Draft Haines Borough Hazard Mitigation Plan Update

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in collaboration with

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Acronyms/Abbreviations

°F	Degrees Fahrenheit
ACS	American Community Survey
ADFG	Alaska Department of Fish and Game
AEC	Alaska Earthquake Center
AICC	Alaska Interagency Coordination Center
BRIC	Building Resilient Infrastructure and Communities
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
DCCED	Department of Commerce, Community, and Economic Development
DCRA	Division of Community and Regional Affairs
DGGS	Department of Geological and Geophysical Survey
DHS&EM	Division of Homeland Security and Emergency Management
DMA 2000	Disaster Mitigation Act of 2000
DMVA	Department of Military and Veterans Affairs
DNR	Department of Natural Resources
DOF	Division of Forestry
DOL	Department of Labor
DOT/PF	Department of Transportation and Public Facilities
ENSO	El Nino/La Nina Southern Oscillation
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FMA	Flood Mitigation Assistance
FP&S	Fire Prevention and Safety
FY	Fiscal Year
g	gravity as a measure of peak ground acceleration
GIS	Geographic Information System
HDEC	Haines Economic Development Corporation
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HUD	Housing and Urban Development
M	Magnitude
Mb	Millibars
MMI	Modified Mercalli Intensity
mph	miles per hour

NFIP	National Flood Insurance Program
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PGA	peak ground acceleration
PSHAs	Probabilistic Seismic Hazard Analyses
RI	return interval
RL	repetitive loss
SHMP	State of Alaska Hazard Mitigation Plan
Sq.	Square
SRL	Severe Repetitive Loss
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
UAF	University of Alaska Fairbanks
US or U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGS	United States Geological Survey
WRCC	Western Regional Climate Center
WUI	Wildland Urban Interface

1.0 Introduction

This section provides a brief introduction to hazard mitigation planning, associated grants, and a description of this 2022 Hazard Mitigation Plan (HMP) Update for Haines Borough.

1.1 HAZARD MITIGATION PLANNING

Hazard mitigation, as defined in Title 44 of the Code of Federal Regulations (CFR), Part 201.2, is "any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards." Many areas have expanded this definition to include human-caused in addition to natural hazards. As such, hazard mitigation is any work done to minimize the impacts of any type of hazard event before it occurs and aims to reduce losses from future disasters. Hazard mitigation is a process in which hazards are identified and profiled, people and facilities at risk are analyzed, and mitigation actions are developed. Implementation of the mitigation actions, which include long-term strategies such as planning, policy changes, programs, projects, and other activities, is the result of this process. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage. As such, governments are encouraged to take advantage of funding provided by Federal Hazard Mitigation Assistance (HMA) programs.

1.2 PLANNING REQUIREMENTS

1.2.1 Local Mitigation Plans

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). Section 322 directs State and Local entities to closely coordinate mitigation planning and implementation efforts. Additionally, Section 322 establishes the HMP requirement for the Federal Emergency Management Agency's (FEMA) HMA.

On October 2, 2015, FEMA published the Mitigation Planning Final Rule in the Federal Register, [Docket ID: FEMA-2015-0012], 44 CFR Part 201, effective November 2, 2015. Planning requirements for Local entities are described in Section §201.6. Locally adopted and FEMA-approved HMPs qualify jurisdictions for several HMA grant programs. This HMP Update complies with Title 44 CFR Section §201.6 and applicable FEMA guidance documents as well as the 2018 Alaska State HMP.

Section 322 of the Stafford Act (42 USC 5165) as amended by P.L. 106-390 provides for State and Local governments to undertake a risk-based approach to reduce risks from natural hazards through mitigation planning. The National Flood Insurance Act of 1968 (42 USC 4001 et seq.) as amended, further reinforces the need and requirement for HMPs, linking Flood Mitigation Assistance (FMA) programs to State and Local HMPs. This change also requires participating National Flood Insurance Program (NFIP) communities' risk assessments and mitigation strategies to identify and address repetitively flood damaged properties.

1.3 GRANT PROGRAMS WITH MITIGATION PLAN REQUIREMENTS

FEMA HMA grant programs provide funding to States and Local entities that have a FEMA-approved State or Local HMP. 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. As of June 19, 2008, the grant programs were segregated. The Hazard Mitigation Grant Program (HMGP) is a competitive, disaster-funded grant program whereas the other Unified Mitigation Assistance Programs (Pre-Disaster Mitigation [PDM] and FMA, although competitive) rely on specific pre-disaster grant funding sources, sharing several common elements. As a result of amendments by the Disaster Relief and Recovery Act of 2018, the PDM program is being replaced with the new Building Resilient Infrastructure and Communities (BRIC) program.

