

Proposed by:	Dept. of Disaster & Emergency Services
Attorney Review:	04/30/2020
Vote:	6 Aye 0 Nay 0 Absent

**MUNICIPALITY OF SKAGWAY, ALASKA
RESOLUTION NO. 20-16R**

A RESOLUTION OF THE MUNICIPALITY OF SKAGWAY, ALASKA, UPDATING THE MULTI-HAZARD MITIGATION PLAN (MHMP) FOR THE MUNICIPALITY OF SKAGWAY.

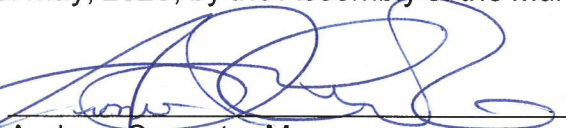
WHEREAS, the purpose of the Multi-Hazard Mitigation Plan (MHMP) is to: educate residents about the risk of natural hazards in their community and what mitigation actions or projects may be undertaken to reduce the risk to human life and property; and make the community eligible to apply for Pre-Disaster Mitigation (PDM) Grant Program funding and Hazard Mitigation Grant Program (HMGP) funding; and

WHEREAS, the Municipality of Skagway adopted an MHMP in 2009 via Ordinance No. 09-24, and has recently updated the plan through an Alaska Division of Homeland Security and Emergency Management grant; and

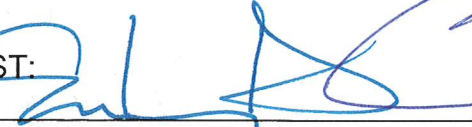
WHEREAS, SMC 3.02.050(C)(2) indicates that updates to the MHMP are recommended to the Borough Assembly and approved by resolution;

NOW, THEREFORE, BE IT RESOLVED by the Borough Assembly of the Municipality of Skagway that the updated Skagway Multi-Hazard Mitigation Plan dated October 2019 is hereby approved.

PASSED AND APPROVED this 7th day of May, 2020, by the Assembly of the Municipality of Skagway, Alaska.



Andrew Cremata, Mayor

ATTEST: 

Emily Deach
Municipal Clerk

(SEAL)





Municipality of Skagway, Alaska Local Hazard Mitigation Plan

October 2019

Prepared by:

AECOM



This document was prepared under a grant from the Federal Emergency Management Agency (FEMA)'s Grant Programs Directorate, U.S. Department of Homeland Security, and the Alaska Division of Homeland Security and Emergency Management. Points of view or opinions expressed in this document are those of the authors and do not necessarily represent the official position or policies of FEMA's Grant Programs Directorate, the U.S. Department of Homeland Security, or the State of Alaska.

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TABLE OF CONTENTS

1	INTRODUCTION.....	1-1
1.1	OVERVIEW	1-1
1.2	GRANT PROGRAMS WITH MITIGATION PLAN REQUIREMENTS	1-1
1.2.1	LHMP Layout Description	1-2
2	COMMUNITY DESCRIPTION	2-1
2.1	PLANNING AREA LOCATION, GEOGRAPHY, AND HISTORY.....	2-1
2.2	DEMOGRAPHICS.....	2-1
2.3	ECONOMY	2-2
2.4	TRANSPORTATION	2-2
3	PLANNING PROCESS.....	3-1
3.1	OVERVIEW	3-1
3.2	PLANNING TEAM.....	3-2
3.3	PUBLIC INVOLVEMENT AND OPPORTUNITIES FOR INTERESTED PARTIES TO PARTICIPATE.....	3-3
3.4	PLAN MAINTENANCE.....	3-3
3.4.1	Incorporating Existing Plans and Other Relevant Information.....	3-3
3.4.2	Integrating LHMP Precepts into Existing Planning Mechanisms.....	3-4
3.4.3	Continued Public Involvement	3-4
3.4.4	Monitoring, Reviewing, Evaluating, and Updating the LHMP	3-4
3.5	PLANNING TEAM LHMP MAINTENANCE RECOMMITMENT	3-5
3.6	MONITORING THE LHMP	3-5
3.7	REVIEWING THE LHMP.....	3-5
3.8	EVALUATING THE LHMP	3-5
3.9	Legacy 2009 MHMP Review and Analysis.....	3-7
4	JURISDICTIONAL ADOPTION.....	4-1
4.1	JURISDICTIONAL ADOPTION.....	4-1
5	HAZARD ANALYSIS.....	5-1
5.1	OVERVIEW	5-1
5.2	HAZARD IDENTIFICATION AND SCREENING	5-1
5.3	PLANNING AREA AND HAZARD PROFILES	5-2
5.4	NATURAL HAZARD PROFILES	5-3
5.4.1	Earthquake.....	5-3
5.4.2	Flood	5-9
5.4.3	Ground Failure	5-18
5.4.3	Tsunami and Seiche	5-26
5.4.4	Weather.....	5-33
6	VULNERABILITY ASSESSMENT	6-1
6.1	OVERVIEW	6-1
6.2	LAND USE AND DEVELOPMENT TRENDS.....	6-2
6.2.1	Land Use.....	6-2
6.3	CURRENT ASSET EXPOSURE ANALYSIS.....	6-2
6.3.1	Asset Inventory	6-2

6.4	NATIONAL FLOOD INSURANCE PROGRAM PARTICIPATION	6-3
6.5	VULNERABILITY ASSESSMENT METHODOLOGY	6-3
6.6	DATA LIMITATIONS.....	6-4
6.7	VULNERABILITY EXPOSURE ANALYSIS – NARRATIVE SUMMARIES.....	6-4
6.8	FUTURE DEVELOPMENT.....	6-5
7	MITIGATION STRATEGY	7-1
7.1	OVERVIEW	7-1
7.2	MUNICIPALITY OF SKAGWAY’S CAPABILITY ASSESSMENT.....	7-1
	7.2.1 Local Resources	7-2
	7.2.2 FEMA and Other Mitigation Program and Initiative Eligibility	7-3
7.3	DEVELOPING MITIGATION GOALS	7-3
7.4	IDENTIFYING MITIGATION ACTIONS	7-4
7.5	EVALUATING AND PRIORITIZING MITIGATION ACTIONS	7-8
7.6	MITIGATION ACTION PLAN.....	7-8
8	REFERENCES.....	8-1
9	APPENDICES.....	9-1
	Appendix A – Funding Resources	
	Appendix B – FEMA Review Tool, Local Hazard Mitigation Plan	
	Appendix C – Community LHMP Adoption Resolutions	
	Appendix D – Public Outreach Activities	
	Appendix E – Benefit-Cost Analysis Fact Sheet	
	Appendix F – Plain Maintenance Documents	

LIST OF FIGURES

Figure 2-1: Skagway Location	2-1
Figure 2-2: Population of the Municipality of Skagway	2-2
Figure 2-3: Aerial Photograph of Skagway.....	2-3
Figure 5-1: Alaska’s Known Active Faults.....	5-7
Figure 5-2: Neotectonic Map of Alaska, Skagway Area.....	5-8
Figure 5-3: The Skagway River Levee.....	5-15
Figure 5-4: Taiya River Mudslide.....	5-16
Figure 5-5: Chilkoot Trail Flooding	5-16
Figure 5-6: Site of Rockslide in Skagway, Alaska	5-22
Figure 5-7: Designated Natural Hazards.....	5-24
Figure 5-8: Avalanche Regions in Alaska.....	5-25
Figure 5-9: Permafrost Characteristics of Alaska.....	5-25
Figure 5-10: The Location of the 1994 Submarine Landslide.....	5-28
Figure 5-11: Potential Submarine Landslide Areas in Skagway, Alaska	5-30
Figure 5-12: Maximum Tsunami Flooding Inundation Map	5-31
Figure 5-13: Tsunami Hazard Map.....	5-33
Figure 5-14: Statewide Rainfall Map.....	5-35
Figure 5-15: Skagway Weather Service Office Summary	5-36
Figure 5-16: Skagway’s Historic and Predicted Precipitation Ranges	5-39
Figure 5-17: Skagway’s Historic and Predicted Temperature Ranges.....	5-39
Figure 5-18: USA.com Weather Data.....	5-40

LIST OF TABLES

Table 1-1: HMA Eligible Activities	1-1
Table 3-1: Skagway Hazard Mitigation Planning Team	3-2
Table 3-2: Documents Reviewed	3-4
Table 5-1: Identification and Screening of Hazards	5-1
Table 5-2: Hazard Magnitude/Severity Criteria	5-2
Table 5-3: Hazard Recurrence Probability Criteria	5-3
Table 5-4: Modified Mercalli Intensity	5-5
Table 5-5: Skagway Area’s Historical Earthquakes >M4.0 Since 2010.....	5-6
Table 5-6: Annual Flood Chance of Occurring.....	5-11
Table 5-7: NOAA Recorded Flood Events in Skagway.....	5-12
Table 5-8: Skagway Area Avalanche Events	5-21
Table 5-9: Tsunami Effects on Skagway.....	5-29
Table 5-10: Skagway’s Severe Weather Events.....	5-37
Table 6-1: Vulnerability Overview.....	6-2
Table 6-2: Estimated Population and Building Inventory	6-2
Table 7-1: Municipality of Skagway’s Regulatory Tools	7-1
Table 7-2: Municipality of Skagway’s Technical Specialists	7-2
Table 7-3: Municipality of Skagway’s Financial Resources	7-2
Table 7-4: Federal Agency Mitigation Programs.....	7-3
Table 7-5: Mitigation Goals	7-4
Table 7-6: Mitigation Goals and Potential Actions	7-6
Table 7-7: Skagway Area’s Combined Mitigation Action Plan	7-9

LIST OF ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
BCA	Benefit Cost Analysis
CFR	U.S. Code of Federal Regulations
DCCED	Department of Commerce, Community, and Economic Development
DCI	Disaster Cost Index
DCRA	Division of Community and Regional Affairs
DEC	Department of Environmental Conservation
DHS&EM	Division of Homeland Security and Emergency Management
DGGS	Division of Geological and Geophysical Survey
DMA 2000	Disaster Mitigation Act Of 2000
DMVA	Department of Military and Veterans Affairs
DNR	Department of Natural Resources
DOT/PF	Department of Transportation and Public Facilities
FEMA	Federal Emergency Management Agency
FMA	Flood Mitigation Assistance
ft	feet
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HUD	Housing and Urban Development
M	magnitude
MAP	Mitigation Action Plan
MMI	Modified Mercalli Intensity
mph	miles per hour
LHMP	Local Hazard Mitigation Plan
NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PGA	Peak Ground Acceleration
SHMP	Alaska State Hazard Mitigation Plan
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
UAF/GI/AEC	University of Alaska Fairbanks/Geophysical Institute/Alaska Earthquake Center
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

1 INTRODUCTION

1.1 Overview

In recent years, local hazard mitigation planning has been driven by federal law. On October 30, 2000, Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390), which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) (Title 42 of the United States Code [USC] 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. In addition, it provided the legal basis for the Federal Emergency Management Agency's (FEMA's) mitigation plan requirements for mitigation grant assistance.

To implement these planning requirements, FEMA published an Interim Final Rule in the Federal Register on February 26, 2002 (FEMA 2002), 44 CFR (Code of Federal Regulations) Part 201 with subsequent updates. The planning requirements for local entities are described in detail in Section 2 and are identified in their appropriate sections throughout this Local Hazard Mitigation Plan (LHMP).

In October 2007 and July 2008, FEMA combined and expanded flood mitigation planning requirements with local hazard mitigation plans (44 CFR §201.6). Furthermore, all hazard mitigation assistance program planning requirements were combined eliminating duplicated mitigation plan requirements. This change also required participating National Flood Insurance Program (NFIP) community risk assessments and mitigation strategies to identify and address repetitively flood damaged properties. Local hazard mitigation plans now qualify communities for several Federal Hazard Mitigation Assistance (HMA) grant programs.

This LHMP complies with Title 44 CFR current as of March 11, 2015 and applicable guidance documents. (FEMA 2015a).

1.2 Grant Programs with Mitigation Plan Requirements

FEMA HMA grant programs provide funding to states, tribes, and local entities that have a FEMA-approved state, tribal, or local mitigation plan. Two of the grants are authorized under the Stafford Act and DMA 2000, while the remaining three are authorized under the National Flood Insurance Act and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act.

Table 1-1 lists Hazard Mitigation Assistance eligible grant program activities:

Table 1-1: HMA Eligible Activities

Activities	HMGP	PDM	FMA
1. Mitigation Projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Property Acquisition and Structure Demolition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Property Acquisition and Structure Relocation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Structure Elevation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mitigation Reconstruction	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dry Flood proofing of Historic Residential Structures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dry Flood proofing of Non-residential Structures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Generators	<input type="checkbox"/>	<input type="checkbox"/>	
Localized Flood Risk Reduction Projects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Non-localized Flood Risk Reduction Projects	<input type="checkbox"/>	<input type="checkbox"/>	

Table 1-1: HMA Eligible Activities

Activities	HMGP	PDM	FMA
Structural Retrofitting of Existing Buildings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Non-structural Retrofitting of Existing Buildings and Facilities	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Safe Room Construction	<input type="checkbox"/>	<input type="checkbox"/>	
Wind Retrofit for One- and Two-Family Residences	<input type="checkbox"/>	<input type="checkbox"/>	
Infrastructure Retrofit	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Soil Stabilization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wildfire Mitigation	<input type="checkbox"/>	<input type="checkbox"/>	
Post-Disaster Code Enforcement	<input type="checkbox"/>		
Advance Assistance	<input type="checkbox"/>		
5 Percent Initiative Projects	<input type="checkbox"/>		
Miscellaneous/Other ⁽¹⁾	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Hazard Mitigation Planning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Planning Related Activities	<input type="checkbox"/>		
3. Technical Assistance			<input type="checkbox"/>
4. Management Cost	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

⁽¹⁾ Miscellaneous/Other indicates that any proposed action will be evaluated on its own merit against program requirements. Eligible projects will be approved provided funding is available.

Source: FEMA 2015b

The Hazard Mitigation Grant Program (HMGP) is a competitive, disaster-funded grant program. Other unified mitigation assistance such as the Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA) programs, although competitive, rely on specific pre-disaster grant funding sources, sharing several common elements.

1.2.1 LHMP Layout Description

The LHMP consists of the following sections and appendices:

Section 1: Introduction

Defines what a hazard mitigation plan is, delineates federal requirements and authorities, and introduces the HMA program listing the various grant programs and their historical funding levels.

Section 2: Community Description

Provides a general history and background, including historical trends for population, as well as the demographic and economic conditions that have shaped the area.

Section 3: Planning Process

Describes the LHMP update's planning process, identifies the planning team members, meetings held as part of the planning process, and key stakeholders in the Skagway area. This section documents public outreach activities (supporting documents are in Appendix D); including document reviews and relevant plans, reports, and other appropriate information data used for LHMP development; actions the community plans to implement to ensure continued public participation; and their methods and schedule for keeping the plan current.

This section also describes the planning team's formal plan maintenance process to ensure that the LHMP remains an active and applicable document throughout its 5-year life cycle. The process includes monitoring, reviewing, evaluating (Appendix F), updating the LHMP; and implementation initiatives.

Section 4: Jurisdictional Adoption

Describes the community's LHMP adoption process (supporting documents are in Appendix C).

Section 5: Hazard Analysis

Describes the process through which the planning team identified, screened, and selected the hazards to be included in this version of the LHMP. The hazard analysis includes the nature, location, extent, impact, and future event recurrence probability for each hazard. Historical impact and hazard location figures are included when available.

Section 6: Vulnerability Assessment

Identifies the municipality's vulnerable assets—people, residential and non-residential buildings (where available), critical facilities, and critical infrastructure. The resulting information identifies land use and development trends, the full range of hazards the Skagway area could face, and potential social impacts, damages, and economic losses.

Section 7: Mitigation Strategy

Defines the mitigation strategy which provides a blueprint for reducing the potential losses identified in the vulnerability assessment. This section lists the community's governmental authorities, policies, programs, and resources.

The planning team reviewed legacy mitigation goals and actions from nearby communities to address current applicability to the risks associated with the Skagway area.

Section 8: References

Lists reference materials and resources used to prepare this LHMP.

Appendices

- Appendix A: Lists federal, state, and other potential mitigation funding sources. This section will aid the community with researching and applying for funds to implement their mitigation strategy.
- Appendix B: Provides the FEMA Local Mitigation Plan Review Tool, which documents compliance with FEMA criteria.
- Appendix C: Provides adoption resolutions.
- Appendix D: Provides public outreach information, including newsletters and meeting minutes.
- Appendix E: Discusses Benefit-Cost Analysis (BCA) processes used to prioritize mitigation actions.
- Appendix F: Provides the plan maintenance documents, such as an annual review sheet and the progress report form.

2 COMMUNITY DESCRIPTION

2.1 Planning Area Location, Geography, and History

Figure 2-1 shows the general location of Skagway. For the purposes of this plan, the area included as the Municipality of Skagway encompasses the entire community footprint (see Figure 2-3).

Figure 2-1: Skagway Location



The Municipality of Skagway covers 452.4 square miles of land and approximately 12 square miles of water. Moderate maritime temperature changes occur along Alaska's Southeast Panhandle. Skagway's maritime temperatures range from a winter low of 4 degrees Fahrenheit (°F) to a high of 81°F. The area annually receives approximately 74.6 inches of rain and 54 inches of snow. The Municipality of Skagway's 2020 Comprehensive Plan (Municipality of Skagway 2010) provides information on Skagway history; a brief summary includes:

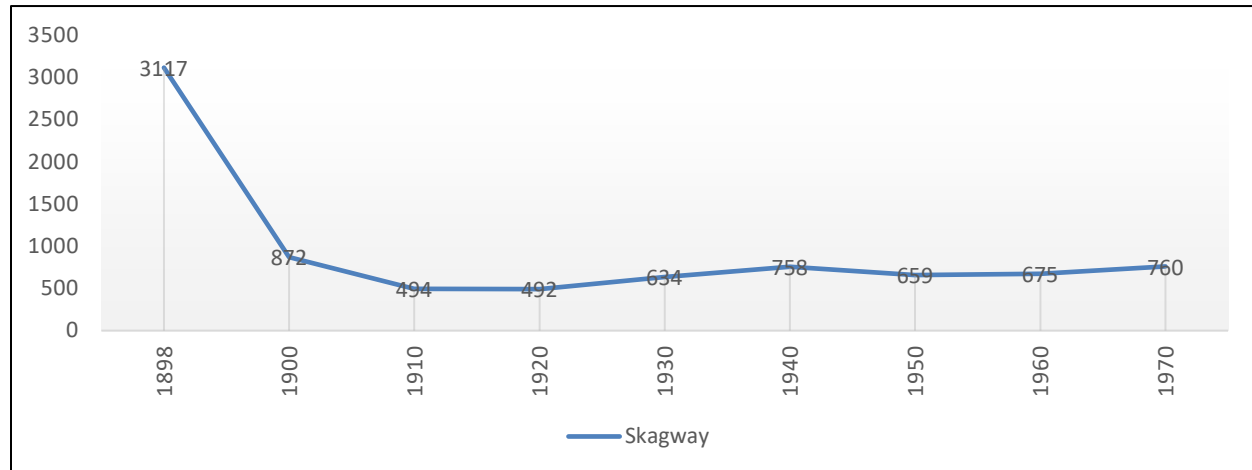
- | | |
|-----------|--|
| 1896-1899 | The Klondike Gold Rush brings prospectors to the area. Population estimated to reach nearly 10,000. |
| 1900 | Skagway becomes Alaska's first incorporated city. |
| 1910 | Skagway experiences a drastic population decline to about 872. |
| 1930 | Population continues to decline to approximately 490. Remains relatively steady at this number through 1970. |

2.2 Demographics

Figure 2-2 illustrates Skagway's historic population. The 2010 U.S. Census (2019) estimated 910 residents with a median age of 51.6, indicating a relatively aging population. The most recent 2018 Alaska Department of Community, Commerce, and Economic Development (DCCED)

certified population is 1,088. The population of Skagway is expected to remain steady, as over half of the population is between 18 and 64 years old. 80 percent of the population is primarily of European descent. The male and female composition is approximately 47 and 53 percent, respectively. It is important to note that these population estimates do not include the summer influx due to tourism, which is estimated to double or triple normal population numbers through visitors and seasonal work force.

Figure 2-2: Population of the Municipality of Skagway



2.3 Economy

Skagway's economy is primarily based on tourism and other general employment opportunities that exist in the community.

According to U.S. Census (2019) estimates, the median household income in Skagway was \$70,673 in 2017. Approximately 4.8 percent of residents were reported to be living below the poverty level according to the 2016 American Community Survey. The potential workforce (i.e., those aged 16 years or older) in Skagway was estimated to be 82.4 percent. In 2015, the unemployment rate was 8.7 percent, compared to the U.S. average of 5.2 percent; however, this rate included part-time and seasonal jobs.

2.4 Transportation

Skagway is accessible by road via the Klondike Highway, which provides a connection through British Columbia and the Yukon Territory, Canada, to the lower 48 states or north to Interior Alaska. Skagway is accessible via air, road, and water. The State owns a paved runway, and Skagway receives regular State ferry and barge services. A breakwater, ferry terminal, small boat harbor, boat launch, and boat haul-out are available, as well as three deep-water docks for cruise and cargo ship berthing, cargo loading, and storage. Freight arrives by barge, ferry, and truck. Figure 2-3 depicts an aerial photograph of Skagway.

Figure 2-3: Aerial Photograph of Skagway



Source: National Park Service

3 PLANNING PROCESS

This section provides an overview of the planning process; identifies the planning team members and key stakeholders; documents public outreach efforts; and summarizes the review and incorporation of existing plans, studies, and reports used to develop this LHMP. Outreach support documents and meeting information regarding the planning team and public outreach efforts are provided in Appendix D.

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

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))

Source: FEMA 2015b

3.1 Overview

The State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) provided funding and project oversight to AECOM to facilitate and guide planning team development and LHMP development.

The planning process began on January 28, 2019 with introductory emails followed by personal phone conversations with Borough Treasurer and initial Planning Team Lead, Heather Rodig. On February 13, 2019, AECOM contacted Heather Rodig, Ray Leggett, and Shane Rupprecht to discuss LHMP information needs. Ray Leggett was then appointed as the Skagway LHMP planning team lead.

The Municipality of Skagway was selected as a Division of Homeland Security and Emergency Management's (DHS&EM) HMGP recipient. The LHMP development requirement, which enables the community to qualify for PDM grants and further HMGP grants was described to Skagway's planning team participants as well as the overall LHMP development process, including neighboring communities' participation opportunities. Representatives from Skagway explained that no other jurisdictions would need to have separate communication, as the neighboring community of Dyea is included in the municipality and is represented on the Borough Assembly.

Appointed by the municipality, Chief Leggett and Shane Rupprecht agreed to act as the Skagway LHMP planning team, involving other members as needed, and together identified applicable resources and capabilities during their joint meetings. The planning team further discussed the hazard mitigation planning process, along with determining legacy LHMP mitigation action status identifying new actions, and prioritizing all mitigation actions for potential future mitigation project funding.

The team noted that current hazards have affected the area since the legacy 2009 LHMP was implemented, such as riverine and coastal erosion, sediment and heavy debris deposition in the municipality's 15 watersheds, and ground failure (most commonly landslides and small avalanche) impacts, which are increasing in intensity and frequency.

The following five-step process took place from January 2019 through October 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 needs 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 5-year update.
3. **Assess risks:** The planning team identified the hazards specific to the Skagway area and with the assistance of a hazard mitigation planning consultant (AECOM), developed the risk assessment for seven identified hazards. The planning team reviewed the risk assessment, including the vulnerability assessment, prior to and during the development of the 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.

3.2 Planning Team

The local planning team members include Police Chief Ray Leggett (LHMP Lead), Borough Treasurer Heather Rodig, and Municipal Permitting Official Shane Rupprecht. Mayor Monica Carlson, prior to her untimely passing in December 2018, was involved in engaging a contractor; Mayor Andrew Cremata was elected to complete the term through October 2019 and was then re-elected. Table 3-1 lists Skagway's complete hazard mitigation planning team.

Table 3-1: Skagway Hazard Mitigation Planning Team

Name	Title	Organization	Role
Ray Leggett	Police Chief	Municipality of Skagway	LHMP lead, data gathering and LHMP review
Shane Rupprecht	Permitting Official	Municipality of Skagway	Data Gathering, LHMP review
Heather Rodig	Borough Treasurer	Municipality of Skagway	LHMP review, document and financial reviews
Various	Borough Assembly	Municipality of Skagway	LHMP review
Arika Mercer	Emergency Management Planning Intern	AECOM	AECOM lead consultant researcher, technical assistance.
Kelly Isham	Senior Emergency Management Planner	AECOM	AECOM deputy project manager, lead writer, technical assistance.

3.3 Public Involvement and Opportunities for Interested Parties to Participate

AECOM extended an invitation to all individuals and entities identified on the project mailing list describing the planning process and announcing the upcoming community planning activities. The announcement was emailed to relevant academia, nonprofits, and local, state, and federal agencies on February 2, 2019. The following agencies were invited to participate and review the LHMP during and after draft completion (email outreach copy in Appendix D):

- University of Alaska Fairbanks, Geophysical Institute, Alaska Earthquake Center (UAF/GI/AEC)
- Alaska Volcano Observatory
- Alaska Department of Environmental Conservation (DEC)
 - Division of Spill Prevention and Response
- Alaska Department of Transportation and Public Facilities (DOT/PF)
- Alaska Department of Community, Commerce, and Economic Development (DCCED)
- Division of Community and Regional Affairs (DCRA)
- Alaska Department of Military and Veterans Affairs (DMVA)
- Division of Homeland Security and Emergency Management (DHS&EM)
- U.S. Environmental Protection Agency
- National Weather Service (NWS)
 - NWS Southeast Region
- U.S. Department of Agriculture (USDA)
 - USDA Division of Rural Development
 - Natural Resources Conservation Service (NRCS)
- U.S. Army Corps of Engineers (USACE)
- U.S. Bureau of Land Management
- U.S. Department of Housing and Urban Development (HUD)
- U.S. Fish & Wildlife Service

The public was invited to attend and participate in three public meetings during development of the HMP and mitigation strategy development on March 3, 2019; July 30, 2019; and September 27, 2019. In addition, the draft plan and mitigation ideas were presented the Borough Assembly meeting (open to the public) on October 24, 2019, to discuss the the final draft of the HMP. The process of feedback was verbal public discussion during meetings. The team brought forth discussed ideas and suggestions that were reasonable and attainable to incorporate into the plan.

