2,500 years. For each of these exceedance probabilities, the color on the map at your location corresponds to a shaking intensity in percent of gravitational acceleration.* (DHS&EM 2013)

Wrangell has a low recurrence earthquake probability for an M5.0 event. It is "Unlikely" but possible an event could occur within the next 10 years with a (1/10=10 percent) chance of occurring; due to an event history that is less than or equal to10 percent likely per year.

4.2 FLOOD AND EROSION

4.2.1 Nature

Flooding is the accumulation of water where usually none occurs or the overflow of excess water from a stream, river, lake, reservoir, glacier, or coastal body of water onto adjacent floodplains. Floodplains are lowlands adjacent to water bodies that are subject to recurring floods. Floods are natural events that are considered hazards only when people and property are affected.

Flood events not only impact communities with high water levels, or fast flowing waters, but sediment transport also impacts infrastructure and barge and other river vessel access limitations. Dredging may be the only option to maintain an infrastructure's viability and longevity.

Two primary flooding types occur in Wrangell: sheet flow (include rainfall and snowmelt runoff) and storm surge floods.

FEMA defines sheet flooding as:

> *Water flows across the surface as either confined or unconfined flow. Unconfined flow moves in broad sheets of water often causing sheet erosion. It can also pick up and adsorb or carry contaminants from the surface. Water that flows along the surface may become trapped in depressions. Here water may either evaporate back into the air, infiltrate into the ground, or spill out of the depression as it fills. If local drainage conditions are inadequate to accommodate rainfall through a combination of evaporation, infiltration into the ground, and surface runoff, accumulation of water in certain areas may cause localized flooding problems.* (FEMA nd).

Sheet Flow

Rainfall-Runoff Flooding occurs in is spring and early fall. The rainfall intensity, duration, distribution, and geomorphic characteristics of the watershed all play a role in determining the magnitude of the flood. Rainfall runoff flooding is the most common type of flood. This type of flood event generally results from weather systems that have associated prolonged rainfall.

Snowmelt Floods typically occur from April through June. The depths of the snowpack and spring weather patterns influence the magnitude of flooding.

Dam breach floods are unpredictable. Their longevity is conditional, based on their age, condition, and recurring maintenance consistency, and periodic safety inspection results. These factors combine to determine dam facility current and future stability probabilities.

Storm Surge

Also known as coastal floods, occur when the sea is driven inland above the high-tide level onto land that is normally dry. Often, heavy surf conditions driven by high winds accompany a storm surge adding to the destructive-flooding water's force. The conditions that cause coastal floods also can cause significant shoreline erosion as the flood waters undercut roads and other structures. Storm surge is a leading cause of property damage in Alaska.

The meteorological parameters conducive to coastal flooding are low atmospheric pressure, strong winds (blowing directly onshore or along the shore with the shoreline to the right of the direction of the flow), and winds maintained from roughly the same direction over a long distance across the open ocean (fetch).

Communities that are situated on low-lying coastal lands with gradually sloping bathymetry near the shore and exposure to strong winds with a long fetch over the water are particularly susceptible to coastal flooding. Several communities and villages throughout Southeast Alaska's coast have experienced significant damage from coastal floods over the past several decades. Most coastal flooding occurs during

the late summer or early fall season in these locations, however, winter brings changing wind patterns and directional impacts not normally experienced during other times of the year.

Coastal scour, sometimes referred to as tidal, bluff, or beach erosion, may encompass different categories altogether. For this profile, tidal, bluff and beach erosion will be nested within this category.

Coastal Scour rarely causes death or injury. However, erosive forces cause property destruction, prohibits development, and impacts community infrastructure. Erosion is typically gradual land loss through wind or water scour. However, erosion can occur rapidly as the result of floods, storms, or other event or slowly as the result of long-term environmental changes such as melting permafrost and other ground failure events. Erosion is a natural process, but its effects can be easily exacerbated by human activity.

Land scour, no matter the source results from either natural activity or human influences. Coastal damage occurs throughout the area roughly from the top of the bluff out into the near-shore region to about the 30 feet water depth. It is measured as the rate of change in the position or horizontal displacement of a shoreline over time. Bluff recession is the most visible aspect of coastal erosion because of the dramatic change it causes to the landscape. As a result, this aspect of coastal erosion usually receives the most attention.

Scour damages may also be due to multi-year impacts and long-term climatic change such as sea-level rise, lack of sediment supply, subsidence, or long-term human factors such as aquifer depletion or the construction of shore protection structures and dams. Attempts to control erosion using shoreline protective measures such as groins, jetties, seawalls, or revetments can lead to increased erosion.

High water flow forces are embodied in waves, currents, and winds; surface and ground water flow; freeze-thaw cycles may also play a role. Not all of these forces may be present at any particular location. Coastal scour can occur from rapid, short-term daily, seasonal, or annual natural events such as waves, storm surge, wind, coastal storms, and flooding, or from human activities including boat wakes and dredging. The most dramatic erosion often occurs during storms, particularly because the highest energy waves are generated under storm conditions.

Many flood damages are predictable based on rainfall and seasonal thaw patterns. Most of the annual precipitation is received from April through October with October being the wettest. This rainfall leads to flooding in late spring/early summer and/or fall. Spring snowmelt increases runoff, which can cause excessive surface flooding. It also breaks riverine winter ice cover, exacerbating localized ice-jam flood or coastal ice override damage impacts.

4.2.2 Location

The planning team indicated that Wrangell has a minor flooding impact threat; most of which occur from rainfall and snowmelt run-off sheet flow flooding and wind driven wave storm surge. The USGS Hydrogeologic Conditions at Wrangell, Alaska describes their typical minor flood susceptibility:

> *The Stikine River lies north and east of Wrangell Island, the Eastern Passage lies along Wrangell's east side and Zimovia Strait is due west.*
>
> *The city of Wrangell has a low flood hazard rating and has no history of significant waterfront flooding (Federal Emergency Management Agency, 1981; U.S. Army Corps of Engineers, 1993). Although there is a small risk of flooding by storm-surge or tsunami waves, the Thanksgiving Day Storm of 1968, considered to be the largest storm in recent times, produced no unusual flooding in Wrangell. (Federal Emergency Management Agency, 1981; U.S. Army Corps of Engineers, 1993). Winds at that time were generally from the southeast and the effects from high waves and storm surges were negligible. A storm on October 26, 1976, considered to be less severe than the Thanksgiving Day storm, did cause some waterfront damage near Wrangell (Federal Emergency Management Agency, 1981). The winds were predominately from the southwest, an unusual direction. These winds acting over a large area of water*

> *resulted in a combination of high tide and large waves that eroded fill and exposed some homes to minor wave and log damage. Brower and others (1977) describe return periods for maximum wave heights for coastal areas in Alaska. A 100-year-wave more than 20-m high is estimated for coastal areas near Wrangell Island... A flood of this magnitude may affect the FAA facility which is about 10 m above sea level.* (USGS 1995).

Wrangell's dams are located about 0.5 miles east and above the city of Wrangell, on Wrangell Island, in Alaska. The surrounding land is either owned by the Borough, Alaska Mental Health Trust, or part of the Tongass National Forest. Wrangell's dams are owned and maintained by the City of Wrangell, which uses the water stored in the Lower Reservoir for City water, with the water in the Upper Reservoir replenishing the level of the Lower Reservoir as needed. The two dams are approximately 28 feet high, 315 and 320 feet long, and constructed of earth over log crib dam structures. The dams are about 1,500 feet apart, with an elevation difference of about 64 feet.

The May 2016 Periodic Dam Safety Inspection report stated that both dams are marginally stable under static conditions, but are likely not stable under operating basis earthquake or maximum design earthquake. Outlet works for both dams require remediation.

Therefore, based on the 2016 Periodic Dam Safety Inspection report, if a breach were to occur, the Upper Dam would likely overtop the Lower Dam and potentially wash out and drain the Lower Reservoir then flow downstream to impact Wrangell facilities.

Wrangell's 1992 Emergency Action Plan displays potential dam failure flood inundation areas:

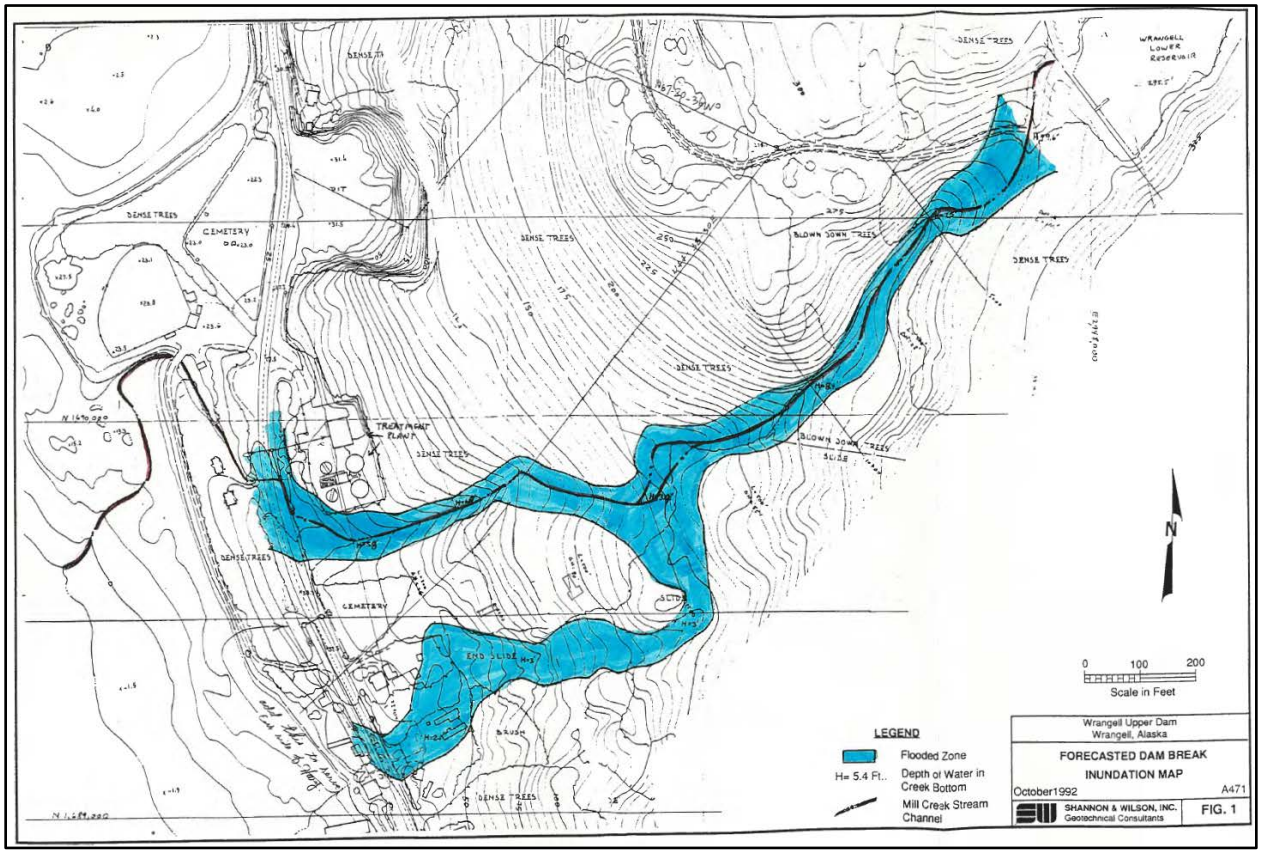

Figure 5. Wrangell's Potential Failure Dam Inundation Areas

The planning team stated they experience minor erosion along the island from various seasonal storm sources and directions. High water flow threatens the island's shoreline. Rain and snow melt run-off

removes the road topping material, creates severe pot holes, and contributes to increasing landslide potential.

4.2.3 History

The December 15, 1981 City of Wrangell, Alaska, Wrangell-Petersburg Division, FEMA Flood Insurance Study described Wrangell's flood challenges:

> *Wrangell has no history of significant waterfront flooding. The Thanksgiving Day storm of 1968, considered to be the major storm of the last decade, produced no unusual flooding hazards, although instances of wind damage were reported. Winds were generally from the southeast, resulting in negligible effects from high waves and storm surge.*
>
> *The storm of October 26, 1976, caused some waterfront damage. The storm was considered less severe by residents than the 1968 Thanksgiving Day storm. However, winds were predominantly from the southwest, and the storm was of unusual duration. The south-westerly winds acting over a relatively long fetch of open water resulted in a combination of high tide and large waves that eroded fill and exposed residences built over the water to wave and log damage. The placed fill, upon which the city dock and barge ramp facilities are built, was severely affected by this storm. From 5 to 6 horizontal feet of fill were lost during the storm. The lost fill has subsequently been replaced; however, armoring was not attempted. The small boat harbor located approximately 5 miles south of the city, in Shoemaker Bay, was also damaged. Fill was lost from the end of the L-shaped levee forming the harbor.*
>
> *Although waterfront flooding has not proved to be a problem in Wrangell, damage from wave action combined with high water can be expected.* (FEMA 1981)

The 1981 Flood Insurance Study included data delineating the following flood recurrence intervals:

> *…Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance premium rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year…*
>
> ***[Riverine Analysis]***
>
> *Riverine analyses were limited to approximate studies of Cemetery Creek, Rainbow Falls Creek, and Mill Creek…*
>
> ***[Coastal Analysis]***
>
> *The frequency of occurrence of high water due to coastal flooding consists of three major components: astronomical tide, storm surge, and wave runup…*

The 1995 "Overview of Environmental and Hydrogeologic Conditions at Wrangell, Alaska," USGS, Open File Report 95-344 prepared for the Federal Aviation Administration describes the Wrangell area flood threat:

> *The city of Wrangell has a low flood hazard rating and has no history of significant waterfront flooding (Federal Emergency Management Agency, 1981; U.S. Army Corps of Engineers, 1993). Although there is a small risk of flooding by storm-surge or tsunami waves, the Thanksgiving Day Storm of 1968, considered to be the largest storm in recent times, produced no unusual flooding in Wrangell. (Federal Emergency Management Agency, 1981; U.S. Army Corps of Engineers, 1993). Winds at that time were generally from the southeast and the effects from high waves and storm surges were negligible. A*

> *storm on October 26, 1976, considered to be less severe than the Thanksgiving Day storm, did cause some waterfront damage near Wrangell (Federal Emergency Management Agency, 1981). The winds were predominately from the southwest, an unusual direction. These winds acting over a large area of water resulted in a combination of high tide and large waves that eroded fill and exposed some homes to minor wave and log damage. Brower and others (1977) describe return periods for maximum wave heights for coastal areas in Alaska. A 100-year-wave more than 20-m high is estimated for coastal areas near Wrangell Island. A flood of this magnitude may affect the FAA facility which is about 10 m above sea level.*
>
> *Riprapping of exposed land formations has provided flood protection along Zimovia Strait and the Eastern Passage (Federal Emergency Management Agency, 1981). Protection for the small boat harbor is provided by a rubble mound breakwater constructed in 1926. The structure is well armored and shows no signs of damage (Federal Emergency Management Agency, 1981).*
>
> *Over-bank flooding of stream channels in southeast Alaska usually occurs during heavy rainfall; snowmelt rarely causes flooding. Rood crests are typically of short duration, often less than one day, and are characterized by a very sharp rise and decline of flow. On September 11,1981 rainfall runoff caused a maximum discharge of about 8,500 m3/s at U.S. Geological Survey streamgaging station 15024800, on the Stikine River near Wrangell, Alaska (U.S. Geological Survey, 1994). However, no flooding was reported near the city of Wrangell at this time.*
>
> *…Flooding by tsunami and storm-surge waves is a low-rated hazard…* (USGS 1995)

There is potential for coastal flooding in some areas due to storm related wave surge, exacerbated by high winds, high tides, and rising sea levels.

The Wrangell planning team further explained they have insufficient drainage infrastructure in many locations throughout the borough. Some locations have connected storm drains other areas do not. Some of the storm drains direct run-off directly into their sewer system. This creates a potentially very serious sanitation threat to the area; if the sewer pumps quit due to water capacity overload, fatigue, or stress the drains will back up and spread their contents throughout the area. The 2010 Wrangell Comprehensive Plan describes the borough's storm water and wastewater discharge concerns as they could potentially increase sheet flow flooding impacts:

> ***Concerns and Opportunities***
>
> *When there are heavy rains, high volumes of stormwater enter the wastewater system and overwhelm the pumps causing effluent discharge volumes that come close to, and occasionally exceed, permit limits and the treatment capacity of the system. Stormwater enters the wastewater treatment system either through ground water filtration into pipes or through the many commercial and residential storm drains that are directly connected to the wastewater system.*
>
> *Property owners whose downspouts connect to the wastewater system need to be identified and disconnected. Commercial businesses on Front Street will disconnect their buildings downspouts and drainage from the wastewater system and connect to the storm drainage system as part of the 2010 street reconstruction work. Once the Borough's stormwater management system is improved, the wastewater treatment capacity should be sufficient to meet the community's needs for the next 10 to 20 years.*

The 2018 DHS&EM Disaster Cost Index delineates historical flood events that could have directly or indirectly affected the Wrangell area. The index lists the following events:

3. Wrangell/Craig, November 6, 1978: *During this period an intense storm occurred in the Wrangell/Craig area in Southeastern Alaska generating high winds, torrential rains and heavy sea waves. The storm caused considerable damage to both private and public property in the two communities. Subsequent to the Governor's Proclamation of Disaster Emergency, DHS&EM provided both public assistance and assistance to individuals and families to assist the communities in recovering from the disaster. SBA made disaster loans available to affected businesses and homeowners.*

32. Southeast Alaska, November 26, 1984: *A hurricane force windstorm and wind driven tides caused extensive damage to public and private property in five Southeast Alaskan communities. The State provided public and individual assistance grants and temporary housing in Juneau, Sitka, Kake, Angoon and Tenakee Springs. SBA provided disaster loan assistance and the American Red Cross made grants to meet immediate needs of victims. The Governor's request for a Presidential declaration was denied.*

06-216. 2005 Southeast Storm (AK-06-216) declared December 23, 2005 by Governor Murkowski: *Beginning on November 18, 2005 and continuing through November 26, 2005, a strong winter storm with high winds and record rainfall occurred in the City/Borough of Juneau, the City/Borough of Haines, the City/Borough of Sitka, the City of Pelican, the City of Hoonah, and the City of Skagway, which resulted in widespread coastal flooding, landslides, and severs damage and threat to life and property, with the potential for further damage. The following conditions exist as a result of this disaster: severe damage to personal residences requiring evacuation and relocation of residents; to individuals personal and real property; to businesses; and to a marine highway system dock, the road systems eroded and blocked by heavy debris that prohibited access to communities and residents, and other public infrastructures, necessitating emergency protective measures and temporary and permanent repairs. The total estimated amount of assistance is approximately $1.87 million. This includes the following: Individual Assistance totaling $500K for 52 applicants and Public Assistance totaling $1.1 million for 14 applicants and 31 PW's. There was no hazard mitigation. Nov 21,08 update—Closeout later to DAS total cost of $1,684,311 (included $183,088 for IA, plus IA Admin of $35,748, PA Grantee admin of $133,779, and subgrantee admin allowance of $30,290.) Lapse to DRF was $183,586. RBS-11/28/08.*

AK-15-254. 2015 August Southeast Raines declared by Governor Walker on August 27, 2015: *Commencing on August 14, 2015, the City and Borough of Sitka received almost three inches of rain in six hours. This intense rainfall was accompanied by heavy wind and came on the heels of an unusually wet summer. Due to ground saturation and the wind, the hillsides within the borough failed resulting in* ***three deaths****, seven landslides and a sinkhole. The landslides and heavy rain, damaged homes, roads, and other infrastructure. The City and Borough of Sitka, along with state staff and contracted engineers, are monitoring slope stability to ensure safety of search and rescue and assessment efforts. On August 18, the City and Borough of Sitka declared a local disaster and requested state assistance. They have been fully engaged in debris removal operations since August 19th. After the failure of the slope on August 18, the Borough activated and staffed an emergency operations center to coordinate the response efforts and provide guidance to first responders, with utility and engineering specialists conducting body recovery as well as evaluating the slopes and affected residential areas.*

4.2.4 Extent/Impact

Extent

Floods are described in terms of their extent (including the horizontal area affected and the vertical depth of floodwaters) and the related recurrence probability.

The following factors contribute to riverine flooding frequency and severity:

- Rainfall intensity and duration
- Antecedent moisture conditions
- Watershed conditions, including terrain steepness, soil types, amount, vegetation type, and development density
- The attenuating feature existence in the watershed, including natural features such as swamps and lakes and human-built features such as dams
- The flood control feature existence, such as levees and flood control channels
- Flow velocity
- Availability of sediment for transport, and the bed and embankment watercourse erodibility
- Location related to identified-historical flood elevation

Based on limited historical flood damage history and the criteria identified in Table 7, the extent of flooding and resultant damages to infrastructure and their protective embankments in Wrangell are considered "Negligible" where critical facilities would shut-down for 24 hours or less with less than 10 percent of property is severely damaged.

Impact

Nationwide, floods result in more deaths than any other natural hazard. Physical damage from floods includes the following:

- Structure flood inundation, causing water damage to structural elements and contents.
- High water flow storm surge floods scour (erode) coastal embankments, coastal protection barriers, and result in infrastructure and residential property losses. Additional impacts can include roadway embankment collapse, foundations exposure, and damaging impacts.
- Damage to structures, roads, bridges, culverts, and other features from high-velocity flow and debris carried by floodwaters. Such debris may also accumulate on bridge piers and in culverts, decreasing water conveyance and increasing loads which may cause feature overtopping or backwater damages.
- Sewage, hazardous or toxic materials release, materials transport from wastewater treatment plant or sewage lagoon inundation, storage tank damages, and/or severed pipeline damages can be catastrophic to rural remote communities.

Floods also result in economic losses through business and government facility closure, communications, utility (such as water and sewer), and transportation services disruptions. Floods result in excessive expenditures for emergency response, and generally disrupt the normal function of a community.

Impacts and problems also related to flooding are deposition as well as embankment, coastal, and/or wind erosion. Deposition is the accumulation of soil, silt, and other particles on a river bottom or delta. Deposition leads to the destruction of fish habitat, presents a challenge for navigational purposes, and prevents access to historical boat and barge landing areas. Deposition also reduces channel capacity, resulting in increased flooding or bank erosion. Embankment erosion involves material removal from the stream or river banks, coastal bluffs, and dune areas. When bank erosion is excessive, it becomes a concern because it results in loss of embankment vegetation, fish habitat, and land, property, and essential infrastructure (BKP 1988).

4.2.5 Recurrence Probability

Based on previous occurrences, USACE Floodplain Manager's report, and criteria in Table 8, Wrangell has a low 100-year (1 percent chance of occurring in a given year) flood recurrence probability for high intensity event. It is "Unlikely" but possible an event could occur within the next 10 years with a (1/10=10 percent) chance of occurring; due to an event history that is less than or equal to10 percent likely per year.

There is no data identifying a 500-year (0.2 percent chance of occurring in a given year) event for this area.

4.3 GROUND FAILURE

4.3.1 Nature

Ground failure describes avalanche, landslide, subsidence, and unstable soils gravitational or other soil movement mechanisms. Soil movement influences can include rain, snow, and/or water saturation induced avalanches or landslides; as well as from seismic activity, melting permafrost, river or coastal embankment undercutting, or in combination with steep slope conditions.

Landslides are a dislodgment and fall of a mass of soil or rocks along a sloped surface, or for the dislodged mass itself. The term is used for varying phenomena, including mudflows, mudslides, debris flows, rock falls, rockslides, debris avalanches, debris slides, and slump-earth flows. The susceptibility of hillside and mountainous areas to landslides depends on variations in geology, topography, vegetation, and weather. Landslides may also be triggered or exacerbated by indiscriminate development of sloping ground, or the creation of cut-and-fill slopes in areas of unstable or inadequately stable geologic conditions.