"The Department of Homeland Security and Emergency Management (DHS&EM) FEMA HMA grant programs present a critical opportunity to protect individuals and property from natural hazards while simultaneously reducing reliance on Federal disaster funds. The HMA programs provide PDM/BRIC grants annually to States, and Local and Tribal communities. The statutory origins of the programs differ, but all share the common goal of reducing the loss of life and property due to natural hazards. The PDM/BRIC program is authorized by the Stafford Act and focuses on mitigation project and planning activities that address multiple natural hazards, although these activities may also address hazards caused by manmade events. The FMA program is authorized by the National Flood Insurance Act and focuses on reducing claims against the NFIP" (FEMA, 2002).

1.3.1 Hazard Mitigation Assistance (HMA) Unified Programs

The HMGP provides grants to State, Local, and Tribal entities to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce loss of life and property due to natural disasters and to enable mitigation measures to be implemented during immediate recovery from a disaster. Projects must provide a long-term solution to a problem; for example, elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood. In addition, a project's potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The amount of funding available for the HMGP under a particular disaster declaration is limited. FEMA may provide a State, City, or Tribe with up to 20% of the total aggregate disaster damage costs to fund HMGP project or planning grants. The cost-share for this grant is 75% Federal/25% non-Federal.

Haines Borough has participated in the NFIP since 1975.

The PDM/BRIC grant program provides funds to State, Local, and Tribal entities for hazard mitigation planning and mitigation project implementation prior to a disaster event. PDM/BRIC grants are awarded on a nationally competitive basis. Like HMGP funding, a PDM/BRIC project's potential savings must be more than the cost of implementing the project. In addition, funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The total amount of PDM funding available is appropriated by Congress on an annual basis. In Fiscal Years (FY) 2018 and 2019, PDM program funding totaled approximately $235 and $250 million each year, respectively. The cost-share for this grant is 75% Federal/25% non-Federal.

The goal of the FMA grant program is to reduce or eliminate flood insurance claims under the NFIP. Emphasis for this program is placed on mitigating repetitive loss (RL) properties. The primary source of funding for this program is the National Flood Insurance Fund. Grant funding is available for three types of grants, including Planning, Project, and Technical Assistance. Project grants, which use the majority of the program's total funding, are awarded to States, Local, and Tribal entities to apply mitigation measures to reduce flood losses to properties insured under the NFIP. In FY 2018, FMA funding totaled $160 million. In FY 2019, FMA funding totaled $210 million. The cost-share for this grant is 75% Federal/25% non-Federal. However, 100% Federal to mitigate severe repetitive loss (SRL) properties is available in certain situations as well as 90% Federal/10% non-Federal to mitigate RL properties.

1.4 HMP UPDATE DESCRIPTION

The remainder of this HMP Update consists of the following sections and appendices:

Prerequisites

Section 2 addresses the prerequisites of plan adoption, which includes adoption by the Borough Assembly. The adoption resolution is included in Appendix B.

Community Description

Section 3 provides a general history and background of Haines Borough, including historical trends for population and the demographic and economic conditions.

Planning Process

Section 4 describes the planning process and identifies the Planning Team Members, the meetings held as part of the planning process, and the key stakeholders within the Borough. In addition, this section documents public outreach activities (Appendix A) and the review and incorporation of relevant plans, reports, and other appropriate information.

Hazard Analysis

Section 5 describes the process through which the Planning Team identified, screened, and selected the hazards to be profiled in this HMP Update. The hazard analysis includes the characteristics, history, location, extent, impact, and recurrence probability for each hazard.

Vulnerability Analysis

Section 6 identifies potentially vulnerable assets in Haines Borough. The resulting information identifies the full range of hazards that Haines Borough could face and potential social impacts, damages, and economic losses. Trends in land use and development are also included.

Mitigation Strategy

Section 7 defines the mitigation strategy which provides a blueprint for reducing the potential losses identified in the vulnerability analysis. The Planning Team developed a list of mitigation goals and potential actions to address the risks that potentially face Haines Borough.

Plan Maintenance

Section 8 describes the Planning Team's formal plan maintenance process to ensure that the HMP Update remains an active and applicable document. The process includes monitoring, evaluating (Appendix E), and updating the HMP; implementation through existing planning mechanisms; and continued public involvement. Capabilities are also included for Haines Borough, and potential grant funding sources are identified.

References

Section 9 lists the reference materials used to prepare this HMP Update.

Appendix A

Appendix A provides public outreach information, including newsletters, agendas, and sign-in sheets.

Appendix B

Appendix B provides the adoption resolution for Haines Borough and FEMA's Approval letter.

Appendix C

Appendix C provides the FEMA review tool, which documents compliance of this HMP Update with FEMA criteria.

Appendix D

Appendix D contains the Benefit-Cost Analysis Fact Sheet used to prioritize mitigation actions.