3.4 Plan Maintenance

This section describes a formal plan maintenance process to ensure that the LHMP remains an active and applicable document. It includes an explanation of how the community's planning team intends to organize their efforts to ensure that improvements and revisions to the LHMP occur in a well-managed, efficient, and coordinated manner. The planning team will:

- Incorporate and integrate LHMP components into existing planning mechanisms
- Continue public involvement
- Monitor, review, evaluate, and update the LHMP annually

Table 3-2: Documents Reviewed

Existing plans, studies, reports, ordinances, etc.	Contents summary (How will this information improve mitigation planning?)
State of Alaska Hazard Mitigation Plan (SHMP), 2019 update	Defined statewide hazards and their potential locational impacts
Municipality of Skagway 2020 Comprehensive Plan	Provides city governance, economic, land use, housing, road, water, and air transportation, etc. Identifies the goals, objectives, and implementation action items, updated and developed for each comprehensive plan element. Also presents background information and planning issues identified for each of these elements.
Skagway Zoning Map, 2016	Depicts Skagway's land use locations
Tsunami Inundation Maps of Skagway	Tsunami impact study depicting historical and future impact locations
USACE, Erosion Information Paper, Alaska, October, 2006	Defined the community's historical erosion impacts
USACE, Alaska Baseline Erosion Assessment, 2009	Defined the area's erosion threats
USACE, Floodplain Manager's Reports, Community Specific 2011	Defined the area's historical flood impacts
State of Alaska, DCCED Community Profile	Provided historical and demographic information

3.4.1 Incorporating Existing Plans and Other Relevant Information

During the new LHMP development and annual update planning process, the planning team reviewed and incorporated pertinent information from local, state, and federal resources. Data collected included newly available plans, studies, reports, and technical research listed in Table 3-2. The data were reviewed and referenced where applicable for the LHMP's jurisdictional information, hazard profiles, risk analysis, and vulnerability assessment. Additional references are provided in Section 8.

3.4.3 Continued Public Involvement

The planning team is committed to involving the public directly in the continual reshaping and updating the 2019 LHMP to maintain relevancy and applicability. The following activities are proposed:

- A hardcopy of the LHMP and any proposed changes will be available at the municipal office along with contact information for the planning team lead, should people have questions, comments, or concerns.
- The planning team will provide periodic opportunities to present and review the plan, and mitigation strategy, during regularly scheduled Municipality of Skagway Borough meetings, including Borough Assembly meetings.
- The Municipality of Skagway maintains a current website with information on meetings, resources, and events; there is a documents page that will have a link to the plan electronically for the public to download and view. Information on the plan to raise awareness of the plan could be posted on the website periodically as well.

- The planning team could sent out an annual mailing to the public (via mail, email, the website, and by public meeting distribution) to continue to inform the public that the HMP exists, is available, is a resource for looking at opportunities for the community, and would be updated regularly with public input.

3.4.4 Monitoring, Reviewing, Evaluating, and Updating the LHMP

The LHMP was prepared as a collaborative effort. To maintain momentum and build upon previous hazard mitigation planning efforts and successes, the Municipality of Skagway will continue to include their Planning and Zoning Commission, the Fire Department, and members of the public as their local planning team to monitor, review, evaluate, and update the LHMP.

3.4.2 Integrating LHMP Precepts into Existing Planning Mechanisms

Each planning team member ensures that the LHMP, each Mitigation Action Plan's (MAP's) project or initiative, is incorporated into existing municipal planning mechanisms whenever possible. Once the LHMP is community adopted and receives FEMA's final approval, each member of the planning team will undertake the following activities. (Note: Implementing these requirements may require updating or amending specific planning mechanisms).

- Review community-specific regulatory tools to assess integrating LHMP components. These regulatory tools are identified in the following capability assessment section.
- Work with pertinent community departments to increase awareness of the LHMP and aid with integrating the mitigation strategy (including the MAP) into relevant planning mechanisms.

3.5 Planning Team LHMP Maintenance Recommitment

Skagway's joint planning team intends to organize their efforts to ensure that the 2019 LHMP improvements and revisions occur in a well-managed, efficient, and coordinated manner. The planning team will follow these three process steps:

1. Review and revise the 2019 LHMP to reflect development changes, planning process improvements, project implementation progress, project priority changes, and mitigation strategy progress.
2. Submit LHMP update at the end of its 5-year life cycle for State and FEMA review and approval.
3. Continually strive to implement and integrate mitigation initiatives within community planning and other essential documents.

3.6 Monitoring the LHMP

The municipality and its planning team will strive to monitor the 2019 LHMP continually, evaluate the plan annually, and update the plan every 5 years (or within 90 days of a presidentially declared disaster if required), or as necessary to reflect changes in local, state, or federal law.

The Hazard Mitigation Plan Annual Progress Report and Hazard Mitigation Plan Annual Evaluation Forms are plan review tools (Appendix F). The planning team, with advisement from the State Hazard Mitigation Officer and FEMA, determines when significant changes warrant a LHMP update prior to its 5-year anniversary date.

Each authority identified in the MAP matrix will be responsible for implementing the MAP and determining whether their respective actions were effectively implemented. The planning team leader (or designee) will serve as the primary point of contact and will coordinate local efforts to monitor, evaluate, revise, and update LHMP mitigation strategy actions' progress, status, and closure status.

3.7 Reviewing the LHMP

The planning team recommits to reviewing their successes and challenges for achieving LHMP's review, maintenance, and mitigation goals, as well as activities and initiatives during the annual review process.

The planning team will complete LHMP maintenance components as described. Projects or initiatives tracking will be completed to assure they are properly managed and closed. The planning team will integrate LHMP components into other planning mechanisms or initiatives as their respective councils determine.

Additionally, during each annual review, each authority or agency administering a mitigation project will submit a Progress Report (Appendix F) to the planning team leader (or designee). The report will include the mitigation project's current status, including any project changes, a list of identified implementation problems (with appropriate strategies to overcome them), and a statement of whether or not the project has helped achieve the appropriate goals identified in the plan.

3.8 Evaluating the LHMP

The Annual Review Questionnaire (Appendix F) provides the basis for future LHMP evaluations by guiding the planning team with identifying new or more threatening hazards, adjusting to changes to, or increases in, resource allocations, and garnering additional support for LHMP implementation. The planning team leader will initiate the annual review two months prior to the scheduled planning meeting date to ensure that all data is assembled for discussion with the planning team. The findings from these reviews will be presented at the annual planning team meeting. Each review, as shown on the Annual Review Worksheet, will include an evaluation of the following:

- Determine authorities, outside agency, stakeholder, and residents' participation with LHMP implementation successes.
- Identify notable risk changes for each identified and newly considered natural hazards.
- Consider land development activities and related programs' impacts on hazard mitigation.
- MAP implementation progress and integration (identify problems and suggest improvements as necessary).
- Evaluate LHMP local resource implementation for identified activities.

3.9 Legacy 2009 MHMP Review and Analysis

44 CFR requires communities to schedule MJHMP 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. The legacy 2009 Municipality of Skagway Multi-Hazard Mitigation Plan HMP document (completed by W. H. Pacific) was revised as described below:

- Planning Process and Methodology (Chapter 1) – Updated overview, current requirements, and general planning process (1. Introduction, 3. Planning Process).
- Skagway Community Profile and Capability Assessment (Chapter 2) - Updated and expanded community information, including new census and state data; added more detailed planning process information (2. Community Description, 3. Planning Process, 4. Jurisdictional Adoption).
- Risk Assessment, General Overview (Chapter 3) – Updated hazard identification and screening (5. Hazard Analysis).
- Risk Assessment, Hazard Specific Sections (Chapter 4) – Reviewed hazard identification and risk assessment for earthquake, flood, ground failure, tsunami and seiche, and weather (5. Hazard Analysis).
- Mitigation Strategy (Chapter 5) – Reviewed and refine the status of mitigation goals and actions (7. Mitigation Strategy).
- Added new section, 6. Vulnerability Analysis - Added a new section to discuss land use, current asset inventory, assessment methodology and limitation, exposure analysis, and future trends).
- The updated plan also includes references and appendices.

The 2009 plan included the following hazards: Flood/Erosion Hazard, Earthquake Hazard, Snow Avalanche, Tsunami Hazard, and Severe Weather. These hazards were carried forward to this plan, although organized differently, including: Earthquake, Flood (all types), Ground Failure (covering avalanche), Tsunami (include Seiche), and Severe Weather.

Hazard type, and mitigation priorities, remain similar to the 2009 plan. These same hazards described in the 2009 plan still exist in the community, due to the dynamic landscape and weather conditions in the area. Land development in the community is also restricted by the local geography. In terms of Flood Hazard, some property improvements have taken place based on this hazard being identified in the 2009 plan. However, the dynamic river systems continue to present new hazard challenges, which are described in Section 5.4 below. It should also be noted that since approximately 2010, the Alaska DCRA is no longer able to collect diverse agency project data for Alaskan communities; these data previously provided information more readily on aging infrastructure improvement.

Table 7-6 below in the Mitigation Strategy section lists relevant hazard mitigation actions. The 2009 plan listed potential actions with potential funding source which was used to start building the detailed, updated table in this plan during the HMP development process. Relevant potential actions that have not been completed are included in this plan. Many mitigation actions for this community, like the hazards themselves, are often dynamic to accommodate annual weather patterns and stochastic events.

4 JURISDICTIONAL ADOPTION

This section is included to fulfill FEMA regulatory criteria for the Municipality of Skagway's formal LHMP adoption requirements. The Municipality of Skagway, represented in this Local Hazard Mitigation Plan, meets the requirements of Section 409 of the Stafford Act and Section 322 of DMA 2000, and 44 CFR Parts 201.6(c)(5), and §201.7(c)(5) & (6) respectively.

4.1 Jurisdictional Adoption

DMA 2000 requirements and implementing local governance regulations for the LHMP adoption include:

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))

Source: FEMA 2015b

The Municipality of Skagway's Assembly adopted the LHMP on **date, 20xx** and submitted the final draft LHMP to FEMA for formal approval.

A scanned copy of the Municipality's formal adoption is included in Appendix C.

5 HAZARD ANALYSIS

5.1 Overview

A hazard analysis includes the identification, screening, and profiling of each hazard. Hazard identification is the process of recognizing the natural events that threaten an area. Natural hazards result from unexpected or uncontrollable natural events of enough magnitude. Human, technological, and terrorism-related hazards are beyond the scope of this plan. Even though a particular hazard may not have occurred in recent history in the study area, all natural hazards that may potentially affect the study area are considered; the hazards that are unlikely to occur or for which the risk of damage is accepted as being very low, are eliminated from consideration.

Hazard profiling is accomplished by describing hazards in terms of their nature, history, magnitude, frequency, location, extent, and probability. Hazards are identified through historical and anecdotal information collection, existing plans, studies, and map reviews, and study area hazard map preparations when appropriate. Hazard maps are used to define a hazard's geographic extent as well as define the approximate risk area boundaries.

5.2 Hazard Identification and Screening

This is the first step of the hazard analysis. Prior to application for grant dollars, the planning team reviewed and evaluated their legacy 2008 LHMP's identified hazards based on a range of factors, including prior current threat perception, the current relative risk presented by each hazard, the municipality's ability to mitigate the hazard, and the known or expected hazard threat information availability (Table 5-1).

The planning team determined that five hazards pose a great threat to the municipality: earthquake, flood/scour, ground failure, tsunami, and severe weather; some of which are influenced by increasing changing climate conditions.

Table 5-1: Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Earthquake	Yes	Skagway is located near the Fairweather fault, moving right-laterally approximately 2.25 inches per year, and the Denali Fault which produced the largest on-land earthquake in North America in almost 150 years. This fault has produced six major earthquake events, M7.0 or higher, in the last century.
Flood (Riverine and/or coastal related floods and resultant erosive scour damages)	Yes	There are two major river systems in the municipality, including the Taiya River and the Skagway River, which runs adjacent to the Skagway town-site. The 1977 Legacy Flood Insurance Rate Maps have designated these areas subject to sheet flooding; however, multiple protective levees constructed on the Skagway River since that time protect the town-site from a 100-year flood.
Ground Failure (Avalanche, Landslide/Debris Flow, Subsidence)	Yes	Ground failure occurs throughout Alaska from avalanches, landslides, melting permafrost, and ground subsidence. There are various locations that have been identified in the Municipality that have potential for rockslides and avalanches.
Tsunami (Seiche)	Yes	The 1964 9.2M Earthquake generated a tsunami in the Pacific Ocean impacting many coastal communities along with the Municipality of Skagway. In 1994, the Municipality experienced a locally generated tsunami that caused the death of one person and destroyed infrastructure.
Severe Weather (Cold, Drought,	Yes	Severe weather impacts the community with climate change influences such as changing El Niño/La Niña Southern Oscillation (ENSO) patterns generating increasingly severe weather events such as winter storms,

Table 5-1: Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Rain, Snow, Wind, etc.)		heavy or freezing rain, thunderstorms and with subsequent secondary hazards such as riverine or coastal storm surge floods, landslides and avalanches, heavy snow, and high wind, and extreme cold temperatures.
Wildland Fire	No	This hazard is not a substantial threat to this community.

5.3 Planning Area and Hazard Profiles

DMA 2000 requirements and implementing city governance regulations for hazard profile development include:

ELEMENTS. Planning Area and Natural Hazard Profiles
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)(i))
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))

Source: FEMA 2015b

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 under the severe weather hazard profile but are also identified where deemed appropriate within each hazard profile.
- History (Previous Occurrences)
- Location
- Extent (breadth, magnitude, and severity)
- Impact (Section 5 provides general impacts associated with each hazard; Section 6 provides detailed impacts to the Skagway area's residents and critical facilities)
- Recurrence Probability

NFIP insured Repetitive Loss structures are addressed in Section 6.

Each hazard is assigned a rating based on the following criteria for magnitude/severity (Table 5-2) and future recurrence probability (Table 5-3).

Estimating magnitude and severity are determined based on historic events using Table 5-2 identified criteria from narrative descriptions.

Table 5-2: Hazard Magnitude/Severity Criteria

Magnitude / Severity	Criteria
4 - Catastrophic	<ul style="list-style-type: none"> • Multiple deaths. • Complete shutdown of facilities for 30 or more days. • More than 50 percent (%) of property is severely damaged.
3 - Critical	<ul style="list-style-type: none"> • 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.

Table 5-2: Hazard Magnitude/Severity Criteria

Magnitude / Severity	Criteria
2 - Limited	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 5-3 identified criteria, to provide estimated future event recurrence likelihood.

Table 5-3: Hazard Recurrence Probability Criteria

Probability	Criteria
4 - Highly Likely	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Event is possible within the next 10 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.

5.4 Natural Hazard Profiles

The hazards profiled for the Skagway area are presented throughout Section 5.4. Hazards are not listed in order of importance or risk level

5.4.1 Earthquake

5.4.1.1 Nature

An earthquake is a sudden motion or trembling caused by a release of strain accumulated within 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 (seismic waves) and along the earth's surface (surface waves). Two kinds of seismic waves occur: P (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 S (secondary) waves, also known as shear waves, are slower than P 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 (MMI) Scale (Table 5-4). The MMI Scale consists of 10 increasing levels of shaking intensity that range from "Not Felt" (imperceptible) to "Extreme" (catastrophic) destruction. Peak ground acceleration (PGA) is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location. PGA can be measured as acceleration due to gravity. The USGS describes the MMI Scale as:

The effect of an earthquake on the Earth's surface is called the intensity. The intensity scale consists of a series of certain key responses such as people awakening, movement of furniture, damage to chimneys, and finally - total destruction. Although numerous intensity scales have been developed over the last several hundred years to evaluate the effects of earthquakes, the one currently used in the United States is the Modified Mercalli (MM) Intensity Scale. It was developed in 1931 by the American seismologists Harry Wood and Frank Neumann. This scale, composed of increasing levels of intensity that range from imperceptible shaking to catastrophic destruction, is designated by Roman numerals. It does not have a mathematical basis; instead it is an arbitrary ranking based on observed effects.

The Modified Mercalli Intensity value assigned to a specific site after an earthquake has a more meaningful measure of severity to the nonscientist than the magnitude because intensity refers to the effects actually experienced at that place.

The lower numbers of the intensity scale generally deal with the manner in which the earthquake is felt by people. The higher numbers of the scale are based on observed

structural damage. Structural engineers usually contribute information for assigning intensity values of VIII or above.

Table 5-4: Modified Mercalli Intensity

Intensity	Shaking	Description/Damage
I	Not Felt	Not felt except by a very few under especially favorable conditions.
II	Weak	Felt only by a few persons at rest, especially on upper floors of buildings.
III	Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
IV	Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI	Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
VII	Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken
VIII	Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned
IX	Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations
X	Extreme	Some well build wooden structured destroyed; most masonry and frame structures destroyed with foundations, Rails bent.

5.4.1.2 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 LHMP's Alaska earthquake information is based on best available data; obtained from the U.S. Geological Survey (USGS) and the University of Alaska Fairbanks (UAF) Geophysical Institute's archives.

Research included searching the USGS earthquake database for events spanning from 1973 to present. Of the 57 events with a M4.0 or higher that the area has experienced since the legacy 2009 LHMP, three were a M6.0 or higher. Each M6.0 event had a recorded estimated intensity of VII on the Modified Mercalli scale, characterized by very strong perceived shaking and a moderate potential for damage. However, some residents of Skagway reported in USGS's "Did You Feel It?" report, a IV-V, characterized by light to moderate shaking and none to very light potential for damage. Highlighted rows in Table 5-5 show the three largest events occurring on May 1, 2017, and July 25, 2014 (USGS 2019a).

Table 5-5: Skagway Area's Historical Earthquakes >M4.0 Since 2010

Date/Time	Latitude	Longitude	Depth	Magnitude	Alaska Epicenter Location
2018-04-12	60.8665	-138.2663	10	4.1	43km NWN of Haines Junction, Canada
2018-01-18	59.7913	-136.7916	10	4.3	91km WNW of Skagway
2017-12-19	59.8411	59.8411	10	4	90km WNW of Skagway
2017-09-16	61.3277	-150.053	38.1	4.5	13km NW of Anchorage
2017-09-16	59.8659	-136.7936	6.55	5	94km WNW of Skagway
2017-08-18	59.0023	-136.3941	11.6	4	59km WSW of Haines
2017-06-22	59.7837	-136.559	3.24	4	79km WNW of Skagway
2017-05-04	59.7847	-136.705	1.06	4	86km WNW of Skagway
2017-05-04	59.8032	-136.6826	10	4.7	86km WNW of Skagway
2017-05-01	59.7949	-136.663	10	4	84km WNW of Skagway
2017-05-01	59.7634	-136.6574	4.03	4.1	83km WNW of Skagway
2017-05-01	59.8428	-136.7041	10	4.1	89km WNW of Skagway
2017-05-01	59.8653	-136.6306	10	4.1	86km WNW of Skagway
2017-05-01	59.7709	-136.5826	10.8	4.9	79km WNW of Skagway
2017-05-01	59.7953	-136.6481	12.31	5	84km WNW of Skagway
2017-05-01	59.7489	-136.6058	10	4.8	79km WNW of Skagway
2017-05-01	59.7421	-136.6143	3.87	4	79km WNW of Skagway
2017-05-01	59.7689	-136.6818	10	5.7	84km WNW of Skagway
2017-05-01	59.7772	-136.6292	4.09	5.6	82km WNW of Skagway
2017-05-01	59.8295	-136.7042	2.53	6.3	88km WNW of Skagway
2017-05-01	59.878	-136.838	8.11	5	97km WNW of Skagway
2017-05-01	59.7823	-136.7688	3.62	4.3	89km WNW of Skagway
2017-05-01	59.858	-136.6745	5	4.3	88km WNW of Skagway
2017-05-01	59.8209	-136.7114	10	6.2	88km WNW of Skagway
2017-01-16	58.1475	-136.8539	13.1	4.5	76km WSW of Gustavus
2017-01-16	58.1749	-136.8297	10.6	4.1	69km WSW of Gustavus
2016-11-16	59.6131	-137.6481	1.52	4.6	117km E of Yakutat
2015-08-10	58.5118	-137.3418	13	4.1	93km W of Gustavus
2015-05-21	59.5389	-136.398	15.3	4.1	66km WNW of Haines
2015-02-18	58.3366	-137.0316	3.4	4.5	68km W of Gustavus
2014-11-05	59.1626	-136.3071	5.5	4.9	48km W of Haines
2014-07-25	58.2766	-137.0648	5.1	4	79km W of Gustavus
2014-07-25	58.2313	-137.102	1.8	4.6	82km W of Gustavus
2014-07-25	58.2988	-136.9846	9.7	4.4	74km W of Gustavus
2015-02-18	58.3366	-137.0316	3.4	4.5	68km W of Gustavus
2014-11-05	59.1626	-136.3071	5.5	4.9	48km W of Haines
2014-07-25	58.2766	-137.0648	5.1	4	79km W of Gustavus
2014-07-25	58.2313	-137.102	1.8	4.6	82km W of Gustavus
2014-07-25	58.2988	-136.9846	9.7	4.4	74km W of Gustavus
2014-07-25	58.3753	-136.951	9.6	4.1	71km W of Gustavus
2014-07-25	58.3283	-137.0081	10	4.7	74km W of Gustavus
2014-07-25	58.3354	-136.9711	10	6	72km W of Gustavus
2014-07-25	58.3219	-137.0442	10	4.7	74km W of Gustavus
2014-07-20	60.3235	-140.3079	5.6	5	97km NNW of Yakutat
2014-07-17	60.3737	-140.3314	11.6	4.9	98km NNW of Yakutat
2014-07-17	60.3491	-140.3333	10	6	90km NNW of Yakutat
2014-07-12	61.1726	-140.1545	6.8	4.7	157km WNW of Haines Junction, Canada
2014-06-05	61.1645	-140.2468	1	5.3	157km WNW of Haines Junction, Canada
2014-06-05	61.1722	-140.2434	1	4.9	156km WNW of Haines Junction, Canada

Table 5-5: Skagway Area’s Historical Earthquakes >M4.0 Since 2010

Date/Time	Latitude	Longitude	Depth	Magnitude	Alaska Epicenter Location
2014-06-04	58.9804	-136.7282	8.1	5.2	77km WSW of Haines
2014-05-09	59.7682	-136.5988	15.44	4.2	80km WNW of Skagway
2014-02-25	60.908	-138.374	9.1	4.2	50km WNW of Haines Junction, Canada
2013-11-19	59.5143	-138.9978	18.4	4.5	46km E of Yakutat
2013-10-03	60.9785	-150.964	68	4.2	Kenai Peninsula
2012-01-04	61.1175	-149.926	61.7	4.9	Southern AK
2011-09-15	61.0071	-150.914	10	4	Southern AK
2011-03-17	61.1207	-150.198	47.2	4.4	Southern AK
2011-01-08	60.2239	-151.826	72.7	4	Kenai Peninsula
2010-12-10	59.8977	-151.827	55.9	4	Kenai Peninsula
2010-10-14	60.7649	-151.076	58.9	5.1	Kenai Peninsula
2010-07-03T	60.7248	-150.276	40.9	4.5	Kenai Peninsula
2010-02-15	60.0358	-151.934	64.6	4.6	Kenai Peninsula

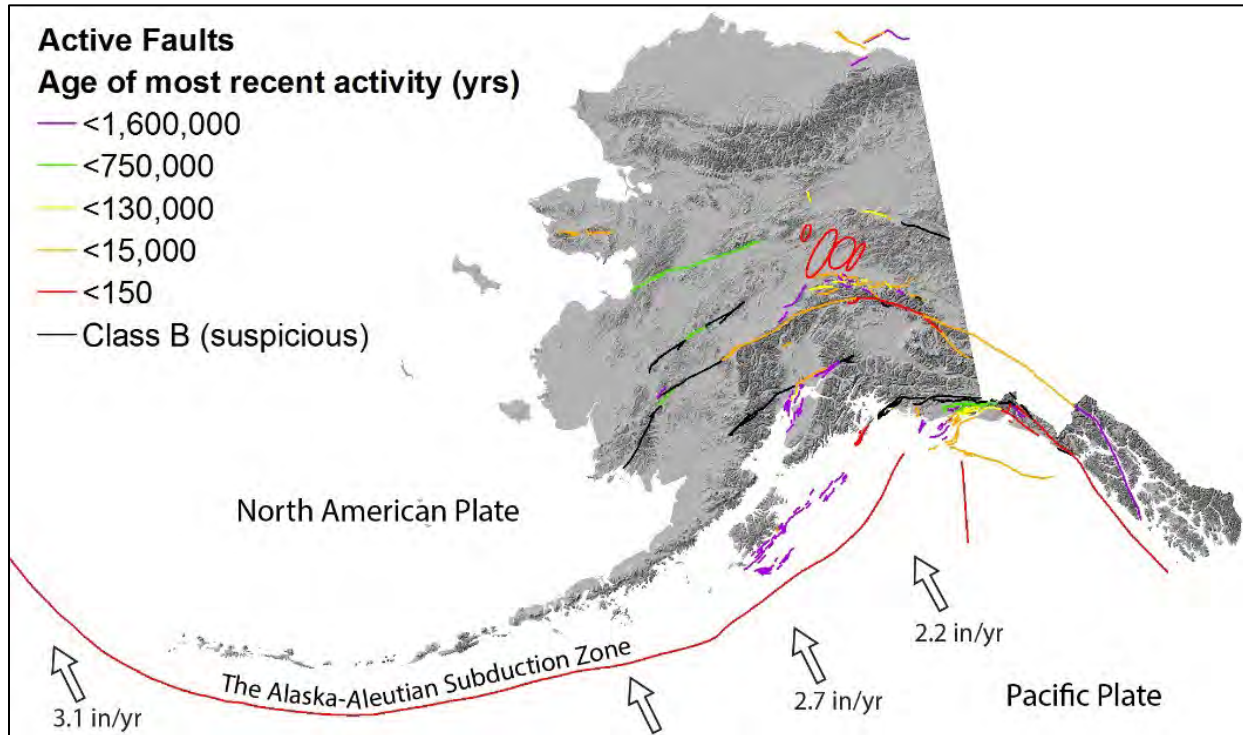
Source: USGS 2019a

5.4.1.3 Location, Extent, Impact, and Recurrence Probability

Location

The entire geographic area of Alaska is prone to earthquake effects. The hazards of an earthquake could potentially impact any area of Skagway. Figure 5-1 shows the locations of active and potentially active faults in Alaska.

Figure 5-1: Alaska’s Known Active Faults



Source: DGGs 2019b

Notes: Colored by activity recency. The North American plate and the Pacific plate are converging at the Alaska-Aleutian subduction zone at a rate of several inches per year.

Major faults in the area include the Queen Charlotte fault, the Fairweather fault, and the Chatham Strait fault. Minor faults in the area include the Clarence Strait fault and the Peril Strait fault. The eastern end of the Denali and Transition faults are also found in southeastern Alaska (AEC 2019).