Additionally, avalanches and landslides often occur secondary to other natural hazard events, thereby exacerbating conditions, such as:

- Earthquake ground movement can trigger events ranging from rock falls and topples to massive slides
- Intense or prolonged precipitation can cause slope over-saturation and subsequent destabilization failures such as avalanches and landslides.
- Climate change related drought conditions may increase wildfire conditions where a wildland fire consumes essential stabilizing vegetation from hillsides significantly increasing runoff and ground failure potential

Development, construction, and other human activities can also provoke ground failure events. Increased runoff, excavation in hillsides, shocks and vibrations from construction, non-engineered fill places excess load to the top of slopes, and changes in vegetation from fire, timber harvesting, and land clearing have all led to landslide events. Broken underground water mains can also saturate soil and destabilize slopes, initiating slides. Something as simple as a blocked culvert can increase and alter water flow, thereby increasing the potential for a landslide event in an area with high natural risk. Weathering and decomposition of geologic material, and alterations in flow of surface or ground water can further increase the potential for landslides.

The USGS identifies six landslide types, distinguished by material type and movement mechanism including:

- **Slides**, the more accurate and restrictive use of the term landslide, refers to a mass movement of material, originating from a discrete weakness area that slides from stable underlying material. A rotational slide occurs when there is movement along a concave surface; a translational slide originates from movement along a flat surface.
- **Debris Flows** arise from saturated material that generally moves rapidly down a slope. A debris flow usually mobilizes from other types of landslide on a steep slope, then flows through confined channels, liquefying and gaining speed. Debris flows can travel at speeds of more than 35 mph for

several miles. Other types of flows include debris avalanches, mudflows, creeps, earth flows, debris flows, and lahars.

- **Lateral Spreads** are a type of landslide generally occurs on gentle slope or flat terrain. Lateral spreads are characterized by liquefaction of fine-grained soils. The event is typically triggered by an earthquake or human-caused rapid ground motion.
- **Falls** are the free-fall movement of rocks and boulders detached from steep slopes or cliffs.
- **Topples** are rocks and boulders that rotate forward and may become falls.
- **Complex** is any combination of landslide types.

In Alaska, earthquakes, seasonally frozen ground, and permafrost are often agents of ground failure. Permafrost is defined as soil, sand, gravel, or bedrock that has remained below 32°F for two or more years. Permafrost can exist as massive ice wedges and lenses in poorly drained soils or as relatively dry matrix in well-drained gravel or bedrock. During the summer, the surficial soil material thaws to a depth of a few feet, but the underlying frozen materials prevent drainage. The surficial material that is subject to annual freezing and thawing is referred to as the "active layer."

Seasonal freezing can cause frost heaves and frost jacking. Frost heaves occur when ice forms in the ground and separates sediment pores, causing ground displacement. Frost jacking causes unheated structures to move upwards. Permafrost is frozen ground in which a naturally occurring temperature below 32ºF has existed for two or more years.

Indicators of a possible ground failure include:

- Springs, seeps, or wet ground that is not typically wet
- New cracks or bulges in the ground or pavement
- Soil subsiding from a foundation
- Secondary structures (decks, patios) tilting or moving away from main structures
- Broken water line or other underground utility
- Leaning structures that were previously straight
- Offset fence lines
- Sunken or dropped-down road beds
- Rapid increase in stream levels, sometimes with increased turbidity
- Rapid decrease in stream levels even though it is raining or has recently stopped and
- Sticking doors and windows, visible spaces indicating frames out of plumb

The State of Alaska 2013 State Hazard Mitigation Plan provides additional ground failure information defining mass movement types, topographic and geologic factors which influence ground failure which may pertain to the Wrangell area.

4.3.2 Location

There are various ground failure locations throughout the Wrangell area. Sources include USACE, NRCS, USGS, as well as other agencies' developed plans and studies. Land subsidence such as floodwater soil saturation cause the most common ground failure impacts in the Wrangell area.

The June 2018 Borough Assembly meeting minutes provides a little in-sight into Wrangell's precipitation, ground water, and soil composition challenges:

> *Wrangell averages over 80 inches of precipitation per year and the former Byford Junkyard site has slopes up to 17%, which together creates the potential for erosion during site operations from run-on and precipitation. In addition, groundwater in this area is usually shallow with variable depths due to the presence of silt/glacial till that controls*

groundwater flow. There are small drainage channels, and an existing drainage ditch parallel transmitting drainage water to three existing culverts under the Zimovia Highway and into Zimovia Strait approximately 150 feet west of the site.

A Storm Water Pollution Prevention Plan (SWPPP) has been prepared for this project and has been previously submitted. Shane O'Neill, Project Site Superintendent for NRC Alaska is CESCL certified and will perform the weekly SWPPP inspections and event inspections. Additional details pertaining to this issue are available within the Plan.

According to Permafrost Characteristics Map of Alaska (Figure 6) developed for the National Snow and Ice Data Center/World Data Center for Glaciology (Jorgenson et al 2008), shows that Wrangell has no permafrost.

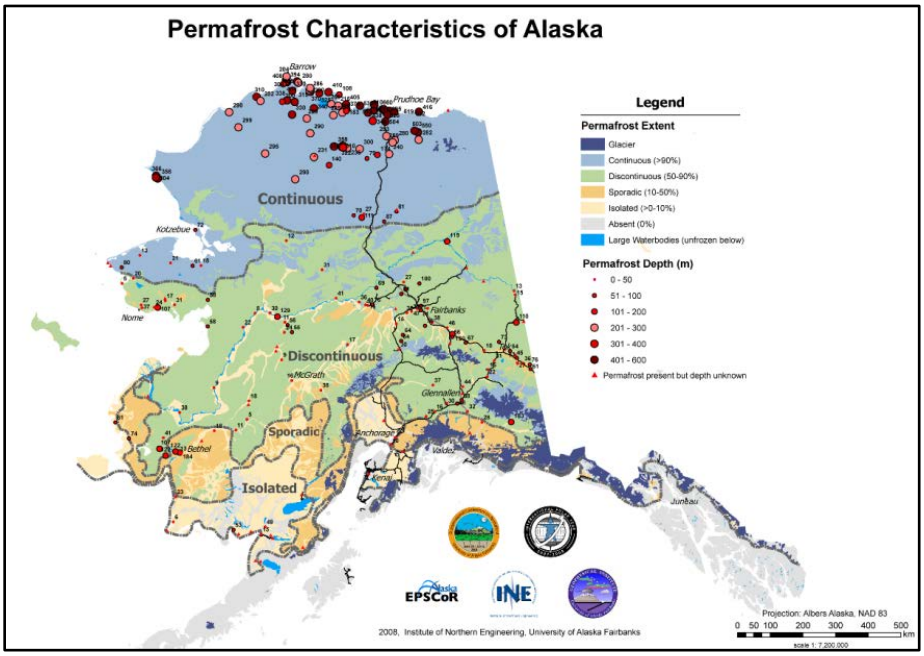

Figure 6. Permafrost Characteristics of Alaska

4.3.3 History

There are few written records defining ground failure impacts to the Wrangell area. However, the planning team states they have potential landslide and other ground failure threats in a couple residential areas.

4.3.4 Extent/Impact

Extent

The damage magnitude could range from minor with some repairs required and little to no damage to transportation, infrastructure, or the economy to major if a critical facility (such as the airport or water supply dams) were damaged and transportation or drinking water was affected.

Based on research and the planning team's knowledge of past ground failure and various degradation events and the criteria identified in Table 7, the extent of ground failure impacts in Wrangell are considered "Negligible". Impacts would not occur quickly but over time with warning signs. The Planning team described ground failure as:

> *…slide impacts usually occur unexpectedly... you think the ground is fine and then it is not there. The [slide events occurred in] areas [that] I am aware of in the community were completely unexpected and happened quickly.*

Therefore, Wrangell's landslides would occur quickly with little to no warning. This hazard may not likely cause injuries or death, neither would it likely shutdown critical facilities and services for extensive time periods. However, less than 10 percent of property could potentially receive severe damage.

Impact

Impacts associated with ground failure include surface subsidence, infrastructure, building, and/or road damage. Ground failure does not typically pose a sudden and catastrophic hazard; however, landslides and avalanches may. Ground failure damage occurs from improperly designed and constructed buildings that settle as the ground subsides, resulting in structure loss or expensive repairs. It may also impact buildings, communities, pipelines, airfields, as well as road and bridge design costs and location. To avoid costly damage to these facilities, careful planning and location and facility construction design is warranted.

4.3.5 Recurrence Probability

Even though there are few written records defining ground failure impacts for the Wrangell area, the planning team notes there are recurring landslide, avalanche, and ground failure damages within the community that could threaten structures, roads, and the airport. The planning team stated the probability for ground failure follows the criteria in Table 8, future damage probability resulting from ground failure is "Possible" in the few known locations in the next five years, with a (1/5=20 percent) percent chance of occurring with a history of events greater than 20 percent but less than 33 percent likely per year.

4.4 TSUNAMI AND SEICHE

4.4.1 Nature

A tsunami is a series of waves generated in a body of water by an impulsive disturbance along the seafloor that vertically displaces the water. A seiche is an oscillating wave occurring in a partially or totally enclosed water body.

Subduction zone earthquakes at plate boundaries often cause tsunamis. However, submarine landslides, submarine volcanic eruptions, and the collapses of volcanic edifices can also generate tsunamis. A single tsunami may involve a series of waves, known as a train, of varying heights. In open water, tsunamis exhibit long wave periods (up to several hours) and wavelengths that can extend up to several hundred miles, unlike typical wind-generated swells on the ocean, which might have a period of about 10 seconds and a wavelength of 300 feet.

The actual height of a tsunami wave in open water is generally only 1 to 3 feet and is often practically unnoticeable to people on ships. The energy of a tsunami passes through the entire water column to the seabed. Tsunami waves may travel across the ocean at speeds up to 700 miles per hour (mph). As the wave approaches land, the sea shallows and the wave no longer travels as quickly, so the wave begins to "pile up" as the wave-front becomes steeper and taller, and less distance occurs between crests. Therefore, the wave can increase to a height of 90 feet or more as it approaches the coastline and compresses.

Tsunamis not only affect beaches that are open to the ocean, but also bay mouths, tidal flats, and the shores of large coastal rivers. Tsunami waves can also diffract around land masses and islands. Since tsunamis are not symmetrical, the waves may be much stronger in one direction than another, depending on the nature of the source and the surrounding geography. However, tsunamis do propagate outward from their source, so coasts in the shadow of affected land masses are usually fairly safe.

Local tsunamis and seiches may be generated from earthquakes, underwater landslides, atmospheric disturbances, or avalanches and last from a few minutes to a few hours. Initial waves typically occur quite soon after onslaught, with very little advance warning. They occur more in Alaska than any other part of the U.S.

Seiches occur in an enclosed water body such as a lake, harbor, cove or bay. They are localized event-generated waves characterized as a "bathtub effect" where successive water waves move back and forth in the enclosed area until the energy is fully spent causing repeated impacts and damages.

4.4.2 Location

The 1995 "Overview of Environmental and Hydrogeologic Conditions at Wrangell, Alaska," USGS, Open File Report 95-344 prepared for the Federal Aviation Administration describes the Wrangell tsunami threat as: "*…Flooding by tsunami and storm-surge waves is a low-rated hazard…"* due to their fairly protected location away from the open ocean.

The University of Alaska Fairbanks', Dmitry Nicolski, Geophysical Institute, Research Assistant Professor stated:

> *Wrangell is at the top of their "to-be-modeled" list. Research indicates there is a recognition of the submarine landslide potential at the Stikine River. A geologist presumably traced remnants of the previous submarine landslide in the Eastern Channel based on currently available bathymetry. UAF/GI anticipates they will be working with NCEI to develop Digital Elevation Models for Wrangell and other southeast Alaska regions.*

Many believe that Wrangell's relatively protected location on the northern side of the island – away from the open Pacific tsunami sources would protect them from severe impacts. The planning team described their tsunami threat potential as:

> *Yes, we have potential [for future tsunami event impacts]. Even though [we are] behind other islands that could [provide] protect[ion]... depending on where [the] center is, if wave action comes from certain directions... We are [located near a] confluence of two straights … [we] could [potentially experience] impacts. There was a Tsunami threat years ago, but I think water levels only rose about 1 foot. (Source: 2018 Wrangell planning team comment)*

4.4.3 History

Wrangell has minimal tsunamigenic event history. However, the Wrangell Sentinel reported that on January 10, 2013:

> *A 7.5 magnitude earthquake, with an epicenter located 110 kilometers west of Craig and approximately 6 miles under the earth's surface, struck just minutes before midnight on Friday, shaking houses across the region.*
>
> *A tsunami warning was initially lodged for almost all of Southeast, including Wrangell and Petersburg, though it was cancelled within hours of the initial quake. No substantial elevation in the tide level at Wrangell or Petersburg was reported.…*

The West Coast/Alaska Tsunami Warning Center lists the following Alaska earthquake generated tsunamis with observed or measured tsunami waves (Table 10) throughout Alaska.

Table 10. Alaska's Historic Aleutian Tsunamis Waves

Date	Location	Magnitude (MW)	Wave Height (Ft/m)	Latitude	Longitude
11/10/1938	Alaska Peninsula	8.2	0.1	54.48	-158.37
4/1/1946	Near Unimak Island, Eastern Aleutian Islands, AK	8.6	Unknown	25.8	-163.5
3/9/1957	South of Andreanof Islands, Central Aleutian Islands, AK	8.3	Unknown	51.5	-175.7
3/27/1964	Prince William Sound	9.2	0.35	61.05	-147.48
2/4/1965	Rat Islands, Western Aleutian Islands, AK	8.7	<0.1	51.29	-178.49
5/7/1986	Central Aleutian Islands, AK	8.0	0.15	51.52	-166.54
2/21/1991	Bering Sea	6.7	0.15	58.43	-175.45
6 10/1996	Central Aleutian Islands, AK	7.9	0.6	51.56	-177.63

4.4.4 Extent/Impact

Extent

There is limited anecdotal tsunami impact data available at this time. Based on limited data and the criteria identified in Table 7, the magnitude and severity of tsunami impacts to the Wrangell area are considered "Limited" with injuries and/or illnesses that do not result in permanent disability; critical facility could shut down for more than one week, and more than 10 percent of property could be severely damaged.

Impact

Dmitry Nicolski further postulates:

> *Some local landslide-generated tsunamis might produce higher run-up values, but there is little known about them in this region.*

4.4.5 Recurrence Probability

The Alaska Division of Geological & Geophysical Surveys (DGGS) Makushin Volcano Assessment, Report of Investigation, 2000-4 states that it is unlikely the volcano will generate a tsunami:

> *No tsunamis have been produced at Makushin Volcano during the relatively small eruptions of the last few hundred years, and tsunamis are very unlikely to be produced by typical eruptions of Makushin Volcano in the future. However, if an unusually large eruption, similar to the caldera-forming eruptions of about 8,000 years ago, were to occur again, tsunami waves might be produced. During the prehistoric eruptions, pyroclastic flows and surges traveled from the volcano to the sea, especially on the north flank, where the sea is closest (McConnell and others, 1997). Slightly older debris avalanches also reached the sea on the north flank of Makushin Volcano (Bean, 1999). No geologic deposits of tsunamis produced by eruptions of Makushin were identified during field studies (Bean, 1999)* (DGGS 2000).

The Wrangell has a minor tsunami impact history with no fully documented tsunami impact data. However, the National Oceanic and Atmospheric Administration (NOAA) and UAF/GI state that southeast Alaska is near the top of their tsunami mapping list. Following the criteria delineated in Table 8, a distant source tsunami is "Possible" however, the recurrence interval is unknown. Too many factors determine when an

impact event will occur, and there is limited data for the area to determine bathymetric conditions adjacent to Wrangell Island area and the surrounding area.

4.5 VOLCANIC ASH

4.5.1 Nature

Alaska is home to 40 historically active volcanoes stretching across the entire southern portion of the state from the Wrangell Mountains to the far western Aleutian Islands. "Historically active" refers to actual eruptions that have occurred during Alaskan historic time, in general the time-period in which written records have been kept; from about 1760. Alaska averages 1-2 eruptions per year. In 1912, the largest eruption of the 20th century occurred at Novarupta and Mount Katmai, located in what is now Katmai National Park and Preserve on the Alaska Peninsula.

A volcano is a vent or opening in the earth's crust from which molten lava (magma), pyroclastic materials, and volcanic gases are expelled onto the surface. Volcanoes and other volcanic phenomena can unleash cataclysmic destructive power greater than nuclear bombs and can pose serious hazards if they occur in populated and/or cultivated regions.

There are different eruption classifications. Eruption types are a major determinant of the physical impacts an event will create, and the particular hazards it poses. Six main types of volcano hazards exist including:

- Volcanic gases are made up of water vapor (steam), carbon dioxide, ammonia, as well as sulfur, chlorine, fluorine, and boron compounds, and several other compounds. Wind is the primary source of dispersion for volcanic gases. Life, health, and property can be endangered from volcanic gases within about 6 miles of a volcano. Acids, ammonia, and other compounds present in volcanic gases can damage eyes and respiratory systems of people and animals, and heavier-than-air gases, such as carbon dioxide, can accumulate in closed depressions and suffocate people or animals.
- Lahars are usually created by shield volcanoes and stratovolcanoes and can easily grow to more than 10 times their initial size. They are formed when loose masses of unconsolidated, wet debris become mobilized. Eruptions may trigger one or more lahars directly by quickly melting snow and ice on a volcano or ejecting water from a crater lake. More often, lahars are formed by intense rainfall during or after an eruption since rainwater can easily erode loose volcanic rock and soil on hillsides and in river valleys. As a lahar moves farther away from a volcano, it will eventually begin to lose its heavy load of sediment and decrease in size.
- Landslides are common on stratovolcanoes because their massive cones typically rise thousands of feet above the surrounding terrain and are often weakened by the very process that created the mountain – the rise and eruption of molten rock (magma). If the moving rock debris is large enough and contains a large content of water and soil material, the landslide may transform into a lahar and flow down valley more than 50 miles from the volcano.
- Lava flows are streams of molten rock that erupt from a vent and move downslope. Lava flows destroy everything in their path; however, deaths caused directly by lava flows are uncommon because most move slowly enough that people can move out of way easily and flows usually do not travel far from the source vent. Lava flows can bury homes and agricultural land under tens of feet of hardened rock, obscuring landmarks and property lines in a vast, new, hummocky landscape.
- Pyroclastic flows are dense mixtures of hot, dry rock fragments and gases that can reach 50 mph. Most pyroclastic flows include a ground flow composed of coarse fragments and an ash cloud that can travel by wind. Escape from a pyroclastic flow is unlikely because of the speed at which they can move.
- Tephra is a term describing any size of volcanic rock or lava that is expelled from a volcano during an eruption. Large fragments generally fall back close to the erupting vent, while smaller fragment

particles (ash) can be carried hundreds to thousands of miles away from the source by wind. Ash clouds are common adaptations of tephra.

Ash fall poses the most significant volcanic threat to Wrangell because, unlike other secondary eruption effects such as lahars and lava flows, ash fall can travel thousands of miles from the eruption site.

Volcanic ash consists of tiny jagged particles of rock and natural glass blasted into the air by a volcano. Ash can threaten the health of people, livestock, and wildlife. Ash imparts catastrophic damage to flying jet aircraft, operating electronics and machinery, and interrupts power generation and telecommunications. Wind can carry ash thousands of miles, affecting far greater areas and many more people than other volcano hazards. Even after a series of ash-producing eruptions has ended, wind and human activity can stir up fallen ash for months or years, presenting a long-term health and economic risk. Special concern is extended to aircraft because volcanic ash completely destroys aircraft engines.

Ash clouds have caused catastrophic aircraft engine failure, most notably in 1989 when KLM Flight 867, a 747 jetliner, flew into an ash cloud from Mt. Redoubt's eruption and subsequently experienced flameout of all four engines. The jetliner fell 13,000 feet before the flight crew was able to restart the engines and land the plane safely in Anchorage. The significant trans-Pacific and intrastate air traffic traveling directly over or near Alaska's volcanoes, has necessitated developing strong communication and warning links between the AVO, other government agencies with responsibility for aviation management, and the airline and air cargo industry (AVO 2012, USGS 2002).

4.5.2 Location

The legacy 2009 HMP states that the closest active volcano to Wrangell at being over 400 miles away. The AVO, which is a cooperative program of the USGS, DGGS, and the UAF/GI, monitors the seismic activity at 23 of Alaska's 41 active volcanoes in real time. In addition, satellite images of all Alaskan and Russian volcanoes are analyzed daily for evidence of ash plumes and elevated surface temperatures. Russian volcanoes are also a concern to Alaska as prevailing winds could carry large ash plumes from Kamchatka into Alaskan air space. AVO also researches the individual history of Alaska's active volcanoes and produces hazard assessment maps for each center. The AVO identifies the closest active volcano to Wrangell as being over 400 miles away.

Each report contains a description of the eruptive history of the volcano, the hazards they pose, and the likely effects of future eruptions to populations, facilities, and ecosystems. Figure 7 lists Wrangell's closest volcanoes. However, there is very little known eruption data for these volcanoes and are not seismically monitored.

Volcanos Nearby

A total of 6 volcanoes are found in or near Wrangell, AK.

Distance (miles)	Name	Region	Latitude	Longitude	Elevation (foot)	Type	Status	Last Eruption
43.3	Duncan Canal	Alaska-SE, United States	56.5	-133.1	15	Unknown	Holocene	Undated, but probable Holocene eruption
45.1	Hoodoo Mountain	Canada, Canada	56.78	-131.28	1820	Subglacial volcano	Holocene	Undated, but probable Holocene eruption
60.6	Iskut-Unuk River Cones	Canada, Canada	56.58	-130.55	1880	Cinder cone	Radiocarbon	Last known eruption 1800-1899
76.6	Behm Canal-Rudyerd Bay	Alaska-SE, United States	55.32	-131.05	500	Cinder cone	Holocene	Unknown
86.3	Tlevak Strait-Suemez Is.	Alaska-SE, United States	55.25	-133.3	50	Volcanic field	Holocene	Undated, but probable Holocene eruption
94.6	Spectrum Range	Canada, Canada	57.43	-130.68	2430	Shield volcano	Holocene	Undated, but probable Holocene eruption

Figure 7. Wrangell Area Volcanoes

Figure 8 displays a simplified illustration of approximate flight paths traveling over Alaska's historically active volcanoes (AVO 2018). Aircraft flying along these routes, some of the busiest in the world carry more than 50,000 passengers and millions of dollars of cargo each day to and from Asia, North America, and Europe.