Appendix E

Appendix E provides the plan maintenance documents, such as an annual review sheet, a progress report form, and community survey.

2.0 Prerequisites

2.1 ADOPTION BY LOCAL GOVERNING BODIES AND SUPPORTING DOCUMENTATION

Requirements for the adoption of this HMP Update by the local governing body, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 REQUIREMENTS: PREREQUISITES
Local Plan Adoption
Requirement §201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., Borough Assembly, Mayor, etc.).
Element
▪ Has the local governing body adopted the updated plan?
▪ Is supporting documentation, such as a resolution, included?
Source: FEMA, 2015.

Haines Borough is the local jurisdiction represented in this 2022 HMP Update that meets the requirements of Section 322 of DMA 2000. The Haines Borough Assembly adopted this HMP Update by resolution on __________ __, 2022. A scanned copy of the resolution is included in Appendix B.

3.0 Community Description

This section describes the location, geography, and history; demographics; and economy of Haines Borough.

3.1 LOCATION, GEOGRAPHY, AND HISTORY

Figure 1. Haines Location Map

Haines Borough is located on the shores of the Lynn Canal between the Chilkoot and Chilkat Rivers, 80 air miles northwest of Juneau (Figure 1). It is in the northern part of the Alaska Panhandle, near Glacier Bay National Park and Preserve, and is just south of the Canadian border at British Columbia. By road, it is 775 miles from Anchorage. Haines lies at approximately 59.2345 North Latitude and -135.453 West Longitude. The Borough covers approximately 2,344 square (sq.) miles of land and approximately 382 sq. miles of water (Department of Community, Commerce, and Economic Development [DCCED], Division of Community and Regional Affairs [DCRA], 2021a).

The region is typified by snow-capped mountains, some over 6,000 feet, glaciated and forested valleys, and numerous salmon-rich streams and rivers descending to saltwater fjords (Haines Borough, 2012). The landscape is constantly changing due to its location along the northern edge of the earth's Pacific Plate and post-glacial rebound, or uplift of terrain after the weight of glaciation is removed, causing measurable elevation increases, especially along shorelines, mud flats, and riverine basins.

Haines Borough can be divided into five major river drainages: the Chilkat River, Chilkoot River, Ferebee River, Katzehin River, Tsirku and several small creeks (Sawmill Creek) which drain directly into Chilkat, Lutak, and Chilkoot Inlets. All of these freshwater watersheds flow into the Lynn Canal (Haines Borough, 2012).

Haines Borough has an incredibly diverse habitat including glaciers, large and tall mountain ranges, floodplains, estuaries, wetlands, tidelands, islands, lagoons, freshwater rivers, and lakes. This wide range of environments is home to many species of bird, fish, shellfish, and marine and terrestrial mammals. Area soils are rich from years of river deposition loaded by nutrients that abundant salmon and eagles create. Areas of best agricultural potential are located on stream terraces. Small vegetable gardens have been successful in the Borough for years, and multiple farms produce commercial sales.

The Alaska Department of Fish and Game (ADFG) has catalogued anadromous fish streams in the Haines coastal management area. The Chilkoot and Chilkat Rivers are major producers of all five species of salmon: Sockeye, Chum, Coho, Pink and King, and support the area's sport and subsistence fisheries. Most streams and tideflats in the entire area host one or more species of spawning fish at some time during the year as documented by the ADFG surveys. Smelt spawn in the Chilkoot-Chilkat Rivers annually, and herring spawning occurs at Tanani Point, Nukdik Point, and Flat Bay (Haines Borough, 2007).

The terrestrial vegetation of the Haines area is comprised of three major plant community types: upland hemlock/Sitka spruce forest, alpine tundra, and lowland cottonwood and alder woodlands. These upland and floodplain plant communities are indicators of topography, soils, and drainage characteristics in coastal areas. Vegetation also indicates the resource potential of an area for timber harvest and wildlife habitat and is valuable for its scenic beauty (Haines Borough, 2007).

The Haines area is in a seismically active region in Alaska and constitutes a part of the highly active circum-pacific seismic belt where earthquakes of magnitude 8 and greater have occurred. Five earthquakes of that size have occurred in Southeast Alaska and the vicinity in historic times along or near the tectonically active Fairweather, Queen Charlotte Islands Fault system, and along the Chugach - St. Elias fault (Haines Borough, 2012).

The Haines area was called "Dei Shu" by the Tlingit, meaning "end of the trail." The Chilkat Tlingit controlled the trading routes between the coast and the Interior. The first non-Native to settle here was George Dickinson, an agent for the Northwest Trading Company, in 1880. In 1881, S. Young Hall, a Presbyterian minister, received permission from the Chilkat to build the Willard Mission and School. The mission was renamed Haines in 1884 in honor of Mrs. F.E. Haines, Secretary of the Presbyterian Women's Executive Society of Home Missions, who had raised funds for the mission's construction.