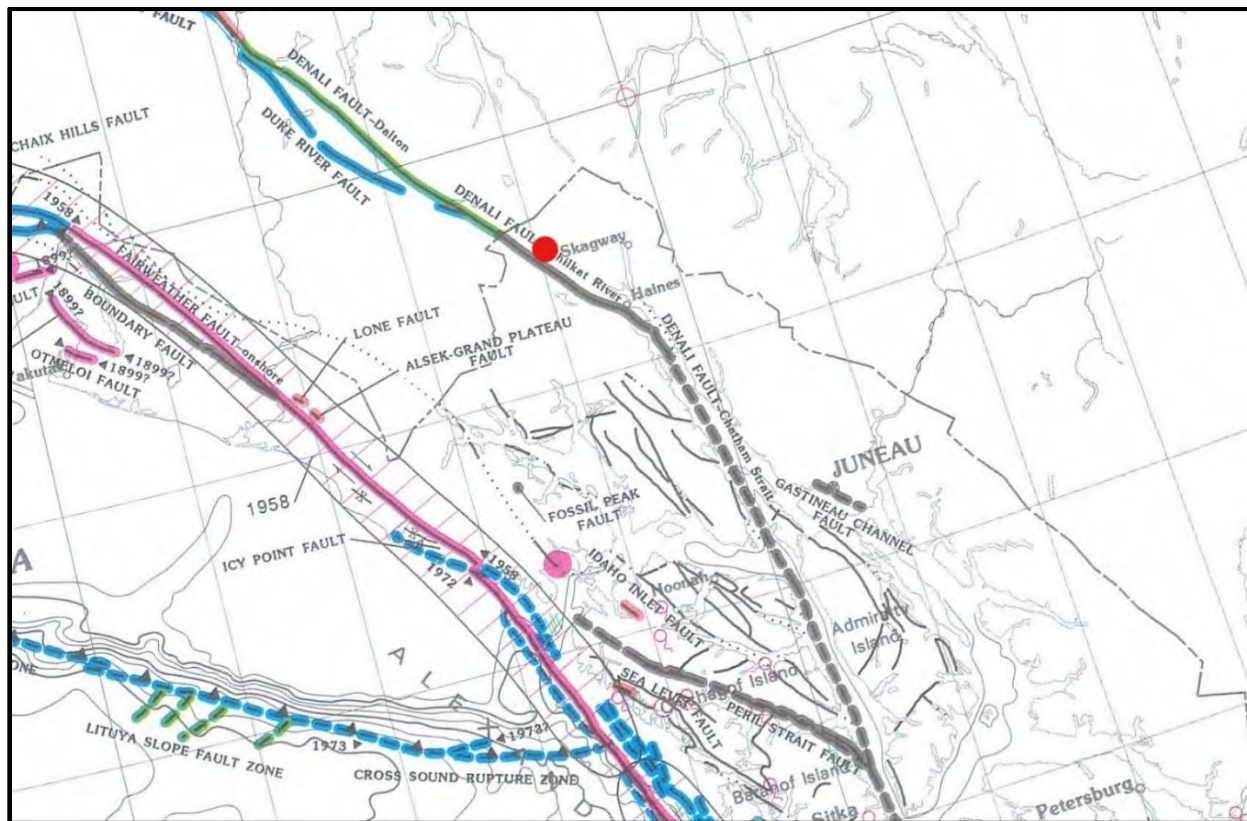
Skagway is located near the Fairweather fault, which extends from south of Queen Charlotte Islands to Skagway. The fault moves right-laterally approximately 2.25 inches per year. During the past century, the Fairweather fault has generated six major earthquakes with a magnitude 7 or greater. A study by the U.S. Geological Survey predicts a magnitude 8 or greater earthquake will occur near Skagway in the future. Ground shaking can cause liquefaction of Skagway's thixotropic soils, which could cause devastation (Municipality of Skagway 2008).

Extent

The Richter scale expresses magnitude as a decimal number. A 5.0 earthquake is a moderate event, 6.0 characterizes a strong event, 7.0 is a major earthquake, and a great earthquake exceeds 8.0. The scale is logarithmic and open-ended. A magnitude of 2 or less is called a microearthquake, which typically cannot be felt by people and is recorded only on local seismographs. Events with magnitudes of about 4.5 or greater are strong enough to be recorded by seismographs all over the world. A magnitude higher than 5 is considered a moderate earthquake, and a large earthquake might be rated as magnitude 6 and major as 7.

Figure 5-2 depicts a portion of the 1994 USGS generated Neotectonic Map of Alaska with Skagway at the center point. Numerous active faults lines lay within close proximity to the municipality (red dot).

Figure 5-2: Neotectonic Map of Alaska, Skagway Area



Source: DGGS 2019b

Based on historic earthquake events and the criteria identified in Table 5-2, the magnitude and severity of earthquake impacts in the Skagway area are considered "Critical" with an event

producing injuries and/or illnesses resulting in permanent disability, complete critical facilities shutdown for at least two weeks; and more than 25 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 are expected. Damage could be area wide. Major shaking may be seen or felt based on past events. Limited building damage assessors are available in Skagway to determine structural integrity following earthquake damage. Impacts to future populations, residences, critical facilities, and infrastructure are anticipated to remain the same.

Recurrence Probability

While it is not possible to predict an earthquake, the USGS has developed Earthquake Probability Maps that use the most recent earthquake rate and probability models. These models are derived from earthquake rate, location, and magnitude data from the USGS National Seismic Hazard Mapping Project. A USGS study conducted in 1972 describes multiple legacy seismic probability maps of Skagway (Municipality of Skagway 2008):

From the available seismic probability maps, derived from instrumented earthquake data, it appears that an earthquake of at least magnitude 6. But, if the available data on geologic structure and probable tectonic activity of adjacent areas also are considered, it is concluded that an earthquake of magnitude 7 might occur. In addition, it is concluded that earthquakes of magnitude about 8 will occur again somewhere to the southwest, west and northwest of the city, on or near the Queen Charlotte Islands, Fairweather, and Chugach-St. Elias faults... The nearest parts of these faults are a minimum of about 100 miles from Skagway. Despite a decrease in energy of an earthquake with distance from its point of origin, especially across structural trends, the potential for damage at Skagway from the longer period motions of these earthquakes is important to consider.

Earthquake probability mapping for Skagway (USGS 2019b) indicates that the probability of an earthquake with an intensity of 5.0 or greater will occur in the next 10 years within 50 kilometers (31 miles) of Skagway is 20 percent. Table 5-3 indicates its recurrence is categorized as “Possible” that a M5.0 or greater earthquake could potentially recur within the next 5 years with a (1/5= 20 percent) chance of occurring, due to an event history that is equal to 20 percent.

5.4.2 Flood

5.4.2.1 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.

Types of flooding that occur in the Skagway are described below. See Table 5-6 for annual flood percent chance of occurrence.

Rainfall-Runoff Flooding occurs in late summer 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.

Flash floods typically originate from slow-moving storms that can generate immense rainfall and snow melt volumes which rapidly raise water levels bursting levees and seeking new routes to lower ground. Flash floods quickly reach high velocities; often carrying debris. They can strike populated areas with little to no warning and may bring several feet of water. These events have moved small car-sized boulders, uprooted trees, destroyed structures and facilities, eroded roadways, swept away vehicles and created new water channels. The intensity of flash flooding is a function of rainfall intensity and duration, watershed steepness, stream gradients, watershed vegetation resistance, natural and artificial flood storage area capacities, and streambed and floodplain configuration. Urban areas are more vulnerable to flash flooding because of development, land clearing, drainage system construction, and open areas that allow water to move unobstructed; such as parking lots and ditches. Wildfires exacerbate flood and land slide conditions because wildfires alter soil conditions and remove essential landslide resistant vegetation.

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

Storm Surge, or 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 coastal wave run-up 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.

Ice Override is a phenomenon that occurs when motion of the sheet ice is initiated by wind stress acting on the surface of ice that is not confined. Onshore wind coupled with conditions such as a smooth gradual sloping beach and high tides can cause ice sheets to slide up or "override" the beach and move inland as much as several hundreds of feet. Ice override typically occurs in fall and early winter (though events have been reported at other times) and is usually associated with coastal storms and storm surge but may also happen in calm weather.

Override advances are slow enough to allow people to move out of its path, and therefore poses little immediate safety hazard. Intact sheets of ice up to several feet thick moving into buildings or across roads and airports can however cause structural damage and impede travel. Shoreline protection in the form of bulkheads or other structures to break-up the ice can limit the movement of ice. In at least one occasion, a bulldozer was able to break-up the ice and prevent damage.

Coastal Scour (used interchangeably with erosion) rarely causes death or injury. However, both coastal and riverine scour causes property destruction, prohibits development, and impacts community infrastructure. Erosive scour can occur rapidly as the result of floods, storms or other events or slowly as the result of long-term environmental and other climate changes occur. Erosion is a natural process, but its effects can be easily exacerbated by human activity.

Land scour, no matter the source, results in lost beach, shoreline, or dune material from 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.

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 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.

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 downstream affects from shore protection structures such as groins, jetties, seawalls, or revetments can lead to increased erosion.

Riverine Scour results from extreme flowing water forces river channels damages. This scouring affects the river channel, river bed and banks and can alter or preclude any channel navigation or riverbank development. In less stable braided channel reaches, scour, and material deposition are constant issues. In more stable meandering channels.

Many flood damages are predictable based on rainfall and seasonal thaw patterns. Most of the annual precipitation is received from April through October with August being the wettest. This rainfall leads to flooding in early/late 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.

Table 5-6: Annual Flood Chance of Occurring

Category	Definition
1-Year Flood	A 100% chance an annual flood will occur (also described as having a 100% probability in any year)
2-Year Flood	There is a 50% chance a flood event will occur (5.0 Probability)
5-Year Flood	There is a 20% chance a flood event will occur (or 2.0 probability)
10-Year Flood	There is a 10% chance a flood event will occur (or 0.1 probability)
50-Year Flood	There is a 2% chance a flood event will occur (or 0.02 probability)
100-year Flood	There is a 1% chance a flood event will occur (or 0.01 probability)
500-Year Flood	There is a 0.2% chance a flood event will occur (or 0.002 probability)

Hazards related to flooding include erosion, ground failure, and coastal storm surge. Flooding and erosion commonly occur together because of increased water currents that get raised above the normal tide line or riverbank.

5.4.2.2 History

Skagway's flood challenges were described by HUD (1976):

Floods occur primarily in September and October and in the spring and can result from a combination of factors, including snow melt and precipitation; however, the primary cause of flooding in the study area is rapid runoff during heavy rains. The sequence of events also affects the flooding potential. For example, spring floods may occur as a result of above normal snowfall during the winter, followed by an unusually cold spring and finally a rapid snow melt. High temperatures in the glacial areas or warm rain on snow or ice fields will contribute to higher base flows during the summer months.

...The bed of the Skagway River has been aggrading at the rate of about 0.06 feet per year. This has the effect of raising the river by this amount and thus increasing the chance that the dike will be overtopped in a flood. A close look at the topography reveals that the river channel invert is very close to, or above, some of the lower elevations in the city. Therefore, any breach in the dike could potentially develop into a major flood

problem.

The 100-year flood will overtop the existing dike in two locations - at the old city dump near First Avenue and Alaska Street, and across the airport runway from Tenth and Eleventh Avenues. If the dike maintains its structural integrity as assumed, sheet flow with a depth less than one foot can be expected in the city; this area being designated as Zone B. The assumption of a stable dike is based on the fact that the location of major overflow is along the existing airport where fill material was used to construct the airfield to the height of the then existing dike.

The entire city can be considered flood prone for the 200-year flood, since this flood will overtop the dike in numerous locations. The 500-year flood would essentially cover the same area as the 200-year flood, only to a greater depth, since the town is closed in on both sides by sharply rising mountains. B Zones were established in the city where sheet flow conditions would exist during the 500-year flood and points of high velocity with shallow flooding depths are possible.

The National Oceanic and Atmospheric Administration (NOAA) Storm Events Database provides detailed information on flood events in the Skagway area. The following Flood Event history was extracted from the NOAA database and is included in Table 5-7.

Table 5-7: NOAA Recorded Flood Events in Skagway

Date	Watershed	Episode Narrative
09/23/1997	Skagway River	Skagway received over 2 inches of rain in 24 hours September 22-23, which is over one-half of the normal September precipitation, and a flood watch was issued for the Skagway River. The river rose 5 feet, within inches of bank-full, during the afternoon of the 23rd. The city of Skagway piled rock along the east bank of the river to mitigate erosion and prevent the river from flowing around the dike into town.
10/20/1998	Skagway and Taiya Rivers	Flooding occurred along the Taiya and Skagway Rivers due to heavy rain over Oct.19-20. The Haines ASOS measured 4.40 inches of rain in 24 hours...highways along the rivers near Skagway were damaged due to erosion... several other state roads and trails were washed out.
07/22/2002	Taiya River	The West Creek flood inundated the small, remote community of Dyea on this date. A 700-foot high moraine above the West Creek Glacier collapsed during the early morning hours of Tuesday, July 23rd. This landslide collapsed into the glacial lake below, causing an estimated six foot rise in the lake level. Official estimates of between 536-766 million cubic yards of material slid into the lake. The displaced water volume surged downstream into the West Creek in a tsunami-like manner.35 people total had to be evacuated. Major flood, mud and silt damage resulted in Dyea. The flood waters receded a mere 5 hours after the initial flood wave gushed through...again indicating a tsunami-like flash flood due to the landslide
07/04/2014	Taiya River Inlet	Moderate rain began to fall over the Taiya River basin...The rain that fell primed the ground and raised the river level to near bankful stage.... Rainfall amounts for the July 3 and 4 were two point three inches at Skagway, two in and a half at Sheep Camp along the Chilkoot trail at an elevation of nine hundred and nineteen feet. The rain gauge at the Taiya River gauge reported one point seventy one inches. The freezing level were well above the mountain tops in the area so all the precipitation came down in the liquid form ... increase the runoff into the Taiya River basin. The Taiya River began to rise ... The river crested at 17.5 feet by mid day of Friday and a half foot above moderate flood stage of 17.0 feet. Above 17.0 feet there is significant flooding along the Chilkoot trail within the Klondike Gold Rush National Park with flood waters at least thigh deep in places along the trail. The National Park Service may close the trail above moderate flood stage due to safety concerns from the high and swift water.

Table 5-7: NOAA Recorded Flood Events in Skagway

Date	Watershed	Episode Narrative
08/12/2014	Taiya River Inlet	Steady moderate rain began to fall over the Taiya River basin ...This front produced daily record precipitation records for the day at the Skagway airport with zero point sixty-two inches and at the Skagway power Continuity of Operations station. The rainfall raised the river level on the Taiya River to bankful stage of 16.0 ft ...Rain amounts at Sheep Camp in the headwaters of the Taiya River were in the order three quarters of an inch in twelve hours and temperatures remained above 50 degrees to increase the snow and ice melt. The Taiya River began to rise steadily from the moderate rain and snow/ice melt ... before cresting at 17.91 feet almost a foot above moderate flood stage of seventeen feet in the late morning. The river slowly receded through the day and evening to be below minor flood stage late Tuesday evening. Above moderate flood stage of seventeen feet there is significant flooding along the Chilkoot Trail within the Klondike Gold Rush National Park with flood waters at least thigh deep in places along the trail. The Park Service may close the trail above moderate flood stage due to safety concerns from the high and swift water.
09/22/2014	Taiya River Inlet	Moderate rain began to fall over the Taiya River basin in the early morning hours of September 21st. The moderate rain continued through the early evening hours and by the time the rain stopped the Skagway airport received record rainfall for that day with one point fourteen inches. In the headwaters...the Sheep Camp weather station reported one point twenty one inches on the 21st and the warm front... increase the ice melt from glacier input. The Taiya River began to rise ... crested 17.06 feet just above moderate flood stage of seventeen feet in the early hours on the 22nd... There were reports of moderate flood along the lower portions of the Chilkoot trail in the Klondike Gold Rush National Historical Park with waist to thigh deep water in places.
08/19/2015	Taiya River Inlet	Heavy rain moved over the area...the Taiya River began to rise significantly through the day as the moist weather front moved over Southeast Alaska. The freezing levels were very high and ample amount of moist as the front had sub-tropical characteristics. The river crested in the afternoon at a stage of 17.27 feet. This was just over moderate flood stage of seventeen feet and it flooded the Chilkoot trail with knee to thigh deep water in places. The river was below minor flood stage by the early morning of the 19th.
09/07/2017	Taiya River Inlet	The Taiya River started a steep rise in the mid afternoon ... went above minor flood stage of 16.5 feet during the evening hours. There was about ankle deep water in the lower portions of the Chilkoot Trail within the Klondike Gold rush Historical Park near Skagway. ... the Taiya River began another steep rise and went up above moderate flood stage of 17.0 feet just before midnight. The Taiya River crested at a stage of 17.78 feet around 0400AKDT and water levels started to fall as the rain rates tapered off. The river level went below minor flood stage by the mid afternoon. There was flooding impacts along the Chilkoot Trail as the National Park Service closed the trail due to impacts associated with the high waters.
09/10/2015	Taiya River Inlet	Rainfall amounts were pretty impressive for the driest area in Southeast Alaska with three quarters to one and a half inch of rain at sea level station with about three inches at high elevations. The Taiya River that goes through the Klondike National Park along the Chilkoot trail continued to rise ... The river went over minor flood stage in the early evening on the 10th and crested above moderate flood stage at 17.32 feet in the early morning hours of the 11th. Once the heavy rain stopped after the cold front passed over the are the river slowly receded below flood stage by the early afternoon on the 11th. The Chilkoot trail was flooded with significant amount of water over the trail from ankle to thigh deep in places along the lower portions of the trail near the river.
09/28/2017	Taiya River Inlet	The Taiya River continued to rise at a steep rate for 36 hours from the moderate rainfall. The river went above moderate flood stage of 17 feet in the late afternoon ...and did not go below that threshold until the early morning of September 28th.

Table 5-7: NOAA Recorded Flood Events in Skagway

Date	Watershed	Episode Narrative
		The Chilkoot trail within the Klondike Gold Rush Historical Park near Skagway Alaska was impacted by flooding along the lower portions of the trail. The river crested at a level of 17.59 feet and in doing so produced flood waters of knee deep or higher in places. In the morning hours of the 28th NPS advised boaters and other recreational water based actives on the Taiya River to be suspended until the water level went down. The water levels receded through the day on the 28th and was below flood stage by the early afternoon.

Buzzell (2004) chronicles the early efforts to control flooding on the Skagway River, and includes information on early floods. The 2018 DHS&EM Disaster Cost Index (DCI) lists historical flood events affecting the Skagway area that received state of federal funding. The 2007 Skagway Coastal Management Plan provides information on the 2002 glacial lake outburst flood that affected the Taiya River watershed and surrounding communities.

5.4.2.2 Location, Extent, Impact, and Future Events Probability

Location

The Municipality of Skagway has two major river systems, the Taiya and the Skagway. These valleys provide a route to glacier free mountain passes that link the coast to the interior. The city townsite is located on the delta of the Skagway River, downstream of the narrow river valley. The SHMP (DHS&EM 2019) states that because of its location on the river deltas, the Municipality of Skagway is one of the most flood-prone cities. Multiple dikes along the Skagway River partially protect the municipality, however, they have experienced ten flood disasters since the 1900s.

Beginning in the 1940s, flood control dikes have been built on both sides of the Skagway River, through the townsite and to about 1.5 miles upstream, by the U.S. Army, the USACE, private landowners and the Alaska DOT&PF. The primary dike is approximately 6,700 feet long and provides flood protection to the commercial and residential areas of Skagway. Dikes have since been constructed upstream of the townsite by various entities, including private landowners, the USACE, and DOT&PF (USACE 2019). Figure 5-3 shows the location of the primary dike.

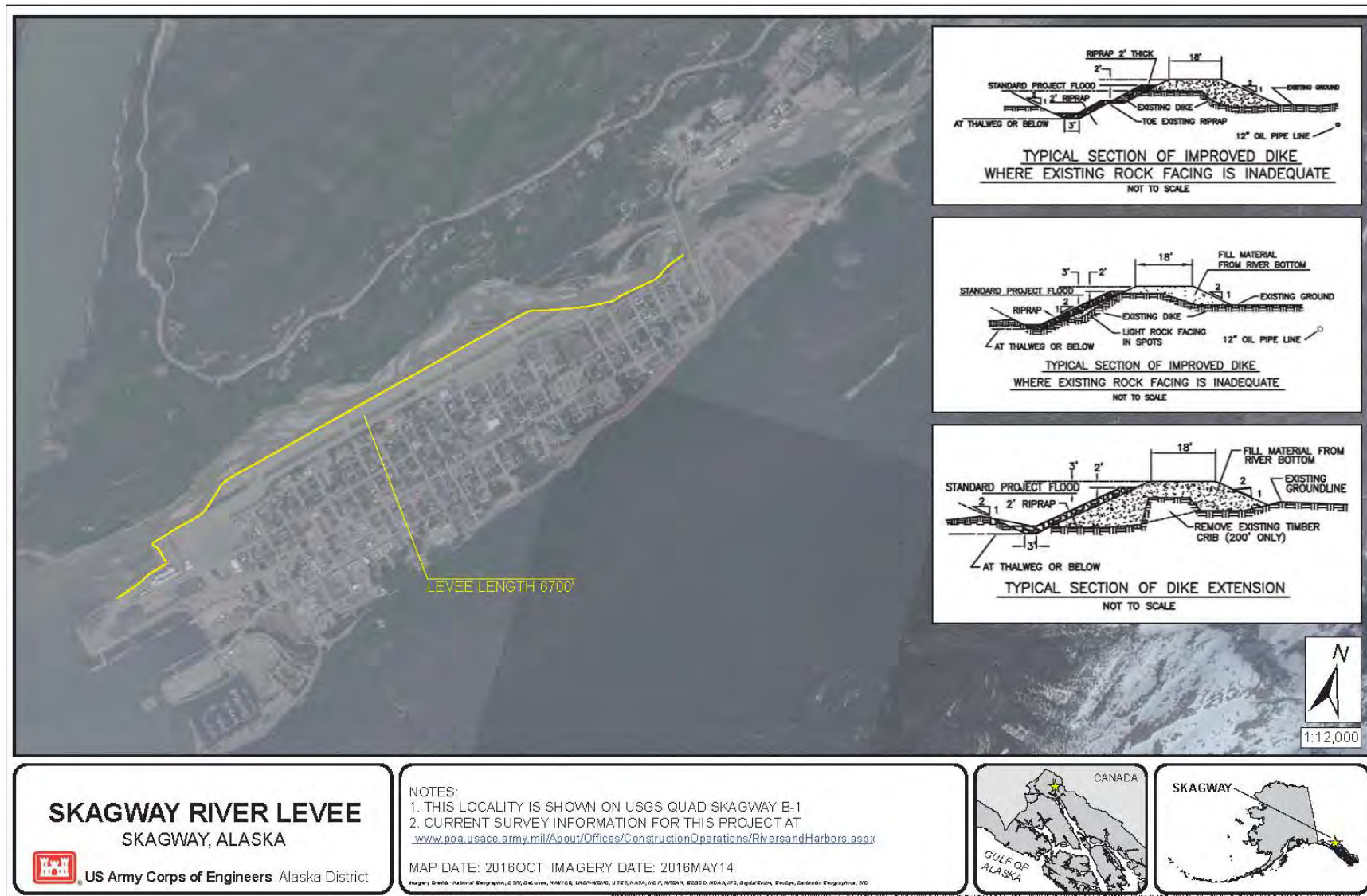
Skagway's townsite has not flooded since its construction, though larger flood events have required major flood fighting efforts to prevent the flows from overtopping the levee. The National Levee Database, kept by the USACE, explains the risk characteristics of the levee:

The LSOG considers the risk associated with the Skagway River Levee to be Moderate (LSAC 3) for Prior to Overtopping based on anticipated poor performance with a high annual likelihood of breach, moderate life safety and high property damage consequences and to be High (LSAC 2)...Overtopping due to anticipated high annual likelihood of overtopping and associated moderate life safety and high property damage consequences. The risk is driven by overtopping and levee seepage due to the pervious and erodible embankment materials. There is also some concern with embankment stability and erosion. Uncertainty in risk is increased by the poor community awareness due to the large transient population from the cruise industry.

The Skagway River Levee is not accredited through FEMA and the NFIP, meaning it does not meet the requirements in the NFIP because it is not shown on a Flood Insurance Rate Map as reducing the base flood hazards.

The municipality experienced a glacial lake outburst flood in 2002. It resulted in a mudslide in the Taiya River floodplain that damaged private and government property, bridges and roads, and forced the evacuation of campers at Dyea (Figure 5-4).

Figure 5-3: The Skagway River Levee



Source: USACE 2019

Figure 5-4: Taiya River Mudslide



Source: NOAA

Figure 5-5 shows flooding on the Chilkoot trail (17.36 feet). The National Weather Service describes 17 feet as a “Moderate Flood Stage.” At this level, the National Park Service (NPS) may close the trail due to the impacts associated with high water in the surrounding watershed.

Figure 5-5: Chilkoot Trail Flooding



Source: NOAA

BLM (2005) investigated the geological hazards that are present and describes two areas with a potential for a large flood event:

This investigation identified a second lateral moraine, adjacent to West Creek Glacier Lake, which could replicate the results of the first lateral moraine slide. This same study identified a much larger potential threat at the Nourse Glacier, located within a tributary of the Taiya River. Nourse Lake has formed within the past 50 years due to the retreat of its glacier. This lake has a surface area of approximately 170 acres (0.69 square kilometers) with a maximum depth of 95 feet (ft) (29 meters (m)). The lake has formed behind a 3944 (120 m) high terminal moraine. A catastrophic failure of this moraine may result in a peak discharge twice as large as the West Creek glacial flood.

Nourse Glacier. The Nourse River glacial area does have the potential for catastrophic flooding...However, the large volume of water trapped behind this moraine has the potential to cause significant downstream damage if catastrophically released. According to Hal Pranger (geomorphologist, NPS), seven different dam failure equations were used to estimate peak discharge in the event of a catastrophic moraine failure. All seven equations estimate an at-the moraine discharge in the 250,000 cubic foot per second (cfs) range. Five equations estimate the peak discharge at Dyea to be in excess of five times the estimated 500-year flood event on the Taiya River.

Extent

Floods are described in terms of their extent which includes the horizontal area affected, the vertical floodwater depth, 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

The following factors contribute to glacial outburst flooding frequency and severity:

- Very large or rapidly growing or retreating glaciers
- Long term degradation
- Changing precipitation patterns
- Climate change

In the past decade, the Skagway coastal district has experienced routine riverine flooding, including flooding of the Taiya River induced by glacial lake outburst. Glaciers are currently estimated to be thinning at the rate of two meters per year and about 13 percent of the ice cover in the watershed has been lost in the last 50 years. The rate at which ice cover is being lost is increasing, which is likely to increase the frequency of outburst floods as retreating glaciers leave pro-glacial lakes in their wake.