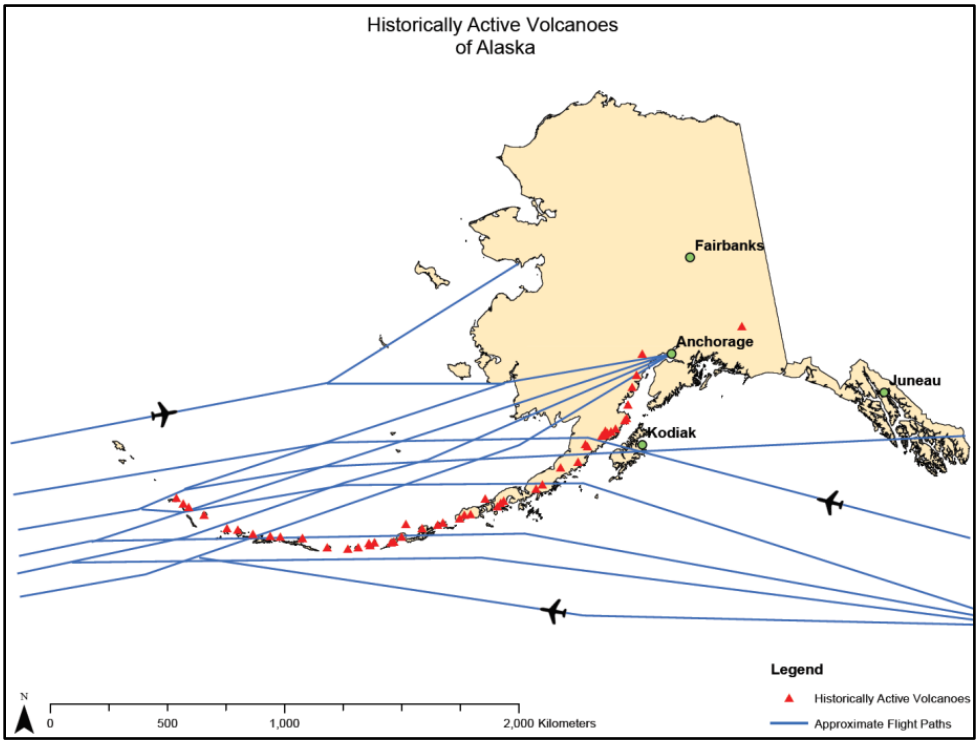

Figure 8. North Pacific Air Travel Routes

4.5.3 History

The AVO, and its constituent organizations (USGS, Alaska Department of Natural Resources, and UAF), have volcano hazard identification and assessment responsibility for Alaska's active volcanic centers. The AVO monitors active volcanoes several times each day using Advanced Very High Resolution Radiometers and satellite imagery.

DHS&EM's Disaster Cost Index records the following volcanic eruption disaster events:

> ***103. Mt. Redoubt Volcano, December 20, 1989*** *When Mt. Redoubt erupted in December 1989, posing a threat to the Kenai Peninsula Borough, Mat-Su Borough, and the Municipality of Anchorage, and interrupting air travel, the Governor declared a Disaster Emergency. The Declaration provided funding to upgrade and operate a 24-hr. monitoring and warning capability.*
>
> ***104. KPB-Mt. Redoubt, January 11, 1990*** *The Kenai Peninsula Borough, most directly affected by Mt. Redoubt, experienced extraordinary costs in upgrading air quality in schools and other public facilities throughout successive volcanic eruptions. The Borough also sustained costs of maintaining 24-hr. operations during critical periods. The Governor's declaration of Disaster Emergency supported these activities.*
>
> ***161. Mt. Spurr, September 21, 1992*** *Frequent eruptions and the possibility of further eruptions has caused health hazards and property damage within the local governments of the Municipality of Anchorage, Kenai Peninsula Borough and Mat-Su Borough. These*

eruptions caused physical damage to observation and warning equipment. Funds to replace equipment for AVO.

The AVO's Service Review, Mount Redoubt Volcanic Eruptions, March – April 2009 states that the Mount Redoubt volcano was in continuous eruption on March 31, 2009. Plume height was no more than 15,000 feet above sea level. The small amount of ash in the plume created a haze layer downwind of the volcano and dustings of fine ash fell out of the plume.

On March 22, 2009, Mount Redoubt volcano, 106 miles southwest of Anchorage, Alaska, began a series of eruptions after persisting in Orange or "Watch" status since late January 2009. Plume heights were observed at or above 60,000 feet during two of the six significant eruptions. Ashfall occurred over south central Alaska, including in Anchorage, with amounts ranging from a trace to one-half inch in depth.

The Redoubt eruptions also disrupted air traffic in the region. Hundreds of commercial flights were cancelled and cargo companies were significantly impacted. This resulted in employees being placed on unpaid leave during periods when airport operations were shut down. Anchorage is Alaska's major population center; its airport serves as a critical strategic transportation hub as the third busiest cargo airport in the world.

The impacts of the unrest at Mount Redoubt volcano continued through spring and into the summer. The threat of continuing eruptions and lahars (volcanic mud flows composed of water, ash, mud, and debris) necessitated the removal of millions of gallons of oil from Chevron's nearby Drift River Terminal. Residents, emergency management, and health officials remained on alert until Mount Redoubt volcano was downgraded to Yellow or "Advisory" status on June 30, 2009, and finally to Green or "Normal" status on September 29, 2009.

Recent volcano eruption impacts demonstrate modern community vulnerability to volcanic ash dispersal and travel distance statewide.

Alaska's volcanoes have very diverse eruption histories spanning thousands of years. Activity spanning such an extensive timeline is nearly impossible to define. However modern science has enabled the AVO with determining fairly recent historical eruption dates.

4.5.4 Extent/Impact

Extent

Volcanic effects include severe blast, turbulent ash and gas clouds, lightning discharge, volcanic mudflows, pyroclastic flows, corrosive rain, flash flood, outburst floods, earthquakes, and tsunamis. Some of these activities include ash fallout in various communities, air traffic, road transportation, and maritime activity disruptions.

Southeast Alaska could receive some ash fall during a massive volcanic eruption from Russian as and Alaska volcanoes. Prolonged traffic disruptions (air, land, or rail) would potentially prevent essential community resupply e.g. food and medicine delivery, and medical evacuation service capabilities to full service hospitals.

A massive eruption anywhere on earth could severely affect the global climate; radically changing Wrangell's (and everyone else's) long-term weather event risks for weeks, months, or years.

Based on historic volcanic activity impacts and the criteria identified in Table 7, the magnitude and severity of impacts in Wrangell are considered "Negligible" with minor injuries, minor quality of life lost, the potential for critical facilities to shut down for 24 hours or less, and less than 10 percent of property or critical infrastructure being severely damaged.

Impact

As the Preliminary Volcano-Hazard Assessment for Makushin Volcano, Alaska, Summary of Hazards states,

> *If eruptions as large as those of 8,000 years ago were to occur, volcanic ash falls would be much thicker and more extensive than any seen in the area in historic time, and highly mobile pyroclastic flows, surges, or lateral blasts might affect areas tens of kilometers from the volcano... Such huge eruptions could also significantly disrupt air travel over the north Pacific area for days and perhaps weeks. However, based on the volcano's pattern of past behavior, eruptions of this magnitude are very rare, and therefore unlikely to recur in the near future* (DGGS 2000).

Such an ash fall event would undoubtedly be devastating to the entire state by straining its resources as well as transportation (air, ocean, land, and rail routes); especially if other hub communities are also significantly affected by a volcanic eruption. Wrangell residents could experience respiratory problems from airborne ash, general property damage (electronics and unprotected machinery), state or regional transportation interruptions, loss of commerce, as well potential as water supply contamination.

These impacts can range from inconvenience – a few days with no transportation capability; to disastrous – heavy, debilitating ash fall throughout the state, forcing Wrangell residents to be completely self-sufficient.

4.5.5 Recurrence Probability

Geologists can make long-term general forecasts associated with individual volcanoes by carefully analyzing past activity, but they would be based trends and likelihood, rather than specific events or timelines. Short-range forecasts are often possible with greater accuracy. Several signs of increasing activity can indicate that an eruption will follow within weeks or months. Magma moving upward into a volcano often causes a significant increase in small, localized earthquakes, and measurable carbon dioxide, sulfur, and chlorine compound emission increases. Shifts in magma depth and location can cause ground level elevation changes that can be detected through ground instrumentation or remote sensing.

Based on the criteria identified in Table 8 and information presented in the Alaska State Hazard Mitigation Plan, it is "Possible" a volcanic eruption will occur within the next ten years. Event has up to 1 in 10 years (1/10=10 percent) chance of occurring. History of events is less than or equal to 10 percent likely per year. Vulnerability depends on the type of activity and current weather, especially wind patterns.

4.6 SEVERE WEATHER

4.6.1 Nature

Severe weather events occur throughout Alaska and vary by location. The Wrangell area continually experience rain, thunderstorms, lightning, hail, high winds, moderate snow, freezing rain/ice storm, and extreme cold.

Climate Change influences the environment, particularly historical weather patterns. Climate change and ENSO determines create increased weather volatility such as hotter summers (drought) and colder winters, intense thunderstorms, lightning, hail, snow storms, freezing rain/ice storms, high winds and even a few tornadoes in and around Alaska.

ENSO is comprised of two weather phenomena known as El Niño and La Niña. While ENSO activities are not a hazard, they can lead to severe weather events and large-scale damage throughout Alaska's varied jurisdictions. Direct correlations were found linking ENSO events to severe weather across the Pacific Northwest, particularly increased flooding (riverine and storm surge) and severe winter storms. Therefore,

increased awareness and understanding how ENSO events potentially impact Alaska's vastly differing regional weather.

Climate change is described as a phenomena of water vapor, carbon dioxide, and other gases in the earth's atmosphere acting like a blanket over the earth, absorbing some of the heat of the sunlight-warmed surfaces instead of allowing it to escape into space. The more gasses, the thicker the blanket, the warmer the earth. Trees and other plants cannot absorb carbon dioxide through photosynthesis if foliage growth is inhibited. Therefor carbon dioxide builds up and changes precipitation patterns, increases storms, wildfires, and flooding frequency and intensity; and substantially changes flora, fauna, fish, and wildlife habitats.

Heavy Rain occurs rather frequently over the coastal areas along the Bering Sea and the Gulf of Alaska. Figure 9 displays Alaska's annual rainfall map based on Parameter-elevation Regressions on Independent Slopes Model that combines climate data from the NOAA and the NRCS climate stations with a digital elevation model to generate annual, monthly, and event-based climatic element estimates such as precipitation and temperature.

Wrangell is centrally located in the Tongass National Forest which is a temperate rainforest. The last several years have shown decreased precipitation and higher than average temperatures for longer periods of time. Snow pack has been reduced which in turn reduces the spring melt feeding into lakes and streams. This can impact not only salmon returns but also impacts residents. In 2019, NOAA declared extreme drought conditions for the Wrangell area and south.

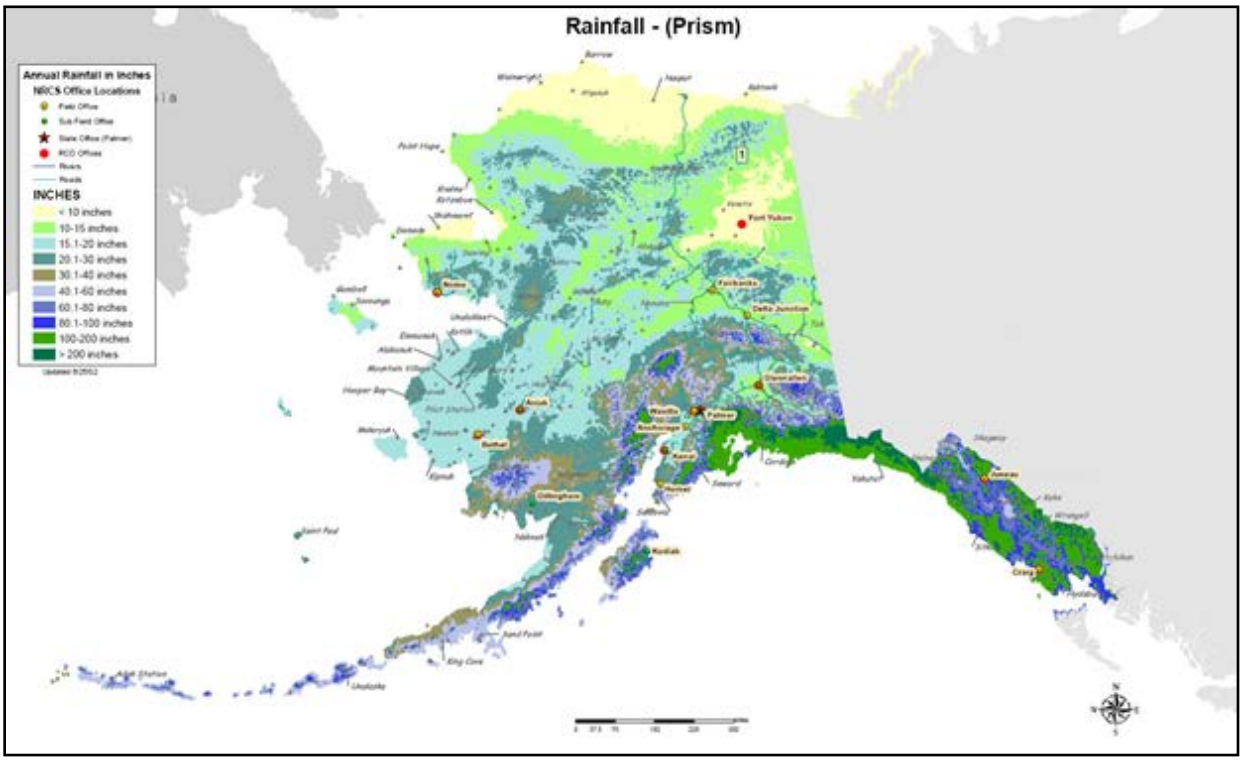

Figure 9. Statewide Rainfall Map

Freezing Rain and Ice Storms occur when rain or drizzle freezes on surfaces, accumulating 12 inches in less than 24 hours. Ice accumulations can damage trees, utility poles, and communication towers which disrupts transportation, power, and communications.

Extreme Cold varies according to normal regional climate. Near freezing temperatures are considered "extreme" in areas unaccustomed to winter weather. Alaska's extreme cold usually involves temperatures between -20 to -50°F. Excessive cold may accompany winter storms, be left in their wake, or can occur

without storm activity. Extreme cold accompanied by wind exacerbates exposure injuries such as frostbite and hypothermia.

High Winds occur in Alaska when there are winter low-pressure systems in the North Pacific Ocean and the Gulf of Alaska. Alaska's high wind can equal hurricane force but fall under a different classification because they are not cyclonic nor possess other hurricane characteristics. Strong winds occasionally occur over the interior due to strong pressure differences, especially where influenced by mountainous terrain, but the windiest places in Alaska are generally along the coastlines.

Winter Storms include a variety of phenomena described above and as previously stated may include several components; wind, snow, and ice storms. Ice storms, which include freezing rain, sleet, and hail, can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power outages, and personal injury. Ice storms result in freezing rain accumulation which coats and glazes every surface it falls on. Freezing rain is most commonly found in a narrow band on the cold side of a warm front, where surface temperatures are at, or just below, freezing temperatures. Typically, ice crystals high in the atmosphere grow by collecting water vapor molecules, which are sometimes supplied by evaporating cloud droplets. As the crystals fall, they encounter a layer of warm air where the particles melt and collapse into raindrops. As the raindrops approach the ground, they encounter a layer of cold air and cool to temperatures below freezing. However, since the cold layer is so shallow, the drops themselves do not freeze, but rather, are supercooled, that is, in liquid state at below-freezing temperature. These supercooled raindrops freeze on contact when they strike the ground or other cold surfaces.

4.6.2 Location

The entire Wrangell area experiences periodic severe weather impacts. The most common to the area are high winds and severe winter storms.

4.6.3 History

The Wrangell area is continually impacted by severe weather events. Hurricane force wind, storm surge, and cold typically have disastrous results.

Table 11 lists a representative sample of Wrangell's major storm events the NWS identified for their Weather Zone. Each weather event may not have specifically impacted the area.

These storm events are listed due to their close proximity to Wrangell or by location within the Inner Channels from Kupreanof Island to Etolin Island's Weather zone 026. Listed impacts may not have affected the Wrangell area.

Table 11. Wrangell Area Severe Weather Events

Location	Date	Event Type	Magnitude
Inner Channels from Kupreanof Island to Etolin Island. (AK Zone 026)	2/23/2018	Winter Storm	The weather front swept over the central panhandle on 24 February, spreading snow over the… easterly slopes increasing the snowfall. Temperatures began warming in the afternoon leading to a wetter snowfall in the afternoon and snowpack compaction.
AK Zone 026	2/1/2018	Winter Storm	N-NE-E wind… kept temperatures cold enough on the north side of the front to allow snow to get up to southern Admiralty Island. Increasing temps above freezing late Thursday night into Friday morning made the rain/snow line critical and difficult to forecast. Significant snowfall occurred for Port Alexander, Petersburg, Wrangell, Point Baker and Coffman Cove. Ketchikan had wintry mix. No damage was reported and the impact was snow removal. Some places could have had blizzard conditions... Port Alexander had gusts

Table 11. Wrangell Area Severe Weather Events

Location	Date	Event Type	Magnitude
			of around 46 mph (40kts)... Highest snow falls extended a little farther south than expected. Petersburg, to Whale Pass to Thorne Bay, and Coffman Cove got buried. Lighter amounts elsewhere. Snow changed to rain early in Ketchikan and overnight at Kasaan limited snow amounts to 1 to 2 inches there…
AK Zone 026	2/12/2018	Heavy Snow	… Juneau and Petersburg got hit with a heavy snow storm that was not well forecasted. By Tuesday morning Juneau got 6 to 15 inches of new snow plus some freezing drizzle, and Petersburg got 7 to 8 inches. This was due to deep WSW flow aloft that was expected to rain, but cold air never changed over.
AK Zone 026	2/22/2018	Winter Storm	… heavy snow for the Central Panhandle. Cold air in place closer to the coast mountains resulted in heavy snow with a high water content. Most snow was 10 to 1 or less which made heavy snow removal the main impact… Petersburg and Wrangell temperatures warmed overnight but more snow was observed before the changeover especially at Petersburg. Wildly varying snow amounts with less than 1 inch at Kake and Wrangell while 5 to 6 inches were observed at 9 mile on the Mitkof highway.
AK Zone 026	4/10/2018	High Wind	A very strong wave developed south of Haida Gwaii and skirted the coast of SE Alaska causing storm force wind and hurricane force gusts. There was some damage reported, and the peak wind was 100 MPH. The strong wave moved off the coast and into the western Gulf on the morning of 4/11.
AK Zone 026	3/12/2017	Winter Storm	An arctic front was over the central Panhandle as another in a series of storms moved northward from off the Pacific Northwest. The storm center had deepened… off Dixon Entrance forcing warm moist air over the arctic air in place resulting in heavy snow for most of the Panhandle... The impact was intense snow removal for storm totals up to 20 inches on top of an already deep snowpack. This was a setup for avalanches later that week.
AK Zone 026	2/11/2017	High Wind, Snow, Blizzard	Strong SSW flow… brought snow, high winds, and even blizzard conditions to the Panhandle. Warm air overrunning very cold air at the surface caused the snow to accumulate rapidly. White Pass was closed, and snow combined with wind gusts over 60 mph (52kts) caused road and marine problems throughout SE Alaska. Some locations measured over a foot of new snowfall.
AK Zone 026	2/27/2017	Winter Storm	Gale force wind just off Ocean Cape. A strong front moved on to the coast dumping snow. The impact was snow removal but no damage was reported.
AK Zone 026	1/25/2016	High Wind	A Hurricane Force wind over the western Gulf... A series of gale force to storm force winds. One of these systems caused extensive damage in the Edna Bay harbor… wrecking boats in the harbor. Max gusts in these systems were 75 to 80 mph (65-69 kts).
AK Zone 026	12/25/2016	Winter Storm	A very strong Bering Sea low… spawned a strong frontal system that raced across the Gulf to slam SE with another heavy snow event. This was a typical case of warm moist air overrunning cold air at the surface. Snowfall ranged from 1 to 2 ft. The only impact was intense snow removal.
AK Zone 026	11/29/2016	High Wind	…a radical pattern shift with a storm off the coast… brought warm moist air over the arctic front while… causing high wind. Trees came down and snow was hard to remove, but no significant damage was reported.
AK Zone 026	2/5/2015	Winter Storm	A second major wind storm hit Southeast Alaska beginning on the evening of Wednesday February 4th… extreme surface pressure gradients in the channels over the entire Panhandle and an arctic front from Cape Spencer to Petersburg. Classical Taku wind conditions persisted for Downtown Juneau and Douglas through Thursday night into Friday. There were many wind speed observations in excess of 100 mph, and damage was reported. Also,

Table 11. Wrangell Area Severe Weather Events

Location	Date	Event Type	Magnitude
			heavy snow developed over the arctic front and winter storm watches and warnings were issued well in advance. Brief blizzard conditions occurred over the Klondike Highway, and a number of high wind warnings were issued well in advance of this storm. Extensive decision support services were conducted by the Juneau Forecast Office. All concerned emergency managers across the region were directly contacted either in person or by phone for briefings. The Alaska Department of Transportation was directly contacted about the hazardous white-out conditions at White Pass and the potential for snow removal in the central Panhandle. The Alaska Marine Highway (ferries) were briefed two days in advance of this event and some routes were cancelled due to the hurricane force winds, giant wind waves - one report to 20 ft. on Inside waters - and heavy freezing spray. There was significant damage to windows and windshields and power outages during this storm. As previously stated, ferry service was canceled and also airline schedules were disrupted. Freezing spray iced over some marine observations which were out of service for a few days until there was a thaw. Snow removal was easier than usual due to the snow being fluff.
AK Zone 026	4/28/2015	High Wind	An unseasonable storm hit the Southern Panhandle… SSW of the Queen Charlotte Islands... The center moved over Sitka… then rapidly weakened over the Eastern Gulf of Alaska... Numerous reports of downed trees, power outages, and wind damage were reported particularly in Ketchikan. Gusts over 100 mph (86 kts) were measured.
AK Zone 026	10/9/2015	High Wind	[High wind] caused minor damage for several coastal areas. Power outages were common and there was significant damage to a dock.
AK Zone 026	11/30/2014	Winter Storm	Cold air was trapped over the inner channels… due to blocking high pressure. Heavy snow began as warm moist air moved over the area as the block broke down… A second snow event occurred on Dec 1, but the amounts were not as heavy... No damage or power outages were reported, but snow removal was a challenge due to this being the first measurable snowfall of the 2014-2015 season.
AK Zone 026	11/5/2014	High Wind	…The storm center…, just off Dixon Entrance… weakened over land… near Cape Spencer... Marine storm force winds were common with this system with hurricane force gusts. Land winds gusted as high as 92 mph (80 kts) and caused damage particularly in Ketchikan with one roof blown away with trees down and power outages.
AK Zone 026	4/28/2014	High Wind	A weak low… caused high wind along the coast of Cape Decision measured 50 mph (43 kts) sustained wind… with gusts as high as 85 mph (74 kts)... some areas along Baranof, Kuiu, and Prince of Wales islands were hit.
AK Zone 026	10/19/2014	High Wind	… a strong associated front approached the Panhandle from the SSW. A secondary low developed... This second center made landfall near Cape Decision... Gale force winds with storm force gusts were observed over much of the Southern Panhandle including Kuiu Island ... Winds rapidly diminished... with no damage reported.
AK Zone 026	12/19/2013	Winter Storm	…gale force triple point low moved into the central Gulf of Alaska… forcing warm moist air over cold air at the surface in the Panhandle. This system brought heavy snow to much of SE Alaska including the northern Panhandle, Yakutat, and Hyder.
AK Zone 026	1/29/2013	Winter Storm	…cold northerly flow [occurred] through mountain passes and Lynn Canal… [carrying] moisture-laden frontal system… into the eastern Gulf. This… brought heavy snow to some parts of SE Alaska...

Table 11. Wrangell Area Severe Weather Events

Location	Date	Event Type	Magnitude
AK Zone 026	11/21/2013	Winter Storm	Arctic air… over SE Alaska [that] changed to SW and warm moist air… over the Panhandle... snow changed to rain, precipitation became freezing rain in a few locations. Strong winds… with a switch over to rain. Temperatures warmed rapidly causing the snow pack to become very difficult to manage. This storm … [caused widespread] snowfall, freezing rain, and wind problems.
AK Zone 026	2/2/2012	High Wind	… hurricane force low deepened… off Sand Point… This storm brought hurricane force winds to all of SE Alaska and a few areas of heavy snow.
AK Zone 026	12/1/2012	Winter Storm	Arctic high pressure… Petersburg got around 11.2 inches of snow...
AK Zone 026	12/8/2012	Winter Storm	... [combined moist] … air masses [brought] heavy snowfall to the northern Panhandle. The heavier snowfall amounts were from 5 to 9 inches... Most areas had rain later that day making snow management difficult.
AK Zone 026	1/20/2012	Winter Storm	… Strong north wind developed for Downtown Juneau, but no damage was reported ... The storm deepened…, cold air, and heavy snow [occurred along] most of the Panhandle… [lasting for 2 days].
AK Zone 026	11/22/2012	High Wind	…hurricane force low… slowed down but deepened... over Prince of Wales Island that evening. The high winds were brief but intense for much of SE Alaska... Strong winds lasted for another day afterward.