During the Klondike gold rush in the late 1890s, Haines grew as a mining supply center, because the Dalton Trail from Chilkat Inlet to Whitehorse offered an easier route to the Yukon for prospectors. Gold was also discovered 36 miles from Haines in 1899 at the Porcupine District. Four canneries had been constructed in the area by the turn of the century.

The first permanent United States (U.S.) military installation in Alaska, Fort William H. Seward, was constructed south of Haines in 1904. In 1922, the fort was renamed Chilkoot Barracks. Until World War II, it was the only U.S. Army post in Alaska. It was deactivated in 1946 and sold as surplus property to a group of veterans who established it as Port Chilkoot. The City of Port Chilkoot was incorporated in 1956. The Borough formed as a third-class borough on August 29, 1968. In 1970, Port Chilkoot merged with Haines into the City of Haines. In 1972, the post was designated a national historic site and the name, Fort William Seward, was restored.

The last of the early canneries closed in 1972 due to declining fish stocks. Expansion of the timber industry in the early 1970s fueled growth. In 1974, the Borough annexed 420 sq. miles to the south. In 1978, the former military petroleum distribution facility at Lutak Inlet was annexed. The City of Haines and the Haines Borough were consolidated in 2002.

Historically Chilkat territory, Haines is now predominantly a non-native community. There are two recognized tribal groups in the area, the Chilkoot in Haines and the Chilkat in Klukwan (DCRA, 2021a).

Haines is a major trans-shipment point because of its ice-free, deep-water port and dock and year-round road access to Canada and Interior Alaska. It is a northern terminus of the Alaska State Ferry System and a hub for transportation to and from southeast Alaska. Haines has an asphalt airport runway and a landing area for float planes (DCRA, 2021a).

The Alaska Marine Highway System is the main component of the marine transportation system in Southeast Alaska. This system provides surface links for passengers and vehicles to, from, and within the panhandle area. Several vessels operate between the southern road systems from Prince Rupert, B.C. to Bellingham, Washington and the northern road connections out of Haines and Skagway. These vessels provide a link for the through movement of traffic as well as carrying passengers and vehicles to and from the region and within the region (Haines Borough, Alaska, 2007).

Tug and barge operations are primarily from Seattle. They carry substantial volumes of freight and commerce and handle the majority of the general cargo-type freight that supplies the needs of Southeast Alaskans. In addition, tug and barge companies carry a large portion of the region's fish and seafood products (frozen and canned) to the Seattle area for further distribution. Additional tug and barge operators provide petroleum products delivery and wood and forest products transshipment for Haines.

Access to the continental road system from Southeast Alaska is provided at two points in the region: from Haines via the Haines Highway, and Skagway via the Klondike Highway. The Haines Highway extends from Haines, 159 miles to Haines Junction in the Yukon. It was constructed in 1949 for strategic purposes to link the tidewater port of Haines by road with the Alcan Highway. Within the U.S., the Haines Cutoff Highway has a paved, two-lane Federal-aid primary route that carries traffic from the Lutak Dock to the town site and beyond to the Alaskan and Canadian interiors.

Haines Borough falls within the southeast maritime climate zone, characterized by cool summers, mild winters, and heavy rain throughout the year. This zone lacks prolonged periods of freezing weather at low altitudes and is characterized by cloudiness and frequent fog. Average summer temperatures in Haines range from 44 to 65 degrees Fahrenheit (°F); average winter temperatures range from 19 to 40°F. However, maximum summer highs reach into the 90s with extreme winter lows down to -15°F. Average annual precipitation is 48 inches, and average snowfall is 10 feet (Western Regional Climate Center [WRCC], 2021). The combination of heavy precipitation and low temperatures at high altitudes in the coastal mountains of southern Alaska accounts for the numerous mountain glaciers (DCRA, 2021a).

Haines Borough is a "home rule" municipality with a manager form of government. The Borough Assembly is the sole legislative body creating and adopting any and all new Borough laws and amendments or repealing laws and amendments (Haines Borough Alaska, 2021).

The Assembly consists of six members elected to three-year staggered terms. The elected mayor, also elected for a three-year term, serves as the presiding officer but is not a member of the assembly. A deputy mayor, chosen by the mayor among the assembly members, presides when the mayor is absent. The Borough Assembly has powers and duties provided for by the Haines Borough Charter and Code, and State of Alaska statute (including Title 29).

3.2 DEMOGRAPHICS

According to the 2010 U.S. Census, the population in Haines has increased between 1970 and 2010 (Figure 2). The 2010 U.S. Census recorded 2,508 residents, of which the median age was 47 years. The population is expected to remain fairly constant, with the majority of new residents historically coming from elsewhere in Alaska (Haines Borough, 2012). The male and female composition is approximately 51.5% to 48.5%, respectively. There are approximately 1,691 housing units, 1,007 of which are occupied, with the average household having approximately 2.5 individuals (ACS, 2019). The 2020 certified population is 2,520 (DCCED, 2021).