Therefore, based on historical flood damage history and the criteria identified in Table 5-2, the extent of flooding and resultant damages to infrastructure and their protective embankments in the Skagway area are considered “Critical” where injuries and illness may result in permanent

disability, critical facilities would shut-down for at least two week and more than 25 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 erosion, and/or wind. 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 (Baker et al. 1988).

Recurrence Probability

Based on previous occurrences, the SHMP (DHS&EM 2019), the USACE's National Levee Database (2019), NFIP (FEMA 2019), and criteria in Table 5-3, it is "Highly Likely" that Skagway will have a flood event within the next year. A "Highly Likely" event has a 1 in 1 year (1/1=100) percent chance of occurring based on their flood history being greater 33 percent likely per year. It should be noted that in the PND (2016) report (Figure 4 on page 7), a 100-year flood with the levees in place to protect the town would be expected to spill over to the recreation area on the west side of the River. The "Highly Likely" designation is based on the above listed criteria.

5.4.2.3 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 (2004) identifies nine landslide types, distinguished by material type and movement mechanism including:

- **Complex** is any combination of landslide types.
- **Cornice Collapse** is an overhanging snow mass formed by wind blowing snow over a ridge crest or the sides of a gully. The cornice can break off and trigger bigger snow avalanches when it hits the wind-loaded snow pillow.
- **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 miles per hour (mph) for several miles. Other types of flows include debris avalanches, mudflows, creeps, earth flows, debris flows, and lahars.
- **Falls** are the free-fall movement of rocks and boulders detached from steep slopes or cliffs.
- **Ice Fall Avalanches** result from the sudden fall of broken glacier ice down a steep slope. They can be unpredictable as it is hard to know when ice falls are imminent. Despite common belief, they are unrelated to temperature, time of day or other typical avalanche factors.
- **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.
- **Slab Avalanches** are the most dangerous types of avalanches. They happen when a mass of cohesive snow breaks away and travels down the mountainside. Slab avalanches occur as a result of the presence of structural weaknesses within interfacing layers of the snowpack.
- **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.

- **Topples** are rocks and boulders that rotate forward and may become falls.

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 that are most common along road systems. Frost heaves occur when ice forms in the ground and separates sediment pores, causing ground displacement. Frost jacking causes unheated structures to move upwards.

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 SHMP (DHS&EM 2019) provides additional ground failure information defining mass movement types, topographic and geologic factors which influence ground failure which may pertain to the Skagway area.

Related Hazards

Ground failure is associated with many other hazards such as flooding, erosion, and earthquakes. Each could directly initiate mass movement by destabilizing slopes; making them more failure-susceptible. For example,

- Water and sediment can add weight that overloads the surface making it unstable
- Removing material at the base of a steep slope or within the ground results in lateral support failure or structural subsidence
- Ground motion commonly initiates a variety of ground failure impacts

5.4.2.4 History

Alaska has a long history of snow avalanches. It has been estimated that there have been over 4,500 avalanche disaster events in the past 200 years. The Palm Sunday avalanche, April 3, 1898 is considered to be the deadliest event of the Klondike Gold Rush. The Chilkoot Trail experienced multiple slides that day, including three with fatalities. The first fatal slide caused three fatalities. The second one killed the entire Chilkoot Railroad and Transportation Company crew who were trying to evacuate an avalanche prone area further up the trail. The third slide occurred in about

the same location as the second, killing approximately 70 people who were following the trail left by the construction crew. The exact death toll is unknown because of the transient nature of those involved and inefficiencies in the identification process.

The NOAA Events Database documents historic avalanche events. This information is detailed in Table 5-8 below.

Table 5-8: Skagway Area Avalanche Events

Date	Type	Description
12/22/03	Avalanche	A low that bottomed out at 967 mb, moved north from the southern Gulf up into Prince William Sound during this time. A strong southerly flow developed behind the associated front and ushered in warmer air. Sea level locations throughout Southeast Alaska changed over to rain as the snow level quickly rose in elevation during this storm. Only the higher elevations along the Klondike Highway remained snow into Monday morning. A quick foot of snow was reported overnight on White Pass (3116 ft). The nearest automated observing station located at the Skagway airport measured south winds gusting as high as 43 mph. The combination of heavy snow and gusty winds helped cause a three foot high, 120 foot long avalanche over the Klondike Highway. This major roadway between the Northern Panhandle and Canada, was closed for nearly 18 hours.
01/08/09	Avalanche	Strong north winds (sustained 35 to 40 mph and gusts to 55 mph) combined with overrunning snow to create blizzard conditions for nearly 24 hours in Skagway. A report from the Canadian Highway Department of an avalanche closed White pass road overnight.
01/11/10	Avalanche	The Skagway Customs Port of Entry reported blizzard conditions onsite and on the Klondike Highway. The Klondike Highway was closed briefly earlier due to avalanche of snow and rocks.

The residents of Skagway are concerned about the hazards associated with ground failure. Various local news sources contain articles relating to rockslides and other ground failure events the Skagway area and citizens have experienced in recent years. Figure 5-6 depicts a recent rockslide.

August 30, 2017: “Rockslide draws attention to potential hazard looming over Skagway cruise dock,” Emily Files – KTOO

On Aug. 25, it rained close to half an inch in Skagway. The next morning at about 6:30 a.m., a rockslide occurred. Two ships, the Volendam and Island Princess, had just tied up to the dock....“We made the decision to move the ships out of an abundance of care and safety,” said White Pass official Tyler Rose...The ships were relocated to Skagway’s other two cruise docks. Meanwhile, White Pass reviewed the damage, which Rose says was minimal. A large rock struck and damaged a railing meant to protect the facility...Rose says in addition to cleaning up the debris, White Pass had geotechnical engineers assess the slide area. White Pass already has fences on the cliff and a catchment in place to shield the dock from slides...“That is an active slide area,” Rose said. “We’ve put mechanisms in place to mitigate that risk, as you can see by the infrastructure that’s been put in that area. We’re monitoring it constantly. We will do what is best to address the safety issues down there because safety is paramount to our organization.”...“It has raised our attention to this issue,” said Skagway Borough Manager Scott Hahn. (<https://www.ktoo.org/2017/08/30/rockslide-draws-attention-potential-hazard-looming-skagway-cruise-dock/>)

September 5, 2017: “Early-morning Rockfall Damages Railroad Dock” -The Skagway News

At approximately 3 a.m. on Sept. 5, a rockslide occurred at the north end of the Railroad Dock, breaking a piece of the railing off and spilling rubble across the dock itself.

The White Pass & Yukon Route Railroad closed the dock for the remainder of the day, with two of the expected cruise ships being re-routed. The Ruby Princess docked on the Ore Dock and the Nieuw Amsterdam docked at the Broadway Dock as scheduled.

The topic of landslides/rockslides at the Railroad Dock was on the agenda for the assembly prior to the Sept. 5 event. A rockslide had occurred at 6:30 a.m. on Saturday, Aug. 26, causing minor damage to a railing and knocking a hole in the side of a covered waiting area. The cruise ships in harbor on Aug. 26 were shifted to the Ore and Broadway docks. No one was injured in either slide.

Rocks falling can be damaging on their own, however given proximity that the mountains around Skagway have to water, other hazards could potentially arise from a large-scale landslide or rockslide. Notably, enough heavy material falling directly into the water could trigger a tsunami. Such an event is not unprecedented in Southeast Alaska – in 1958, a magnitude 7.7 earthquake triggered a rockslide in Lituya Bay. The breakaway parts of mountain struck the water and triggered a mega-tsunami with a wave over 1,700 feet tall.

Figure 5-6: Site of Rockslide in Skagway, Alaska



Source: Photo taken by Andrew Cremata, appearing in Skagway News.

Local officials are aware of the hazards ground failure events pose to the community. In a Mayor's Report from May 2, 2019, Mayor Andrew Cremata addressed an incident that occurred the week prior involving a rockslide on the railroad dock and the efforts that have been put forth to begin mitigating the issue.

Rockslides on the Railroad Dock

As many of you know, there was more activity at the Railroad Dock slide area last week. It appears as though a large boulder came down, broke through older fencing, hit the dock, and then shattered into pieces.

I met with representatives from White Pass about the work they've been doing to mitigate this ongoing issue. They have been working with a geologist to identify problem areas on the mountain and develop a multi-layered strategy to minimize risk to dock users. Sensors are also in place that monitors rock movement in real time. More work needs to be done, but much has already been completed and I'm confident further safety enhancements will be expedited. I intend to ensure the dialog between White Pass and the municipality continues.

In another report from July 16, 2019, Mayor Cremata speaks again about the rockslide threat at the railroad dock and the impact it has on Skagway.

I want to point out that the majority of these issues are due to the fact that trains are not able to load and unload on the dock because of the ongoing rockslide threat. While the plan is not perfect and still evolving, I'm satisfied that White Pass is taking steps to address concerns about pedestrian traffic.

The plan is to add some stanchions and crosswalks to control passenger flow. White Pass Train Agents are also making detailed announcements to passengers in an effort to direct them accordingly.

The November 1994 tsunami that affected the Skagway Harbor and caused one fatality was caused by an underwater landslide. The 2018 DHS&EM DCI lists the following:

175. Skagway Submarine Landslide: *On November 16, 1994, the Governor declared that a condition of disaster emergency exists in the City of Skagway, as a result of a submarine landslide. As a result of this disaster damages to Alaska Marine Ferry facilities have interrupted normal service and require emergency repairs, and damages to the small boat harbor exceed the capability of the City of Skagway to repair in an urgent manner to preclude ongoing collateral damages.*

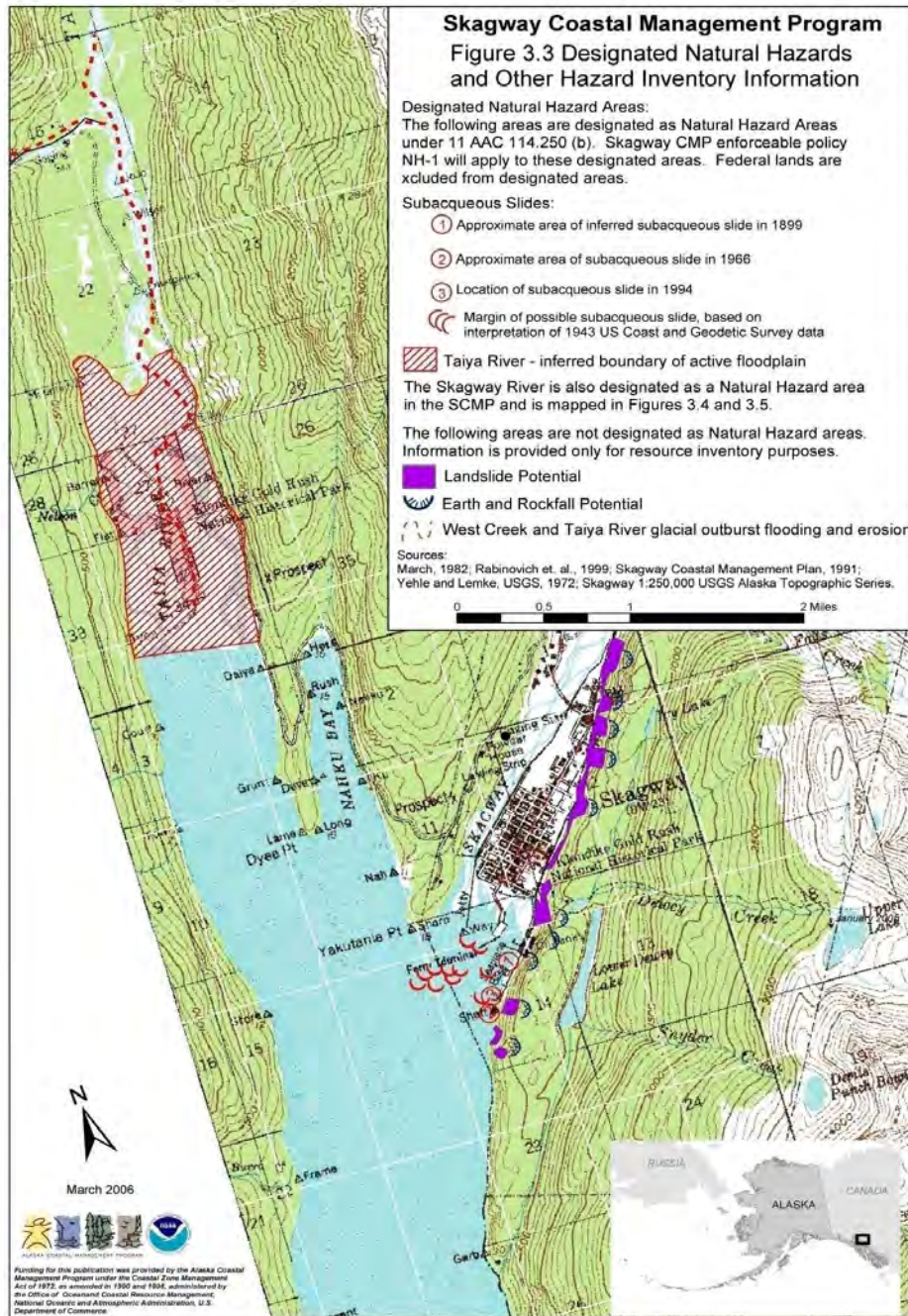
More information on this event can be found in Section 5.4.3, Tsunami and Seiche.

5.4.2.5 Location, Extent, Impact, and Recurrence Probability

Location

The steep slopes in the Skagway area are subject to large and small-scale slides, debris flows, rock falls, soil flows, and underwater slides. Although slides may be triggered by earthquake, many occur as the result of normal river delta formation, heavy rainfall, seasonal freezing and thawing, and man's alteration of slopes. Slides and avalanches have occurred along the Skagway waterfront and port, along the White Pass and Yukon Route Railroad tracks, and along the Klondike Highway. These areas are identified in the Skagway Coastal Management Plan (2007) and on Figure 5-7 below.

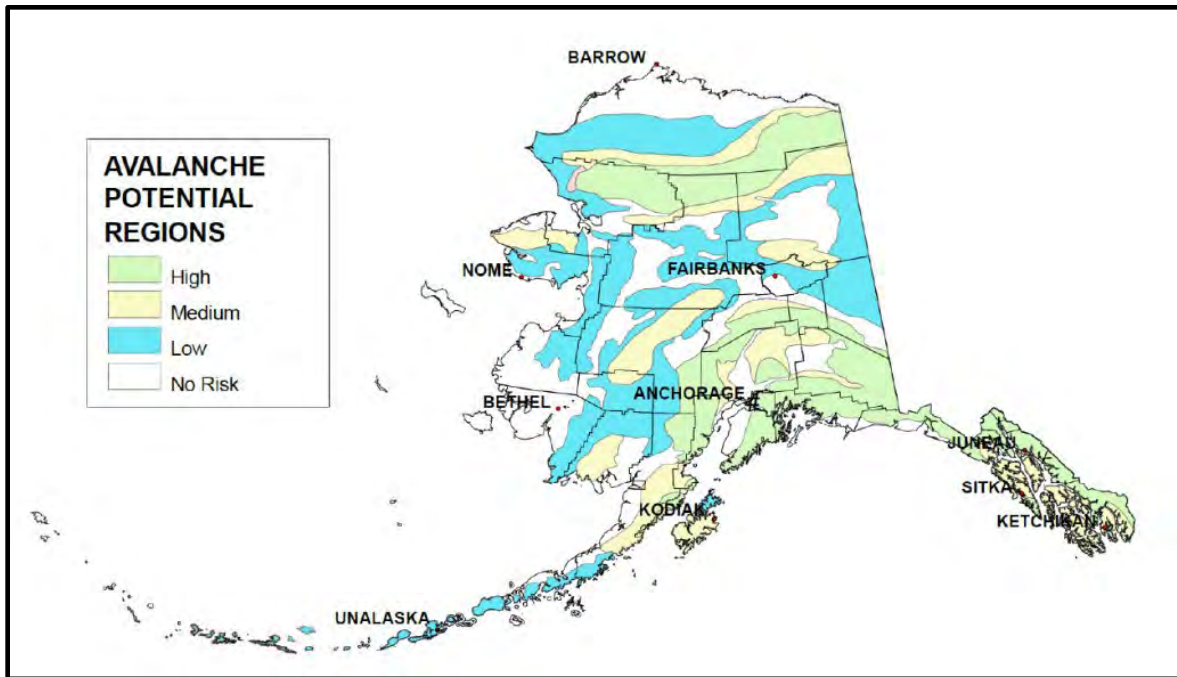
Figure 5-7: Designated Natural Hazards



Source: Municipality of Skagway Multi-Hazard Mitigation Plan 2008

Backcountry areas are prone to snow avalanches. Potentially affected areas roads and infrastructure areas include Skagway Road, South Klondike Highway, White Pass, Chilkoot Pass, and Whitehorse areas. Figure 5-8 is a generalized avalanche-potential map of Alaska that was produced in 1980 by compiling and cross-correlating topographic relief, snow-avalanche regions, climatic zones, snowpack characteristics, and known and suspected avalanche activity.

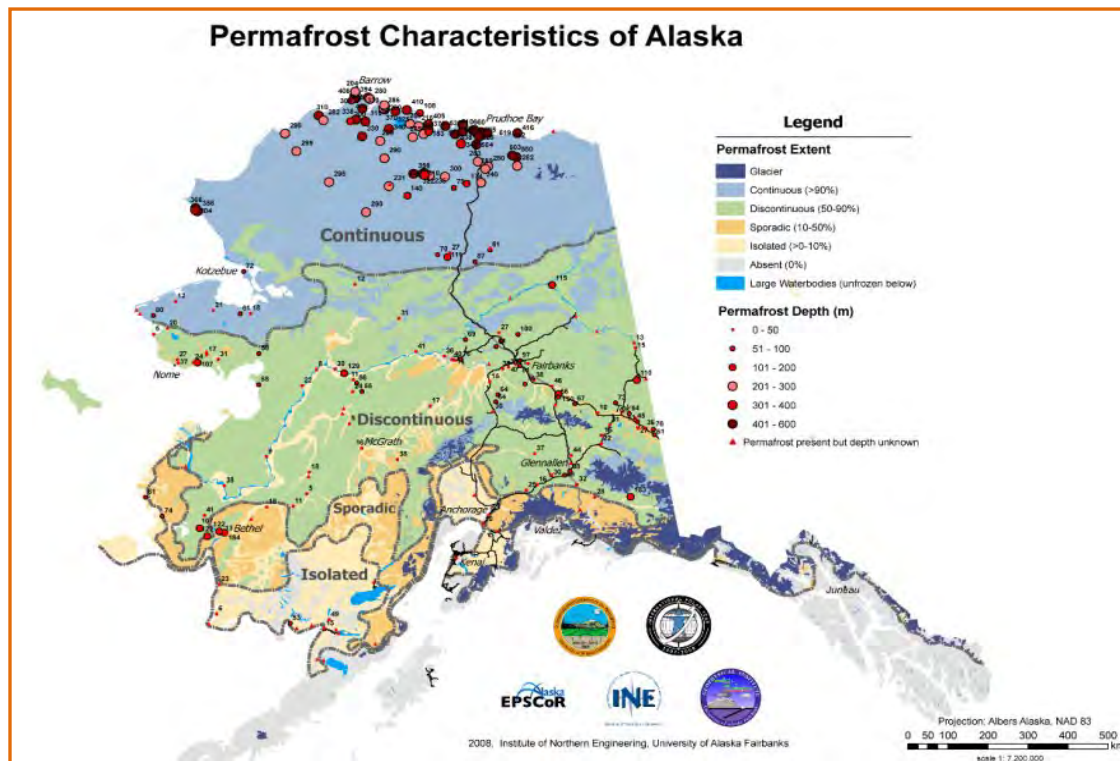
Figure 5-8: Avalanche Regions in Alaska



Source: Hackett and Santeford 1980

According to Permafrost Characteristics Map of Alaska (Figure 5-9) developed for the National Snow and Ice Data Center/World Data Center for Glaciology (Jorgenson et al. 2008), shows that the immediate Skagway area has no permafrost threat.

Figure 5-9: Permafrost Characteristics of Alaska



Source: Jorgenson et al. 2008

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 hospital and airport) were damaged or destroyed.

Based on research and the criteria identified in Table 5-2, Skagway's ground failure impacts threats are considered "Limited" where critical facilities would be shutdown for more than one week, and more than 10 percent of property is severely damaged. The locations identified with the potential for a ground failure event, as mentioned above, are in heavily populated areas and near critical facilities, such as the railroad dock and near the port. Complete shutdown of critical facilities involving the transportation routes and infrastructure could occur causing extreme financial hardship

This hazard could cause injuries or fatalities but is limited to a few known locations. Impacts would result in road closures with unknown durations. More than 10 percent of property of infrastructure could be severely damaged.

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 have no warning signs. Ground failure damage occurs from improperly designed and constructed buildings that settle as the ground subsides, resulting in structure loss or expensive repairs. Landslides and avalanches could cause death and injury because they occur with no advance warning.

The greatest danger from snow avalanche is in the backcountry in the municipality. Several times in the past, as described above, Skagway has been isolated by road closures due to snow avalanches. Infrastructure damage is also a high risk in Skagway, as well as the potential for injuries or fatalities.

Recurrence Probability

Few locations in the Skagway area experience recurring ground failure from landslides and avalanches. Roads and community coastal areas are the most susceptible to landslide and avalanche impacts. Community hazard event history coupled with Table 5-3 Hazard Magnitude and Severity categories places Skagway's landslide and avalanche threat as "Likely." An event has a (33 percent) chance of occurring in any given year, as the history of events is greater than 20 percent but less than or equal to 33 percent likely per year.

5.4.3 Tsunami and Seiche

5.4.3.1 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 within 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 within 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 within the enclosed area until the energy is fully spent causing repeated impacts and damages.

5.4.3.2 History

Many potential tsunami causes are present in Alaska. For example, submarine landslide-generated tsunamis threaten numerous communities where nearby rivers deliver fine-grained sediment into the ocean (e.g., Valdez, Seward, Whittier, Skagway, Haines, Juneau, Wrangell). These locally generated tsunamis can make community landfall in minutes. The 2008 Skagway LHMP recounts the historical tsunami that occurred in 1994:

An underwater landslide on November 3, 1994, on the east side of the Skagway Harbor occurred during one of the lowest tides of the year, producing a locally generated tsunami with estimated amplitude of 9 to 11 meters (Kulikov, et. al, 1996). There was no earthquake trigger for that landslide. Since the tide was very low, the wave did not leave the inlet basin. However, the wave caused the death of one person and destroyed a cargo terminal and 1.5 km of railway lines. There has been considerable scientific and legal interest and investigation of the circumstances of that event, but no follow up work to further assess risk, potential for damage, or appropriate prevention or response measures. (SCMP, 2007)...Engineering work can create slopes that may become unstable and fail – causing tsunamis. On the evening of November 3, 1994 in Skagway, Alaska, construction of a railroad dock extension is thought to have overloaded the sediments on which it was built. About 1 million cubic meters of rubble and sediment slid into the fjord. The resulting tsunami, up to 12 m high, surged across the harbor. In addition to the \$20 million loss and one death on the dock itself, around two million dollars' worth of damage was caused to small boats and a ferry terminal (unoccupied at the time).

The 2018 DHS&EM DCI lists historical tsunami events that received federal funding. The following was listed for the Skagway area (see Figure 5-10).

175. Skagway Submarine Landslide: *On November 16, 1994, the Governor declared that a condition of disaster emergency exist in the City of Skagway, as a result of a submarine landslide. As a result of this disaster damages to Alaska Marine Ferry facilities have interrupted normal service and require emergency repairs, and damages*

to the small boat harbor exceed the capability of the City of Skagway to repair in an urgent manner to preclude ongoing collateral damages.

Figure 5-10: The Location of the 1994 Submarine Landslide



Source: UAF/GI/AEC

Table 5-9 below provides a summary of the landslide and tectonic tsunami effects observed in Skagway during the last century.

Table 5-9: Tsunami Effects on Skagway

Date	Origin	Earthquake Moment Magnitude (MW)	Max Wave Height (Meters)	Comments
October 24, 1927	Southeast Alaska	7.1	Observed	Heavy seas broke towline, water muddy and churned. The Juneau-Skagway-Haines cable broke in two places. Cable breaks were ascribed to a submarine slide.
November 4, 1952	Kamchatka Peninsula	8.2	0.01	
August 10, 1958	Southeast Alaska	7.9	7.6	Landslide caused cable breaks.
May 22, 1960	Chile	9.3	0.18	
March 28, 1964	Gulf of Alaska	9.2	3.00	
November 3, 1994	Skagway Harbor	Landslide	7.62	One person dead, \$20 million damage; generated tsunami and reached the municipality on March 28, 1964. DGGS's <i>The Tsunami Inundation Maps for Skagway and Haines, Alaska, Report of Investigation 2018-2</i> describes the event.
March 11, 2011	Japan: Honshu	9.0	0.21	

Source: DGGS 2019a

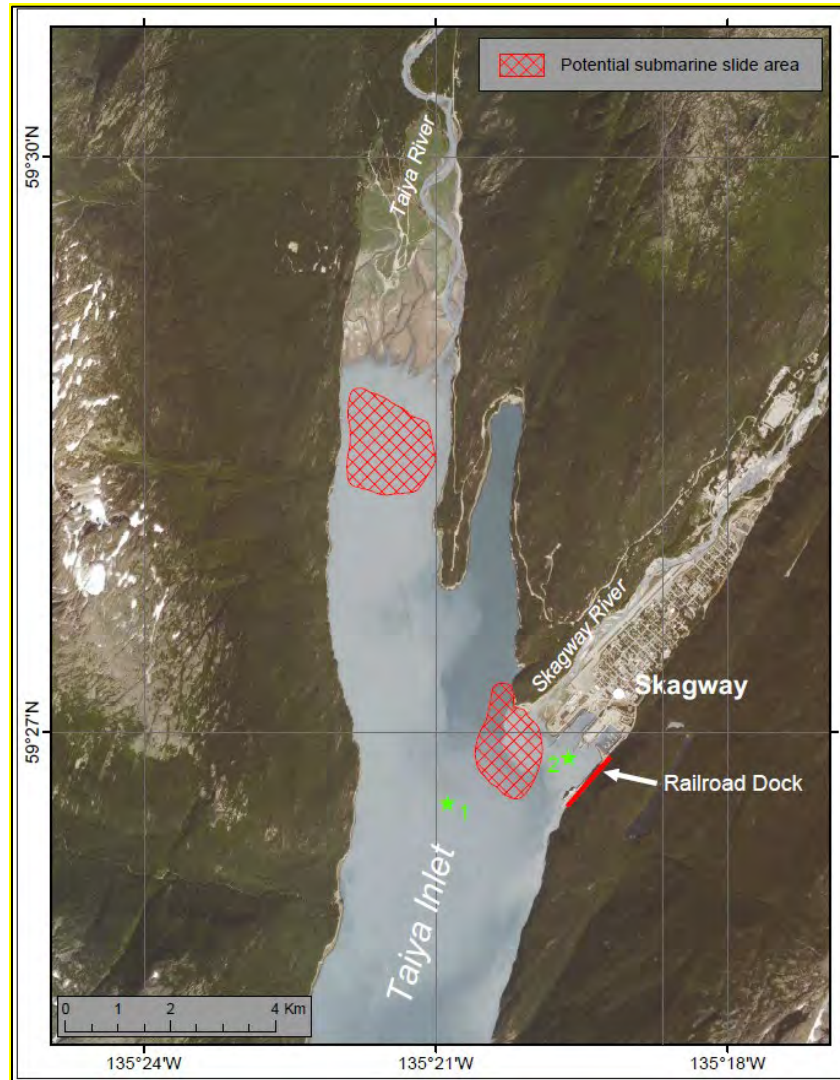
5.4.3.3 Location, Extent, Impact, and Probability of Future Events

Location

The underwater front slope of the active Skagway River delta, south of the port and harbor, is subject to underwater landslide. Sliding of delta fronts can occur due to normal sediment accumulation, caused by the increasing weight and steepness or the mass of sediment; or may be triggered by earthquakes or other destabilizing forces. The Skagway Coastal Management Plan (2007) designates areas in Taiya Inlet subject to underwater landslides and locally generated tsunamis as a natural hazard area under the provisions of 11 AAC 114.250(b).