Figure 10 delineates the Weather Service Office's weather data. Actual community temperatures and depths may vary due to their relative proximity to the Weather Service Office (WRCC 2018).

WRANGELL AP, ALASKA (509919)

Period of Record Monthly Climate Summary

Period of Record : 11/01/1917 to 02/19/2013

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	33.9	37.7	42.0	49.1	56.3	61.7	64.0	63.5	57.7	49.4	41.1	36.4	49.4
Average Min. Temperature (F)	24.7	27.7	30.8	35.3	41.1	46.5	49.8	49.7	45.9	39.2	32.1	27.6	37.5
Average Total Precipitation (in.)	6.71	5.72	5.49	4.65	4.21	3.93	4.88	5.98	9.62	13.32	9.08	7.92	81.51
Average Total SnowFall (in.)	18.4	12.4	7.9	0.8	0.0	0.0	0.0	0.0	0.0	0.1	5.8	12.6	58.0
Average Snow Depth (in.)	4	5	1	0	0	0	0	0	0	0	1	3	1

Percent of possible observations for period of record.
Max. Temp.: 95.6% Min. Temp.: 95.5% Precipitation: 90.1% Snowfall: 86.9% Snow Depth: 86.9%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

Figure 10. Wrangell Airport Climate Summary

DHS&EM's Disaster Cost Index records the following severe weather disaster events which may have affected the Wrangell area due to their close proximity to declared disaster events:

> ***3. Wrangell/Craig, November 6, 1978:*** *During this period an intense storm occurred in the Wrangell/Craig area in Southeastern Alaska generating high winds, torrential rains and heavy sea waves. The storm caused considerable damage to both private and public property in the two communities. Subsequent to the Governor's Proclamation of Disaster Emergency,*

DHS&EM provided both public assistance and assistance to individuals and families to assist the communities in recovering from the disaster. SBA made disaster loans available to affected businesses and homeowners.

83. Omega Block Disaster, January 28, 1989 & FEMA declared (DR-00826) on May 10, 1989. *The Governor declared a statewide disaster to provide emergency relief to communities suffering adverse effects of a record breaking cold spell, with temperatures as low as -85 degrees. The State conducted a wide variety of emergency actions, which included: emergency repairs to maintain & prevent damage to water, sewer & electrical systems, emergency resupply of essential fuels & food, & DOT/PF support in maintaining access to isolated communities.*

32. Southeast Alaska, November 26, 1984: *A hurricane force windstorm and wind driven tides caused extensive damage to public and private property in five Southeast Alaskan communities. The State provided public and individual assistance grants and temporary housing in Juneau, Sitka, Kake, Angoon and Tenakee Springs. SBA provided disaster loan assistance and the American Red Cross made grants to meet immediate needs of victims. The Governor's request for a Presidential declaration was denied.*

111. '89 Spring Floods Hazard Mitigation, April 14, 1990: *The Major Disaster Declaration by the President in response to statewide flooding in the Spring of 1989 authorized the commitment of federal funds to projects designed to mitigate flood damage in future years. Since the federal funding required a State matching share, the Governor declared a disaster to provide these funds and authorize their expenditure.*

97-182 '96 Southeast Storm (Pelican/Elfin Cove): *On Wednesday, September 25,1996 a severe storm struck Southeast Alaska causing severe damage to some of the communities in the area. The community of Pelican sustained erosion damage to temporary construction (sandbags) placed to curtail erosion on Pelican Creek. The storm also caused additional erosion around the bridge that crosses the creek. In Elfin Cove the landslide damaged electrical distribution lines to homes, disrupted telephone service to 12 homes and caused remaining telephones to operate off battery power. Two homes sustained damage. Also the trail which provided the only means of access between the two sides of town was damaged causing residents to commute from one side of town to the other by boat. The Governor declared the area a disaster on November 1, 1996 due to the threat to life and property. Public Assistance totaled $486K for 1 applicant with 1 DSR. The total for this disaster is $528K.*

06-216 2005 Southeast Storm (AK-06-216) declared December 23, 2005 by Governor Murkowski: *Beginning on November 18, 2005 and continuing through November 26, 2005, a strong winter storm with high winds and record rainfall occurred in the City/Borough of Juneau, the City/Borough of Haines, the City/Borough of Sitka, the City of Pelican, the City of Hoonah, and the City of Skagway, which resulted in widespread coastal flooding, landslides, and severs damage and threat to life and property, with the potential for further damage. The following conditions exist as a result of this disaster: severe damage to personal residences requiring evacuation and relocation of residents; to individuals personal and real property; to businesses; and to a marine highway system dock, the road systems eroded and blocked by heavy debris that prohibited access to communities and residents, and other public infrastructures, necessitating emergency protective measures and temporary and permanent repairs. The total estimated amount of assistance is approximately $1.87 million. This includes the following: Individual Assistance totaling $500K for 52 applicants and Public Assistance totaling $1.1 million for 14 applicants and 31 PW's. There was no hazard mitigation. Nov 21,08 update—Closeout later to DAS total cost of $1,684,311 (included $183,088 for IA, plus IA Admin of $35,748, PA Grantee admin of $133,779, and subgrantee*

admin allowance of $30,290.) Lapse to DRF was $183,586. RBS-11/28/08.

Severe weather events have historically impacted the entire Wrangell Borough area. Rural communities generally lack capacity to track changing climate conditions. It is fortunate the University of Alaska Fairbanks Scenarios Network for Alaska and Arctic Planning (SNAP) is part of the International Arctic Research Center provides this data for planning purposes. The following provides a guideline for using SNAP data:

> *Due to variability among climate models and among years in a natural climate system, these graphs are useful for examining trends over time, rather than for precisely predicting monthly or yearly values.*
>
> *How to interpret climate outlooks for your community*
>
> *You can examine SNAP community outlooks for certain key changes and threshold values—for example, higher mean monthly temperatures in the spring and fall may be of particular interest. This could signify any or all of these conditions:*
>
> - *a longer growing season*
> - *a loss of ice and/or frozen ground needed for travel or food storage*
> - *a shift in precipitation from snow to rain, which impacts water storage capacity and surface water availability*
>
> ***Note:** Precipitation may occur as either rain or snow but is reported for all months in terms of rainwater equivalent.*
>
> *Warmer, drier spring weather may also be an indicator for increased fire risk. In many locations, winter temperatures are projected to increase dramatically. Warmer winters may favor growth of species that are less cold-hardy (including desirable crops and invasive species), or it may decrease snowpack and increase the frequency of rain-on-snow events that impact wildlife. Higher temperatures across all seasons will likely impact permafrost and land-fast ice (SNAP 2016)*

SNAP data tools depict Wrangell's historic and future predicted precipitation and temperatures. (Figures 11 and 12) The long bars that look like a capital "I" displays the colored bar's estimated temperature or precipitation range.

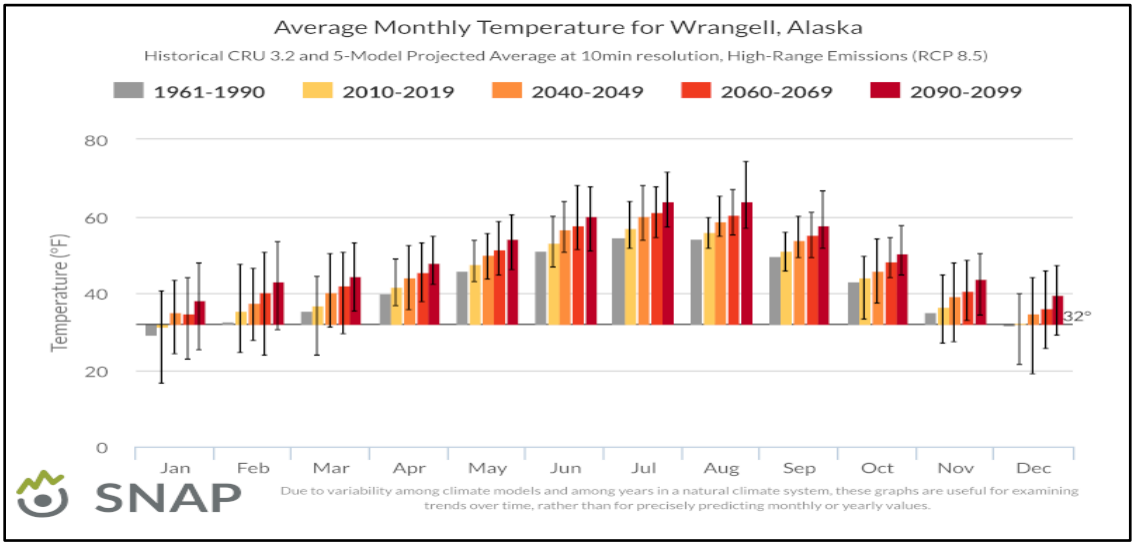

Figure 11. Wrangell's Historic and Predicted Temperature Ranges

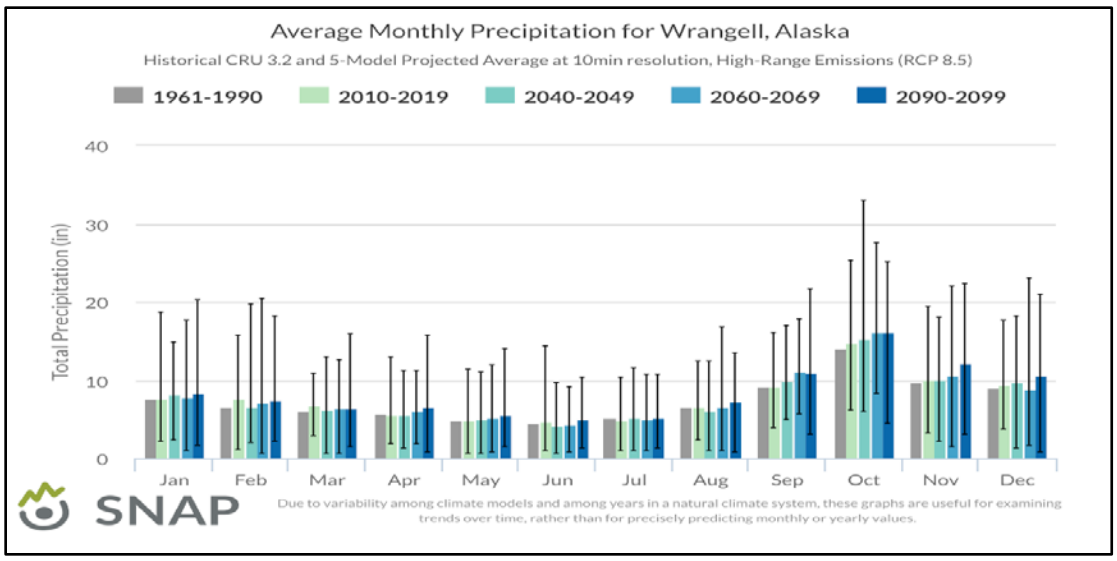

Figure 12. Wrangell's Historic and Predicted Temperatures

4.6.4 Extent/Impact

Extent

The entire Wrangell area is equally vulnerable to the severe weather effects. The area experiences severe storm conditions with moderate snow depths; wind speeds exceeding 90 mph.

Based on past severe weather events and the criteria identified in Table 7, the extent of severe weather in the Wrangell area are considered "Limited" where injuries do not result in permanent disability, complete shutdown of critical facilities could occur for more than one week, and more than 10 percent of property is severely damaged.

Impact

The intensity, location, and the land's topography influence a severe weather event's impact within a community. Hurricane force winds, rain, snow, and storm surge can be expected to impact the entire area.

Heavy snow can immobilize a community by bringing transportation to a halt. Until the snow can be removed, airports and roadways are impacted, even closed completely, stopping the supply flows and disrupting emergency and medical services. Accumulations of snow can cause roofs to collapse and knock down trees and power lines. Heavy snow can also damage light aircraft and sink small boats. A quick thaw after a heavy snow can cause substantial sheet flow flooding throughout Wrangell. Extreme cold can also bring transportation to a halt. Aircraft may be grounded due to extreme cold and ice fog conditions, cutting off access as well as the flow of supplies to communities.

Extreme cold also interferes with the proper functioning of a community's infrastructure by causing fuel to congeal in storage tanks and supply lines, stopping electric generation. Without electricity, heaters and furnaces do not work, causing water and sewer pipes to freeze or rupture. If extreme cold conditions are combined with low or no snow cover, the ground's frost depth can increase, disturbing buried pipes. The greatest danger from extreme cold is its effect on people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. Casualties also occur due to overexertion while shoveling snow and hypothermia caused by overexposure to the cold weather.

4.6.5 Recurrence Probability

Based on previous occurrences and the criteria identified in Table 8, it is "Likely" a severe storm event will occur in the next three years with a (1/3=33 percent) years chance of occurring as the history of events is greater than 20 percent but less than or equal to 33 percent likely per year.

4.7 WILDLAND FIRE

4.7.1 Nature

A wildland fire is a wildfire type that spreads through vegetation consumption. It often begins unnoticed, spreads quickly, and is usually signaled by dense smoke that may be visible from miles around. Wildland fires can be caused by human activities (such as unattended burns or campfires) or by natural events such as lightning. Wildland fires often occur in forests or other areas with ample vegetation. In addition to wildland fires, wildfires can be classified as tundra fires, urban fires, interface or intermix fires, and prescribed burns.

The following three factors contribute significantly to wildland fire behavior and can be used to identify wildland fire hazard areas.

Topography describes slope increases, which influences the rate of wildland fire spread increases. South-facing slopes are also subject to more solar radiation, making them drier and thereby intensifying wildland fire behavior. However, ridge tops may mark the end of wildland fire spread since fire spreads more slowly or may even be unable to spread downhill.

Fuel is the type and condition of vegetation plays a significant role in the occurrence and spread of wildland fires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the "fuel load"). The ratio of living to dead plant matter is also important. Climate change is deemed to increase wildfire risk significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel load continuity, both horizontally and vertically, is also an important factor.

Weather is the most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity.

Climate change increases the susceptibility of vegetation to fire due to longer dry (drought) seasons. By contrast, cooling and higher humidity often signal reduced wildland fire occurrence and easier containment.

The frequency and severity of wildland fires is also dependent on other hazards, such as lightning and infestations (such as the damage caused by spruce-bark beetle infestations). If not promptly controlled, wildland fires may grow into an emergency or disaster. Even small fires can threaten lives and resources and destroy improved properties. In addition to affecting people, wildland fires may severely affect livestock and pets. Such events may require emergency water/food, evacuation, and shelter.

The indirect effects of wildland fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance rivers and stream siltation, thereby enhancing flood potential, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards.

The community of Wrangell experienced extreme drought conditions during 2019. It is reported that significant amounts of spruce and cedar required clearing due to lack of water to reduce the interface wildland fire hazard.

4.7.2 Location

Under certain conditions wildland fires may occur near residential areas and other infrastructure when weather, fuel availability, topography, and ignition sources combine. Wrangell area does not have official fuels data. However, the planning team stated that persistent and recurring unseasonably hotter temperatures create drought conditions that are perfect for increasing wildland fire susceptibility. Wrangell's historical wildland fire locations are displayed in Figure 13 (AICC 2018).

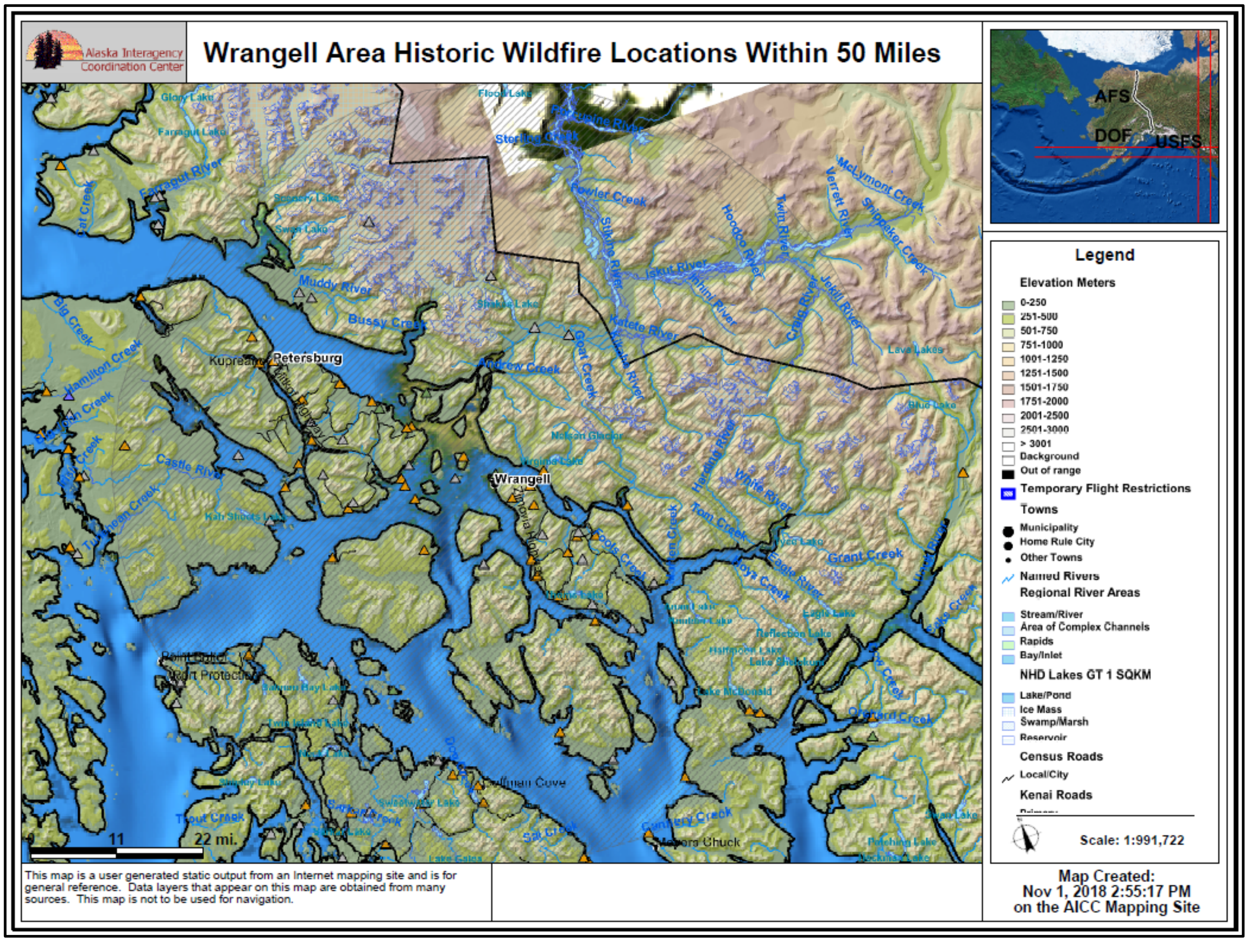

Figure 13. Wrangell's Historical Wildfire Locations

4.7.3 History

The Alaska Interagency Coordination Center identified 114 historical wildland fires that occurred within 50 miles of Wrangell. The majority of these fires ranged in size from 0.1 to 0.9 acres burned and were human caused from trash burning, camp fires, and children. Table 12 lists 18 of those fires that exceeded 1 acre with the largest one burning 588 acres in 1980, and another burning 26 acres in 1958 (AICC 2018).

Table 12. Wrangell's Historic Fires within 50 Miles

Fire Name	Fire Year	Estimated Acres	Cause
Highbush Fire	2009	1	Campfire
Sweetwater	2005	1.3	Human

Rainbow Falls	2004	6	Lightning
Whiskey Cove	2004	1	Human
Kosciusko Bay	2004	3.5	Human
Petersburg Creek	2003	1	Children
Union Bay	2002	4	Human
Ketili	1999	2	Recurrent
Farragut Bay	1998	1	Trash Burning
Snake Ridge	1996	2	Campfire
Sarkar Route	1995	4	Campfire
Clamdigger 2	1994	1	Campfire
Clamdigger	1994	1	Campfire
Canoe	1993	1	Lightning
Unnamed	1990	6	Camping
N Hamilton	1980	588	Undefined
Bay Log	1958	26	Debris Burning
Blind River	1958	5.6	Campfire

4.7.4 Extent/Impact

Extent

Wrangell is experiencing greater fire vulnerability because their spring, summer, and early fall temperatures have been increasing. Vegetation dries out from decreasing plant moisture content and increases the ratio of dead fuel to living fuel. The area's humidity, wind speed and direction, fuel load and fuel type, and topography can contribute to the fire intensity and spread rates. Wrangell's most common wildland fire cause is human negligence, followed by increased lightning strikes from changing climate patterns.

The 1980 fire burned approximately 588 acres. Due to poor records, the location is approximate. The cause of the fire was unknown. The Alaska Interagency Coordination Center historical fire report indicates an average number of acres burned amounted to 5.9 acres burned. Subtract the (large, undefined but atypical) 588 acre fire and the average falls to 0.75 acres burned from human carelessness.

Based on the limited number of large historical wildland fire events and the criteria identified in Table 7, the magnitude and severity from wildland fire in Wrangell are considered "Negligible" where minor injuries or illnesses would be treatable with first aid, minor quality of life lost, with potential for critical facilities to be shut down for 24 hours or less with less than 10 percent of property or critical infrastructure being severely damaged.

Impact

Wildland fire impacts with the population center of Wrangell could grow into an emergency or disaster if not properly controlled. A small fire can threaten lives and resources and destroy property.

Fire is recognized as a critical feature of the natural history of many ecosystems. It is essential to maintain the biodiversity and long-term ecological health of the land. The role of wildland fire as an essential ecological process and natural change agent has been incorporated into Alaska's fire management planning process its full range of fire management activities to help achieve ecosystem sustainability. This includes

interrelated ecological, economic, and social consequences on firefighters, public safety and welfare; natural and cultural resources threatened.

4.7.5 Recurrence Probability

An important issue related to the wildland fire probability is the urban interface fire. Increased development along the community's perimeter, accumulation of hazardous wildfire fuels, and the uncertainty of weather patterns that may accompany climate change increases wildland urban-interface fire recurrence probability. These three combined elements are reason for concern and require heightened mitigation management of each community's wildland interface areas, natural areas, and open spaces.

Climate change and flammable vegetation species are prolific throughout Wrangell's forests locations especially since extreme heat days have been increasing and drought conditions are a year recurrence. Fire frequency will likely increase in the future.

Based on the history of wildland fires in the Wrangell area and applying the criteria identified in Table 8, it is "Unlikely" but possible a wildland fire event will occur within Wrangell in the next ten years. The event has 1 in 10 years (1 in 10= 10 percent) chance of occurring and the history of events is less than or equal to 10 percent likely each year.

4.8 VULNERABILITY ASSESSMENT

This section describes and summarizes the overall vulnerability of the people and critical facilities to the hazards that occur in Wrangell.

4.8.1 Asset Inventory - Critical Facilities

A critical facility provides services and functions essential to a community, especially during and after a disaster. Common types of critical facilities include: fire stations, police stations, hospitals, schools, water and waste water systems, and utilities. Critical facilities may also include places that can be used for sheltering or staging purposes, such as community centers and libraries. Critical facilities may also include large public gathering spots.