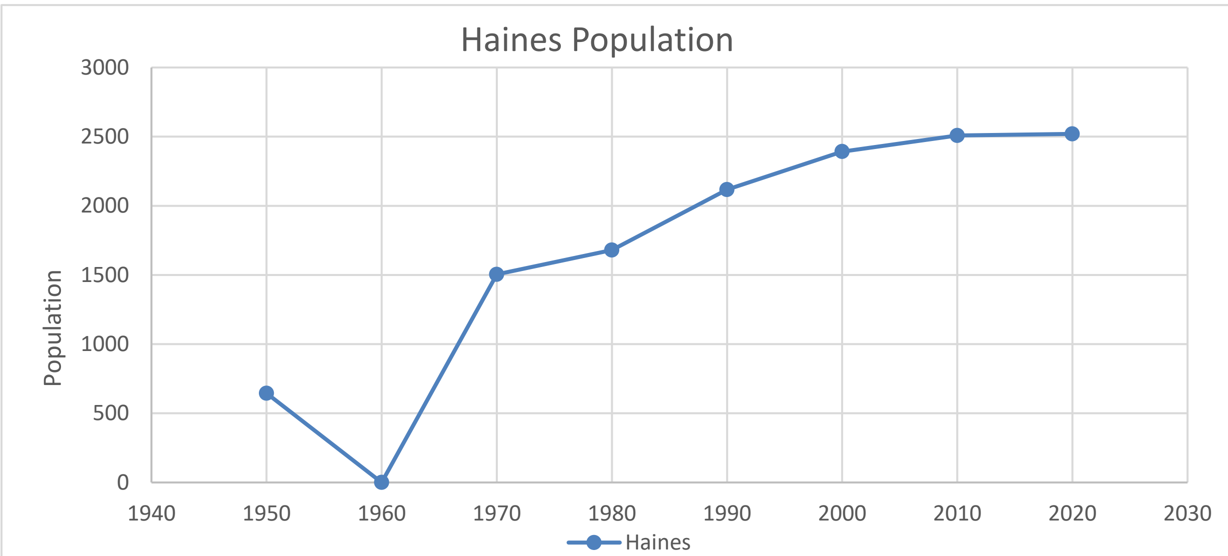

Figure 2. Haines Historic Population

3.3 ECONOMY

The Borough School District, retail trade, business and transportation services, fishing and forestry provide most of the employment in the Borough. Tourism and the traffic Haines draws as a result of its road connection to the State Ferry are important. Except for 2020 and 2021 seasons impacted by the COVID-19 pandemic, over 40,000 cruise ship passengers visit Haines annually.

Published employment statistics do not reflect key economic drivers in Haines. For example, the visitor industry includes jobs in the retail, transportation, and leisure & hospitality sectors. Commercial fishing employment is excluded from wage and salary employment data (HEDC, 2018a).

The Haines economy is built on a diverse mix of business and government activity. While the tourism, seafood, and health care sectors have the largest economic footprints in the community, mining, the arts, forest products, and other activities are also part of the community's economy (HEDC, 2018b). Many residents hold commercial fishing permits, and three shore-based seafood processors employ seasonal, typically non-resident, workers (Table 1). Recreational fishing opportunities, both saltwater and freshwater, are world-class.

Table 1. Commercial Fishing Earnings

Year	Number of Permit Holders	Number of Fishermen who Fished	Gross Earnings	Total Pounds Landed
2007	113	84	$5,840,615	5,945,493
2008	109	86	$7,312,820	7,601,718
2009	110	83	$5,273,373	6,105,387
2010	108	89	$7,084,810	6,345,206
2011	113	92	$7,734,064	7,149,676
2012	113	89	$8,777,083	8,030,690
2013	109	90	$6,929,118	6,832,624
2014	112	91	$7,270,974	5,605,685
2015	106	86	$4,984,863	5,056,517
2016	103	80	$5,967,486	6,213,347
2017	102	79	$6,625,994	6,976,259
2018	100	76	$5,349,345	4,129,039
2019	98	83	$7,490,783	6,200,910
2020	100	76	$4,036,122	3,913,577

Source: CFEC, 2021

Subsistence hunting, fishing, and gathering, and sharing of subsistence resources, are an important aspect of the local economy, with many households relying on these resources as primary or supplemental sources of food. According to ADFG data, in 2012, Haines households harvested an average 198 of pounds of fish (including 109 pounds of salmon, 32 pounds of halibut, 31 pounds of smelt, plus herring and various other finfish). Haines households also harvested an average of 16 pounds of crab, 12 pounds of shrimp, 36 pounds of moose, 18 pounds of deer, and 17 pounds of berries, along with an assortment of other products (HEDC, 2018a).