The Alaska Division of Geological and Geophysical Survey (DGGS) identifies potential underwater (submarine) slide areas on Figure 5-11 (DGGS 2019a):

The combination of high sedimentation rates, abundant seismic activity, and a history of submarine landslides in the steep-sided fjords and canals of Southeast Alaska led us to consider several potential landslides as sources of tsunami waves that could impact Skagway and Haines.

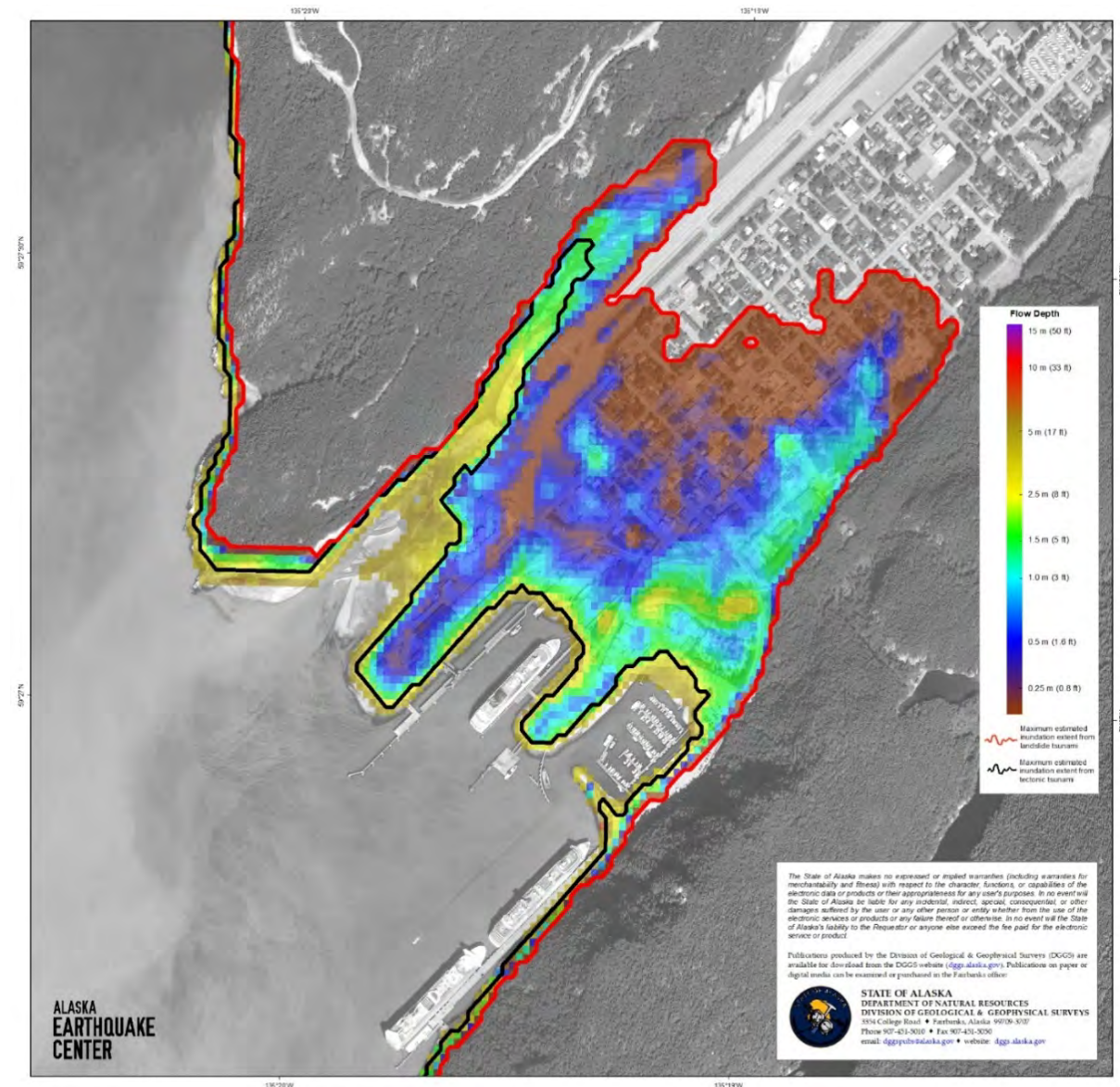
Figure 5-11: Potential Submarine Landslide Areas in Skagway, Alaska

Source: DGGS 2019a

The same report developed two landslide-generated tsunami scenario-based models to demonstrate the area's maximum estimated tsunami inundation flooding extent (Figure 5-12). The following is a result of the modeling:

While the waves that reach the city harbor are rather small (i.e., only about 2 m [6 ft] high) they nevertheless breach the shoreline and flood low-lying areas. Because the city is located on flat, low-lying ground, waves travel far inland and flood an extensive area beyond the harbor...It is important to note that while most of the flooding beyond the shoreline areas is less than 0.6 m (2 ft), tsunami currents can be strong (and may carry debris) and could easily overwhelm pedestrians.

Figure 5-12: Maximum Tsunami Flooding Inundation Map



MAXIMUM ESTIMATED TSUNAMI INUNDATION FROM TECTONIC AND LANDSLIDE SOURCES, SKAGWAY, ALASKA

Source: DGGGS 2019a

Extent

Coastline configuration is a factor that impacts the severity of a tsunami. Concave shorelines, bays, sounds, inlets, rivers, streams, offshore canyons, and flood control channels may create effects that result in greater damage. Offshore canyons can focus tsunami wave energy, and islands can filter the energy. The orientation of the coastline determines whether the waves strike head-on or are refracted from other parts of the coastline. Tsunami waves entering flood control channels could reach a mile or more inland, especially if the tsunami enters at high tide. DGGGS (2019a) provides information on the landscape near Skagway and its potential effects on a tsunami event.

Based on historic tsunami events, DGGGS (2019a), Skagway's historical tsunami, and the criteria identified in Table 5-2, the magnitude and severity of distant tsunami impacts to the Skagway area are considered "Limited," where injuries and illness do not result in permanent disability,

complete critical facility shutdown for more than one week, and more than 10 percent of property and infrastructure severely damaged.

Impact

DGGS data (DGGS 2019a) indicates the Skagway area could receive significant tsunami impacts. The most damaging are anticipated from locally generated tsunami and seiche events occurring from a submarine landslide in the vicinity of Skagway. Tsunami impacts are described:

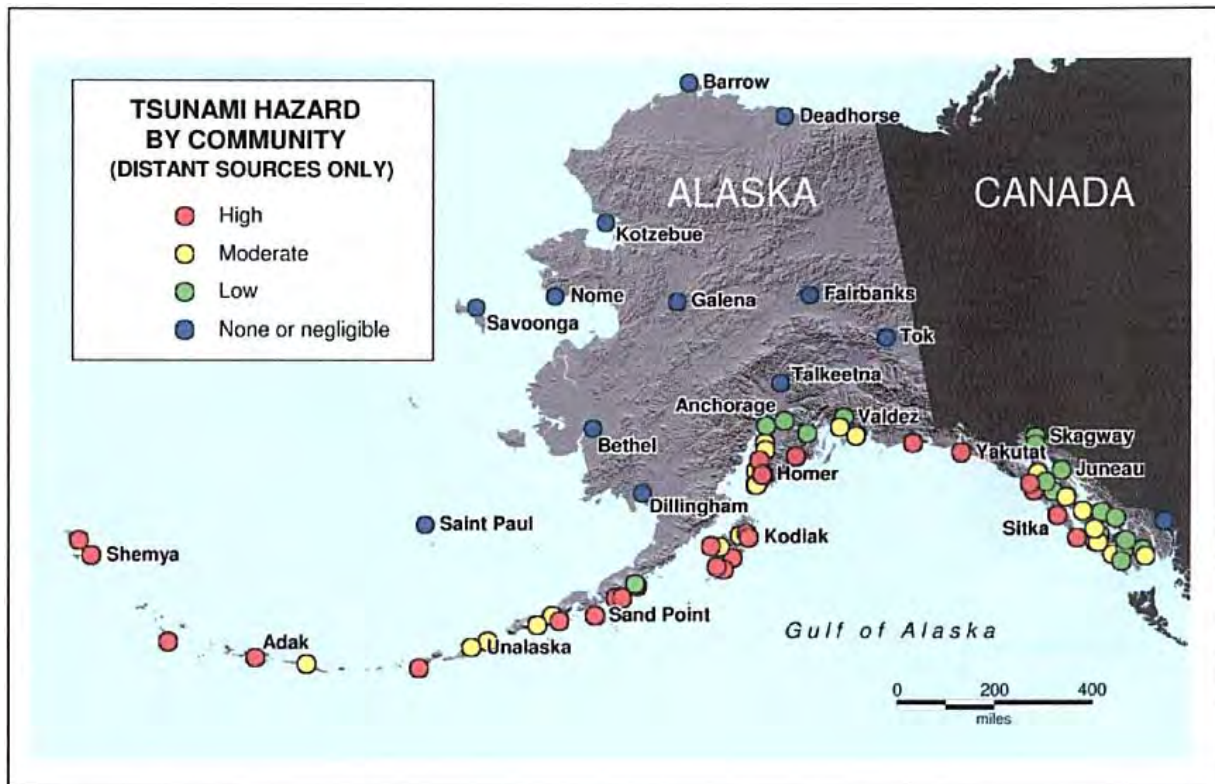
... Because water level oscillations can continue for more than a full day, even if the earthquake occurs during a low tide, these oscillations will be affected by the subsequent rising tide. Low-lying areas that were not initially flooded may become inundated 24–48 hours after the earthquake. Another important factor in the tsunami hazard assessment for any coastal community is the arrival time of the first wave. The time series plots demonstrate that the first wave arrives at both Skagway and Haines about 3 hours after the earthquake. This means that people in the communities would have up to 3 hours for evacuation if the tsunami is generated by a megathrust earthquake in the Gulf of Alaska. However, underwater landslides in the vicinity of Skagway and Haines are capable of producing waves that could reach onshore locations within minutes after the slope failure... These figures demonstrate the very large flow velocities compared to the results of the modeling for seismic sources, indicating that a near-field landslide tsunami can produce very large flow velocities that result in large impulse forces on buildings, causing much greater damage than just the static flow depth.

A tsunami event in Skagway could damage the structures and infrastructure that are located along the shoreline in the community, and within the flood zones described above and could isolate the community from other areas of the state and cause wide spread damage.

Recurrence Probability

A distant source tsunami recurrence interval is unknown and it is therefore, unpredictable as too many factors determine when the next event will occur. The Skagway Coastal Management Plan (2007) states that tsunamis from the open ocean would have to traverse 160 miles of fiord before reaching Skagway, which would allow time to assess impending danger and take necessary emergency actions. The potential hazard from distant tsunamis to the community of Skagway was estimated to be “low” by DGGS. See Figure 5-13.

Figure 5-13: Tsunami Hazard Map



Source: Skagway LHMP 2009

Based on historical events, DHS&EM Disaster Cost Index (2018), DGGs (2019a), and the criteria delineated in Table 5-3, the recurrence probability for a distant source tsunami is “Unlikely,” with the hazard present with an event having a 1 in 10 years chance of occurring and a history of event is less than or equal to 10 percent likely per year. However, the recurrence interval is unknown; too many factors determine when an impact event will occur.

5.4.4 Weather

5.4.4.1 Nature

Severe weather occurs throughout Alaska with extremes experienced by the entire Skagway area that includes hail, heavy and drifting snow, freezing rain/ice storm, extreme cold, and high winds.

Climate Change influences the environment, particularly historical weather patterns. Climate change and El Niño/La Niña Southern Oscillation (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 within 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, coastal 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. Therefore 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 Alaska coastal areas. Heavy rain and snow melt are severe threats to the Skagway area.

Heavy Snow generally means snowfall accumulating to four inches or more in depth in 12 hours or less or 6 inches or more in depth in 24 hours or less.

Drifting Snow is the uneven distribution of snowfall and snow depth caused by strong surface winds. Drifting snow may occur during or after a snowfall.

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 is the definition of extreme cold varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme." In Alaska, 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. In Alaska, high winds (winds in excess of 50 mph) occur rather frequently in the Skagway area during the fall, winter, and spring.

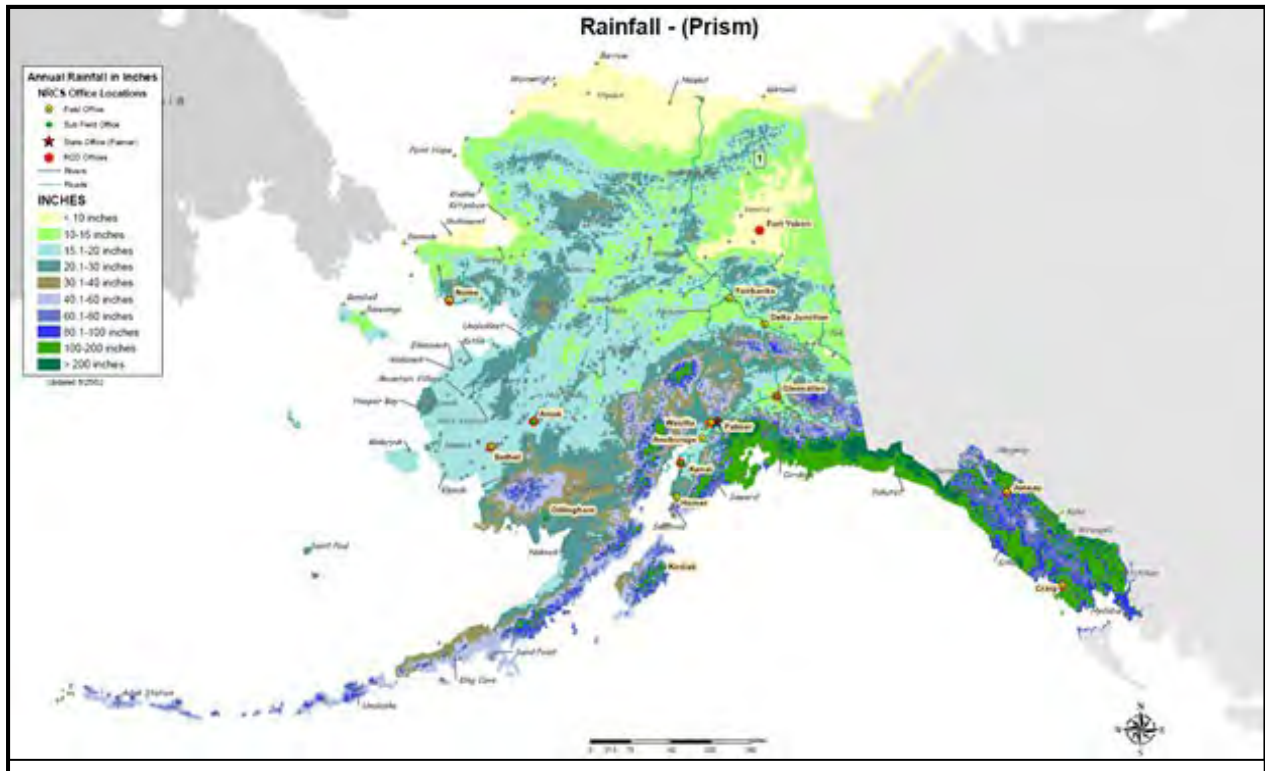
Winter Storms include a variety of phenomena described above and as previously stated may include several components; wind, snow, and ice storms. Ice storms, which include freezing rain, sleet, and hail, can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power outages, and personal injury. Ice storms result in the accumulation of ice from freezing rain, which coats every surface it falls on with a glaze of ice. 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 they 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.

Snowstorms happen when a mass of very cold air moves away from the polar region. As the mass collides with a warm air mass, the warm air rises quickly and the cold air cuts underneath it. This causes a huge cloud bank to form and as the ice crystals within the cloud collide, snow is formed. Snow will only fall from the cloud if the temperature of the air between the bottom of the cloud and the ground is below 40°F. A higher temperature will cause the snowflakes to melt as they fall through the air, turning them into rain or sleet. Similar to ice storms, the effects from a snowstorm can disturb a community for weeks or even months. The combination of heavy snowfall, high

winds and cold temperatures pose potential danger by causing prolonged power outages, automobile accidents and transportation delays, creating dangerous walkways, and through direct damage to buildings, pipes, livestock, crops and other vegetation. Buildings and trees can also collapse under the weight of heavy snow.

Figure 5-14 displays Alaska's annual rainfall map based on Parameter-elevation Regressions on Independent Slopes Model that combines climate data from NOAA and NRCS climate stations with a digital elevation model to generate annual, monthly, and event-based climatic element estimates, such as precipitation and temperature.

Figure 5-14: Statewide Rainfall Map



Source: PRISM Climate Group

5.4.4.2 History

Because of Skagway's location deep within the coast mountain range, the area is influenced both by the rainforest climate of Southeast Alaska and the continental climate typical of interior Alaska and Canada. As a result, Skagway is much drier than the rest of Southeast Alaska with an average of 27 inches of precipitation annually.

Figure 5-15 shows a graphic of the Skagway Weather Service Office weather data summaries. Actual community temperatures and depth locations may vary due to their relative proximity to the weather service office.

Figure 5-15: Skagway Weather Service Office Summary

SKAGWAY, ALASKA (508525)													
Period of Record Monthly Climate Summary													
Period of Record : 11/01/1898 to 06/10/2016													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average													
Max. Temperature (F)	28.1	33.5	37.6	50.4	60.4	66.7	67.1	65.5	58.1	48.4	37.2	32.1	48.8
Average													
Min. Temperature (F)	18.7	22.0	23.6	31.0	39.2	46.5	49.6	48.3	42.5	35.8	27.1	22.4	33.9
Average													
Total Precipitation (in.)	2.43	1.65	1.87	1.23	0.89	1.09	1.64	2.32	4.04	3.88	3.45	2.85	27.33
Average													
Total Snowfall (in.)	12.6	7.3	8.9	0.6	0.0	0.0	0.0	0.0	0.0	0.5	3.8	12.5	46.3
Average													
Snow Depth (in.)	2	2	1	0	0	0	0	0	0	0	1	2	1

Percent of possible observations for period of record.
 Max. Temp.: 19.8% Min. Temp.: 19.3% Precipitation: 6.5% Snowfall: 7.9%
 Snow Depth: 7.7%
 Check [Station Metadata](#) or [Metadata graphics](#) for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

Source: WRCC 2018

DHS&EM's Disaster Cost Index (2018) records the following severe weather disaster events which may have affected the Skagway area. This section shows historical events that demonstrates long-term severe weather affects:

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, Skagway, 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. (DHS&EM 12/2018)

High winds can combine with loose snow to produce a blinding blizzard and wind chill temperatures to 75°F below zero. These conditions occur often in Skagway, often along the Klondike Highway, resulting in “white-out” conditions. The National Weather Service Storm Events Database contains records documenting the occurrence of storms. Table 5-10 represents a sample of the major storm events the National Weather Service identified for the Skagway area since 2003.

Table 5-10: Skagway’s Severe Weather Events

Date	Location	Event Type	Episode Narrative
12/22/2003	Taiya Inlet and Klondike Highway	Winter Storm	A strong southerly flow developed behind the associated front and ushered in warmer air. Sea level locations throughout Southeast Alaska...rain and snow level quickly rose in elevation during this storm...A quick foot of snow was reported overnight on White Pass (3116' ASL)...winds gusting as high as 43 mph. The combination of heavy snow and gusty winds helped cause a three foot high, 120 foot long avalanche over the Klondike Highway. This major roadway between the Northern Panhandle and Canada, was closed for nearly 18 hours.
12/28/2004	Taiya Inlet and Klondike Highway	Blizzard	The Klondike Highway north of Skagway was closed due to blizzard conditions over White Pass. Whitehorse, Yukon (about 70 miles north) saw temperatures drop to 50 deg F below zero during this time.
01/19/2005	Taiya Inlet and Klondike Highway	Winter Storm/Blizzard	Blizzard conditions developed on the higher elevations of the Klondike Highway north of Skagway. The Highway was forced to close early Wednesday due to white out conditions in blowing snow and light falling snow
01/21/2005	Taiya Inlet and Klondike Highway	High Wind	High winds occurred behind an arctic front in the Taiya Inlet/Skagway region on this date. Wind gusts maxed out at 60 mph
10/11/2006	Taiya Inlet and Klondike Highway	High Wind	The Skagway ASOS (PAGY) had a measured gust to 55 KT at 0853 UTC. North wind 60 to 70 MPH was also estimated along the Klondike highway during the early morning hours of October 11th.
01/04/2009	Taiya Inlet and Klondike Highway	Blizzard	Light to moderate snowfall combined with very strong winds with sustained 30 to 40 mph with gusts of 50 to 70 mph, reduced visibilities to near zero for periods of times along the Klondike Highway and in Skagway.
01/11/2010	Taiya Inlet and Klondike Highway	Blizzard	The Skagway Customs station reported blizzard conditions there and on the Klondike Highway. Klondike Highway was closed briefly earlier due to avalanche of snow and rocks.
12/19/2012	Taiya Inlet and Klondike Highway	High Wind	Downtown Skagway had hurricane force wind prior to the onset of the blizzard on 12/19. Numerous peak gusts to 71 MPH early on 12/19. No damage was reported, but as the event developed the Klondike Highway was had blowing and drifting snow problems through 12/21 with wind chill to 50 below
12/19/2012	Taiya Inlet and Klondike Highway	Blizzard	White-out conditions were frequent on the Klondike Highway from Skagway to the pass starting on the morning of 12/19. Wind chill to 50 below was occurring at the summit with -35F

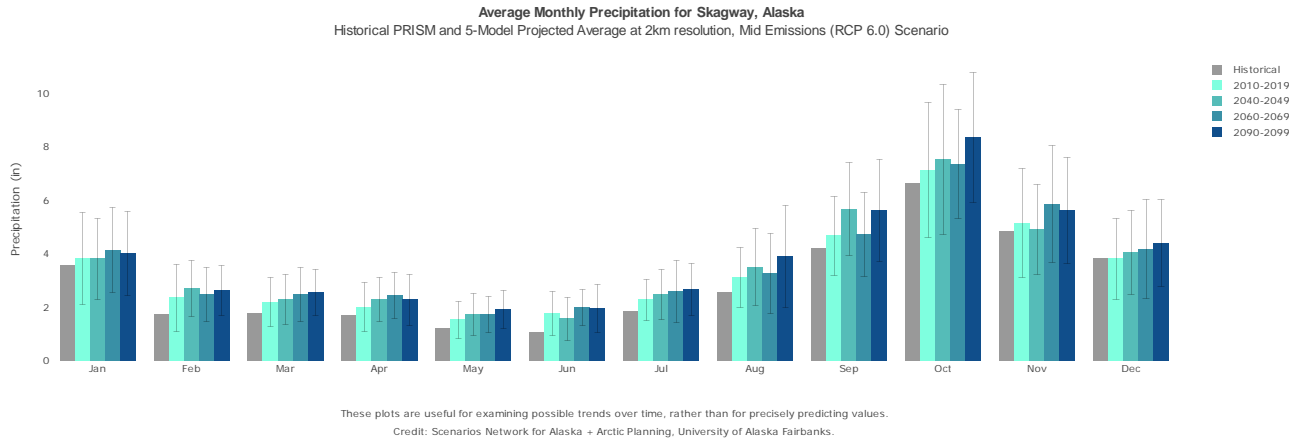
Table 5-10: Skagway's Severe Weather Events

Date	Location	Event Type	Episode Narrative
			wind chill as the highway starts uphill. Hurricane force wind to 65 MPH...Blowing and drifting snow caused problems on the highway for three days. Frequent visibility was below 1/4 mile for white out conditions.
12/13/2013	Taiya Inlet and Klondike Highway	Winter Storm	Skagway Customs observed a storm total of 7 inches of new snow. Winds were as high as 56 mph on the 14th and 54 mph on the 15th for near blizzard conditions.
01/13/2014	Taiya Inlet and Klondike Highway	Winter Storm	...heavy snow for Haines and Skagway with higher amounts and longest duration along the two highways. This system also increased the surface pressure gradients for brief strong winds and blowing snow for near blizzard conditions along the highways...Skagway Customs on the Klondike Highway measured 10 inches of new snow as of 0900 on Tue 14th
01/05/2015	Taiya Inlet and Klondike Highway	High Wind	Skagway had frequent gusts 50 to 60 mph on Jan 5th with peak winds 60 to 65 mph. Wind chills around -9F were observed in Skagway.
11/21/2015	Taiya Inlet and Klondike Highway	High Wind	The snow at higher elevations was loose and with strong winds caused blizzard (white-out) conditions along the Klondike Highway on the morning of the 21 st ...The peak gust was 68 mph
01/15/2017	Taiya Inlet and Klondike Highway	Blizzard	The highway was closed due to avalanche concerns. We had to switch this warning to Blizzard on the afternoon of 1/16. SUMQ2 sensor reported winds up to 70 mph with gusts to 80 mph overnight
12/28/2017	Taiya Inlet and Klondike Highway	High Wind	A 1046 cold arctic high covering all of NW Canada caused high winds and very low wind chills for Skagway and the Klondike Highway. Peak wind gust was 73 MPH at Skagway Airport. Lowest wind chill recorded was -32F. Travel and ordinary activities were disrupted plus blowing snow on the Klondike Highway.
01/28/2018	Taiya Inlet and Klondike Highway	High Wind	A deep storm 972 MB to the SW of Dixon Entrance combined with 1045 MB High pressure over the eastern Yukon. The result was very strong winds for Downtown Juneau, Douglas and Skagway...The ferries did not run that day.