Critical facility information was queried from the Alaska Critical Facilities database and reviewed and updated by the planning team. Due to many of the remote nature of the community – a long distance from their nearest neighboring community, most all facilities are deemed "critical" to their survival. The critical facilities profiled in this plan include the following:

- Government facilities, such as city and tribal administrative offices, departments, or agencies
- Emergency response facilities, including police department and firefighting equipment
- Educational facilities, including K-12
- Care facilities, such as medical clinics, congregate living health, residential and continuing care, and retirement facilities
- Community gathering places, such as community and youth centers
- Utilities, such as electric generation, communications, water and waste water treatment, sewage lagoons, landfills.

Table 13 shows critical facilities and infrastructure identified by the planning team (CBW 2018a; WCA, CCTHITA, and DHS&EM 2009).

Table 13. Wrangell Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood/Erosion	Ground Failure	Tsunami/Seiche	Volcano	Severe Weather	Wildland Fire
Government	8	City Hall	205 Brueger Street	56.470783	-132.384259	$1,697,840	GOV1	X	X		X	X	X	X
Government	3	U.S. Post Office	112 Federal Way	56.472538	-132.387132	Undefined	GOV1	X	X		X	X	X	X
Government	5	Alaska Fish & Game	Front Street	56.470505	-132.380631	Undefined	GOV1	X				X	X	X
Government	20	US Forest Service	525 Benett Street	56.478047	-132.376058	Undefined	GOV1	X				X	X	X
Government	3	Public Works Office	Case Avenue	56.469635	-132.377721	Undefined	COM4	X	X			X	X	X
Government	3	Wrangell Municipal Light & Power Office	1064 Case Avenue	56.461768	-132.378815	$4,664,450	EPPL	X				X	X	X
Government	3	Capital Facilities Office	Bennett Street	56.473652	-132.37529	Undefined	GOV1	X				X	X	X
Government	3	Harbor Office	Shakes Street	56.466554	-132.382074	Undefined	GOV1	X				X	X	X
Government	8	Public Safety Building: Offices for Police, Court System, DMV	Zimovia Highway	56.469635	-132.377721	$10,674,080	GOV1	X				X	X	X
Government	2	Alaska Legislative Information Office	Front Street	56.470505	-132.380631	Undefined	GOV1	X			X	X	X	X
Government	7	WCA Tribal and Transportation offices	Zimovia Highway	56.462685	-132.375328	Undefined	GOV1	X				X	X	X
Government	1	US Customs office	Airport Loop Road	56.485684	-132.3812	Undefined	GOV1	X				X	X	X
Emergency Response	5	Public Safety Building: Fire and Search & Rescue	Zimovia Hwy and Bennett Street	56.469635	-132.377721	$5,000,000	EFEO	X				X	X	X
Emergency Response	6	5.5 Mile Substation	Zimovia Hwy	56.362936	-132.356211	$936,750	GOV2	X				X	X	X
Emergency Response		12 Mile Emergency Van	Undefined	56.324971	-132.3812	Undefined	GOV2	X				X	X	X
Emergency Response	0	Alaska DEC Oil Spill Response Van/Supplies	City Barge Ramp	Undefined	Undefined	Undefined	Undefined	X				X	X	X

Table 13. Wrangell Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood/Erosion	Ground Failure	Tsunami/Seiche	Volcano	Severe Weather	Wildland Fire
Emergency Response	0	Alaska DOT/PF Airport Fire Pumper Truck 3,000 gal	ARRF Bldg. / Airport Loop Road	56.48452	-132.37778	Undefined	EFEO	X				X	X	X
Emergency Response	0	US Forest Service Fire Pumper Truck	Bennett Street	56.474975	-132.374848	Undefined	Undefined	X				X	X	X
Emergency Response	0	SEARHC 10-person remote medical facility / Decon for HazCom (in Vans)	Bennett Street	Undefined	Undefined	Undefined	Undefined	X				X	X	X
Emergency Response	0	CBW/Fire Dept. MMRS (medical response system)	ARRF Bldg. / Airport Loop Road	Undefined	Undefined	Undefined	Undefined	X				X	X	X
Education	4	Wrangell School District Office	350 Bennett Street	56.472497	-132.37463	Undefined	EDU1	X				X	X	X
Education	182	Wrangell High School (167 students, 15 teachers)	310 Reid Street	56.472159	-132.381524	Undefined	EDU1	X				X	X	X
Education	70	Skitine Middle School (60 students, 10 teachers)	321 Church Street	56.472015	-132.378168	Undefined	EDU1	X				X	X	X
Education	92	Evergreen Elementary School (82 students, 10 teachers)	350 Bennett Street	56.472497	-132.37463	Undefined	EDU1	X				X	X	X
Education	30	T&H Head Start	First Ave	Undefined	Undefined	Undefined	EDU1	X				X	X	X
Medical Care	Undefined	Alaska Island Community Services (AICS) Tideline Health Clinic	232 Wood Street	56.412.952	-132.371778	Undefined	EFMC	X				X	X	X
Medical Care	6	AICS Pharmacy	333 Church Street	56.471185	-132.380348	Undefined	COM1	X				X	X	X
Medical Care	3	Stikine Drug	202 Front Street	56.471778	-132.383977	Undefined	COM1	X	X		X	X	X	X
Medical Care	2	State Public Health Nurse	Front Street	56.471329	-132.383619	Undefined	COM7	X			X	X	X	X
Medical Care	80	Wrangell Medical Center	310 Bennett Street	56.471783	-132.375702	$20,000,000	COM6	X				X	X	X
Medical Care	60	SEARHC Hospital (under construction -2020)	235 Wood Street	56.463500	-132.372932	$35,000,000	COM6	X	X	X		X	X	X

Table 13. Wrangell Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood/Erosion	Ground Failure	Tsunami/Seiche	Volcano	Severe Weather	Wildland Fire
Medical Care	2	Coniffs Critters Vet	Front Street	56.470933	-132.381628	Undefined	Undefined	X				X	X	X
Medical Care	15	AICS Dental Clinic	Front Street	56.471935	-132.385813	Undefined	Undefined	X	X		X	X	X	X
Community	2	Bible Baptist Church	535 Church Street	56.467667	-132.377252	Undefined	REL1	X				X	X	X
Community	2	First Presbyterian Church	220 Church Street	56.471223	-132.379016	Undefined	REL1	X				X	X	X
Community	2	Harbor Light Assembly of God	.5 Mile Zimovia Hwy	56.466379	-132.375998	Undefined	REL1	X		X		X	X	X
Community	2	Hope Community Church of God	212 Bennett Street	56.470829	-132.376445	Undefined	REL1	X				X	X	X
Community	2	Island of Faith Lutheran Church	211 Second Street	56.473544	-132.387981	Undefined	REL1	X				X	X	X
Community	2	Seventh Day Adventist Church	432 Zimovia Hwy	56.470862	-132.37902	Undefined	REL1	X				X	X	X
Community	2	St. Phillip's Episcopal Church	Church Street	56.469777	-132.378456	Undefined	REL1	X				X	X	X
Community	2	St. Rose of Lima Catholic Church	202 Church Street	56.471174	-132.379918	Undefined	REL1	X				X	X	X
Community	5	Salvation Army	Zimovia Hwy	56.467899	-132.375391	Undefined	REL1			X		X	X	X
Community	5	First Bank	224 Brueger Street	56.470823	-132.383292	$400,000	COM5	X	X		X	X	X	X
Community	5	Tongass Federal Credit Union	215 Front Street	56.47134	-132.383635	$400,000	COM5	X	X		X	X	X	X
Community	5	Wells Fargo	115 Front Street	56.471.549	-132.384807	$400,000	COM5	X	X			X	X	X
Community	12	Nolan Center Convention Center, Museum & Wrangell Visitor Ctr	296 Campbell Drive	56.469838	-132.382941	$9,625,140	GOV1	X	X		X	X	X	X
Community	15	Irene Ingle Public Library	124 2nd Street	56.473242	-132.386377	$2,198,480	GOV1	X		X		X	X	X
Community	25	Wrangell Community Center	Church Street	56.472138	-132.381927	$5,378,340	COM8			X		X	X	X
Community	25	Wrangell Parks and Recreation Pool	321 Church Street	56.47195	-132.381386	Undefined	COM8	X		X		X	X	X

Table 13. Wrangell Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood/Erosion	Ground Failure	Tsunami/Seiche	Volcano	Severe Weather	Wildland Fire
Community	Undefined	Harbor Dept. Warehouses	Front Street	Undefined	Undefined	Undefined	PWH		X			X	X	X
Community	4	Ava's Bed & Breakfast	15 Crest Drive	56.475081	-132.380892	$325,000	RES4	X				X	X	X
Community	15	Armstrong Rents	522 Front Street	56.46887	-132.380038	$325,000	RES4	X				X	X	X
Community	Undefined	Airport Hangers	Airport Way	Undefined	Undefined	Undefined	AMF	X				X	X	X
Community	3	Little Bitty Getaway	Church Street	Undefined	Undefined	$300,000	RES4	X				X	X	X
Community	4	Be Still Bed and Breakfast	318 McKinnon Street	56.473676	-132.38473	$325,000	RES4	X		X		X	X	X
Community	7	Grand View B&B	1.5 Mile Zimovia Hwy	56.451198	-132.381104	$325,000	RES4	X			X	X	X	X
Community	2	Heritage Harbor Boathouse	Berger Street	Undefined	Undefined	Undefined	RES4	X	X		X	X	X	X
Community	4	Mt. Dewey Garden Guest House	120 Third Street	56.474283	-132.385587	$325,000	RES4	X		X		X	X	X
Community	4	Mt. Dewey Sunset Bed & View	111 Mt. Dewey Lane	56.474521	-132.386822	$300,000	RES4	X		X		X	X	X
Community	2	Northstar Reflections Guest Suite	Zimovia Avenue	Undefined	Undefined	Undefined	RES4	X				X	X	X
Community	3	Off the Hook Extended Stay	Evergreen Ave	Undefined	Undefined	Undefined	RES4	X	X		X	X	X	X
Community	5	Reliance Harbor View	Peninsula Street	Undefined	Undefined	$300,000	RES4	X				X	X	X
Community	6	Rooney's Roost B&B	206 McKinnon Street	56.472575	-132.384068	$300,000	RES4	X				X	X	X
Community	4	That Place	928 Zimovia Highway	Undefined	Undefined	Undefined	RES4	X				X	X	X
Community	75	Stikine Inn, Restaurant Café	105 Skitine Avenue	56.471886	-132.38773	$800,000	RES4	X	X		X	X	X	X
Community	8	Wrangell Extended Stay	312 Stikine Avenue	56.474777	-132.38942	$400,000	RES5	X			X	X	X	X
Community	4	Wrangell Seawatch House B&B	506 Evergreen Avenue	56.476894	-132.390616	Undefined	RES6	X	X		X	X	X	X
Community	6	Zimovia B&B	319 Webber Street	56.472273	-132.372453	$400,000	RES7	X				X	X	X

Table 13. Wrangell Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood/Erosion	Ground Failure	Tsunami/Seiche	Volcano	Severe Weather	Wildland Fire
Community	30	Senior Apartments	351 Bennett Street	56.473022	-132.376046	$500,000	RES3	X	X		X	X	X	X
Community	35	Wrangell IGA (Grocery)	223 Brueger Street	56.470428	-132.383706	$400,000	COM1	X	X		X	X	X	X
Community	35	City Market (Grocery)	423 Front Street	56.47004	-132.381145	$400,000	COM1	X	X		X	X	X	X
Community	5	Twisted Root Market	628 Shakes Street	56.467478	-132.384004	Undefined	COM1	X	X		X	X	X	X
Community	25	Elks Lodge	Front Street	56.471499	-132.385295	$400,000	RES4	X	X		X	X	X	X
Community	5	J&W's Fast Food	120 Front Street	56.471824	-132.384411	Undefined	COM1	X	X		X	X	X	X
Community	8	Michelle's Taste of Asia	216 Front Street	56.470907	-132.381573	Undefined	COM1	X	X		X	X	X	X
Community	15	Marine Bar and Pizza	640 Shakes Street	56.466746	-132.381181	Undefined	COM1	X	X		X	X	X	X
Community	4	Notsofamous Pizza	325 Front Street	56.470769	-132.381921	Undefined	COM1	X	X		X	X	X	X
Community	2	The Pit Stop	Front Street	56.468585	-132.380078	Undefined	COM1	X	X		X	X	X	X
Community	8	The Cabin Cafe	305 Front Street	56.471368	-132.382645	Undefined	COM1	X	X		X	X	X	X
Community	15	Zak's Café	Front Street	Undefined	Undefined	Undefined	COM1	X	X		X	X	X	X
Community	12	Churchills Apartments and Laundry	Shakes Street	Undefined	Undefined	Undefined	COM1	X	X		X	X	X	X
Community	75	Sea Level Seafoods	2204 Zimovia Hwy	56.458723	-132.381508	Undefined	COM2	X	X		X	X	X	X
Community	75	Trident Seafoods, Inc.	641 Shakes Street	56.467211	-132.381705	$5,000,000	COM2	X	X		X	X	X	X
Community	0	Cold Storage	Shakes Street	Undefined	Undefined	$2,633,450	COM2	X	X		X			
Community	2	Wrangell Sentinel	205 Front Street	56.471375	-132.38403	Undefined	COM2	X	X		X	X	X	X
Community	10	Senior Center	Church Street	56.472284	-132.385521	Undefined	COM7	X	X		X	X	X	X
Community	20	Harbor House Assisted Living	Berger Street	56.461192	-132.384531	$400,000	COM7	X	X	X	X	X	X	X
Community	2	Wrangell Chamber of Commerce	Undefined	56.471385	-132.382618	Undefined	GOV1	X	X	X	X	X	X	X

Table 13. Wrangell Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood/Erosion	Ground Failure	Tsunami/Seiche	Volcano	Severe Weather	Wildland Fire
Community	20	Southeast AK Regional Health Consortium (SEARHC) Offices	Church Street	Undefined	Undefined	Undefined	COM7	X	X	X	X	X	X	X
Community	Undefined	Chief Shakes Tribal House	Shakes Street	56.472284	-132.385521	Undefined	Undefined	X	X	X	X	X	X	X
Community	Undefined	Totem Park	Front Street	Undefined	Undefined	Undefined	COM8	X	X	X	X	X	X	X
Community	2	Tribal Community House and Carving Shed	Front Street	56.470807	-132.382318	Undefined	COM8	X	X	X	X	X	X	X
Roads	0	Total paved road miles: 9.9		Cost per paved mile: $5M			HRD 2	X	X	X	X	X	X	X
Roads	0	Total gravel road miles: 7.65		Cost per gravel mile: 1.5M			HRD2	X	X	X	X	X	X	X
Bridge	0	Pats Creek Bridge	Pat's Creek Road	56.342059	-132.338188	Undefined	HWB1	X			X	X	X	X
Bridge	0	McCormacks Bridge	Zimovia Highway	56.310421	-132.335998	Undefined	HWB1	X			X	X	X	X
Bridge	0	City Park Bridge	Zimovia Highway	Undefined	Undefined	Undefined	HWB1	X	X		X	X	X	X
Bridge	0	SMB Park Bridge/Institute Creek	Zimovia Highway	Undefined	Undefined	Undefined	HWB1	X	X		X	X	X	X
Bridge	0	SMB near pullout/Zimovia Highway culvert	Zimovia Highway	Undefined	Undefined	Undefined	HWB1	X	X		X	X	X	X
Bridge	0	USFS Bridges on Wrangell Island	Various				HWB1			X		X	X	X
Culvert	0	Wood St/Zimovia Hwy culvert	Zimovia Highway	Undefined	Undefined	Undefined	HWB1	X	X	X	X	X	X	X
Culvert	0	Pine St/Zimovia Hwy Culvert	Zimovia Highway	56.468916,	-132.3764	Undefined	HWB1	X	X		X	X	X	X
Culvert	0	Evergreen/Trailer Park Culvert	Evergreen	56.48118	-132.391572	Undefined	HWB1	X	X		X	X	X	X
Culvert	0	Nugget Trailer Park Culvert	Zimovia Highway	Undefined	Undefined	Undefined	HWB1	X	X		X	X	X	X
Culvert	0	Spur Road Culvert	Spur Road	56.46889	-132.333389	Undefined	HWB1	X				X	X	X
Dam	0	Wrangell Upper Reservoir	Wood Street	56.456118	-132.370065	$40,000,000	HPDE	X				X	X	X

Table 13. Wrangell Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood/Erosion	Ground Failure	Tsunami/Seiche	Volcano	Severe Weather	Wildland Fire
Dam	0	Wrangell Lower Reservoir	Wood Street	56.462123	-132.361254	$25,000,000	HPDE	X				X	X	X
Transportation	2	Wrangell Airport (PAWG)	1 Airport Loop Road	56.4843333	-132.3698333	Undefined	ATB	X				X	X	X
Transportation	0	Wrangell Airport Runway	1 Airport Loop Road	56.4843333	-132.3698333	Undefined	ARW	X				X	X	X
Transportation	0	Wrangell Seaplane Base	Shakes Street	56.466325	-132.3800181	Undefined	AFO	X				X	X	X
Transportation	15	Alaska Airlines Terminal and Hangar	1 Airport Loop Road	56.485	-132.3796	Undefined	AMF	X				X	X	X
Transportation	4	State DOT/PF Highway Maintenance	Airport Loop Road	Undefined	Undefined	Undefined	Undefined	X				X	X	X
Transportation	0	City Bulk Fuel Tanks	Zimovia Highway	Undefined	Undefined	Undefined	OTF	X				X	X	X
Transportation	8	U.S. Transportation Security Administration offices	Front Street	56.485104	-132.37954	Undefined	ATB	X				X	X	X
Transportation	0	Wrangell ports and harbors	Various locations			Undefined	PWS	X	X		X	X	X	X
Transportation	5	Wrangell Ferry Terminal	Stikine Avenue at Evergreen	56.474024	-132.390154	Undefined	FPT	X	X		X	X	X	X
Transportation	4	Samson Tug & Barge	102 Outer Drive	56.471417	-132.386619	Undefined	FMF	X	X		X	X	X	X
Transportation	1	6-mile Industrial Yard / Dock	Zimovia Highway	Undefined	Undefined	Undefined	PEQ/FMF	X	X		X	X	X	X
Transportation	5	Alaska Marine Lines Lynden Transport	520 Front Street	56.469	-132.378956	Undefined	Undefined	X				X	X	X
Transportation	2	Etolin Bus Company Inc.	Howell Avenue	56.470846	-132.37662	Undefined	BMFW	X				X	X	X
Transportation	0	Arrowhead Transfer and Arrowhead L.P. Gas	520 Front Street	56.469249	-132.379751	Undefined	Undefined	X		X	X	X	X	X
Transportation	3	Alpine Fuel Expediting	930 Zimovia Highway	56.463081	-132.374911	Undefined	Undefined	X		X		X	X	X
Transportation	3	LN'M Services and Gas Station	Front Street	Undefined	Undefined	Undefined	Undefined	X		X		X	X	X
Transportation	4	Petro Marine Services	1427 Peninsula Street	56.462595	-132.383143	Undefined	Undefined	X		X		X	X	X

Table 13. Wrangell Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood/Erosion	Ground Failure	Tsunami/Seiche	Volcano	Severe Weather	Wildland Fire
Transportation	4	Alaska Charters and Adventures	5 Front Street	56.471477	-132.386964	Undefined	COM3	X	X		X	X	X	X
Transportation	4	Alaska Vistas	103 Front Street	56.471431	-132.387147	Undefined	COM3	X	X		X	X	X	X
Transportation	4	Alaska Waters	107 Skitine Avenue	56.471688	-132.387512	Undefined	COM3	X	X		X	X	X	X
Transportation	3	Breakaway Adventures	104 Front Street	56.471688	-132.384136	Undefined	COM3	X	X		X	X	X	X
Transportation	Undefined	Muddy Water Adventures	Undefined	Undefined	Undefined	Undefined	COM4	X				X	X	X
Transportation	3	Practical Car Rental	Airport Way	Undefined	Undefined	Undefined	COM5	X				X	X	X
Transportation	Undefined	Summit Charters	318 McKinnon Street	56.473676	-132.38473	Undefined	COM3	X				X	X	X
Transportation	2	Sunrise Aviation	Airport Loop Road	56.484624	-132.378116	Undefined	AMF	X				X	X	X
Utility	12	Public Works Maintenance Barn	Case Avenue	56.469635	-132.377721	Undefined	COM4	X				X	X	X
Utility	5	Wrangell Municipal Light & Power Generator Warehouse (Large)	1064 Case Avenue	56.461768	-132.378815	$7,392,770	EPPL	X	X		X	X	X	X
Utility	2	SE Alaska Power Agency Substation	4.5 Zimovia Highway	Undefined	Undefined	Undefined	ESSM	X				X	X	X
Utility	0	SE Alaska Power Agency / Tyee Intertie Distribution Lines	Undefined	Undefined	Undefined	Undefined	EDC	X		X		X	X	X
Utility	2	Potable Water Plant	Wood Street	56.456512	-132.376483	$1,199,610	PWTM	X		X		X	X	X
Utility	0	Potable Water Distribution Lines	Community-wide	N/A	N/A	Undefined	PWP	X	X	X	X	X	X	X
Utility	0	Potable Water Storage Tanks	Wood Street	56.456512	-132.376483	Undefined		X		X		X	X	X
Utility	2	Wastewater Plant (medium)	Zimovia Hwy	56.453653	-132.380397	Undefined	WWTM	X	X	X	X	X	X	X
Utility	0	Sewer Collection Lines	Community-wide	N/A	N/A	Undefined	PWP	X	X	X	X	X	X	X

Table 13. Wrangell Critical Facilities and Infrastructure

Type	Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Flood/Erosion	Ground Failure	Tsunami/Seiche	Volcano	Severe Weather	Wildland Fire
Utility	2	Solid Waste Transfer Facility	3 Evergreen Avenue	56.485591	-132.388848	$1,799,510	Undefined	X		X	X	X	X	X
Utility	3	AP&T Power & Telephone	20 Front Street	56.471933	-132.386013	Undefined	DBO	X	X	X	X	X	X	X
Utility	3	GCI Communication	325 Front Street	56.470777	-132.38195	Undefined	CBO	X	X	X	X	X	X	X
Utility	4	KSTK Public Radio - 101.7, 94.7 FM	202 St. Michael Street	56.471174	-132.379918	Undefined	DBR	X		X		X	X	X
Utility	0	Cell Tower Repeater System	Undefined	Undefined	Undefined	Undefined	CBO	X		X		X	X	X

4.8.2 Vulnerability

Table 14 lists CBW, WCA, and the CCTHITA's infrastructures' hazard vulnerability synopsis.

Table 14. Wrangell Vulnerability Overview

Hazard	Hazard Vulnerability			
	Percent of Jurisdiction's Geographic Area	Percent of Population	Percent of Building Stock	Percent of Critical Facilities and Utilities
Earthquake	100%	100%	100%	100%
Flood and Erosion	30%	30%	25%	42%
Ground Failure	10%	20%	10%	19%
Tsunami and Seiche	10%	30%	35%	41%
Volcanic Ash	100%	100%	100%	100%
Severe Weather	100%	100%	100%	100%
Wildland Fire	100%	100%	100%	100%

Table 15 lists the key issues or overall summary of vulnerability for each hazard profiled in the 2020 MJHMP.