According to the 2015-2019 American Community Survey (ACS) 5-year data profile, the median household income was $58,059 with a per capita income of $31,731. Approximately 5.2% of the population were reported to be living below the poverty level (DCRA, 2021a). The potential work force (those aged 16 years or older) in the Borough was estimated to be 1,909, of which 1,181 were actively employed.

Haines' economy is similar in employment diversity to the State of Alaska as a whole (Table 2). Government employment in Haines comprised approximately 20% of the community's jobs in 2019 (ADOL, 2019). Haines is unique in the larger percentage of personal income derived from dividends, interests, and rent (29% in 2016) versus the average for Alaska (18%) (HEDC, 2018a). This has been referred to as the "mailbox economy" and represents purchasing power that is not directly tied to current production in the area.

Table 2. Haines Borough Non-Government Employment in 2015-2019

Industry	Alaska		Haines Borough	
	Estimate	%	Estimate	%
Total Civilian employed population 16 years and over	347,774		1,181	
Agriculture, forestry, fishing and hunting, and mining	16,454	4.7	31	2.6
Construction	23,403	6.7	108	9.1
Manufacturing	13,160	3.8	44	3.7
Wholesale trade	6,361	1.8	21	1.8
Retail trade	38,118	11	112	9.5
Transportation and warehousing, and utilities	28,984	8.3	47	4
Information	7,260	2.1	20	1.7
Finance and insurance, and real estate and rental and leasing	12,261	3.5	49	4.1
Professional, scientific, and management, and administrative and waste management services	28,879	8.3	89	7.5
Educational services, and health care and social assistance	85,092	24.5	311	26.3
Arts, entertainment, and recreation, and accommodation and food services	31,793	9.1	169	14.3
Other services, except public administration	15,463	4.4	46	3.9
Public administration	40,546	11.7	134	11.3

Source: ACS, 2019

Employment in Haines continues to be seasonal in nature. In 2016, the number of jobs in Haines more than doubled in the summer (HEDC, 2018a). The additional summer jobs tend to be seafood processing and tourism related. Government jobs are mostly year-round.

There are three seafood processing plants in Haines, which employ 300-400 people during the height of the season. Although approximately 90% of these employees are not year-round Alaska residents, their spending at local businesses adds to the economy (HEDC, 2018a).

According to the 2018 *5-Year Economic Development Plan,* economic diversification and strengthening should take advantage of Haines's assets and competitive advantages to achieve the goals and objectives listed below.

1. **Increase Community Economic Development Awareness and Engagement**: By proactively engaging Chilkat Valley residents, and by sharing relevant information regarding economic development issues, community members will be empowered and motivated to participate productively in development activities. Priority actions include:
    - Produce and provide objective information to the community surrounding key economic development issues, promote awareness of Haines' key economic sectors, and promote awareness of threats, opportunities, and achievements in the economy.
    - Investigate and increase awareness surrounding motivating factors for arriving and departing Haines residents to understand underlying issues driving in-

migration and out-migration. Develop policy recommendations in response to trends.
    - Conduct economic impact studies, economic development research, and community surveys as needed.

2. **Strengthen Economic Foundations**: Sustain and enhance Haines' existing businesses and economic foundations while fostering new entrepreneurs, creating a resilient and vibrant year-round economy. Priority actions include:
    - Continue and enhance Haines business retention and expansion program in partnership with the Greater Haines Chamber of Commerce.
    - Establish mentorship program for budding entrepreneurs and established businesses. Create an "inventory" of skills and experiences in the community and act as a matchmaker as needed. In particular, this may be used as an effective tool to engage the retiree and seasonal population.
    - Attract private sector investment in the community, including possible public private partnerships in public infrastructure.
    - Increase youth participation in Haines' key economic sectors, including fisheries, tourism, mining, timber, transportation, natural resource management, professional services, art, and others.
    - Working with Haines Borough, Tribes, and other relevant entities, support the development of critical community infrastructure, telecommunications and broadband, and industrial support services. Identify economic development programs that can be leveraged for infrastructure investment.
    - Create and implement a Haines industry cluster initiative.
3. **Enhance Business Climate and Stimulate Economic Activity**: Promote initiatives that help create a vibrant, year-round economy, while projecting Haines as a business-friendly location to outside businesses, professionals, and families. Priority actions include:
    - Evaluate local regulatory environment, including tax structure, permit processes, regulations, fees, and reporting requirements, to identify their key influences on business development in order to inform public policy decisions.
    - Increase year-round traffic and spending by developing and implementing policies that enhance the town core (Main Street, Fort Seward, and waterfront.)
    - Design and implement a location-neutral worker attraction strategy.
4. **Enhance Year-Round Quality of Life**: As the Adventure Capital of Alaska (Figure 3), Haines offers residents of all ages a quality of life that seizes upon its year-round world class outdoor recreation opportunities. These adventures are balanced by a clean, affordable, and attractive community that maintains its smalltown character and charm with year-round amenities and a thriving arts community. Priority actions include:
    - Develop a winter ski and recreation plan that increases outdoor recreation opportunities for residents, promotes winter employment and residency in

Haines, increases year-round visitation, and generates additional sales and property taxes.