Source: NOAA 2019

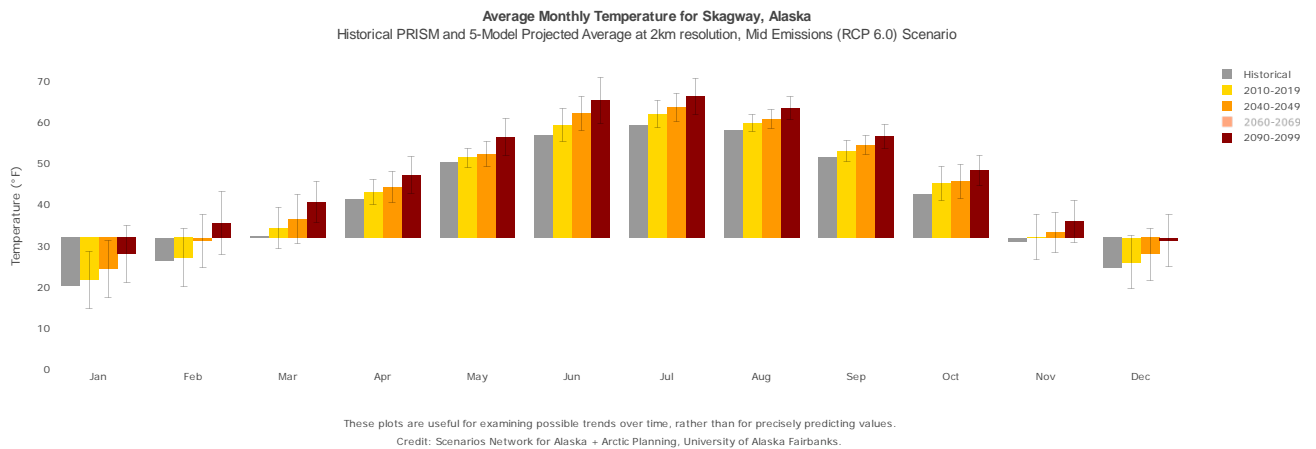
Severe weather events have historically impacted the entire Skagway area. Rural communities generally lack capacity to track changing climate conditions. The UAF Scenarios Network for Alaska and Arctic Planning (SNAP) is part of the International Arctic Research Center and provides this data for planning purposes. SNAP data tools depict Skagway's historic and future predicted precipitation and temperatures. (Figures 5-16 and 5-17). Both precipitation and temperature are projected to remain fairly consistent throughout the various seasons. However, the warm weather months (July through October) may experience slightly higher temperatures and precipitation due to anticipated climatic changes. Rain and snow variations could dramatically determine wildland fire potential as well as adversely impact future subsistence food source and wildlife habitat support capacity.

Figure 5-16: Skagway’s Historic and Predicted Precipitation Ranges



Source: SNAP 2019

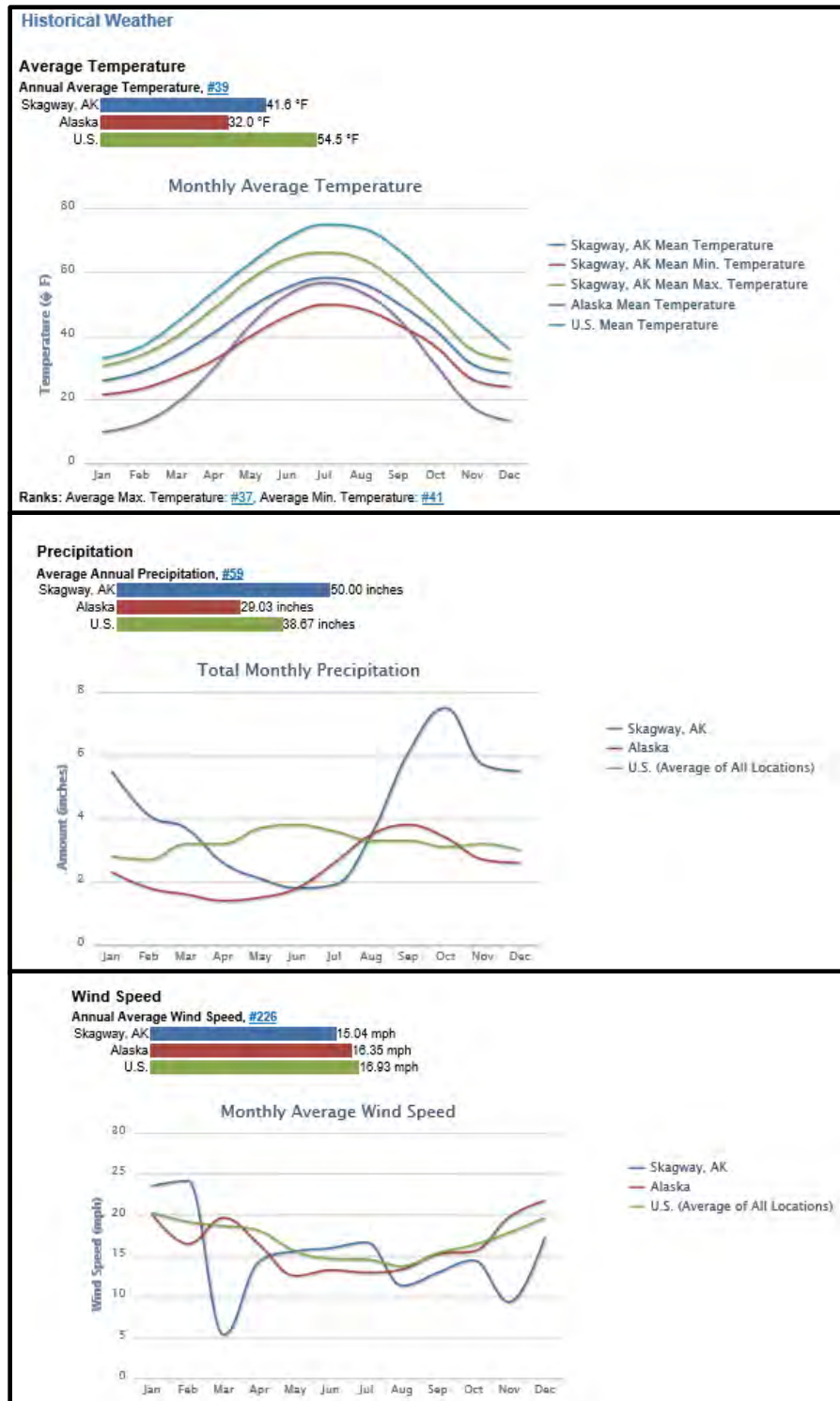
Figure 5-17: Skagway’s Historic and Predicted Temperature Ranges



Source: SNAP 2019

USA.com provides comprehensive climate data and other community information in a useable yet comprehensive format for the Skagway area. The flowing figures enable the reader to better understand the area’s climate (Figure 5-18).

Figure 5-18: USA.com Weather Data



Source: USA.com

5.4.4.4 Location, Extent, Impact, and Recurrence Probability

Location

The entire Skagway area experiences periodic severe weather impacts. The most common for the municipality are high winds resulting in blizzards and winter storms. Table 5-10 depicts weather events that have impacted the area since 2003 and is provided as a representative sample.

Extent

Skagway is equally vulnerable to all severe weather effects as well as Alaska's changing climate. Severe storm conditions bring heavy rain, moderate snow and high wind speeds. Based on Skagway's past severe weather events and the criteria identified in Table 5-2, the extent of severe weather is considered "Limited" where injuries or illness do not result in permanent disability, complete shutdown of critical facilities occurs for more than a 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 on a community. Strong winds, rain, and snow 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 flow of supplies 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 flooding. The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts on cities and towns.

Injuries and deaths related to heavy snow usually occur as a result of vehicle and or snow machine accidents. Fatalities also occur due to overexertion while shoveling snow and hypothermia caused by overexposure to the cold weather.

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. Long cold spells can cause rivers to freeze, disrupting shipping and increasing the likelihood of ice jams and associated flooding.

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. The risk of hypothermia due to exposure greatly increases during episodes of extreme cold, and carbon monoxide poisoning is possible as people use supplemental heating devices.

Because of its remote location, Skagway must be very self-reliant. Severe weather can cut off air access limiting medevac availability and access to goods and services, including groceries and medical supplies. Severe wind and heavy snow can cause extensive damage to critical structures including residences, and closure to public facilities and roadways. A severe weather event could potentially isolate Skagway from the rest of the state.

Recurrence Probability

Based on previous occurrences and the criteria identified in Table 5-3, it is “Likely” Skagway will experience a severe weather event. The hazard is present in the next three years with a (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.

6 VULNERABILITY ASSESSMENT

This section outlines the vulnerability assessment process for determining potential losses for the community from various hazard impacts.

6.1 Overview

A vulnerability assessment predicts the exposure extent that may result from a hazard event, with a given intensity, within a given area. This analysis provides quantitative data that may be used to identify and prioritize potential mitigation measures by allowing communities to focus attention on areas with the greatest risk of damage. A vulnerability assessment is divided into eight steps:

1. Asset Inventory
2. Exposure Analysis for Current Assets
3. National Flood Insurance Program Participation
4. Land Use and Development Trends
5. Vulnerability Assessment Methodology
6. Data Limitations
7. Vulnerability Exposure Analysis
8. Future Development

DMA 2000 requirements and implementing city governance regulations for current assets, and area future development initiatives:

ELEMENTS. Planning Area and Natural Hazard Profiles
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))

Source: FEMA 2015b

Vulnerability assessment requirements include:

- Summarizing the community's vulnerability to each hazard that addresses the impact of each hazard on the community.
- Identifying the types and numbers of Repetitive Loss properties in the identified hazard areas.
- Identifying the types and numbers of existing vulnerable buildings, infrastructure, and critical facilities and, if possible, the types and numbers of vulnerable future development.
- Estimating potential dollar losses to vulnerable structures and the methodology used to prepare the estimate.

Table 6-1 details the hazard vulnerability synopsis for the Municipality of Skagway's infrastructure.

Table 6-1: Vulnerability Overview

Hazard	Area's 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	45	65	65	65
Tsunami	45	65	65	65
Weather	100	100	100	100
Volcano	100	100	100	100

6.2 Land Use and Development Trends

6.2.1 Land Use

Land use in the Municipality of Skagway is predominately residential, with limited area for commercial services and community (or institutional) facilities. Suitable developable vacant land is in short supply in the municipality boundaries, and various waterbodies surround the community. Several areas in the borough are classified as airport land use. (See Section 6.8 for future development goals.)

6.3 Current Asset Exposure Analysis

6.3.1 Asset Inventory

Asset inventory is the first step of a vulnerability assessment. Assets that may be affected by hazard events include population (for community-wide hazards), residential buildings (where data is available), and critical facilities and infrastructure.

6.3.1.1 Population and Building Stock

Population data for Skagway were obtained from the 2010 U.S. Census and the State of Alaska DCCED's 2018 estimates. The U.S. Census reports the municipality's total population for 2010 as 3,141, and the 2018 State of Alaska estimates 3,515 (Table 6-2).

Table 6-2: Estimated Population and Building Inventory

Population		Residential Buildings	
2010 Census	DCCED 2018 Data	Total Building Count	Total Value of Buildings
968	1,148	697	U.S. Census \$ 204,778,600

Source: US Census 2010, and 2018 AEB population data.

Notes: US Census listed housing value at \$124,700. The project team determined that the average structural replacement value of all single-family residential buildings is \$150,000.

Residential replacement values are generally underestimated because replacement costs exceed Census structure estimates due to material purchasing, barge or airplane delivery, and construction costs in rural Alaska. An average 30 ft by 40 ft (1,200 square feet) residential structure in Skagway costs approximately \$290,000. A total of 752 single-family residential buildings were considered in this analysis.

6.3.1.2 Existing Infrastructure

Since approximately 2010, the Alaska DCRA is no longer able to collect diverse agency project data for Alaskan communities. Older grants highlight ongoing efforts toward improving aging infrastructure. (Note: recent infrastructure improvement projects are still ongoing; however, there is no current information repository for these data.)

6.3.1.3 Municipality of Skagway's Critical Facilities

A critical facility is defined as a facility that provides essential products and services to the general public, such as preserving the quality of life in the municipality and fulfilling important public safety, emergency response, and disaster recovery functions. Most facilities are deemed "critical," due to the municipality's remote location. The critical facilities profiled in this plan include the following:

- Government facilities, such as city administrative offices.
- 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.

6.4 National Flood Insurance Program Participation

This section estimates the number and type of structures at risk to repetitive flooding.

DMA 2000 requirements and implementing city governance regulations for estimating the number and type of structures at risk to repetitive flooding include:

ELEMENT B. NFIP Insured Structures
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))
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)(ii))

Source: FEMA 2015b

Skagway participates in the NFIP (community #025011). The municipality participates in and complies with NFIP requirements at 44 CFR 201.6(3)(ii) as appropriate. It should be noted that the municipality does not have a repetitive flood property inventory that meets NFIP criteria, and there are not any repetitive flood properties in Skagway that currently fulfill NFIP criteria due to the use of multiple protective levees. The community practices informal floodplain management in accordance with the Skagway Municipal Code, Title 15 - Buildings and Construction, Chapter 15.12 - Flood Zone Land Use (<https://www.codepublishing.com/AK/Skagway/#!/Skagway15/Skagway1512.html#15.12>).

6.5 Vulnerability Assessment Methodology

A conservative exposure-level analysis was conducted to assess the risks of the identified hazards. This analysis is a simplified assessment of the potential effects of the hazards on values at risk without considering recurrence probability or damage level.

The community planning team determined facility locations in identified hazard impact zones. These data were used to develop a vulnerability assessment for those hazards.

Combined structure and contents replacement values were determined by the community for physical assets.

The community's aggregate exposure was calculated by assuming the worst-case scenario (i.e., the asset and contents that would be destroyed and need to be replaced) for each physical asset located in a hazard area. A similar analysis was used to evaluate the proportion of the population at risk. However, the analysis only represents the number of people at risk; no estimate of potential injuries or fatalities was prepared.

6.6 Data Limitations

The vulnerability estimates use the best data currently available, and the methodologies applied result in a risk approximation. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment, as well as the use of approximations and simplifications that are necessary for a comprehensive analysis.

It is also important to note that the quantitative vulnerability assessment results are limited to the exposure of people, buildings, critical facilities, and infrastructure to the identified hazards. It was beyond the scope of this LHMP to develop a more detailed or comprehensive assessment of risk (including annualized losses, people injured or killed, shelter requirements, loss of facility/system function, and economic losses). Such impacts may be addressed with future LHMP updates.

6.7 Vulnerability Exposure Analysis – Narrative Summaries

There are insufficient GIS data available for Skagway. The following discussion contains data obtained from the project team and subsequent analysis. The results of exposure analysis and loss estimations are summarized below.

Earthquake

Skagway and the surrounding area can expect to experience limited, moderate, and significant earthquake ground movement that may result in infrastructure damage. Intense shaking may be seen or felt based on past events. Although all structures are exposed to earthquakes, buildings in the municipality constructed with wood have slightly less vulnerability to the effects of earthquakes than those with masonry.

Based on earthquake probability (PGA) maps produced by the USGS, the entire municipality is not at risk of experiencing moderate to significant earthquake impacts because of its proximity to known earthquake faults.

The probability is low or limited that "severe" ground movement may result in infrastructure damage and personal injury. However, the entire existing, transient, and future population; residential structures; and critical facilities and infrastructure are susceptible to the effects of "severe" earthquake events.

Future impacts to populations, residential structures, critical facilities, and infrastructure are anticipated at the same historical impact level.

Flood

Typical flood impacts include water damage to structures and contents; roadbed, embankment, and coastal erosion; boat stranding; and standing water in roadways and other areas. Flood events may also damage or displace fuel tanks, powerlines, 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 to pass through an open area under the main floor of a building) are more vulnerable to flood impacts. No detailed 100-year flood analysis has been prepared for Skagway. The USACE completed initial reviews for the Seven Pastures levee project (USACE 2017).

A Skagway River Flood Containment and Erosion Protection Dike report (PND Engineers 2016) desktop analysis provided design recommendations and considerations for flood protection along the northwest bank of the Skagway River to protect properties from dangerous flooding conditions.

The report was part of the permit application to USACE; USACE approved the permit (408-POA-2019-0001, Skagway River Levee [West Bank]) and accepted the findings of the report. It is anticipated that impacts to future populations, residential structures, critical facilities, and infrastructure will be at the same historical impact level.

Ground Failure

Based on known events, areas within Skagway are affected by ground failure events (e.g., slope failure, permafrost, sink holes), with infrastructure damage, particularly from slides.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated to occur slowly over time. Land use ordinances and zoning controls are guiding Municipality of Skagway residents where to develop with low hazard risks.

Tsunami

The UAF/GI/AEC and DGGs sources indicate that there are moderate distant and local source tsunami threats to Skagway's population and infrastructure in the identified tsunami impact area.

Using information provided by the UAF/GI/AEC and DGGs sources, the municipality's residential structures and infrastructure located adjacent to the identified tsunami impact area have a limited risk from impacts.

Future impacts to populations, residences, critical facilities, and infrastructure are anticipated at the same historical impact level.

Severe Weather

Impacts associated with severe weather events include roof collapse, trees and powerlines falling, damage to light aircraft and sinking small boats, injury and fatalities resulting from snowmachine or vehicle accidents, and overexertion from shoveling due to heavy snow. A quick thaw after a heavy snow can also cause substantial flooding. Impacts from extreme cold include hypothermia, fog and ice delaying transportation, congealed fuel, frozen pipes, utility disruptions, 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.

Based on information provided by the Municipality of Skagway and the National Weather Service; the entire municipality's existing, transient, and future population; residential structures; and critical facilities are susceptible to future severe weather impacts.

Future impacts to populations, residential structures, critical facilities, and infrastructure are anticipated at the same historical impact level.

6.8 Future Development

The municipality and its planning team continually seek to maintain and upgrade aging infrastructure. Section 7 identifies potential projects, which demonstrate how the community intends to continue improving and future development initiatives. These initiatives are culminated in the Mitigation Action Plan (MAP).

7 MITIGATION STRATEGY

7.1 Overview

A mitigation strategy provides the blueprint for implementing desired activities that will enable the community to continue to save lives and preserve infrastructure by systematically reducing hazard impacts, damages, and community disruption. A mitigation strategy is divided into six steps:

1. Identifying each jurisdiction's existing authorities for implementing mitigation action initiatives
2. NFIP participation
3. Developing mitigation goals
4. Identifying mitigation actions
5. Evaluating mitigation actions
6. Implementing the Mitigation Action Plan (MAP)

7.2 Municipality of Skagway's Capability Assessment

The LHMP includes DMA 2000 and 44 Part CFR 201.6 (local jurisdictional) requirements to guide LHMP development. Pertinent support data follow each regulatory criteria text box to fulfill regulatory criteria.

Skagway's planning team will review and monitor their 2019 LHMP annually and will integrate the mitigation strategy into their existing community plans and strategies to fulfill FEMA mitigation programs' and initiatives' regulatory requirements as practicable.

Skagway's capability assessment reviews pre- and post-disaster technical and fiscal resources available to the community.

DMA 2000 Requirements

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))

Source: FEMA 2015

The available resources have been assessed as summarized in the following tables, which list Skagway's regulatory tools, technical specialists, and financial and training resources available for project management. Table 7-1 shows regulatory tools, and Table 7-2 shows technical specialists.

Table 7-1: Municipality of Skagway's Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing Yes / No	Source
Comprehensive Plan	Yes	Skagway 2030 Comprehensive Plan
Land Use Plan	Yes	2010 CCIAP funded small boat harbor plan
Emergency Response Plan	Yes	2017 Emergency Operations Plan
Wildland Fire Protection Plan	Yes	2019 Alaska Statewide Annual Operating Plan
Building code	Yes	Skagway Municipal Code, as amended 2019

7.2.1 Local Resources

The Municipality of Skagway has extensive “formal” planning and land management tools that will allow them to implement and integrate local hazard mitigation activities with FEMA mitigation actions and initiatives. The municipality works closely with State agencies such as the DCCED/DCRA, DHS&EM, DOT/PF, and Alaska Department of Natural Resources (DNR) staff to guide them with project development, funding, and planning activities. The resources available in these areas have been assessed by the hazard mitigation planning team and are summarized below.

Table 7-2: Municipality of Skagway’s Technical Specialists

Staff/Personnel Resources	Yes / No	Department/Agency and Position
Planner or engineer with knowledge of land development and land management practices	Yes	The municipality has staff with this knowledge
Engineer or professional trained in construction practices related to buildings and/or infrastructure	Yes	The municipality has staff with this knowledge
Planner or engineer with an understanding of natural and/or human-caused hazards	Yes	The municipality has staff with this knowledge
Floodplain Manager	Yes	The borough clerk serves as the floodplain manager under provisions of the NFIP
Surveyors	Yes	The municipality has staff with this knowledge
Staff with education or expertise to assess the jurisdiction’s vulnerability to hazards	Yes	The municipality has staff with this knowledge
Personnel skilled in Geographic Information System and/or Hazards Us-Multi Hazard software	Yes	The municipality has staff with this knowledge
Scientists familiar with the hazards of the jurisdiction	No	The municipality does not have staff with this knowledge
Emergency Manager	Yes	The Skagway Chief of Police serves as the Emergency Manager
Finance (Grant writers)	Yes	The municipality has staff with this knowledge
Public Information Officer	Yes	The municipality has staff with this knowledge

Table 7-3 lists examples of the municipality’s funding resources. Appendix A provides a detailed list of potential state and federal agency funding resources.

Table 7-3: Municipality of Skagway’s Financial Resources

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	Can exercise this authority with voter approval
Payment in Lieu of Taxes	Provides operating support funding
Municipal Energy Assistance Program	Provides operating support funding
Community Development Block Grants	City jurisdiction is eligible for this funding source
Capital Improvement Project Funding	Can exercise this authority with voter approval
Authority to levy taxes for specific purposes	Can exercise this authority with voter approval
Incur debt through general obligation bonds	Can exercise this authority with voter approval
Incur debt through special tax and revenue bonds	Can exercise this authority with voter approval
Incur debt through private activity bonds	Can exercise this authority with voter approval

7.2.2 FEMA and Other Mitigation Program and Initiative Eligibility

A FEMA-approved and jurisdiction adopted LHMP ensures participant eligibility for FEMA mitigation grant programs and initiatives. The final LHMP ensures that these jurisdictions can potentially fulfill grant management and integration with the available grants, listed in Table 7-4.

Table 7-4: Federal Agency Mitigation Programs

Financial Resources	Accessible or Eligible to Use for Mitigation Activities
Hazard Mitigation Grant Program	FEMA funding is available to eligible local and tribal jurisdictions after a presidentially declared disaster. It can be used to fund both pre- and post-disaster mitigation plans and projects.
Pre-Disaster Mitigation grant program	FEMA funding is available to eligible local and tribal jurisdictions on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects.
Flood Mitigation Assistance grant program	FEMA funding available to eligible local jurisdictions on an annual basis. This grant can be used to mitigate repetitively flooded structures and infrastructure to protect repetitive flood structures. The municipality of Skagway qualifies for this funding source because they participate in the NFIP.
United State Fire Administration Grants	The purpose of these grants is to assist state, regional, national or local organizations to address fire prevention and safety. The primary goal is to reach high-risk target groups including children, seniors and firefighters.
Fire Mitigation Fees	Finance future fire protection facilities and fire capital expenditures required because of new development within special districts.

Mitigation goals and potential mitigation actions were developed to address the identified potential hazard impacts for the Municipality of Skagway.

7.3 Developing Mitigation Goals

DMA 2000 stipulated and implementing city governance regulations for developing hazard mitigation goals include:

ELEMENT C. Mitigation Goals
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))

Source: FEMA 2015.

Mitigation goals and potential mitigation actions were developed to address current and future potential hazard impacts for the area's residents and infrastructure.

Mitigation goals are defined as general guidelines that describe 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 visions. Mitigation goals and potential mitigation actions were developed in order to address identified potential hazard impacts for the Municipality of Skagway.

The exposure analysis results were used as a basis for updating the mitigation goals and actions. Additionally, Skagway's planning team developed three new mitigation actions that could address combined or complex hazard impacts. They are classified as Multi-Hazard (MH) goals and are

listed separately along with identified natural hazard categories. These three MH categories include:

- **Multi-Hazard (MH) 1:** Provide funding, planning, and outreach activities to educate and promote recognizing and mitigating natural hazards that potentially impact the municipality.
- **Multi-Hazard (MH) 2:** Cross-reference and integrate mitigation goals and actions with Skagway's planning mechanisms and projects.
- **Multi-Hazard (MH) 3:** Construction activities that mitigate potential losses and damages from natural and human-made hazards that affect the Skagway area.

Table 7-5 lists the municipality's strategic mitigation goals developed to reduce or avoid identified long-term hazard vulnerabilities. They form the mitigation strategy's foundation, which culminates in the MAP.

Table 7-5: Mitigation Goals

No.	Goal Description
Multi-Hazards (MH)	
MH 1	Provide funding, planning, and outreach activities to educate and promote recognizing and mitigating natural and manmade hazards that potentially impact the municipality of Skagway.
MH 2	Cross-reference and integrate mitigation goals and actions with municipality planning mechanisms and projects.
MH 3	Construction activities that mitigate (to avoid or reduce) potential losses and damages from natural and manmade hazards that affect the Skagway area.
Natural Hazards	
Earthquake	Reduce potential Earthquake vulnerability, damage, and loss.
Flood	Reduce potential Flood and erosion vulnerability, damage, and loss.
Ground Failure	Reduce potential Ground Failure vulnerability, damage, and loss.
Tsunami	Reduce potential Tsunami or Seiche vulnerability, damage, or loss.
Weather	Reduce potential Weather vulnerability, damage, or loss.

7.4 Identifying Mitigation Actions

DMA 2000 requirements and implementing city governance regulations for identifying and analyzing city governmental mitigation actions include:

ELEMENT C. Mitigation Actions
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))

Source: FEMA 2015b

Mitigation actions are activities, initiatives, measures, or projects that help achieve the goals of a mitigation plan. Mitigation actions are usually grouped into three broad categories: property protection, public education and awareness, and construction projects.