Table 15. Overall Summary of Vulnerability

Hazard	Vulnerability
Earthquake	Although all structures are exposed to earthquakes, buildings within the Wrangell area constructed with wood have less vulnerability to the effects of earthquakes than those constructed with other materials. The Wrangell area has a "Low" recurrence probability for a significant event that will generate "severe" ground movement resulting in infrastructure damage and personal injury. The following summarizes potential impacts from a worse-case scenario event: • 1,408 people in 2,387 residences (approximate value $457,600,000) • 66 people in 12 government facilities (approximate value $34,361,370) • 11 people in 8 emergency response facilities (approximate value $5,971,750) • 378 people in 5 educational facilities (approximate value $30,150,000) • 318 people in 7 medical facilities (approximate value $48,700,000) • 679 people in 59 community facilities (approximate value $132,760,410) • 9.9 paved road system miles (approximate value $49,500,000) • 7.65 gravel road system miles (approximate value $11,475,000) • 11 bridges/culverts (approximate value is undefined) • 2 earthen dams (approximate value $65,000,000) • 82 people in 25 transportation facilities (approximate value >$475,000) • 35 people in 14 utility facilities (approximate value $10,391,890)

Table 15. Overall Summary of Vulnerability

Hazard	Vulnerability
Erosion/Flood	Typical flood impacts associated include structures and contents water damage, roadbed, embankment, and coastal erosion, boat stranding, standing water in roadways and other areas. Flood events may also damage or displace fuel tanks, power lines, or other infrastructure. Buildings on slab foundations, not located on raised foundations, and/or not constructed with materials designed to withstand flooding events (e.g., cross vents to allow water pass-through an open area under the main floor of a building) are more vulnerable to flood impacts. Wrangell has a minor flooding impact threats; most of which occur from rainfall and snowmelt run-off sheet flow flooding and wind driven wave storm surge. Wrangell has grown since their initial flood insurance rate maps were created in 1982. They can only be used to estimate where they can potentially expand or create new developments away from their historical floodplain. Therefore, the Wrangell planning team estimated potential impacts from a worse-case scenario event could include: • 525 people in 175 residences (approximate value $56,875,000) • 14 people in 3 government facilities (approximate value $6,697,840) • 18 people in 2 medical facility (approximate value $800,000) • 384 people in 31 community facilities (approximate value $37,133,450) • Undefined paved road system miles (approximate value is undefined) • Undefined gravel road system miles (approximate value is undefined) • 7 bridges/culverts (approximate value is undefined) • 2 earthen dams (approximate value $65,000,000) • 28 people in 9 transportation facilities (approximate value is undefined) • 6 people in 13 utility facilities (approximate value $8,592,380)
Ground Failure	Impacts associated with ground failure include surface subsidence, infrastructure, structure, and/or road damage. Buildings that are built on slab foundations and/or not constructed with materials designed to accommodate the ground movement associated with building on permafrost and other land subsidence and impacts, are more vulnerable to damage. Wrangell's ground failure events periodically cause structure and infrastructure displacement due to ground shifting, sliding, sinking, and/or upheaval. There have been periodic landslides and other ground failure incidents on the island. The following summarizes potential impacts from a worse-case scenario event: • 375 people in 125 residences (approximate value $40,325,000) • 82 people in 7 community facilities (approximate value $38,901,820) • Undefined paved road system miles (approximate value is undefined) • Undefined gravel road system miles (approximate value is undefined) • 2 bridge/culvert (approximate value is undefined) • 2 earthen dams (approximate value is undefined) • 14 people in 4 transportation facilities (approximate value is undefined) • 4 people in 5 utility facilities (approximate value $2,999,380)

Table 15. Overall Summary of Vulnerability

Hazard	Vulnerability
Tsunami and Seiche	The UAF/GI, DGGS, and the National Tsunami Warning Center indicate that Wrangell has experienced minimal distant and local source tsunami threats for population and infrastructure located within the identified tsunami impact area. Wrangell's residential, commercial, and public structures and infrastructure located adjacent to the identified tsunami impact area have a "Possible" risk from tsunamigenic impacts. Potentially threatened population and infrastructure includes: • 1,050 people in 350 residences (approximate value $113,750,000) • 11 people in 2 government facilities (approximate value $1,697,840) • 18 people in 2 medical facility (approximate value $800,000) • 472 people in 30 community facilities (approximate value $37,133,450) • Undefined paved road system miles (approximate value is undefined) • Undefined gravel road system miles (approximate value is undefined) • 9 bridges/culverts (approximate value is undefined) • 32 people in 10 transportation facilities (approximate value is undefined) • 13 people in 7 utility facilities (approximate value $9,192,280)
Volcanic Ash	Impacts associated with a volcanic eruption include strain on resources should other hub communities be significantly affected by volcanic eruption. An eruption of significant size in southcentral Alaska will certainly affect air routes, which in turn affects the entire state. Other impacts include respiratory problems from airborne ash, displaced persons, lack of shelter, and personal injury. Other potential impacts include general property damage (electronics and unprotected machinery), structural damage from ash loading, state/regional transportation interruption, loss of commerce, and contamination of water supply. Using information provided by the planning team, the USGS, and the Alaska Volcano Observatory, Wrangell has a "Possible" risk from volcanic eruptions dispersing volcanic ash into the atmosphere. This could hamper air, land, and ocean resupply capability to Wrangell's isolated island location. The following summaries potential impacts from a worse-case scenario event: • 1,408 people in 2,387 residences (approximate value $457,600,000) • 66 people in 12 government facilities (approximate value $34,361,370) • 11 people in 8 emergency response facilities (approximate value $5,971,750) • 378 people in 5 educational facilities (approximate value $30,150,000) • 318 people in 7 medical facilities (approximate value $48,700,000) • 679 people in 59 community facilities (approximate value $132,760,410) • 9.9 paved road system miles (approximate value $49,500,000) • 7.65 gravel road system miles (approximate value $11,475,000) • 11 bridges/culverts (approximate value is undefined) • 2 earthen dams (approximate value $65,000,000) • 82 people in 25 transportation facilities (approximate value >$475,000) • 35 people in 14 utility facilities (approximate value $10,391,890)

Table 15. Overall Summary of Vulnerability

Hazard	Vulnerability
Severe Weather	Impacts associated with severe weather events include roof collapse, trees and power lines falling, damage to light aircraft and sinking small boats, injury and death resulting from snow machine or vehicle accidents, overexertion while shoveling all due to heavy snow. A quick thaw after a heavy snow can also cause substantial flooding. Impacts from extreme cold include hypothermia, halting transportation from fog and ice, congealed fuel, frozen pipes, utility disruptions, frozen pipes, and carbon monoxide poisoning. Additional impacts may occur from secondary weather hazards or complex storms such as extreme high winds combined with freezing rain, high seas, and storm surge. Buildings that are older and/or not constructed with materials designed to withstand heavy snow and wind (e.g., hurricane ties on crossbeams) are more vulnerable to the severe weather damage. Wrangell is centrally located in the Tongass National Forest which is a temperate rainforest. The last several years have shown decreased precipitation and higher than average temperatures for longer periods of time. Snow pack has been reduced which in turn reduces the spring melt feeding into lakes and streams. This can impact not only salmon returns but also impacts residents. In 2019, NOAA declared extreme drought conditions for the Wrangell area and south. Based on information provided by the planning team and the National Weather Service; the entire area experiences severe storm conditions with moderate snow depths; and wind speeds exceeding 90 mph. The following summarizes potential impacts from a worse-case scenario event: • 1,408 people in 2,387 residences (approximate value $457,600,000) • 66 people in 12 government facilities (approximate value $34,361,370) • 11 people in 8 emergency response facilities (approximate value $5,971,750) • 378 people in 5 educational facilities (approximate value $30,150,000) • 318 people in 7 medical facilities (approximate value $48,700,000) • 679 people in 59 community facilities (approximate value $132,760,410) • 9.9 paved road system miles (approximate value $49,500,000) • 7.65 gravel road system miles (approximate value $11,475,000) • 11 bridges/culverts (approximate value is undefined) • 2 earthen dams (approximate value $65,000,000) • 82 people in 25 transportation facilities (approximate value >$475,000) • 35 people in 14 utility facilities (approximate value $10,391,890)

Table 15. Overall Summary of Vulnerability

Hazard	Vulnerability
Wildfire	The planning team stated that persistent and recurring unseasonably hotter temperatures create drought conditions that are perfect for increasing wildland fire susceptibility. Climate change and flammable vegetation species are prolific throughout Wrangell's forests locations; especially since extreme heat days have been increasing and drought conditions are an annual recurrence. Fire frequency will likely increase in the future. The following summarizes potential impacts from a worse-case scenario event: • 1,408 people in 2,387 residences (approximate value $457,600,000) • 66 people in 12 government facilities (approximate value $34,361,370) • 11 people in 8 emergency response facilities (approximate value $5,971,750) • 378 people in 5 educational facilities (approximate value $30,150,000) • 318 people in 7 medical facilities (approximate value $48,700,000) • 679 people in 59 community facilities (approximate value $132,760,410) • 9.9 paved road system miles (approximate value $49,500,000) • 7.65 gravel road system miles (approximate value $11,475,000) • 11 bridges/culverts (approximate value is undefined) • 2 earthen dams (approximate value $65,000,000) • 82 people in 25 transportation facilities (approximate value >$475,000) • 35 people in 14 utility facilities (approximate value $10,391,890)

4.8.3 Cultural Resources

The 2010 Wrangell Comprehensive Plan describes the areas historic location and describes the Wrangell Cooperative Associations bond to the land.

> *People have lived in the Wrangell area for a long, long time (Figure 6-1). According to clan history, the Tlingit people migrated down the Stikine River during a time when the river still flowed underneath glaciers. The population slowly moved down the river with later settlements on the coast including Anita Bay, Mill Creek, the site of the Wrangell Institute at Shoemaker Bay, Anan and many others. The petroglyphs found at Petroglyph Beach near Wrangell and throughout the Borough and the shell middens found on Etolin Island are evidence of the long settlement in the area. (Source 2010 WCP)*
>
> *The community has always been a major home to the Tlingit Kiks.ádi and Naanyaa.aayí clans, as well as the only home of the Kayaashkiditaan, S'iknax.ádi, Xook'eidí, Kaasx'agweidí, and Taalkweidí clans. Today the Wrangell Cooperative Association, a Tlingit IRA council and the federally recognized tribe for the area, maintains Shakes Island in Wrangell's Inner Harbor, Chief Shakes House and the totem park. Chief Shakes House is a replica of traditional Tlingit houses and was constructed in the 1930's using traditional knowledge and methods.*

Neither the WCA nor the CCTHITA identified sacred or culturally sensitive locations within the Wrangell area.

NOTE: Anyone desiring information concerning their respective culturally sensitive information must contact the appropriate WCA or CCTHITA tribal office for assistance.

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5 MITIGATION STRATEGY

Section 5 – Mitigation Strategy addresses Element C of the Local and Tribal Mitigation Plan Regulation Checklists.

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element C: Mitigation Strategy
C1. Does the Plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement § 201.6(c)(3))
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement § 201.6(c)(3)(i))
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?
(Requirement §201.6(c)(3)(i))
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))
Regulation Checklist – 44 CFR 201.7 Tribal Mitigation Plans
Element C: Mitigation Strategy
C1. Does the plan include a discussion of the tribal government's pre- and post-disaster hazard management policies, programs, and capabilities to mitigate the hazards in the area, including an evaluation of tribal laws and regulations related to hazard mitigation as well as to development in hazard-prone areas? [44 CFR §§ 201.7(c)(3) and 201.7(c)(3)(iv)]

5.1 AUTHORITIES, POLICIES, PROGRAMS, AND RESOURCES

The City and Borough of Wrangell existing authorities, policies, programs and resources available for hazard mitigation are listed in Table 16 through Table 18.

Table 16. Human and Technical Resources for Hazard Mitigation

Staff/Personnel	Principal Activities Related to Hazard Mitigation
City and Borough of Wrangell	
Planner or engineer with knowledge of land development and land management practices	The CBW has staff with this knowledge or works with planning and engineering consultants or contractors as needed
Engineer or professional trained in construction practices related to buildings and/or infrastructure	The CBW Director of Public Works and staff have this knowledge
Planner or engineer with an understanding of natural and/or human-caused hazards	The CBW Director of Public Works and staff have this knowledge

Table 16. Human and Technical Resources for Hazard Mitigation

Staff/Personnel	Principal Activities Related to Hazard Mitigation
CBW	
Floodplain Manager	The CBW does not have a Floodplain Manager
Surveyors	The CBW works with planning and engineering staff, consultants, or contractors as needed
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards	The CBW h has staff with this knowledge or works with planning and engineering staff and consultants or contractors as needed
Personnel skilled in Geospatial Information System (GIS) and/or Hazards Us-Multi Hazard (Hazus-MH) software	The CBW has a GIS professional on staff with this knowledge and work with a contractor as necessary.
Scientists familiar with the hazards of the jurisdiction	The CBW works with consultants or contractors as needed
Emergency Manager	The CBW's Fire Chief and Police Chief and their staff have this knowledge
Finance (Grant writers)	CBW's Economic Development Director fulfills this capacity
Public Information Officer	The Borough Manager
WCA and CCTHITA	
Planner or engineer with knowledge of land development and land management practices	The WCA works with planning and engineering consultants or contractors as needed. The CCTHITA has staff with this knowledge and works with planning and engineering consultants or contractors as needed.
Engineer or professional trained in construction practices related to buildings and/or infrastructure	The WCA works with planning and engineering consultants or contractors as needed. The CCTHITA has staff with this knowledge and works with planning and engineering consultants or contractors as needed.
Planner or engineer with an understanding of natural and/or human-caused hazards	The WCA works with planning and engineering consultants or contractors as needed. The CCTHITA has staff with this knowledge and works with planning and engineering consultants or contractors as needed.
Floodplain Manager	Neither tribe has this capability.
Surveyors	The WCA works with planning and engineering consultants or contractors as needed. The CCTHITA works with planning and engineering consultants or contractors as needed.
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards	The WCA works with planning and engineering consultants or contractors as needed. The CCTHITA works with planning and engineering consultants or contractors as needed.

Table 16. Human and Technical Resources for Hazard Mitigation

Staff/Personnel	Principal Activities Related to Hazard Mitigation
Personnel skilled in Geospatial Information System (GIS) and/or Hazards Us-Multi Hazard (Hazus-MH) software	The WCA works with planning and engineering consultants or contractors as needed. The CCTHITA has staff with this knowledge and works with planning and engineering consultants or contractors as needed.
Scientists familiar with the hazards of the jurisdiction	The WCA has staff with this knowledge or works with planning and engineering consultants or contractors as needed. The CCTHITA has staff with this knowledge or works with planning and engineering consultants or contractors as needed.
Emergency Manager	The WCA Executive Director fulfills this position as needed. The CCTHITA President fulfills this position as needed.
Finance (Grant writers)	Tribal Bookkeeper as applicable.
Public Information Officer	The Borough Manager and Tribal Executive Director as jurisdictionally applicable.

Table 17. Financial Resources for Hazard Mitigation

Type	Administrator	Purpose	Amount
General Fund	Borough Assembly and Tribal Council	Program operations and specific projects.	Variable.
General Obligation Bonds	Borough Assembly and Tribal Council	Used for the construction and/or acquisition of improvements to real property broadly available to residents and visitors. Such facilities include but are not limited to: libraries, hospitals, parks, public safety facilities, and cultural and educational facilities.	Variable.
Special Tax and Revenue Bonds	Borough Assembly and Tribal Council	Used finance capital projects that: 1) have an identified budgetary stream for repayment (e.g., specified fees, tax receipts); 2) generate project revenue but rely on a broader pledge of general fund revenues to reduce borrowing costs; or 3) finance the acquisition and installation of equipment for the local jurisdiction's general governmental purposes.	Variable.
Indian Community Development Block Grants	HUD	Provides operational funds for tribal management activities	Project-specific.
Indian Environmental General Assistance Program	U.S. Environmental Protection Agency (EPA)	Provides funding for tribal environmental improvement activities	Project-specific.
Indian Housing Block Grant	HUD	Assists IRA Tribes with obtaining adequate housing	Variable.
Employment and Training Administration, Disaster Unemployment Assistance	Department of Labor	Provides disaster related unemployment by supporting employment and training activities	Variable.
Hazard Mitigation Grant Program (HMPG)	FEMA	Supports pre- and post-disaster mitigation plans and projects. Available to Alaska communities after a presidentially declared disaster has occurred in Alaska, administered by Alaska DHS&EM.	Project-specific.
Homeland Security Preparedness Technical Assistance Program	FEMA/DHS	Supports preparedness technical assistance activities in support of the four homeland security mission areas (i.e., prevention, protection, response, recovery) and homeland security program management.	Project-specific.
Assistance to Firefighters Grant Program	FEMA/U.S. Fire Administration	Provides equipment, protective gear, emergency vehicles, training, and other resources needed to protect the public and emergency personnel from fire and related hazards. Available to fire departments and nonaffiliated emergency medical services providers.	Project-specific.

Table 17. Financial Resources for Hazard Mitigation

Type	Administrator	Purpose	Amount
Land and Water Conservation Funds	U.S. Department of the Interior	Supports the protection of federal public lands and waters and voluntary conservation on private land.	Project-specific.
Community Action for a Renewed Environment	U.S. EPA	Offers financial and technical assistance offers an innovative way for a community to organize and take action to reduce toxic pollution (e.g., stormwater) in its local environment. Through this program, a community creates a partnership that implements solutions to reduce releases of toxic pollutants and minimize people's exposure to them.	Project-specific.
Clean Water State Revolving Fund	U.S. EPA	Provides low-cost financing to eligible entities on state and tribal lands for water quality projects, including all types of non-point source, watershed protection or restoration, estuary management projects, and more traditional municipal wastewater treatment projects.	Variable.
Flood Control and Coastal Emergencies	USACE	Authorizes the USACE under PL 84-99, Flood Control and Coastal Emergencies for emergency management activities. Under PL 84-99, the Chief of Engineers, acting for the Secretary of the Army, to undertake activities including disaster preparedness, advance measures, emergency operations (flood response and post flood response), rehabilitation of flood control works threatened or destroyed by flood, protection or repair of federally authorized shore protective works threatened or damaged by coastal storm, and provisions of emergency water due to drought or contaminated sources.	Project-specific.
The Cooperative Watershed Management Program	U.S. Department of the Interior Bureau of Reclamation	Supports WaterSMART strategy by providing funding to watershed groups to encourage diverse stakeholders to form local solutions to address their water management needs. Funding is provided on a competitive basis for watershed group development and watershed restoration planning and implementation of watershed management projects.	Project-specific.
Weatherization Assistance Program	U.S. Department of Energy (DOE)	Reduces energy costs for low-income households by increasing the energy efficiency of their homes. It is the nation's single largest residential whole-house energy efficiency program. The program works through local weatherization agency. Once DOE awards the grants, states contract with more than 700 local agencies nationwide to deliver services. All work is energy-related, and does not include new roofing, siding, or similar structural improvements. The average expenditure is $6,500 per home.	$6,500 per project

Table 17. Financial Resources for Hazard Mitigation

Type	Administrator	Purpose	Amount
Renewable Energy Fund (REF)	Alaska Energy Authority	Provides funding for the development of qualifying and competitively selected renewable energy projects in Alaska. The program is designed to produce cost-effective renewable energy for both heat and power For Fiscal Year (FY) 2019, $11 million has been allocated by the governor to fund the REF. This program runs through 2023.	Project-specific.
Wood Innovation Program	U.S. Department of Agriculture	Created to substantially expand and accelerate wood energy and wood products markets throughout the United States to support forest management needs. A minimum of a 50% of the total eligible costs must come from a non-federal source. In FY 2018, $8 million in federal funding was awarded to fund 34 projects.	Project-specific.

Table 18. Legal and Regulatory Resources for Hazard Mitigation

Name	Description	Hazards Addressed
Comprehensive Plan	Road map for community change	Physical environment and community history include: severe weather, erosion/coastal storm surge, wildfire
Land Use Plan	Guides local permitting process	All
Emergency Response Plan	Guides emergency response	All
Building Code	Defines safe building practices ensuring long-term community goals are not threatened	All
Zoning Ordinances	The CBW can exercise this authority	
Subdivision and special purpose ordinances	The CBW can exercise this authority	

5.2 NFIP PARTICIPATION

The City and Borough of Wrangell no longer participates in the National Flood Insurance Program. The City and Borough of Wrangell does not have a repetitive flood property inventory that meets NFIP criteria as the loss thresholds are substantially below FEMA values.

5.3 MITIGATION GOALS

Mitigation goals are defined as general guidelines that explain what a community wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing community-wide vision. For the 2020 MJHMP, the overarching goal is for Wrangell to be a disaster resilient community. A disaster resilient community is able to prepare for, respond to, and recover from adverse hazards and disasters. According to laresilience.org, "in the resilience framework, less emphasis is placed on traditional, individually focused preparedness efforts… building community resilience is really about making communities stronger."

5.4 POTENTIAL MITIGATION ACTIONS AND PROJECTS

Mitigation actions and projects help achieve the goals of the Mitigation Plan. Potential mitigation actions to be considered are listed below in Table 19. This list addresses every hazard profiled in this plan and is based on the plan's risk assessment as well as lessons learned from recent disasters. It was developed using: FEMA success stories and best management practices; FEMA job aids; local and regional plans and reports; and input from subject matter experts and guided by the Wrangell planning team.

The committee determined that high priority activities are essential to remedy or prevent a major health/safety hazard. They meet FEMA HMA grant criteria, including project eligibility, benefit-cost, and performance period. Medium activities are important in building a culture and practice of disaster resilience that will prevent new risks. They do not necessarily require and/or meet FEMA HMA grant criteria (but may qualify for other state and federal funds). Low priority projects still require further investigation toward developing a more comprehensive project idea. There are notes about project status from the legacy plan.

Table 19. Potential Mitigation Actions and Projects

Hazard	Description	Pros	Cons	Priority	Legacy HMP Status
Multiple	Develop a public outreach and education programs regarding potential hazard impacts and personal planning preparations (annual health fair, educational fliers, school visits, high school senior project, hazard awareness week).	Life/Safety issue Risk reduction Benefit to entire community Inexpensive	Staff time	High	Not completed: Staff acquiring funding and resources.
Multiple	Develop a list of internal and external suppliers of equipment, supplies (batteries, shovels etc.), medical supplies (i.e. voluntary registry of equipment such as earthmoving, generators, etc.).	Life/Safety issue Risk reduction Benefit to entire community Inexpensive	Staff time	Medium	
Multiple	Develop or refine local emergency announcement procedures and back up plans.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive	Staff time	Medium	
Multiple	Obtain and install a Siren Warning system to alert for various emergencies or disasters	Life/Safety issue/Risk reduction Benefit to entire community Federal and State assistance available	Staff time, >$50,000	High	Not completed: Staff acquiring funding and resources.
Multiple	Develop and install a signage program for hazards posted at key facilities or locations.	Life/Safety issue Risk reduction Benefit to entire community	Staff time, >$5,000	Medium	
Multiple	Develop alternative water sources: Investigate further feasibility of Sunrise Lake; Consider Desalination; Investigate SMB water supply and hooking into existing system; Explore water opportunities from Institute Creek, the 6.5 mile mill creek for emergency use and hooking into existing system	Risk and damage reduction. Benefit to entire community.	Staff time. Research into feasibility necessary. Potentially expensive	Medium	

Table 19. Potential Mitigation Actions and Projects

Hazard	Description	Pros	Cons	Priority	Legacy HMP Status
Earthquake	Complete Dam stabilization and replacement	Life/Safety Issue Benefit to entire community Federal funding may be available	Expensive, at least $500,000	Medium	
Earthquake	Integrate hazard construction methodologies into newly constructed infrastructure and public buildings.	Benefit to entire community Risk reduction	Staff time	High	
Earthquake	Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available	Staff time	High	Not completed: Staff acquiring funding and resources.
Earthquake	Contract a structural engineering firm to assess the identified buildings and facilities to determine their structural integrity and devise a strategy to improve their earthquake resistance.	Benefit to entire community Risk reduction	Feasibility and need analysis needed. 1 – 5 years	Medium	Not completed: Staff acquiring funding and resources.
Flood and Erosion	Provide public awareness and response education for residents within the potential flood impact zone of the reservoir dams	Benefit to entire community Risk reduction	Staff time	Medium	
Flood and Erosion	Develop a storm Water management plan for sheet flood prone areas of town	Life/Safety issue/Risk reduction Benefit to entire community Federal and State assistance available	Staff time, >$50,000	Low	
Ground Failure	Continued public education.	Life/Safety issue/Risk reduction Benefit to entire community	Mapped landslide zones do not exist at this time.	High	Not completed: Staff acquiring funding and resources.