- Engage with public, private, and non-profit partners to promote, support, and establish more all-season, all-user outdoor recreation activities that will serve as a draw for residents and visitors. This could be combined with findings from the location-neutral attraction study.

Support existing and creation of additional childcare and early-learning programs that attract and retain families in the community, promotes school enrollment, and differentiates Haines from other locations.


Figure 3. Aerial Photograph of Haines

4.0 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 HMP Update. Additional information regarding the Planning Team and public outreach efforts is provided in Appendix A.

Requirements for the planning process, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Planning Process
Local Planning Process
Requirement §201.6(b): An open public involvement process is essential to the development of an effective plan.
In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:
Element
▪ An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
▪ An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and
▪ Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.
Element
▪ Does the plan provide a narrative description of the process followed to prepare the updated plan?
▪ Does the updated plan indicate who was involved in the planning process?
▪ Does the updated plan indicate how the public was involved?
▪ Does the updated plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?
▪ Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?
▪ Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?
Source: FEMA, 2015.

4.1 OVERVIEW OF PLANNING PROCESS

The State of Alaska, DHS&EM provided funding and project oversight to LeMay Engineering & Consulting, Inc. to facilitate and guide Planning Team development and the 2022 HMP planning update process.

The Planning Team examined the full spectrum of hazards listed in the 2018 State of Alaska Hazard Mitigation Plan (SHMP), the 2010 Legacy HMP, the 2015 HMP Update, and identified natural hazards that the 2022 HMP Update would address. Haines Borough staff, LeMay

Engineering & Consulting, Inc., and the public began identifying critical facilities, compiling the hazard profiles, assessing capabilities, and conducting the risk assessment for the identified hazards.

In summary, the following five-step process took place from June 2021 through April 2022.

1. Organize resources: Members of the Planning Team identified resources, including staff, agencies, and local community members, who could provide technical expertise and historical information needed in the development of the 2022 HMP Update.
2. Monitor, evaluate, and update the HMP: The previous Planning Team did not follow through on monitoring progress from 2015 to the present. Borough leadership and staff have changed. New Borough staff have been hired and are dedicated to implement mitigation actions in this 2022 HMP Update and monitor and evaluate the implementation process going forward as defined in Section 8 to ensure compatibility with community needs, making changes for an even better updating process starting in 2027.
3. Assess risks: The Planning Team identified the hazards specific to Haines Borough and updated the hazards based on the 2018 SHMP and updated the risk assessment accordingly. The Planning Team reviewed the risk assessment, including the vulnerability analysis, prior to and during, the update 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. Update the mitigation strategy: After reviewing the risks posed by each hazard, the Planning Team evaluated their comprehensive range of potential mitigation goals and actions developed in 2010 and 2015. Subsequently, in 2021 and 2022, the Planning Team provided updates on each mitigation action that had been previously implemented, identified new mitigation actions that are needed, identified old mitigation actions that are no longer a priority and will be deleted in the next five-year HMP Update, and re-prioritized the actions for implementation based on current needs.

4.2 HAZARD MITIGATION PLANNING TEAM

Table 3 identifies the Planning Team.

Table 3. Planning Team

Name	Title	Organization	Key Input
Alekka Fullerton	Interim Manager/Borough Clerk	Haines Borough	Planning Team Lead, Local data input, and HMP review.
Douglas Olerud	Haines Mayor	Haines Borough	Planning Team Member, Local data input, and HMP review
Carolann Wooton	Contracts and Grant Administrator	Haines Borough	Planning Team Member, Local data input, and HMP review.
Gabe Thomas	Assembly	Haines Borough	Planning Team Member, Local data input, and HMP review.
Caitlin Kirby	Assembly	Haines Borough	Planning Team Member, Local data input, and HMP review.
Steven Auch	Tourism Director	Haines Borough	Planning Team Member, Local data input, and HMP review.
Julie Anderson	Resident	Haines	Planning Team Member, Local data input, and HMP review.
Noble Anderson	Resident	Haines	Planning Team Member, Local data input, and HMP review.
Shel Scarrott	Resident	Haines	Planning Team Member, Local data input, and HMP review.
Jean Scarrott	Resident	Haines	Planning Team Member, Local data input, and HMP review.
Steve Wishstar	Resident	Haines	Planning Team Member, Local data input, and HMP review.
Sylvia Heinz	Resident	Haines	Planning Team Member, Local data input, and HMP review.
Cynthia Jones	Resident	Haines	Planning Team Member, Local data input, and HMP review.
Jennifer LeMay, PE, PMP	Hazard Mitigation Planner	LeMay Engineering & Consulting, Inc.	Project Manager, responsible for 2021-2022 HMP Update, project coordination, and final product review.
Leslie Boughton, PE	Hazard Mitigation Planner	LeMay Engineering & Consulting, Inc.	2021-2022 HMP Update.
Erin Leaders	Hazard Mitigation Plan Manager	State of Alaska, DHS&EM	HMP Update Manager.
Rick Dembroski	Pre-Disaster Mitigation / BRIC Program Manager	State of Alaska, DHS&EM	Grant Manger.