FEMA Hazard Mitigation Assistance Guidance and Addendum (2015b) states the importance of considering, evaluating, and implementing the most effective mitigation actions, projects, activities, and potential alternatives:

Reviewing and incorporating information from the State, tribal, or local mitigation plan can help an Applicant or subapplicant facilitate the development of mitigation project alternatives. Linking the existing mitigation plan to project scoping can support the

Applicant and subapplicant in selecting the most appropriate mitigation activity that best addresses the identified hazard(s), while taking into account community priorities, climate change, and resiliency. In particular, the mitigation strategy section of the plan identifies a range of specific mitigation activities that can reduce vulnerability and includes information on the process that was used to identify, prioritize, and implement the range of mitigation actions considered...

It is important to reference the mitigation plan as potential project alternatives may have been considered during the planning process. If the project alternatives were not considered during the mitigation planning process, they should be considered in the next mitigation plan update.

After developing mitigation goals, the planning team reviewed a comprehensive list of potential mitigation actions that were identified during this LHMP development process. The planning team selected only those they intended to implement during the LHMPs 5-year lifecycle in the MAP.

Newly identified projects indicate whether they were considered or selected for implementation. Considered projects were not carried forward into the MAP. “Ongoing” and “Deferred” actions were included in the 2019 mitigation strategy’s MAP (Table 7-6).

Table 7-6: Mitigation Goals and Potential Actions

Hazard	Description	Pros	Cons	Priority
Multiple	Develop a public outreach and education programs regarding potential hazard impacts and personal planning preparations.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive	Staff time	High
Multiple	Develop and implement hazard overlay zoning districts. Overlay zoning is used by communities to apply area-specific standards and/or conditions. Some overlay zones (e.g., infill and redevelopment) are drafted to permit exceptions or require a less restrictive set of standards than otherwise provided in the zoning regulations.	Benefit to entire community Risk reduction	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	Join Nixle. Nixle is an electronic network systems provider that proactively manages incident communications over multiple paths including voice, text message, email, and social media before, during, and after an event to keep residents safe and informed.	Life/Safety issue/Risk reduction Benefit to entire community Federal and State assistance available	Staff time, >\$50,000	High
Multiple	Develop and install a signage program for hazards posted at key facilities or locations (e.g., at the school for emergency shelter designations).	Life/Safety issue Risk reduction Benefit to entire community	Staff time, >\$5,000	Medium
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
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
Flood and Erosion	Build and/or reinforce revetment walls (e.g., a permanent structure designed to prevent the types of subsidence that commonly occur adjacent to waterways) that are affected by erosion.	Life/Safety issue Risk reduction Benefit to entire community	Expensive, at least \$100,000	High
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	Staff time, >\$50,000	Low

Table 7-6: Mitigation Goals and Potential Actions

Hazard	Description	Pros	Cons	Priority
		Federal and State assistance available		
Severe Weather	Research and consider instituting the National Weather Service program of <i>"Storm Ready"</i> .	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available	Staff time	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.	Potential for increased staff time. Research into feasibility necessary. Political and public support not determined. 1 – 5 year implementation	Low
Tsunami	Siren and lights at both ends of town for tsunami and other hazardous warnings	Life/Safety Project	Staff time, >\$50,000	Low
Tsunami	Develop 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

7.5 Evaluating and Prioritizing Mitigation Actions

DMA 2000 requirements and city governance regulations for implementing mitigation actions.

ELEMENT C. MITIGATION STRATEGY

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))

Source: FEMA 2015b

The MAP represents mitigation projects and programs the municipality could implement to potentially reduce damaging hazard impacts to current and future infrastructure.

The planning team evaluated and prioritized each of the mitigation actions in February 2019 to determine which actions would be included in the MAP. The MAP represents mitigation projects and programs to be implemented during this LHMP's 5-year life cycle. To complete this task, the planning team first prioritized the most significant hazards to the municipality (earthquake, flood, ground failure, severe weather, volcano, wildland/tundra fire).

The planning team reviewed the simplified social, technical, administrative, political, legal, economic, and environmental evaluation criteria and the Benefit-Cost Analysis Fact Sheet (Appendix E) to consider the opportunities and constraints of implementing each particular mitigation action. For each action considered for implementation, a qualitative statement is provided regarding the benefits, costs, and technical feasibility (when available). A detailed cost-benefit analysis is anticipated as part of the application process for the projects that Skagway chooses to implement.

The planning team prioritized natural hazard mitigation actions, which were then selected to be included in the MAP.

The hazard mitigation planning team considered each hazard's history, extent, and recurrence probability to determine each potential action's priority. The project rating categories are defined as high, medium, or low priority:

- High priorities are associated with actions for hazards that impact the community on an annual or near-annual basis and generate impacts to critical facilities and/or people.
- Medium priorities are associated with actions for hazards that impact the community less frequently, and do not typically generate impacts to critical facilities and/or people.
- Low priorities are associated with actions for hazards that rarely impact the community and have rarely generated documented impacts to critical facilities and/or people.

7.6 Mitigation Action Plan

DMA 2000 requirements and city governance regulations for implementing mitigation actions.

ELEMENT C. MITIGATION STRATEGY

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))

Source: FEMA 2015b

The MAP lists the municipality's projects and initiatives to address various hazard impact threats. Table 7-7 defines how each mitigation action will be implemented and administered by the municipality.

Additionally, the MAP lists each selected mitigation action, its priorities, responsible office, potential funding resource(s), anticipated implementation timeline, and provides a brief explanation of how the overall benefit/costs and technical feasibility were taken into consideration.

Table 7-7: Skagway Area's Combined Mitigation Action Plan

Description	Jurisdiction	Potential Funding	Timeframe	Priority
Develop a public outreach and education programs regarding potential hazard impacts and personal planning preparations.	MOS DCRA DHS&EM	MOS budget DCRA DHS&EM	<1 year	High
Develop and implement hazard overlay zoning districts. Overlay zoning is used by communities to apply area-specific standards and/or conditions. Some overlay zones (e.g., infill and redevelopment) are drafted to permit exceptions or require a less restrictive set of standards than otherwise provided in the zoning regulations.	MOS DCRA DHS&EM	City budget DCRA DHS&EM	2-3 years	Medium
Develop or refine local emergency announcement procedures and back up plans.	MOS DCRA DHS&EM	City budget DCRA DHS&EM	Ongoing	Medium
Join Nixle. Nixle is an electronic network systems provider that proactively manages incident communications over multiple paths including voice, text message, email, and social media before, during, and after an event to keep residents safe and informed.	MOS DCRA DHS&EM	HMGP grant	2-3 years	High
Develop and install a signage program for hazards posted at key facilities or locations (e.g., at the school for emergency shelter designations).	MOS	City budget	>1 year	Medium
Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	MOS DCRA DHS&EM	State Grants	>1 year	High
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.	MOS DHS&EM	State Grants PDM	1-2 years	Medium
Build and/or reinforce revetment walls (i.e., a permanent structure designed to prevent the types of subsidence that commonly occur adjacent to waterways) that are affected by erosion.	MOS DCRA DHS&EM	USACE grants FEMA grants	2-3 years	High
Research and consider instituting the National Weather Service program of "Storm Ready".	MOS NWS	City budget	<1 year	Medium
Increase back up power generation: Purchase Generator 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	MOS DHS&EM	HMGP grant/ Assistance to Firefighters Grant Program grants	2-3 years	Medium
Develop Emergency Operations Plan, as needed	MOS	City budget, PDM grant	1-2 years	Medium

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APPENDIX A – FUNDING RESOURCES

Federal Funding Resources

The federal government requires local governments to have a Hazard Mitigation Plan in place to be eligible for mitigation funding opportunities through FEMA such as the UHMA Programs and the HMGP. The Mitigation Technical Assistance Programs available to local governments are also a valuable resource. FEMA may also provide temporary housing assistance through rental assistance, mobile homes, furniture rental, mortgage assistance, and emergency home repairs. The Disaster Preparedness Improvement Grant also promotes educational opportunities with respect to hazard awareness and mitigation.

- FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from FEMA Publication Warehouse (1-800-480-2520) and are briefly described here:
 - How-to Guides. FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides describe the four major phases of hazard mitigation planning. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements (<http://www.fema.gov/hazard-mitigation-planning-resources#1>).
 - Local Mitigation Planning Handbook, March 2013. This handbook explains the basic concepts of hazard mitigation and provides guidance to local governments on developing or updating hazard mitigation plans to meet the requirements of Title 44 Code of Federal Regulations (CFR) §201.6 for FEMA approval and eligibility to apply for FEMA Hazard Mitigation Assistance grant programs. (<http://www.fema.gov/library/viewRecord.do?id=7209>)
 - Earthquake Hazard Mitigation Handbook: This Handbook provides local jurisdictions with mitigation ideas, many of which have demonstrated success and timeliness. These mitigation measures should be used as a source of ideas for potential mitigation projects, regardless of whether it will receive FEMA funding. (<http://www.starr-team.com/starr/RegionalWorkspaces/RegionX/Documents/Hazard%20Mitigation%20Handbooks/EQHazMitHandbook.pdf>)
 - Flood Hazard Mitigation Handbook: This Handbook provides local jurisdictions with mitigation ideas that have demonstrated success and can be timely implemented. These mitigation measures relate to the most common damages sustained by severe flood events. This Handbook can be a useful mitigation tool regardless whether a specific project is proposed for FEMA funding under either the Public Assistance or Mitigation programs. (<http://www.starr-team.com/starr/RegionalWorkspaces/RegionX/Documents/Hazard%20Mitigation%20Handbooks/FloodHazMitHandbook.pdf>)

- Hurricane Hazard Mitigation Handbook: This handbook provides local jurisdictions with mitigation ideas, many of which have demonstrated success in the past. These mitigation measures should be used as a source of ideas for potential mitigation projects, regardless of whether they will receive FEMA funding. (<http://www.starr-team.com/starr/RegionalWorkspaces/RegionX/Documents/Hazard%20Mitigation%20Handbooks/HurricaneMitHandbook.pdf>)
- A Guide to Recovery Programs FEMA 229(4), September 2005. The programs described in this guide may all be of assistance during disaster incident recovery. Some are available only after a Presidential declaration of disaster, but others are available without a declaration. Please see the individual program descriptions for details. (<http://www.fema.gov/txt/rebuild/ltrc/recoveryprograms229.txt>)
- The Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to a community's industries and businesses located in hazard prone areas. (<https://www.fema.gov/media-library/assets/documents/3412>)
- The 2015 Hazard Mitigation Assistance (HMA) Guidance and Addendum, February 27 and March 3, 2015 respectively. Part I of the Hazard Mitigation Assistance (HMA) Guidance introduces the three HMA programs, identifies roles and responsibilities, and outlines the organization of the document. This guidance applies to Hazard Mitigation Grant Program (HMGP) disasters declared on or after the date of publication unless indicated otherwise. This guidance is also applicable to the Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA) Programs; the application cycles are announced via <http://www.grants.gov/>. The guidance in this document is subject to change based on new laws or regulations enacted after publication.
- FEMA, <http://www.fema.gov> - includes links to information, resources, and grants that communities can use in planning and implementing community resilience and sustainability measures.
- FEMA also administers emergency management grants (<http://www.fema.gov/help/site.shtm>) and various firefighter grant programs (<http://www.firegrantsupport.com/>) such as
 - Emergency Management Performance Grant. This is a pass-through grant. The amount is determined by the State. The grant is intended to support critical assistance to sustain and enhance State and local emergency management capabilities at the state and local levels for all-hazard mitigation, preparedness, response, and recovery including coordination of inter-governmental (federal, state, regional, local, and tribal) resources, joint operations, and mutual aid compacts state-to-state and nationwide. Sub-recipients must be compliant with National Incident Management System (NIMS) implementation as a condition for receiving

funds. Requires 50% match. (<https://www.fema.gov/fiscal-year-2015-emergency-management-performance-grant-program>)

- National Earthquake Hazards Reduction Program (NEHRP). The National Earthquake Hazards Reduction Program (NEHRP) seeks to mitigate earthquake losses in the United States through both basic and directed research and implementation activities in the fields of earthquake science and engineering. (<https://www.fema.gov/national-earthquake-hazards-reduction-program>)

The NEHRP is the federal government's coordinated approach to addressing earthquake risks. Congress established the program in 1977 (Public Law 95-124) as a long-term, nationwide program to reduce the risks to life and property in the United States resulting from earthquakes. The NEHRP is managed as a collaborative effort among FEMA, the National Institute of Standards and Technology, the National Science Foundation, the United States Geological Survey, and the Department of Interior.

The four goals of the NEHRP are to:

- Develop effective practices and policies for earthquake loss-reduction and accelerate their implementation.
- Improve techniques to reduce seismic vulnerability of facilities and systems.
- Improve seismic hazards identification and risk-assessment methods and their use.
- Improve the understanding of earthquakes and their effects.

NEHRPDHS information may be found at:

<http://www.fema.gov/plan/prevent/earthquake/nehrrp.shtm>, and

http://www.ehow.com/info_7968511_disaster-research-grant-funding.html

- Assistance to Fire Fighters Grant (AFG), Fire Prevention and Safety (FP&S), Staffing for Adequate Fire and Emergency Response Grants (SAFER), and Assistance to Firefighters Station Construction Grant programs. Information can be found at: (<http://forestry.alaska.gov/fire/vfa.htm>).
- Department of Homeland Security (DHS) provides the following grants:
 - Homeland Security Grant Programs and State Homeland Security Programs (SHSP) are 80 percent passed through grants. SHSP supports implementing the State Homeland Security Strategies to address identified planning, organization, equipment, training, and exercise needs for acts of terrorism and other catastrophic events. In addition, SHSP supports implementing the National Preparedness Guidelines, the NIMS, and the National Response Framework. Must ensure at least 25 percent of funds are dedicated towards law enforcement terrorism prevention-oriented activities. (<https://www.dhs.gov/homeland-security-grant-program-hsgp>)
 - Citizen Corps Program. The Citizen Corps mission is to bring community and government leaders together to coordinate involving community members in emergency preparedness, planning, mitigation, response, and recovery activities. (<http://www.dhs.gov/citizen-corps>)
 - Emergency Operations Center (EOC) Guidance. This program is intended to improve emergency management and preparedness capabilities by supporting flexible, sustainable, secure, strategically located, and fully interoperable Emergency Operations Centers (EOCs)

- with a focus on addressing identified deficiencies and needs. Fully capable emergency operations facilities at the State and local levels are an essential element of a comprehensive national emergency management system and are necessary to ensure continuity of operations and continuity of government in major disasters or emergencies caused by any hazard. Requires 25% match. (<https://www.fema.gov/media-library/assets/documents/20622>)
- Emergency Alert System (EAS). Resilient public alert and warning tools are essential to save lives and protect property during times of national, state, regional, and local emergencies. The Emergency Alert System (EAS) is used by alerting authorities to send warnings via broadcast, cable, satellite, and wireline communications pathways. Emergency Alert System participants, which consist of broadcast, cable, satellite, and wireline providers, are the stewards of this important public service in close partnership with alerting officials at all levels of government. The EAS is also used when all other means of alerting the public are unavailable, providing an added layer of resiliency to the suite of available emergency communication tools. The EAS is in a constant state of improvement to ensure seamless integration of CAP-based and emerging technologies. (<https://www.fema.gov/emergency-alert-system>)
 - U.S. Department of Commerce's grant programs include:
 - National Oceanic and Atmospheric Administration (NOAA), provides funds to the State of Alaska due to Alaska's high threat for tsunami. The allocation supports the promotion of local, regional, and state level tsunami mitigation and preparedness; installation of warning communications systems; installation of warning communications systems; installation of tsunami signage; promotion of the Tsunami Ready Program in Alaska; development of inundation models; and delivery of inundation maps and decision-support tools to communities in Alaska. (http://www.tsunami.noaa.gov/warning_system_works.html)
 - Remote Community Alert Systems grant for outdoor alerting technologies in remote communities effectively underserved by commercial mobile service for the purpose of enabling residents of those communities to receive emergency messages. (<http://www.federalgrants.com/Remote-Community-Alert-Systems-Program-11966.html>) This program is a contributing element of the Warning, Alert, and Response Network (WARN) Act.
 - Public Works and Development Facilities Program. This program provides assistance to help distressed communities attract new industry, encourage business expansion, diversify local economies, and generate long-term, private sector jobs. Among the types of projects funded are water and sewer facilities, primarily serving industry and commerce; access roads to industrial parks or sites; port improvements; business incubator facilities; technology infrastructure; sustainable development activities; export programs; brownfields redevelopment; aquaculture facilities; and other infrastructure projects. Specific activities may include demolition, renovation, and construction of public facilities; provision of water or sewer infrastructure; or the development of stormwater control mechanisms (e.g., a retention pond) as part of an industrial park or other eligible project. (http://cfpub.epa.gov/fedfund/program.cfm?prog_num=51)

- US Environmental Protection Agency (EPA). Under EPA's Clean Water State Revolving Fund (CWSRF) program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management projects.
(<http://yosemite.epa.gov/R10/ecocomm.nsf/6da048b9966d22518825662d00729a35/7b68c420b668ada5882569ab00720988!OpenDocument>)
 - Indian Environmental General Assistance Program (IGAP). 1992, Congress passed the Indian Environmental General Assistance Program Act (42 U.S.C. 4368b) which authorizes EPA to provide General Assistance Program (GAP) grants to federally recognized tribes and tribal consortia for planning, developing, and establishing environmental protection programs in Indian country, as well as for developing and implementing solid and hazardous waste programs on tribal lands.

The goal of this program is to assist tribes in developing the capacity to manage their own environmental protection programs, and to develop and implement solid and hazardous waste programs in accordance with individual tribal needs and applicable federal laws and regulations.

<http://www.epa.gov/Indian/gap.htm>

- Department of Agriculture (USDA). Provides diverse funding opportunities; providing a wide benefit range. Their grants and loans website provide a brief programmatic overview with links to specific programs and services.
(<http://www.rd.usda.gov/programs-services>)
 - Farm Service Agency: Emergency Conservation Program, Non-Insured Assistance, Emergency Forest Restoration Program, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.
(<http://www.fsa.usda.gov/FSA/stateoffapp?mystate=ak&area=home&subject=landing&topic=landing>)
 - Natural Resources Conservation Service (NRCS) has several funding sources to fulfill mitigation needs.
(<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/alphabetical/>)
 - Conservation Technical Assistance Program is voluntary program available to any group or individual interested in conserving their natural resources and sustaining agricultural production. The program assists land users with addressing opportunities, concerns, and problems related to using their natural resources enabling them to make sound natural resource management decisions on private, tribal, and other non-federal lands.
(<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/technical/>)
 - Conservation Innovation Grants (CIG) is a voluntary program intended to stimulate developing and adopting innovative conservation approaches and technologies while leveraging federal investment in environmental enhancement and protection,

in conjunction with agricultural production. Under CIG, Environmental Quality Incentives Program funds are used to award competitive grants to non-federal governmental or nongovernmental organizations, Tribes, or individuals.

CIG enables NRCS to work with other public and private entities to accelerate technology transfer and adoption of promising technologies and approaches to address some of the Nation's most pressing natural resource concerns. CIG will benefit agricultural producers by providing more options for environmental enhancement and compliance with federal, state, and local regulations. (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/cig/>)

- The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides financial and technical assistance to agricultural producers through contracts up to a maximum term of ten years in length. These contracts provide financial assistance to help plan and implement conservation practices that address natural resource concerns and for opportunities to improve soil, water, plant, animal, air and related resources on agricultural land and non-industrial private forestland. In addition, a purpose of EQIP is to help producers meet federal, state, tribal and local environmental regulations. (<http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/financial/eqip/?cid=stelprdb1242633>)
- The Emergency Watershed Protection Program is designed is to undertake emergency measures, including the purchase of flood plain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed. (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/ewpp/>)
- Watershed Surveys and Planning. NRCS watershed activities in Alaska are voluntary efforts requested through conservation districts and units of government and/or tribes. The purpose of the program is to assist federal, state, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, and sediment and to conserve and develop water and land resources. Resource concerns addressed by the program include water quality, opportunities for water conservation, wetland and water storage capacity, agricultural drought problems, rural development, municipal and industrial water needs, upstream flood damages, and water needs for fish, wildlife, and forest-based industries. (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/landscape/wsp/>)
- Department of Energy, Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program. This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks. (<http://www1.eere.energy.gov/wip/wap.html>)
 - The Tribal Energy Program offers financial and technical assistance to Indian tribes to help them create sustainable renewable energy installations on their lands. This program promotes tribal energy self-sufficiency and fosters employment and economic development on America's tribal lands. (<http://energy.gov/eere/wipo/tribal-energy-program>)
- Department of Health and Human Services, Administration of Children & Families, Administration for Native Americans (ANA). The ANA awards funds through grants to

- American Indians, Native Americans, Native Alaskans, Native Hawaiians, and Pacific Islanders. These grants are awarded to individual organizations that successfully apply for discretionary funds. ANA publishes in the Federal Register an announcement of funds available, the primary areas of focus, review criteria, and application information. (<http://www.acf.hhs.gov/grants/open/foa/>)
- Department of Housing and Urban Development (HUD) provides a variety of disaster resources. They also partner with federal and state agencies to help implement disaster recovery assistance. Under the National Response Framework the FEMA and the Small Business Administration (SBA) offer initial recovery assistance. (http://www.hud.gov/info/disasterresources_dev.cfm)
 - HUD, Office of Homes and Communities, Section 108 Loan Guarantee Programs. This program provides loan guarantees as security for federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing. (<http://www.hud.gov/offices/cpd/communitydevelopment/programs/108/index.cfm>)
 - HUD, Office of Homes and Communities, Section 184 Indian Home Loan Guarantee Programs. The Section 184 Indian Home Loan Guarantee Program is a home mortgage specifically designed for American Indian and Alaska Native families, Alaska Villages, Tribes, or Tribally Designated Housing Entities. Section 184 loans can be used, both on and off native lands, for new construction, rehabilitation, purchase of an existing home, or refinance.
 - Because of the unique status of Indian lands being held in Trust, Native American homeownership has historically been an underserved market. Working with an expanding network of private sector and tribal partners, the Section 184 Program endeavors to increase access to capital for Native Americans and provide private funding opportunities for tribal housing agencies with the Section 184 Program. (<http://www.hud.gov/offices/pih/ih/homeownership/184/>)

Indian Housing Block Grant / Native American Housing Assistance and Self Determination Act (IHBG/NAHASDA) administration, operating & construction funds. The act is separated into seven sections:

The IHBG is a formula grant that provides a range of affordable housing activities on Indian reservations and Indian areas. The block grant approach to housing for Native Americans was enabled by the Native American Housing Assistance and Self Determination Act of 1996 (NAHASDA).

Eligible IHBG recipients are federally recognized Indian tribes or their tribally designated housing entity (TDHE), and a limited number of state recognized tribes who were funded under the Indian Housing Program authorized by the United States Housing Act of 1937 (USHA). With the enactment of NAHASDA, Indian tribes are no longer eligible for assistance under the USHA.

An eligible recipient must submit to HUD an Indian Housing Plan (IHP) each year to receive funding. At the end of each year, recipients must submit to HUD an Annual Performance Report (APR) reporting on their progress in meeting the goals and objectives included in their IHPs.

Eligible activities include housing development, assistance to housing developed under the Indian Housing Program, housing services to eligible families and individuals, crime prevention

and safety, and model activities that provide creative approaches to solving affordable housing problems.

(http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/ih/grants/ihbg)

- Community Development Block Grants (CDBG) provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income. persons
(<http://www.hud.gov/offices/cpd/communitydevelopment/programs/>)
- National Disaster Resilience (NDR) grant is a HUD/CDBG. The grant opportunity is called the Community Block Development Grant-National Disaster Resilience (CDBG-NDR). HUD sponsors the National Disaster Resilience Competition (NDRC) to help eligible communities impacted by federally declared disasters in 2011, 2012 and 2013 become more resilient. The NDRC is a two-phase process that will competitively award nearly \$1 billion in HUD Disaster Recovery funds to the most impacted, distressed and needy eligible communities. The grant opportunity is called the Community Block Development Grant-National Disaster Resilience (CDBG-NDR). The State of Alaska is one of many applicants nationwide eligible to apply on behalf of its impacted communities. (<https://www.hudexchange.info/course-content/ndrc-nofa-phase-1-factors/NDRC-NOFA-Phase-1-Factors-Slides-2014-11-03.pdf>)
- HUD/Indian Community Development Block Grants (ICDBG) provide grant assistance and technical assistance to aid communities or Indian tribes in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income. persons
(http://portal.hud.gov/hudportal/HUD?src=/program_offices/public_indian_housing/ih/grants/icdbg)
- Department of Labor (DOL), Employment and Training Administration, Disaster Unemployment Assistance (DUA). Provides weekly unemployment subsistence grants for those who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible.
(<http://www.workforcesecurity.doleta.gov/unemploy/disaster.asp>)
 - The Workforce Investment Act contains provisions aimed at supporting employment and training activities for Indian, Alaska Native, and Native Hawaiian individuals. The Department of Labor's Indian and Native American Programs funds grant programs that provide training opportunities at the local level for this target population.
(<http://www.dol.gov/dol/topic/training/indianprograms.htm>)
- Department of Transportation (DOT), Hazardous Materials Emergency Preparedness (HMEP) Grant. The Hazardous Materials Transportation Safety and Security Reauthorization Act of 2005 authorizes the U.S. DOT to provide assistance to public sector employees through training and planning grants to States, Territories, and Native American tribes for emergency response. The purpose of this grant program is to increase State, Territorial, Tribal, and local effectiveness in safely and efficiently handling hazardous materials accidents and incidents, enhance

- implementation of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), and encourage a comprehensive approach to emergency training and planning by incorporating the unique challenges of responses to transportation situations. (<http://www.phmsa.dot.gov/hazmat/grants>)
- Federal Financial Institutions. Member banks of Federal Deposit Insurance Corporation, Financial Reporting Standards or Federal Home Loan Bank Board may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.
 - Internal Revenue Service, Disaster Tax Relief. Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous year's tax returns (<http://www.irs.gov/Businesses/Small-Businesses-%26-Self-Employed/Disaster-Assistance-and-Emergency-Relief-for-Individuals-and-Businesses-1>).
 - SBA Disaster Assistance Loans and Grants program provides information concerning disaster assistance, preparedness, planning, cleanup, and recovery planning. (<https://www.sba.gov/category/navigation-structure/loans-grants>)
 - May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. (<https://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans>). Requests for SBA loan assistance should be submitted to DHS&EM.
 - United States Army Corps of Engineers (USACE) Alaska District's Civil Works Branch studies potential water resource projects in Alaska. These studies analyze and solve water resource issues of concern to the local communities. These issues may involve navigational improvements, flood control or ecosystem restoration. The agency also tracks flood hazard data for over 300 Alaskan communities on floodplains or the sea coast. These data help local communities assess the risk of floods to their communities and prepare for potential future floods. The USACE is a member and co-chair of the Alaska Climate Change Sub-Cabinet.
 - Civil Works and Planning (<http://www.poa.usace.army.mil/Missions/CivilWorksandPlanning.aspx>)
 - Environmental Resources Section (<http://www.poa.usace.army.mil/About/Offices/Engineering/EnvironmentalResources.aspx>)
 - USACE Alaska District Grants (http://search.usa.gov/search?affiliate=alaska_district&query=grants)
 - The Grants.gov program management office was established, in 2002, as a part of the President's Management Agenda. Managed by the Department of Health and Human Services, Grants.gov is an E-Government initiative operating under the governance of the Office of Management and Budget.