Table 19. Potential Mitigation Actions and Projects

Hazard	Description	Pros	Cons	Priority	Legacy HMP Status
		Federal and State assistance available			
Ground Failure	Conduct studies of unstable soils	Life/Safety issue/Risk reduction Benefit to entire community Federal and State assistance available	Mapped landslide zones do not exist at this time. 5+ years to implement	High	Not completed: Staff acquiring funding and resources.
Tsunami	Siren and lights at both ends of town for Tsunami and other hazardous warnings	Life/Safety Project	Staff time, >$50,000	High	
Tsunami	Inundation Mapping	Life/Safety Issue Benefit to entire community Federal funding may be available	Expensive, at least $100,000	Medium	Not completed: Staff acquiring funding and resources.
Tsunami	Update Wrangell's Emergency Operations Plan, as needed	Life/Safety issue/Risk reduction Benefit to entire community Inexpensive State assistance available 1 – 5 years, or as needed.	Staff time	Medium	Not completed: Staff acquiring funding and resources.
Volcanic Ash	Provide adequate supplies of breathing apparatus for vulnerable populations, first responders, and critical facility crews.	Life/Safety issue/Risk reduction Inexpensive	Staff time, >$50,000	Medium	
Volcanic Ash	Determine needs of equipment that may be needed during an event to assure its continued and safe operation	Life/Safety issue/Risk reduction Inexpensive	Staff time	Medium	
Severe Weather	Research and consider instituting the National Weather Service program of *"Storm Ready"*.	Life/Safety issue Risk reduction Benefit to entire community	Staff time	High	Not completed: Staff acquiring funding and resources.

Table 19. Potential Mitigation Actions and Projects

Hazard	Description	Pros	Cons	Priority	Legacy HMP Status
		Inexpensive State assistance available			
Severe Weather	Increase water storage capacity: Dredge existing reservoirs and perform stump removal; Install a bypass line to the upper reservoir	Life/Safety Issue Benefit to entire community Federal funding may be available	Expensive, at least $100,000	Medium	
Severe Weather	Increase back up power generation: Purchase Generators to provide enough back up power to provide essential services and sustain community; Purchase portable generating units for needs for vulnerable populations (elders, medical); Purchase portable generating units for essential services; Explore alternative power sources such as wind and solar for emergency services; Work with Alaska Dept. of Transportation to purchase back-up generator for the airport	Life/Safety Issue Benefit to entire community Federal funding may be available	Expensive, at least $100,000	Medium	
Severe Weather	Encourage weather resistant building construction materials and practices.	Risk and damage reduction. Benefit to entire community.	May require ordinance change. Potential for increased staff time. Research into feasibility necessary. Political and public support not determined. 1 – 5 year implementation	Medium	Not completed: Staff acquiring funding and resources.
Wildland Fire	Develop a local coordinated response and communication channel with the USFS.	Life/Safety issue/Risk reduction Inexpensive	Staff time	Low	

Table 19. Potential Mitigation Actions and Projects

Hazard	Description	Pros	Cons	Priority	Legacy HMP Status
Wildland Fire	Develop a local Smokey Bear awareness campaign with the USFS to educate against fires and mitigate fire threats	Life/Safety issue/Risk reduction Inexpensive Benefit to entire community	Staff time	Medium	
Wildland Fire	Develop, adopt, and enforce burn ordinances that control outdoor burning, require burn permits and restricts open campfires during identified weather periods (wind, dry etc.)	Life/Safety issue Risk reduction Benefit to entire community Inexpensive	Staff time	High	

5.5 MITIGATION ACTION PLANS

A mitigation action plan is a prioritized list of proposed mitigation projects and actions that a community hopes to implement to reduce its' risks and vulnerabilities. The 2020 mitigation action plan is shown in Table 20. Based on the prioritization criteria developed for Table 19, medium and high priority projects were selected for the mitigation action plan. These prioritized projects are to be pursued by CBW, WCA, and the CCTHITA over the next five years.

Table 20. Mitigation Action Plan

Description	Jurisdiction	Potential Funding	Timeframe	Priority
Develop a public outreach and education programs regarding potential hazard impacts and personal planning preparations (annual health fair, educational fliers, school visits, high school senior project, hazard awareness week).	Borough, Tribes DCRA DHS&EM	Borough DCRA DHS&EM	<1 year	High
Develop a list of internal and external suppliers of equipment, supplies (batteries, shovels etc.), medical supplies (i.e. voluntary registry of equipment such as earthmoving, generators, etc.).	Borough, Tribes	Borough and Tribal Budget	Ongoing	Medium
Develop or refine local emergency announcement procedures and back up plans.	Borough, Tribes DCRA DHS&EM	Borough and Tribal Budget	Ongoing	Medium
Obtain and install a Siren Warning system to alert for various emergencies or disasters	Borough DCRA DHS&EM	HMGP grant	2-3 years	High
Develop and install a signage program for hazards posted at key facilities or locations.	Borough	Borough and Tribal Budget	>1 year	Medium
Develop alternative water sources: Investigate further feasibility of Sunrise Lake; Consider Desalination; Investigate SMB water supply and hooking into existing system; Explore water opportunities from Institute Creek, the 6.5 mile mill creek for emergency use and hooking into existing system	Borough DCRA DHS&EM	HMGP grant	3-5 years	Medium
Complete Dam stabilization and replacement	Borough	Flood Control and Coastal Emergencies funding	3-5 years	Medium
Integrate hazard construction methodologies into newly constructed infrastructure and public buildings.	Borough	Borough and Tribal Budget	>1 year	High
Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	Borough DHS&EM FEMA	State Grants	>1 year	High

Table 20. Mitigation Action Plan

Description	Jurisdiction	Potential Funding	Timeframe	Priority
Contract a structural engineering firm to assess the identified buildings and facilities to determine their structural integrity and devise a strategy to improve their earthquake resistance.	Borough DHS&EM	State Grants PDM	1-2 years	Medium
Provide public awareness and response education for residents within the potential flood impact zone of the reservoir dams	Borough	Borough and Tribal Budget	>1 year	Medium
Continued public education.	Borough, Tribes	Borough and Tribal Budget	Ongoing	High
Conduct studies of unstable soils	Borough DHS&EM	State Grants PDM	>1 year	High
Siren and lights at both ends of town for Tsunami and other hazardous warnings	Borough DHS&EM	PDM or HMGP State DHS&EM/ NOAA (NTHMP), State DHS&EM / Homeland Security Grants	>1 year	High
Inundation Mapping	State DHS&EM NOAA/NTHMP	NOAA/NTHMP	>5 years	Medium
Update Wrangell's Emergency Operations Plan, as needed	Borough	DHS&EM/local funds	As needed	Medium
Provide adequate supplies of breathing apparatus for vulnerable populations, first responders, and critical facility crews.	Borough	Borough and Tribal Budget	>1 year	Medium
Determine needs of equipment that may be needed during an event to assure its continued and safe operation	Borough	Borough and Tribal Budget	>1 year	Medium
Research and consider instituting the National Weather Service program of *"Storm Ready"*.	Borough NWS	Borough and Tribal Budget	<1 year	High
Increase water storage capacity: Dredge existing reservoirs and perform stump removal; Install a bypass line to the upper reservoir	Borough DHS&EM	Flood Control and Coastal Emergencies funding	2-3 years	Medium
Increase back up power generation: Purchase Generators to provide enough back up power to provide essential services and sustain community; Purchase portable generating units for needs for vulnerable populations (elders, medical); Purchase portable generating units for essential services; Explore alternative power sources such as wind and solar for emergency services; Work with Alaska Dept. of Transportation to purchase back-up generator for the airport	Borough DHS&EM	HMGP grant/Assistance to Firefighters Grant Program grants	2-3 years	Medium
Encourage weather resistant building construction materials and practices.	Borough	Borough and Tribal Budget	<1 year	Medium

Table 20. Mitigation Action Plan

Description	Jurisdiction	Potential Funding	Timeframe	Priority
Develop a local Smokey Bear awareness campaign with the USFS to educate against fires and mitigate fire threats	Borough USFS	Borough and Tribal Budget	<1 year	Medium
Develop, adopt, and enforce burn ordinances that control outdoor burning, require burn permits and restricts open campfires during identified weather periods (wind, dry etc.)	Borough	Borough and Tribal Budget	Ongoing	High

5.6 PLAN INTEGRATION

After MJHMP adoption, each planning team member will strive to that the MJHMP, in particular each mitigation action project, is incorporated into existing planning mechanisms such as their Comprehensive Plan, Economic Development or Business Plan, and Bureau of Indian Affairs Indian Reservation Roads Plan, as well as seeking other integration opportunities where appropriate. The MJHMP planning team will achieve this by undertaking the following activities.

- Review city and tribal regulatory tools to determine where to integrate the mitigation philosophy and implementable initiatives within current and future planning mechanisms.
- Work with pertinent community entities to implement MJHMP philosophies and mitigation strategy initiatives (including the MAP) into relevant current and future planning mechanisms (i.e. Comprehensive Plan, Economic Development Plan, Capital Improvement Project List, Transportation Improvement Plan, etc.).

5.7 PROGESS IN LOCAL MITIGATION EFFORTS

The City and Borough of Wrangell's Capital Improvement Projects list (Table 21) contains data for Fiscal Year 2017 – 2018 data. The Tribes did not participate in the legacy HMP.

Table 21. Proposed Wrangell Capital Budget Requests

Project Description	State Request Amt.	Total Project Amt.	State or Federal	Status
Shoemaker Bay Float - Construction	5,000,000	10,000,000	State	Priority #1 in Governor's capital budget for State Harbor funding for FY 2018
Water Treatment Plant Improvements	13,000,000	13,000,000	State/ Federal	Undefined
Water Main Distribution System Replacement, Phase 1 - updated costs based on existing funding in place vs. shortfall	500,000	1,000,000	State/ Federal	DEC Loan paperwork underway; DEC MMG received.
Fire Engine/Pumper	275,000	275,000	--	Undefined
Pool Facility Improvements (Pool Roof, Mechanical, Remodel) Phase I	--	2,000,000	State/ Federal	Assessment completed

Table 21. Proposed Wrangell Capital Budget Requests

Project Description	State Request Amt.	Total Project Amt.	State or Federal	Status
Wrangell Medical Center Design and Construction	--	35,000,000	State	Undefined
Wrangell Boat Yard Improvements - Final Improvements	4,200,000	4,200,000	State/ Fed	Undefined
Public Safety Building Renovations	950,000	950,000	State/ Federal	Undefined
Ozone Generator Replacement - DELETE Pursuing purchase now	300,000	300,000	State/ Federal	DEC Loan paperwork underway
Water Main Distribution System Replacement, Phase 2 (Zimovia Highway)	1,583,560	2,262,229	State	Undefined
Back-up Diesel Generation	2,700, 000	2,700, 000	--	Undefined
Ash Street/Lemiux Watermain Replacement	1,000,000	1,000,000	--	AK Rural Water Utilities completed assessment; DEC loan application 1/17
Community Center Life & Safety Improvements (phase II) Fire System upgrades	250,000	2,715,000	State/ Federal	Phase I design is complete. Condition Assessment is complete.
SCBA's for personal Protective Equipment	60,000	83,700	--	Undefined

6 REFERENCES

This section provides a comprehensive reference list used to develop the MJHMP.

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7 PLAN ADOPTION

Section 7 – Plan Adoption addresses Element E of the Local and Tribal Mitigation Plan Regulation Checklist.

Regulation Checklist – 44 CFR 201.6 Local Mitigation Plans
Element E: Plan Adoption
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5)) E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))
Regulation Checklist – 44 CFR 201.7 Tribal Mitigation Plans
Element E: Plan Adoption
E1. Does the plan include assurances that the tribal government will comply with all applicable Federal statutes and regulations in effect with respect to the periods for which it receives grant funding, including 2 CFR Parts 200 and 3002, and will amend its plan whenever necessary to reflect changes in tribal or Federal laws and statutes? [44 CFR § 201.7(c)(6)] E2. Does the plan include documentation that it has been formally adopted by the governing body of the tribal government requesting approval? [44 CFR § 201.7(c)(5)]

7.1 JURISDICTIONAL ADOPTION

The 2020 City and Borough of Wrangell Multi-Jurisdictional Hazard Mitigation Plan was formally adopted by the City and Borough of Wrangell Assembly via resolution on [To be completed]. A scanned copy of the resolution follows this page. It will also be kept on file with City and Borough of Wrangell and additional copy will be sent to DHS&EM and FEMA.

7.2 TRIBAL GOVERNMENT ADOPTION

All tribal governments will comply with applicable federal statutes and regulations in effect, with regard to any grants or funding awarded to the Tribe for mitigation actions.

The 2020 City and Borough of Wrangell Multi-Jurisdictional Hazard Mitigation Plan was formally adopted by the Wrangell Cooperative Association Tribal Council via resolution on [To be completed]. A scanned copy of the resolution follows this page. It will also be kept on file with Wrangell Cooperative Association Tribal Council and additional copy will be sent to DHS&EM and FEMA.

The 2020 City and Borough of Wrangell Multi-Jurisdictional Hazard Mitigation Plan was formally adopted by the Central Council of the Tlingit and Haida Indian Tribes of Alaska via resolution on [To be completed]. A scanned copy of the resolution follows this page. It will also be kept on file with Central Council of the Tlingit and Haida Indian Tribes of Alaska and additional copy will be sent to DHS&EM and FEMA.

Adoption Resolutions

APPENDIX A – PUBLIC PARTICIPATION AND PLANNING PROCESS DOCUMENTATION

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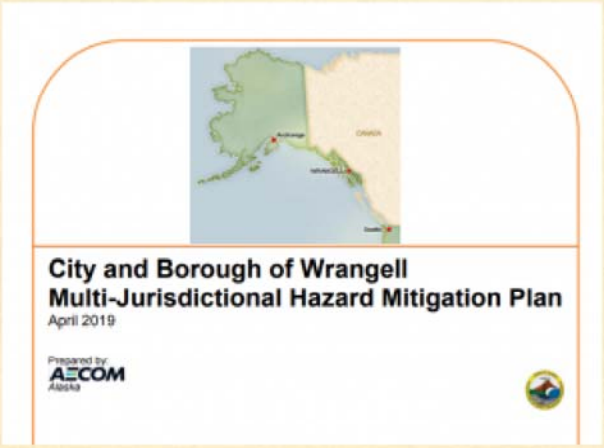
Planning and Zoning

Multi Jurisdictional Hazard Mitigation Plan



In January, 2019, an initial draft of the proposed Hazard Mitigation Plan was made available for review and comments. The Borough's initial comments are listed below, but at the time, staff were still working on the Critical Facility Hazard spreadsheet which provides much of the data for Chapter 6 Vulnerability Assessment and Chapter 7 Mitigation Impacts.

The Planning and Zoning Commission is holding a Special Meeting for public input on the plan and to discuss any changes or additions. The public is encouraged to attend.

Please review the report and if you have questions or comments, please contact Carol Rushmore at 907-874-2381 or ecodev@wrangell.com. Comments should be submitted by June 10.

Supporting Documents

- Draft comments submitted for review to AECOM 7-3-19 (17 MB)
- DRAFT Hazard Mitigation Plan April 2019 (10 MB)
- Critical Facility Spreadsheet 3-27-19 (47 KB)
- Recommended Hazard Mitigation Actions 3-12-19 (19 KB)
- Draft comments submitted for review to AECOM 1-14-19 (17 MB)

About
Borough Entitlement Lands
Online Parcel Mapping
Comprehensive Plan
Conditional Use Permit Application
Variance Permit Application
Zoning Ordinance
Zoning in Remote Outlying Areas
Encroachment Permit

Contact Information

Zoning Administrator
Carol Rushmore
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Wrangell, AK 99929
907-874-2381

fax 907-874-3952
ecodev@wrangell.com

View Full Contact Details

Business

- Business and Economic Opportunities
- Business Licensing
- Bids, RFPs & Auctions
- Forms and Permits
- Business Directory

Departments

- Administration
- Economic Development
- Electrical
- Finance
- Library
- Museum

Additional Info

- Home
- Staff Login
- Sitemap

Visitors

- Visitor Services/Tourism
- Things to Do
- Places to Stay
- Shopping and Dining
- Festivals and Events
- Convention Center
- Museum
- Request Visitor Information
- Business Directory

Departments

- Parks and Recreation
- Planning and Zoning
- Port and Harbors
- Public Safety
- Public Works

P.O. Box 531 | Wrangell, AK 99929 | 907-874-2381
City Hall Hours: 9:00am to 4:00pm

From: Simmons, Scott

To: "sally.cox@alaska.gov"; "jimmy.smith@alaska.gov"; "twolf@denali.gov"; "callard@denali.gov"; "rick.dembroski@alaska.gov"; "mike.johnson@alaska.gov"; "scott.nelsen@alaska.gov"; "eli.ward@alaska.gov"; "deanne.stevens@alaska.gov"; "kathryn.pyne@alaska.gov"; "sheri.gray@alaska.gov"; "paul.khera@alaska.gov"; "dan.monteleone@alaska.gov"; "john.clendenin@alaska.gov"; "michael.angove@noaa.gov"; "louise.fode@noaa.gov"; "aimee.fish@noaa.gov"; "amy.holman@noaa.gov"; "kyle.wright@tananachiefs.org"; "djnicolsky@alaska.edu"; "naruppert@alaska.edu"; "Kenneth.J.Eisses@usace.army.mil"; "scott.crockett@ak.usda.gov"; "brett.nelson@ak.usda.gov"; "ann.Y.gravier@hud.gov"; "jconaway@usgs.gov"; "adevaris@usgs.gov"; "janet.schaefer@alaska.gov"; "robin.bronen@akijp.org"; "denise.pollock@akijp.org"; "essmith@anthc.org"; "kwallace@usgs.gov"; "swhite@avcp.org"; "steve.heppner.bia.ak@gmail.com"; "terri.lomax@alaska.gov"; "Soderlund.Dianne@epamail.epa.gov"; "joel.curtis@noaa.gov"; "sam.albanese@noaa.gov"; "meg.mueller@ak.usda.gov"; "merlaine.kruse@ak.usda.gov"; "patty.burns@alaska.gov"; "margie.goatley1@alaska.gov"; "khoward@blm.gov"; "nicole.kinsman@noaa.gov"; "bruce.r.sexaur@usace.army.mil"; "mtavelton@usace.army.mil"; "steve.mcgroarty@alaska.gov"; "megan.kohler@alaska.gov"; "jade.gamble@alaska.gov"; "essmith@anthc.org"; "kwallace@usgs.gov"; "swhite@avcp.org"; "steve.heppner.bia.ak@gmail.com"; "jimmy.smith@alaska.gov"; "terri.lomax@alaska.gov"; "Soderlund.Dianne@epamail.epa.gov"; "joel.curtis@noaa.gov"; "sam.albanese@noaa.gov"; "meg.mueller@ak.usda.gov"; "merlaine.kruse@ak.usda.gov"; "ak_le@fws.gov"; "eddie.zingone@noaa.gov"; "patty.burns@alaska.gov"; "margie.goatley1@alaska.gov"; "khoward@blm.gov"; "nicole.kinsman@noaa.gov"; "bruce.r.sexaur@usace.army.mil"; "mtavelton@usace.army.mil"; "steve.mcgroarty@alaska.gov"; "megan.kohler@alaska.gov"; "jade.gamble@alaska.gov"

Cc: Evans, Jessica (jessica.evans@aecom.com); Rabon, Angel; Cogger, Corinne; Volper, Kaley

Subject: Hazard Mitigation Project Agency Involvement Participant Invitation Letter

Date: Friday, February 02, 2018 11:38:00 AM

Attachments: image003.png

Dear Potential HMP Development Participants,
AECOM (formerly URS) has received a 2014 contract from the State Division of Homeland Security and Emergency Management (DHS&EM) to develop Local/Tribal Multi-Jurisdictional Hazard Mitigation Plans (MJHMPs) for the following communities: Each group defines the HMP type and targeted communities.

The following communities' do not currently have an HMP. These communities will develop plans that meet FEMA's current MJHMP requirements:

New MJHMP and Tribal HMP Development

- ***Organized Cities with Co-Located Villages***
  - Gustavus (2nd Class City)
  - Manokotak (2nd Class City with Tribal Village)
  - Tenakee Springs (2nd Class City)

The following communities' currently have expired HMPs. These communities will have their plans updated from HMP to MJHMPs to meet current FEMA city and tribal requirements:

MJHMP/Tribal HMP Updates Required

- ***Organized Cities with Co-Located Native Villages***
  - Anvik (2nd Class City with Native Village)
  - Seward (2nd Class City with Native Village)

Borough HMPs converted to MJHMP Update Required

- The City and Borough of Wrangell's (CBW) legacy HMP includes two-collocated villages. CBW's HMP is currently expired. CBW's HMP will be

converted to meet FEMA's Multi-Jurisdictional Plan requirements with each Tribe receiving separate Tribal HMPs within CWB's MJHMP to meet current FEMA city and tribal requirements.

- The Aleutians East Borough's (AEB) legacy HMP includes six organized cities and their collocated villages. AEB's HMP is currently expired. AEB's HMP will be converted to meet FEMA's Multi-Jurisdictional Plan requirements with each constituent community and native village receiving separate HMPs within AEB's MJHMP to meet current FEMA requirements:

  - ***AEB Organized Cities with Co-Located Villages***

    - Akutan (2nd Class City with Tribal Village)
    - Cold Bay (2nd Class City only)
    - False Pass (2nd Class City with Tribal Village)
    - King Cove (2nd Class City with 2-Tribal Villages)
    - Nelson Lagoon (2nd Class City with Tribal Village)
    - Sand Point (2nd Class City with 2-Tribal Villages)

We invite you to participate in this important community planning effort during the development process. Community newsletters will be located on the DHS&EM Local/Tribal All Hazard Mitigation Plan Development website at: *https://ready.alaska.gov/plans/localhazmitplans* as the communities finalize them.

Please feel free to contact me and to forward this email to the most appropriate person within your agency involved with hazard assessments, hazard mitigation plan development or community specific hazard information or planning suggestions. (Please cc me so I may update the contact list)

I encourage you to acknowledge receiving this invitation at your earliest convenience to allow me to include your participation (with appropriate acknowledgments) within the Draft and Final HMPs prior to State and FEMA review and subsequent approvals.

Kind Regards
-Scott-

AECOM
R. Scott Simmons, CFM, CPM
Senior Emergency Management Planner

700 G Street, Suite 500, Anchorage, AK 99501
eMail: scott.simmons@aecom.com
Phone: 907.261.9706 or 800.909.6787
Fax: 907.562.1297
Personal Cell: 907.841.1832

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CITY AND BOROUGH OF WRANGELL
LEGACY 2009 HAZARD MITIGATION PLAN UPDATE

Newsletter #1 **December 2018**

This newsletter describes the City and Borough of Wrangell's Hazard Mitigation Plan Update project development processes to all interested agencies, stakeholders, and the public; and to solicit plan update comments.

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency Management Agency (FEMA) to update your legacy 2009 Hazard Mitigation Plan (HMP) and convert it into a Multi-Jurisdictional Hazard Mitigation Plan (MJHMP) that includes both collocated City and Tribal governments.

AECOM was contracted to assist the City and Borough of Wrangell with converting your 2009 HMP into a 2018 FEMA approvable Multi-Jurisdictional HMP (MJHMP).

The MJHMP will identify all natural hazards, such as earthquake, flood, ground failure, severe weather, drought, and wildland fire hazards, etc. The plan will also identify the people and facilities potentially at risk and ways to mitigate damage from future hazard impacts. The public participation and planning process is documented as part of these projects.

What is Hazard Mitigation?