Under the president's management agenda, the office was chartered to deliver a system that provides a centralized location for grant seekers to find and apply for federal funding opportunities. Today, the Grants.gov system houses information on over 1,000 grant programs and vets grant applications for 26 federal grant-making agencies.

State Funding Resources

- Department of Military and Veterans Affairs (DMVA): Provides damage appraisals and settlements for VA-insured homes, and assists with filing of survivor benefits. (<http://veterans.alaska.gov/links.htm>)
 - DHS&EM within DMVA is responsible for improving hazard mitigation technical assistance for local governments for the State of Alaska. Providing hazard mitigation training, current hazard information and communication facilitation with other agencies will enhance local hazard mitigation efforts. DHS&EM administers FEMA mitigation grants to mitigate future disaster damages such as those that may affect infrastructure including elevating, relocating, or acquiring hazard-prone properties. (<http://ready.alaska.gov/plans/mitigation.htm>)

DHS&EM also provides mitigation funding resources for mitigation planning on their Web site at <http://ready.alaska.gov/grants>.

- Division of Health and Social Services (DHSS): On this site you will find information intended to assist all who are interested in DHSS grants and services they support. (<http://dhss.alaska.gov/fms/grants/Pages/grants.aspx> and <http://dhss.alaska.gov/fms/Documents/FY15GrantBook.pdf>)
- Division of Health and Social Services: Provides special outreach services for seniors, including food, shelter and clothing. (<http://dhss.alaska.gov/dsds/Pages/hcb/hcb.aspx>)
- Division of Insurance: Provides assistance in obtaining copies of policies and provides information regarding filing claims. (<http://commerce.state.ak.us/dnn/ins/Consumers/AlaskaConsumerGuide.aspx>)
- DCRA within the DCCED administers the HUD/CDBG, FMA Program, and the Climate Change Sub-Cabinet's Interagency Working Group's program funds and administers various flood and erosion mitigation projects, including the elevation, relocation, or acquisition of flood-prone homes and businesses throughout the State. This division also administers programs for State's "distressed" and "targeted" communities. (<http://www.commerce.state.ak.us/dca/>)
 - DCRA Planning and Land Management staff provide Alaska Climate Change Impact Mitigation Program (ACCIMP) funding to Alaskan communities that meet one or more of the following criteria related to flooding, erosion, melting permafrost, or other climate change-related phenomena: Life/safety risk during storm/flood events; loss of critical infrastructure; public health threats; and loss of 10% of residential dwellings. (<http://commerce.state.ak.us/dnn/dcra/PlanningLandManagement/ACCIMP.aspx>)

The Hazard Impact Assessment is the first step in the ACCIMP process. The HIA identifies and defines the climate change-related hazards in the community, establishes current and predicted impacts, and provides recommendations to the community on alternatives to mitigate the impact. (http://commerce.alaska.gov/dca/planning/accimp/hazard_impact.html)

- Department of Environmental Conservation (DEC). DEC's primary roles and responsibilities concerning hazards mitigation are ensuring safe food and safe water, and pollution prevention and pollution response. DEC ensures water treatment plants, landfills, and bulk fuel storage tank farms are safely constructed and operated

in communities. Agency and facility response plans include hazards identification and pollution prevention and response strategies. (<http://dec.alaska.gov/>)

- The Division of Water's Village Safe Water (VSW) Program works with rural communities to develop sustainable sanitation facilities. Communities apply each year to VSW for grants for sanitation projects. Federal and state funding for this program is administered and managed by the VSW program. VSW provides technical and financial support to Alaska's smallest communities to design and construct water and wastewater systems. In some cases, funding is awarded by VSW through the Alaska Native Tribal Health Consortium (ANTHC), who in turn assist communities in design and construct of sanitation projects.
- Municipal Grants and Loans Program. The Department of Environmental Conservation / Division of Water administer the Alaska Clean Water Fund (ACWF) and the Alaska Drinking Water Fund (ADWF). The division is fiscally responsible to the Environmental Protection Agency (EPA) to administer the loan funds as the EPA provides capitalization grants to the division for each of the loan funds. In addition, it is prudent upon the division to administer the funds in a manner that ensures their continued viability. (<http://dec.alaska.gov/water/MuniGrantsLoans/loanoverview.html>)
- Under EPA's CWSRF program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management, [and stormwater management] projects.
(<http://yosemite.epa.gov/R10/ecocomm.nsf/6da048b9966d22518825662d00729a35/7b68c420b668ada5882569ab00720988!OpenDocument>)

Alaska's Revolving Loan Fund Program, prescribed by Title VI of the Clean Water Act as amended by the Water Quality Act of 1987, Public Law 100-4. DEC will use the ACWF account to administer the loan fund. This Agreement will continue from year-to-year and will be incorporated by reference into the annual capitalization grant agreement between EPA and the DEC. DEC will use a fiscal year of July 1 to June 30 for reporting purposes. (http://www.epa.gov/region10/pdf/water/srf/cwsrf_alaska_operating_agreement.pdf)

- Department of Transportation and Public Facilities (DOT/PF) personnel provide technical assistance to the various emergency management programs, to include mitigation. This assistance is addressed in the DHS&EM-DOT/PF Memorandum of Agreement and includes but is not limited to: environmental reviews, archaeological surveys, and historic preservation reviews.
 - DOT/PF and DHS&EM coordinate buy-out projects to ensure that there are no potential right-of-way conflicts with future use of land for bridge and highway projects, and collaborate on earthquake mitigation.
 - Additionally, DOT/PF provides the safe, efficient, economical, and effective State highway, harbor, and airport operation. DOT/PF uses its Planning, Design and Engineering, Maintenance and Operations, and Intelligent Transportation Systems resources to identify hazards, plan and initiate mitigation activities to meet the transportation needs of Alaskans, and make Alaska a better place to live and work. DOT/PF budgets for temporary bridge replacements and materials necessary to make the

multi-modal transportation system operational following natural disaster events.

- DNR administers various projects designed to reduce stream bank erosion, reduce localized flooding, improve drainage, and improve discharge water quality through the stormwater grant program funds. Within DNR,
 - The Division of Geological and Geophysical Survey (DGGS) is responsible Alaska's mineral, land, and water resources use, development, and earthquake mitigation collaboration.

Their geologists and support staff are leaders in researching Alaska's geology and implementing technological tools to most efficiently collect, interpret, publish, archive, and disseminate information to the public.

- The DNR's Division of Forestry (DOF) participates in a statewide wildfire control program in cooperation with the forest industry, rural fire departments and other agencies. Prescribed burning may increase the risks of fire hazards; however, prescribed burning reduces the availability of fire fuels and therefore the potential for future, more serious fires.
(<http://forestry.alaska.gov/pdfs/08FireSuppressionMediaGuide.pdf>)
- DOF also manages various wildland fire programs, activities, and grant programs such as the FireWise Program (<http://forestry.alaska.gov/fire/firewise.htm>), Community Forestry Program (<http://forestry.alaska.gov/community/>), AFG, FP&S, SAFER, and Volunteer Fire Assistance and Rural Fire Assistance Grant (VFA-RFA) programs (<http://forestry.alaska.gov/fire/vfarfa.htm>). Information can be found at <http://forestry.alaska.gov/fire/current.htm>.
- The Alaska Interagency Coordination Center (AICC) is the Geographic Area Coordination Center for Alaska. AICC serves as the focal point for initial attack resource coordination, logistics support, and predictive services for all state and federal agencies involved in wildland fire management and suppression in Alaska.

Fire management planning, preparedness, suppression operations, prescribed burning, and related activities are coordinated on an interagency basis. DOF has cooperative agreements with the Departments of Agriculture and Interior, and numerous local government and volunteer fire departments to respond to wildland fires, reduce duplication of efforts, and share resources.

In 1984 the State of Alaska adopted the National Interagency Incident Management System Incident Command System concept for managing fire suppression. The Incident Command System (ICS) guiding principles are followed in all wildland fire management operations. All State of Alaska Departments adopted ICS in 1996 through the governor's administrative order.

Other Funding Resources

The following provide focused access to valuable planning resources for communities interested in sustainable development activities.

- Rural Alaska Community Action Program Inc. (RurAL CAP) In the nearly 50 years since it began, it is difficult to imagine any aspect of rural Alaskan lives which has not been touched in some way by the people and programs of RurAL CAP. From Head Start, parent education, adult basic education, and elder-youth programs, to Native land claims and subsistence rights, energy and weatherization programs, and alcohol and substance abuse prevention, RurAL CAP has left a lasting mark on the history and development of Alaska and its rural Peoples.
(http://ruralcap.com/?page_id=334)

- Weatherization Assistance Program assists low to moderate income households in weatherization needs. The program is available to homeowners as well as renters and includes; single family homes, cabins, mobile homes, condominiums and multifamily dwellings. (http://ruralcap.com/?page_id=794)
- Solid Waste Management. RurAL CAP continues to host an expert solid waste liaison, Ted Jacobson, through funding provided by the Environmental Protection Agency (EPA) and Senior Services America, Inc. The liaison provides solid waste management technical assistance to rural communities through training, site visits, hands-on demonstrations, and remote contact. Resources are provided for dump management activities, collaborating with funders for funding and technical assistance on solid waste management, recycling, and backhaul. (http://ruralcap.com/?page_id=198)
- American Planning Association, <http://www.planning.org> - a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
- Institute for Business and Home Safety, an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. (<http://www.disastersafety.org/>)
- American Red Cross. Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided. (<http://www.redcross.org/find-help>)
- Catalog of Federal Domestic Assistance Crisis Counseling Program. Provides grants to State and Borough Mental Health Departments, which in turn provide training for screening, diagnosing and counseling techniques. Also provides funds for counseling, outreach, and consultation for those affected by disaster. (<http://dialoguemakers.org/Resourses4states+Nonprofits.htm>)
- Denali Commission. Introduced by Congress in 1998, the Denali Commission is an independent federal agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska. With the creation of the Denali Commission, Congress acknowledged the need for increased inter-agency cooperation and focus on Alaska's remote communities. Since its first meeting in April 1999, the Commission is credited with providing numerous cost-shared infrastructure projects across the State that exemplifies effective and efficient partnership between federal and state agencies, and the private sector. (<http://www.denali.gov/grants>)
 - The Energy Program primarily funds design and construction of replacement bulk fuel storage facilities, upgrades to community power generation and distribution systems, alternative-renewable energy projects, and some energy cost reduction projects. The Commission works with the Alaska Energy Authority (AEA), Alaska Village Electric Cooperative (AVEC), Alaska Power and Telephone and other partners to meet rural communities' fuel storage and power generation needs.
 - The goal of the solid waste program at the Denali Commission is to provide funding to address deficiencies in solid waste disposal sites which threaten to contaminate rural drinking water supplies.
- Lindbergh Foundation Grants. Each year, The Charles A. and Anne Morrow Lindbergh Foundation provides grants of up to \$10,580 (a symbolic amount

- representing the cost of the Spirit of St. Louis) to men and women whose individual initiative and work in a wide spectrum of disciplines furthers the Lindbergh's vision of a balance between the advance of technology and the preservation of the natural/human environment. (<http://www.thelindberghfoundation.org/awards>)
- Rasmussen Foundation Grants. The Rasmussen foundation invests both in individuals and well-managed 501(c)(3) organizations dedicated to improving the quality of life for Alaskans.

Rasmussen Foundation awards grants both to organizations serving Alaskans through a base of operations in Alaska, and to individuals for projects, fellowships and sabbaticals. To be considered for a grant award, grant seekers must meet specific criteria and complete and submit the required application according to the specific guidelines of each program. (<http://www.rasmuson.org/index.php?switch=viewpage&pageid=5>)

- Tier 1 Awards: Grants of up to \$25,000 for capital projects, technology updates, capacity building, program expansion, and creative works.
- Tier 2 Awards: Grants over \$25,000 for projects of demonstrable strategic importance or innovative nature.
- Pre-Development Program: Guidance and technical resources for planning new, sustainable capital projects.

The Foundation trustees believe successful organizations can sustain their basic operations through other means of support and prefer to assist organizations with specific needs, focusing on requests which allow the organizations to become more efficient and effective. The trustees look favorably on organizations which demonstrate broad community support, superior fiscal management and matching project support. (<http://www.rasmuson.org/index.php>)

APPENDIX B – FEMA REVIEW TOOL, LOCAL HAZARD MITIGATION PLAN

APPENDIX C – COMMUNITY LHMP ADOPTION RESOLUTIONS

APPENDIX D – PUBLIC OUTREACH ACTIVITIES

Copy of emails sent to interested parties for feedback on the draft plan, and to the planning team.

From: [Isham, Kelly](#)
Cc: [Isham, Kelly](#); [Bella, Elizabeth](#)
Subject: Interested Parties Review of the Mitigation Plan for the Municipality of Skagway
Date: Monday, October 21, 2019 11:12:52 AM
Attachments: [Skaqway LHMP 20191017.pdf](#)
[image003.png](#)

Attached is the Mitigation Plan for the Municipality of Skagway, it is provided as you were identified as an interested party by the Alaska Division of Homeland Security and Emergency Management and AECOM.

This email is being BCC'd to representatives from the following organizations:

- University of Alaska Fairbanks, Geophysical Institute, Alaska Earthquake Center (UAF/GI/AEC)
- Alaska Volcano Observatory
- Alaska Department of Environmental Conservation (DEC)
 - Division of Spill Prevention and Response
- Alaska Department of Transportation and Public Facilities (DOT/PF)
- Alaska Department of Community, Commerce, and Economic Development (DCCED)
 - Division of Community and Regional Affairs (DCRA)
- U.S. Environmental Protection Agency
- National Weather Service (NWS)
- U.S. Department of Agriculture (USDA)
 - USDA Division of Rural Development
 - Natural Resources Conservation Service (NRCS)
- U.S. Army Corps of Engineers (USACE)
- U.S. Bureau of Land Management
- U.S. Department of Housing and Urban Development (HUD)
- U.S. Fish & Wildlife Service

Thank you for your time and consideration.

V/R

- Mr. Kelly D.S. Isham
Senior Emergency Management Planner
AECOM Alaska Safety Representative

AECOM
3900 C Street, Suite 403
Anchorage, AK 99503
eMail: kelly.isham@aecom.com
Phone: 907.261.9724
Fax: 907.562.1297
Personal Cell: 907.740.3637

From: [Basecamp \(Municipality Of Skagway Emergency Management\)](#)
To: [Isham, Kelly](#)
Subject: Basecamp (Municipality Of Skagway Emergency Management): Here's the latest activity
Date: Friday, March 15, 2019 9:00:12 AM















Municipality Of Skagway Emergency Management Here's the latest activity across everything

Since 9am on Thursday, March 14

Hazard Mitigation Plan

Things were added to [Docs & Files](#)

-  Shane Rupprecht uploaded [Public outreach and Sign in.pdf](#)

-  Shane Rupprecht uploaded [Skagway HMP Information.pdf](#)

-  Shane Rupprecht uploaded [Primary Roadways.pdf](#)

-  Shane Rupprecht uploaded [2018 Rock Protection Program.pdf](#)

-  Shane Rupprecht uploaded [1994 Landslide.pdf](#)

-  Shane Rupprecht uploaded [West Creek Glacial Outburst.pdf](#)


Basecamp emails this report every morning. [Stop sending it to me.](#)

Get easier, faster access to Basecamp when it's on your phone. Grab an app!



From: [Shane Rupprecht](#)
To: [Isham, Kelly](#)
Cc: [Ray Leggett](#)
Subject: Haz-Mit Public meeting
Date: Monday, July 22, 2019 10:30:33 AM
Attachments: [image001.png](#)

Hi Kelly,

Chief Leggett and I were planning on holding a public meeting for the Hazard Mitigation Plan on 7/30, Is there any information you would like me to include for the public meeting?

Thanks,

Shane Rupprecht

Permitting Official
Municipality Of Skagway/PO Box 415
Skagway, AK 99840
s.rupprecht@skagway.org
(907)983-3906



Do not pray for an easy life, pray for the strength to endure a difficult one. – Bruce Lee

From: [Isham, Kelly](#)
To: [Shane Rupprecht](#)
Cc: [Ray Leggett](#)
Subject: RE: Flyers
Date: Friday, July 26, 2019 11:30:00 AM
Attachments: [environmental_responsibilities_2012.pdf](#)
[image002.png](#)
[image003.png](#)
[Fact Sheet Mitigation Value to Your Community.pdf](#)
[Local Hazard Mitigation Planning Fact Sheet Final 508.pdf](#)
[what_is_risk_map.pdf](#)

Sir,

Look at having a few of these available to the public and elected officials that attend.

V/R

- Mr. Kelly D.S. Isham
Senior Emergency Management Planner
AECOM Alaska Safety Representative



700 G Street, Suite 500, Anchorage, AK 99501

eMail: kelly.isham@aecom.com

Phone: 907.261.9724

Fax: 907.562.1297

Personal Cell: 907.740.3637

From: Shane Rupprecht [mailto:S.Rupprecht@skagway.org]
Sent: Friday, July 26, 2019 10:52 AM
To: Isham, Kelly
Subject: Flyers

Hi Kelly,

Any chance I can get those flyers for the public meeting.

Thanks,

Shane Rupprecht

Permitting Official

Municipality Of Skagway/PO Box 415

Skagway, AK 99840

s.rupprecht@skagway.org

(907)983-3906

From: [Shane Rupprecht](#)
To: [Isham, Kelly](#)
Subject: RE: Meeting Summary
Date: Tuesday, September 24, 2019 10:11:49 AM
Attachments: [image002.png](#)
[image003.png](#)
[Sign in sheets..pdf](#)
[ATT00001.htm](#)

Sign in sheets are attached.

Shane

From: Isham, Kelly <kelly.isham@aecom.com>
Sent: Tuesday, September 24, 2019 9:46 AM
To: Shane Rupprecht <S.Rupprecht@skagway.org>
Cc: Ray Leggett <r.leggett@skagway.org>
Subject: RE: Meeting Summary

Thank you Shane,

The agenda states that a sign-in sheet was made available. Do you know if anyone signed in? If so, do you have that that you can send me. Getting names and documentation of attendance is a super big deal to FEMA.

V/R

- Mr. Kelly D.S. Isham
Senior Emergency Management Planner
AECOM Alaska Safety Representative



3900 C Street, Suite 403
Anchorage, AK 99503
eMail: kelly.isham@aecom.com
Phone: 907.261.9724
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Personal Cell: 907.740.3637

From: Shane Rupprecht <S.Rupprecht@skagway.org>
Sent: Tuesday, September 24, 2019 9:34 AM
To: Isham, Kelly <kelly.isham@aecom.com>
Subject: Meeting Summary

Hi Kelly,

Attached is a meeting summary. Let me know if you have questions.

Shane Rupprecht

Permitting Official

Municipality Of Skagway/PO Box 415

Skagway, AK 99840

s.rupprecht@skagway.org

(907)983-3906



Do not pray for an easy life, pray for the strength to endure a difficult one. – Bruce Lee

From: [Isham, Kelly](#)
To: [Ray Leggett](#); [Shane Rupprecht](#)
Cc: [Bella, Elizabeth](#); [Mercer, Arika](#)
Subject: Skagway Mitigation Plan for review by Municipal Assembly
Date: Wednesday, October 02, 2019 7:47:26 PM
Attachments: [fema mitigation ideas final508.pdf](#)
[Skagway LHMP 20191002kdsi.docx](#)

Chief Leggett,

Please see the attached most recent recent version of your mitigation plan as well as the FEMA document "Mitigation Ideas."

Please print and pay most attention to Section 7 of the plan. This Mitigation Strategy is the piece that the Assembly will need to evaluate and see if there are any new strategies or plans that we should emulate.

Please let me know if you have any questions.

Kelly Isham, AECOM



Municipality of Skagway
Hazard Mitigation Plan Workshop
March 5, 2019

	Name	Title	Phone #	Email Address
1	Heather Rodig	Acting Manager	907-983-2703	h.rodig@skagway.org
2	Shane Pupprecht	Permitting Official	907-612-0265	S.pupprecht@skagway.org
3	Tyson Ames	Public Works Director	907-612-0051	t.ames@skagway.org
4	Steward Stephens	Cruise Line Agency	907-973-2815	StewardS@clarkskier.com
5	Sara Kinjo-Hischer	Tribal Administrator	612-0454	Sara@skagwaytraditional.org
6	Bruce Weber	SPE	805-2044564	CEP LEPC@skagway.org
7	Josh Coughran	Superintendent, SSP	987-2960	j.coughran@skagway.school.org
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APPENDIX E – BENEFIT-COST ANALYSIS FACT SHEET

Hazard mitigation projects are specifically aimed at reducing or eliminating future damages. Although hazard mitigation projects may sometimes be implemented in conjunction with the repair of damages from a declared disaster, the focus of hazard mitigation projects is on strengthening, elevating, relocating, or otherwise improving buildings, infrastructure, or other facilities to enhance their ability to withstand the damaging impacts of future disasters. In some cases, hazard mitigation projects may also include training or public-education programs if such programs can be demonstrated to reduce future expected damages.

A Benefit-Cost Analysis (BCA) provides an estimate of the benefits and costs of a proposed hazard mitigation project. The benefits considered are avoided future damages and losses that are expected to accrue as a result of the mitigation project. In other words, benefits are the reduction in expected future damages and losses (i.e., the difference in expected future damages before and after the mitigation project). The costs considered are those necessary to implement the specific mitigation project under evaluation. Costs are generally well determined for specific projects for which engineering design studies have been completed. However, benefits must be estimated probabilistically because they depend on the improved performance of the building or facility in future hazard events, the timing and severity of which must be estimated probabilistically.

All benefit-costs must be:

- Credible and well documented
- Prepared in accordance with accepted BCA practices
- Cost-effective ($BCR \geq 1.0$)

General Data Requirements:

- All data entries (other than the Federal Emergency Management Agency [FEMA] standard or default values) MUST be documented in the application.
- Data MUST be from a credible source.
- Provide complete copies of reports and engineering analyses.
- Detailed cost estimate.
- Identify the hazard (flood, wind, seismic, etc.).
- Discuss how the proposed measure will mitigate against future damages.
- Document the Project Useful Life.
- Document the proposed Level of Protection.
- The Very Limited Data (VLD) BCA module cannot be used to support cost-effectiveness (screening purposes only).
- Alternative BCA software MUST be approved in writing by FEMA HQ and the Region prior to submittal of the application.

Damage and Benefit Data

- Well documented for each damage event.
- Include estimated frequency and method of determination per damage event.
- Data used in place of FEMA standard or default values MUST be documented and justified.
- The Level of Protection MUST be documented and readily apparent.

- When using the Limited Data (LD) BCA module, users cannot extrapolate data for higher frequency events for unknown lower frequency events.

Building Data

- Should include FEMA Elevation Certificates for elevation projects or projects using First Floor Elevations (FFE's).
- Include data for building type (tax records or photos).
- Contents claims that exceed 30 percent of building replacement value (BRV) MUST be fully documented.
- Method for determining BRVs MUST be documented. BRVs based on tax records MUST include the multiplier from the County Tax Assessor.
- Identify the amount of damage that will result in demolition of the structure (FEMA standard is 50 percent of pre-damage structure value).
- Include the site location (i.e., miles inland) for the hurricane module.

Use Correct Occupancy Data

- Design occupancy for Hurricane shelter portion of tornado module.
- Average occupancy per hour for the tornado shelter portion of the tornado module.
- Average occupancy for seismic modules.

Questions to Be Answered

- Has the level of risk been identified?
- Are all hazards identified?
- Is the BCA fully documented and accompanied by technical support data?
- Will residual risk occur after the mitigation project is implemented?

Common Shortcomings

- Incomplete documentation.
- Inconsistencies among data in the application, BCA module runs, and the technical support data.
- Lack of technical support data.
- Lack of a detailed cost estimate.
- Use of discount rate other than FEMA-required amount of 7 percent.
- Overriding FEMA default values without providing documentation and justification.
- Lack of information on building type, size, number of stories, and value.
- Lack of documentation and credibility for FFE's.
- Use of incorrect Project Useful Life (not every mitigation measure = 100 years).

APPENDIX F – PLAN MAINTENANCE DOCUMENTS

Annual Review Questionnaire

PLAN SECTION	QUESTIONS	YES	NO	COMMENTS
PLANNING PROCESS	Are there internal or external organizations and agencies that have been invaluable to the planning process or to mitigation action			
	Are there procedures (e.g., meeting announcements, plan updates) that can be done more efficiently?			
	Has the planning team undertaken any public outreach activities regarding the LHMP or implementation of mitigation actions?			
HAZARD PROFILES	Has a natural and/or manmade/technologically caused disaster occurred during this reporting period?			
	Are there natural and/or human-made/technologically caused hazards that have not been addressed in this LHMP and should be?			
	Are additional maps or new hazard studies available? If so, what have they revealed?			
VULNERABILITY ASSESSMENT	Do any critical facilities or infrastructure need to be added to the asset lists?			
	Have there been development patterns changes that could influence the effects of hazards or create additional risks?			
MITIGATION STRATEGY	Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning in the municipality?			
	Are the goals still applicable?			
	Should new mitigation actions be added to the Mitigation Action Plan (MAP)?			
	Do existing mitigation actions listed in the Mitigation Strategies' MAP need to be reprioritized?			
	Are the mitigation actions listed in the MAP appropriate for available resources?			

Mitigation Action Progress Report (Continued)

Plan Goal(s) Addressed: _____

Goal: _____

Success Indicators: _____

Project Status

On Schedule

Completed

Delayed*

* Explain: _____

Canceled

Project Cost Status

Cost Unchanged

Cost Overrun**

** Explain: _____

Cost Underrun***

*** Explain: _____

Summary of progress on project for this report:

A. What was accomplished during this reporting period? _____

B. What obstacles, problems, or delays did you encounter, if any? _____

C. How was each problem resolved? _____

Next Steps: What is/are the next step(s) to accomplish over the next reporting period?

Other Comments: _____