Hazard mitigation projects eliminate the risk or reduce the hazard impact severity to people and property. Projects may include short- or long-term activities to reduce exposure to or the effects of known hazards. Hazard mitigation activities include relocating or elevating buildings, replacing insufficiently sized culverts, using alternative construction techniques, or developing, implementing, or enforcing building codes, and education.

Why Do We Need to Update the HMP?

Communities must have a current State, FEMA approved, and community adopted updated mitigation plan to receive a project grant from FEMA's pre- and post-disaster grants identified in their Hazard Mitigation Assistance Guides as well as for other agency's mitigation grant programs.

A FEMA approved and community adopted MJHMP enables the Local, collocated Tribal governments and other participating jurisdictions to apply for the Hazard Mitigation Grant Program (HMGP), a disaster related assistance program; the Pre-Disaster Mitigation (PDM), and the National Flood Insurance Program (NFIP) Flood Mitigation Assistance (FMA) grant programs.

The Planning Process

There are very specific federal requirements that must be met when preparing a FEMA approvable MJHMP. These requirements are commonly referred to as the Disaster Mitigation Act of 2000, or DMA2000 criteria. Information about the criteria and other applicable laws and regulations may be found at: http://www.fema.gov/mitigation-planning-laws-regulations-guidance.

The DMA2000 requires the updated HMP to include and document the following topics:

- New Planning Team membership and processes
- HMP update participation and plan reviewers,
- Identify new hazards not formerly addressed,
- Explain how your hazard impacted you since adoption and implementation,
- Identify new, existing, and future critical facilities were or may be impacted by known hazards,
- Determine their "estimated" replacement costs,
- Define the community's population risk and critical facility vulnerabilities,
- Review current, and update existing hazard mitigation goals as needed to better meet needs,
- Determine each project's current status within the Mitigation Strategy. Were they completed, deleted, delayed, combined/changed, or still viable and ongoing? Also provide a brief explanation for any changes.
- Update the MJHMP Maintenance section to reflect how the (City, Village, or Borough) completed legacy HMP annual review commitments, integrated HMP components into community planning mechanisms, and identify whether it was effective or not. Then update the process to make it more effective for future use.
- Provide a copy of the community's new MJHMP Adoption Resolution

FEMA has prepared Local and Tribal Planning Guidance (respectively available at: https://www.fema.gov/hazard-mitigation-planning-resources); that explains how the legacy MJHMP Update meets DMA2000 requirements.

We are currently in the very beginning stages of preparing the MJHMP update. We will be conducting a Planning

Team Meeting to introduce the project and planning team, to gather comments from community residents update hazards lists, and collect data to refine the vulnerability assessment.

We Need Your Help

Please use the following table to confirm the hazards AND identify new hazards not formerly addressed.

2018 CBW Hazard Identification Worksheet

Hazard	2009 HMP	Still Valid
Previously Identified and Profiled		
Earthquake (EQ)	Yes (L)	Yes
Flood (Erosion) (FL)	Yes (L)	Yes
Ground Failure (GF) Avalanche, Landslide, Melting Permafrost, and/or Subsidence	Yes (M)	Yes
Weather (WX), Severe Winter storms, rain, snow, drought, etc.	Yes (M)	Yes
Tsunami & Seiche (TS)	Yes (L)	Yes
Volcanic Ash (VO)	No	Yes
Wildland Fire (WF)	Yes (M)	Yes

Critical Facilities Hazard Location Determination

The legacy 2009 HMP identified critical facilities within the Wrangell area, but the list needs to be reviewed and updated and the estimated value and location (latitude/longitude) determined.

In addition, the number and value of structures, and the number of people living in each structure will need to be documented. Once this information is collected we will determine which critical facilities, residences, and populations are vulnerable to specific hazards in Wrangell. Please review and update the facilities list to assist us with better defining your vulnerabilities and potential losses. Please add additional facilities not included on the critical facilities spreadsheet we have included with this newsletter.

Please email or fax updated hazard and critical facility information directly to AECOM or provide it to Ms. Lisa Von Bargen, your community Planning Team Leader.

The Planning Team

The planning team is being led by Borough Manager Lisa Von Bargen with assistance from Borough Mayor Steve Prysunka , Vice Mayor Patty Gilbert, Economic Development Director Carol Rushmore, Facility Maintenance Director Amber Al-Haddad, the Wrangell Coop Association's Ester Ashton, and the Tlingit and Haida Indian Tribes President Richard Peterson, and AECOM (contracted by DHS&EM) providing assistance and guidance to the planning team throughout the planning process.

Public Participation

Public involvement will continue throughout the project. The goal is to receive comments, identify key issues or concerns, and improve mitigation ideas and to guide the community.

We encourage you to take an active part in preparing the City and Borough of Wrangell Hazard Mitigation Plan development effort. The purpose of this newsletter is to keep you informed and to allow you every opportunity to voice your opinion regarding these important projects. Please contact your community HMP Team Leader or Scott Simmons, AECOM directly if you have any questions, comments, or requests for more information:

City and Borough of Wrangell
Planning Team Leader
Lisa Von Bargen
PO Box 531
Wrangell, AK 99929
Phone: 874.2381
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AECOM
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Emergency Management Planner
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DHS&EM
Mike Johnson
State Hazard Mitigation Planner
PO Box 5750
Anchorage, AK 99505-5750
428.7055 or 800.478.2337
mike.johnson@alaska.gov

From:	ecodev@wrangell.com
To:	Simmons, Scott
Cc:	Lisa Von Bargen; Dorianne Sprehe; WORK; Amber Al-Haddad
Subject:	CBW Hazard Mitigation Plan initial plan comments.
Date:	Monday, January 14, 2019 8:04:13 PM
Attachments:	image004.png image003.png City_SE_Map Location_GEN- a.jpg

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Scott,
I am providing a link to the document with comments we have thus far on the Hazard Mitigation Plan. The last version you had emailed was frm (it was too large to email) Chapters 2, 3, 5 and 6 have been reviewed with comments, and Ch. 7 only minimally. It should be in Track Changes format. Until the planning team can meet together sometime in February to discuss some of these tables and how we want to prioritize and define issues, this is all I can provide right now. Also attached is the updated Spreadsheet, but pretty similar to the 12-8-18 version i had sent previously. There is some information that is being worked on and we are trying to get the valuation information but could not get it put together prior to mid January. Please let me know if you have any issues downloading. There are still some questions I have of some individuals, but to meet your deadline of mid January, here are our initial comments. I have also not been able to talk to the Esther at the Tribe regarding some of their resource capabilities as in Ch. 7 so will work with them in the near future as well.

http://www.wrangell.com/planning/multi-jurisdictional-hazard-mitigation-plan

Attached is also a locational map (figure 2.1) if you would like to use it.

Carol Rushmore

-----Original Message-----
From: "Simmons, Scott" <scott.simmons@aecom.com>
Sent: Monday, January 14, 2019 3:15pm
To: "ecodev@wrangell.com" <ecodev@wrangell.com>
Subject: RE: CBW Community Workgroup Meetings' Minutes

Thank you Carol

Kind Regards
-Scott-

R. Scott Simmons, CFM, CPM
Senior Emergency Management Professional

700 G Street, Suite 500, Anchorage, AK 99501
eMail: scott.simmons@aecom.com

Phone: 907.261.9706 or 800.909.6787
Fax: 907.562.1297
Personal Cell: 907.841.1832

From: ecodev@wrangell.com [mailto:ecodev@wrangell.com]
Sent: Monday, January 14, 2019 3:14 PM
To: Simmons, Scott
Subject: RE: CBW Community Workgroup Meetings' Minutes

Scott,
I am trying to compile all the changes to get to you tomorrow, but as an FYI.. I was looking over the notes from our 11/27 and 11/28 meetings.

For 11/27 you say borough assembly members.. then list them as well as staff all underneath. the bold should be assembly members and staff

On the 11/28 notes... you have Borough Assembly members in bold then list the planning team, but there were no Assembly members present, so the bold should say City and Borough of Wrangell Planning Team members. and then the attached sign in sheet you attached for the 11/28 meeting was for 11/27 not the 11/28 meeting.

Carol

-----Original Message-----
From: "Simmons, Scott" <scott.simmons@aecom.com>
Sent: Wednesday, January 9, 2019 3:25pm
To: "Carol Rushmore" <ecodev@wrangell.com>
Subject: RE: CBW Community Workgroup Meetings' Minutes

Thank you Carol,
I think is joint priority is the critical facility (GIS) data so we can begin the vulnerability assessment that you expressed as one your greatest needs.

Kind Regards
-Scott-

R. Scott Simmons, CFM, CPM
Senior Emergency Management Professional

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Personal Cell: 907.841.1832

From: Carol Rushmore [mailto:ecodev@wrangell.com]
Sent: Wednesday, January 09, 2019 3:19 PM
To: Simmons, Scott
Cc: 'Lisa Von Bargen'
Subject: RE: CBW Community Workgroup Meetings' Minutes

Hi Scott,
We are trying to get you some comments by early next week on at minimum chapter 7, but will look at whatever we can. Bulk of our comments will likely be on the public draft. Trying to get some of the reviews consolidated to send to you. If you have an updated version from what we last have from November.. could you please forward that to me? Thank you.

Carol Rushmore
Economic Development Director
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Like “WrangellCVB” or "City and Borough of Wrangell” on Facebook

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From: Simmons, Scott [mailto:scott.simmons@aecom.com]
Sent: Friday, December 07, 2018 1:06 PM
To: Carol Rushmore <ecodev@wrangell.com>
Subject: RE: CBW Community Workgroup Meetings' Minutes

Hi Carol,
Yes, I remember all that we discussed. We had discussed a few times the contract ends in March. We have accomplished a lot and I believe I have made the few changes we discussed during our meetings.

Please keep in mind I have provided a good working draft; mark it up and send it back to me via postal or fax on the pages with mark-ups.

I will edit until Mid-January. I think you and I discussed how to simplify the critical facilities spreadsheet:
we will delete the GPS coordinates from the spreadsheet;

the “X’s” will identify each facilities hazard threats;
structure replacement costs can be estimated (most of your planning team could easily help estimate their facilities replacement costs)
We will make narrative statements drafted in the Vulnerability Analysis section with the tables and the yellow highlighted text

There are only a few legacy 2009 HMP projects to determine their status (most would likely be deleted); we can make action statements from those you select as ongoing. CBW could select a few more realistic projects to implement that Wrangell has already identify within your CIP and community plans.

Is it accurate to state that CBW did not integrate any legacy 2009 HMP components within other community plans or processes?

The January plan will not be a final draft. Wrangell will have two to three weeks to review. I will then finalize the plan with your comments by Mid-February. It should take a short time to accept and approve the plan for FEMA submittal.

Please understand that State/FEMA reviews will also take time; e.g., State (30-day review) and FEMA (45-day review) minimum.

Kind Regards
-Scott-

R. Scott Simmons, CFM, CPM
Senior Emergency Management Professional

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From: Carol Rushmore [mailto:ecodev@wrangell.com]
Sent: Friday, December 07, 2018 11:41 AM
To: Simmons, Scott
Cc: 'Lisa Von Bargen'; rhowell@wrangell.com
Subject: RE: CBW Community Workgroup Meetings' Minutes

Hey Scott… you have in me in a panic as you never said anything before about needing to complete the draft by January. I had told you when you were here that the spreadsheet might not be completed until after the new year. Mid January is awfully soon based on the amount of work we need to do and the reviews required of not only the spreadsheet but also the draft plan itself. And is this the FINAL draft? Or just a draft update. With the holidays here and lots of folks traveling, myself included, I need to know to what extent/detail our review must be by then, because frankly, I can't guarantee we can give it the serious review it needs by end of month for you to have a final draft by mid January.

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---

From: Simmons, Scott [mailto:scott.simmons@aecom.com]
Sent: Friday, December 07, 2018 11:06 AM
To: Carol Rushmore <ecodev@wrangell.com>; 'Lisa Von Bargen' <lvonbargen@wrangell.com>; Amber Al-Haddad, work <aal-haddad@wrangell.com>; rhowell@wrangell.com
Cc: wcatribe@gmail.com; rpaddock@ccthita-nsn.gov; deptfob@ccthita.org
Subject: CBW Community Workgroup Meetings' Minutes

Good Morning,
My return home was smooth until I was awakened in the morning with the M7.0 shaker… our home had no structural damage, just a lot of things out of a few cabinets. Thankfully nothing broken.

I have attached copies of our meeting minutes for your review and a new newsletter for community distribution. Have you posted any public notices or discussed the HMP update activity within Wrangell Public meetings. If yes, please provide PDF copies for inclusion within the HMP's Public Outreach activities appendix.

Thank you for orchestrating the meetings, I pray they were useful.

Please return the critical facilities spreadsheet when completed. We don't need a lot of detail. Although street address can be sufficient, GPS coordinates will improve hazard identification if there are available GIS data to run against facility locations during future mitigation plan updates.

Please review the Section 7 Mitigation Strategy. We need to determine how to address the legacy 2009 HMP's action items listed within Table 7-9. They didn't really seem like projects, just items that need to be addressed. Those you desire to improve will need to be converted to action statements. I can easily edit those you desire to bring forward into the 2018 Mitigation Action Plan, Table 7-12.

Please also coordinate with WCA and CCTHITA concerning HMP contents, planning processes, identified hazards, critical facilities, and project review striving to confirm any culturally significant sites and potential projects they may desire to include within the HMP.

I must complete the draft plan by mid-January to fulfill contract deadlines, budget, and deliverables. Those are the last two sections I need to complete before I can send you a draft plan for community review.

Kind Regards
-Scott-

R. Scott Simmons, CFM, CPM
Senior Emergency Management Professional

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From:	Carol Rushmore
To:	"Lisa Von Bargen"; Amber Al-Haddad, work; rhowell@wrangell.com; "Dorianne Sprehe"; firechief@wrangell.com; Simmons, Scott; WCA; Doug McCloskey
Subject:	Hazard Mitigation Spreadsheet
Date:	Monday, December 10, 2018 11:32:37 AM
Attachments:	Wrangell CritFacil-HzrdSprdst 12-8-18.xlsx 112618 CBW MJHMPMitStrtgySec-7.pdf

---

Hey folks,

Attached is the updated DRAFT Hazard Mitigation Spreadsheet based on our discussion two weeks ago. I had a lot of notes after the meeting so very well could have missed something….. please track changes and save with date/your initials and send back to me when you get a chance. There is still much to do on this…. The x's are not filled in except for those hazards that we know will impact everything. We will also need evaluations and other data. Thanks so much for participating in that meeting because it made a huge difference. I also found out from Scott the end of last week that our deadline is now fast approaching. He has to complete the Draft Plan by mid January. I know we need to have another group session to discuss the draft plan itself - -especially the mitigation portion in chapter 7… but that will likely not be until just after the New Year due to everyone's travel schedules over Christmas. But I have attached it here if you can go through it and make any suggestions at all it would be helpful. Same thing… use track changes and save date/initials.

Call if you have any questions. Thanks everyone!

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From:	Carol Rushmore
To:	Simmons, Scott
Cc:	Amber Al-Haddad, work; "Dorianne Sprehe"; "Rolland Howell"; Doug McCloskey; "Lisa Von Bargen"; Greg Meissner
Subject:	RE: updated hazard mitigation plan spreadsheet
Date:	Wednesday, February 20, 2019 8:48:56 AM
Attachments:	image001.png 0202019 CBW-WCA CritFacil-HzrdSprdst.xlsx

Scott,
Attached is the most updated critical facilities spreadsheet. I have added it to the webpage also. We will continue to fill in the blanks. There could still be some additional facility tweaks, but this is the listing for now.

Per an earlier email regarding timeline, this is planned to go before Assembly at their 3/12 meeting. I am hoping there might be a workshop prior to the meeting but that has not yet been finalized.

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From: Simmons, Scott <scott.simmons@aecom.com>
Sent: Wednesday, February 20, 2019 8:09 AM
To: Carol Rushmore <ecodev@wrangell.com>
Subject: RE: updated plan

Thanks Carol,
I received both documents. You're a life saver!!!

Yes. I sent it only because you are so proficient and desire to edit the plan to assure it conveys Wrangell's hazard threats, vulnerabilities, and needs. I can count on one hand how many of the 200 plans had such skilled participants.

Yes…*it was indeed a major burp.*

I'm still awaiting our company's IT to assist with providing me file back-ups so I can meld what was missed with the work we have completed since. We no longer have an in-house IT person because they centralized and out-sourced it.

-Scott-

R. Scott Simmons, CFM, CPM
Senior Emergency Management Professional

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From: Carol Rushmore [mailto:ecodev@wrangell.com]
Sent: Tuesday, February 19, 2019 4:28 PM
To: Simmons, Scott
Subject: updated plan

The updated word version of the plan you sent me can be found at:

http://www.wrangell.com/planning/multi-jurisdictional-hazard-mitigation-plan

I will email you the updated spreadsheet in the morning with a few minor adjustments. We were not trying to duplicate pub works, Public safety building and wmlp.. but separate out the facilities for each. For example, there is a public works office. And then the utility barn where the rest of the crew work. The Public safety building has offices for DMV, court, police and then we were listing the fire Department under emergency response. Same type of thing for WMlight and power. Valuation for each except the public safety building are separate as well.. and will list the value under the offices. Will that work?

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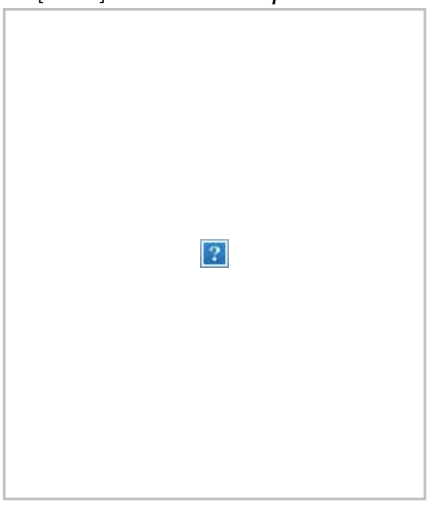
From:	Dmitry Nicolsky
To:	Simmons, Scott
Subject:	Re: Wrangell Alaska Tsunami threat and info inquiry
Date:	Friday, November 02, 2018 11:32:59 AM
Attachments:	ATT00001.png ATT00002.png ATT00003.png

Hi Scott,

Please find my edits (in red) to your text below.

Thanks,
Dmitry
On 11/2/2018 11:26 AM, Simmons, Scott wrote:

> Hi Dmitry,
> That is good news for them. Could you please edit this short description that I can place based on what you wrote.
>
> *NOAA is striving to develop Digital Elevation Model for Southeast Alaska, Integrating Bathymetric and Topographic Datasets (* <!--[if !vml]--><!--[endif]--> *Metadata Updated: February 8, 2018).*
>
> 
>
> *NOAA's National Centers for Environmental Information (NCEI) is building high-resolution digital elevation models (DEMs) to support individual coastal States as part of the National Tsunami Hazard Mitigation Program's (NTHMP) efforts to improve community preparedness and hazard mitigation. These integrated bathymetric-topographic DEMs are used to support tsunami and coastal inundation mapping. Bathymetric, topographic, and shoreline data used in DEM compilation are obtained from various sources, including NCEI, the U.S. National Ocean Service (NOS), the U.S. Geological Survey (USGS), the U.S. Army Corps of Engineers (USACE), the Federal Emergency Management Agency (FEMA), and other federal, state, and local government agencies, academic institutions, and private companies. DEMs are referenced to various vertical and horizontal datums depending on the specific modeling requirements of each State. For specific datum information on each DEM, refer to the appropriate DEM documentation. Cell sizes also vary depending on the specification required by modelers in each State, but typically range from 8/15 arc-second (~15 meters or 50 feet) to 8 arc-seconds (~240 meters or 800 feet). (Source: https://catalog.data.gov/dataset/digital-elevation-model-of-southeast-alaska-integrating-bathymetric-and-topographic-datasets#sec-dates)*
>
> *Dmitry Nicolsky, UAF/GI (Research Assistant Professor) stated that Wrangell is at the top of their "to-be-modeled" list. Research indicates there is a recognition of the submarine landslide potential at the Stikine River. A geologist presumably traced remnants of the previous submarine landslide in the Eastern Channel based on currently available bathymetry.*
>
> *UAF/GI anticipates they will be working with NCEI to develop Digital Elevation Models (DEMs) for Wrangell and other southeast Alaska regions.*

Thank you Dmitry!

Kind Regards
-Scott-

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Senior Emergency Management Professional

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Personal Cell: 907.841.1832

From: Dmitry Nicolsky [mailto:djnicolsky@alaska.edu]
Sent: Friday, November 02, 2018 10:27 AM
To: Simmons, Scott
Subject: Re: Wrangell Alaska Tsunami threat and info inquiry

Good morning, Scott.

Wrangell is at the top of our to-be-modeled list. There is a recognition of the submarine landslide potential at the Stikine River. Looking at the available bathymetry, a geologist presumably traced remnants of the previous submarine landslide in the Eastern Channel.

This year, we are developing the DEM for the area. Unfortunately, we cannot current give any estimates for the maximum wave height in Wrangell. This is pretty much a similar picture for the most of Southeast communities. Hopefully in the couple of years we can say more about the landslide potential in this area.

Thank you,
Dmitry

On 11/1/2018 11:23 AM, Simmons, Scott wrote:
Good Morning Dmitry,
I'm writing the Wrangell, Alaska hazard mitigation plan update.

Tsunamis Affecting Alaska, 1737-1996 only describes possible tsunami or tectonic caused cable breaks.

Can you provide any pertinent tsunami threat, hazard, or event data, preliminary SIFT type map etc. for this area?

Any assistance is greatly appreciated.

Thank you for all you do for us.

-Scott-

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Senior Emergency Management Professional

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Personal Cell: 907.841.1832

From: Isham, Kelly
To: Simmons, Scott
Subject: WCA Contact info
Date: Tuesday, October 16, 2018 11:58:29 AM
Attachments: image001.png

Esther Ashton- Tribal Administrator
Ph: 907-874-4304
Email: wcatribe@gmail.com

Also, Raymond Paddock is the Environmental Manager for CCTHITA
His email is rpaddock@ccthita-nsn.gov
Believe his ph is: 907-463-7013
Even though they aren't the tribe, as a stakeholder, they might be good to involve in planning process. Spoke to him in July, 2018, he is interested in assisting.

V/R

- Mr. Kelly D.S. Isham
Emergency Management Planner

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APPENDIX B – PLAN MAINTENANCE TOOLS

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2020 MJHMP - Annual Review Worksheet				
MJHMP Section	**Questions**	**Yes**	**No**	**Comments**
PLANNING PROCESS	Has Wrangell done any public outreach activities regarding the MJHMP or a mitigation project? If yes, please describe.			
	Has Wrangell integrated any of the MJHMP's elements into other plans or policies? If yes, please describe.			
HAZARD IDENTIFICATION	Has a disaster occurred in this reporting period that affected Wrangell?			
	Do you know of new hazard studies, reports and/or mapping available for Wrangell? If so, what are they?			
RISK ASSESSMENT	Does Wrangell have any new critical assets that should be included in the 2025 MJHMP risk assessment?			
	Have there been changes in development trends that could create additional risks?			
MITIGATION STRATEGY	Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?			
	Should new mitigation actions be added?			

2020 MJHMP - Mitigation Project Progress Report			
Progress Report Period From (date):		**To (date):**	
Project Title:			
Project ID:			
Description of Project:			
Implementing Department/Agency:			
Supporting Department/Agencies:			
Contact Name:			
Contact E-mail:			
Contact Number:			
Grant/Finance Administrator:			
Total Project Cost:			
Anticipated Cost Overrun/Underrun:			
Date of Project Approval:			
Project Start Date:			
Anticipated Completion Date:			
Summary of Progress of Project for this Reporting Period			
1. What was accomplished during this reporting period?			
2. What obstacles, problems, or delays did the project encounter, if any?			
3. How were the problems resolved?			