4.3 PUBLIC INVOLVEMENT & OPPORTUNITY FOR INTERESTED PARTIES TO PARTICIPATE

Table 4 lists the community's public involvement initiatives focused to encourage participation and provide insight for the HMP Update effort.

LeMay Engineering & Consulting, Inc. extended an invitation to individuals and entities via email that described the planning process and announced the upcoming planning activities.

Table 4. Public Involvement Mechanisms

Mechanism	Description
Newsletter #1 Distribution (July 9, 2021)	On July 9, 2021, the Borough posted a newsletter to their website describing the upcoming planning activity. The newsletter encouraged the community to provide hazard and critical facility information at the July 22, 2021, Town Hall meeting. The meeting was held in person in the Borough Assembly Chambers and via Zoom. Leslie Boughton, PE, presented a PowerPoint presentation of the hazard mitigation planning process. Slides and a sign in sheet are included in Appendix A.
Newsletter #2 Distribution (April 27, 2022)	On April 27, 2022, The Borough posted a newsletter to their website announcing the availability of the Draft HMP Update for public review. The Draft HMP Update was also posted on the Borough's website for a 30-day public comment period.
30-Day Public Comment Period	The public comment period was held from April 28 to May 28, 2022.
Public Meeting, July 22, 2021	Notice of the July 22, 2021, meeting was posted according to public notice procedures, which included posting on the Borough website.
Public Meeting, TBD, 2022	Notice of the TBD, meeting was posted according to public notice procedures, which included posting on the Borough website.

On July 22, 2021, Haines Borough held a Town Hall Meeting to discuss hazards, mitigation actions and progress made on previously identified actions from the 2015 HMP. LeMay Engineering & Consulting, Inc. described the specific information needed from the Planning Team and public to assess vulnerability and population risk by the location, value, and population within residential properties and critical facilities.

4.4 INCORPORATION OF EXISTING PLANS AND OTHER RELEVANT INFORMATION

During the planning process, the Planning Team reviewed and incorporated information from existing plans, studies, and technical reports into the HMP Update. Table 5 lists document that were reviewed and used as references for this HMP Update.

Table 5. Haines Plan References

Existing plans, studies, reports, ordinances, etc.	Contents Summary (How will this information improve mitigation planning?)
Haines Borough 2025 Comprehensive Plan, 2012	Implementation examples.
Haines Coastal Management Plan, 2007	Implementation examples.
Haines 5-Year Economic Development Plan, 2018	Implementation examples.
Haines Emergency Operations Guide, 2007	Evaluation of community's hazards and vulnerability
Haines Economic Baseline Report, 2018	Current socio-economic data.
Haines Economic Indicators Report, 2019	Current socio-economic data.
Haines Borough South Portage Cover Harbor Expansion, Harbor Protection Alternatives	Implementation examples.
Dry Bay Facility Improvements Environmental Assessment, Glacier Bay National Park and Preserve, NPS, 2004	Floodplain mitigation examples.
University of Alaska, Fairbanks, and Alaska Earthquake Information Center	Historical earthquake information and historical reports.
U.S. Geological Survey Earthquake Probability Mapping	Hazard probability mapping products.
DCCED/DCRA Haines Borough Community Profile	Current socio-economic data.
State of Alaska Hazard Mitigation Plan, 2018	Defined statewide hazards and their potential locational impacts.
U.S. Army Corps of Engineers, Erosion Information Paper, Haines, Alaska, October 16, 2007	Defined the community's erosion impacts.
U.S. Army Corps of Engineers, Alaska Baseline Erosion Assessment, 2009	Defined the statewide erosion impacts and classification categories.
Nicolsky, D.J., Suleimani, E.N., and Salisbury, J.B., Tsunami Inundation Maps for Skagway and Haines, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2018-2, 2018	Evaluated potential tsunami hazards for Haines and numerically modelled the extent of inundation from tsunami waves generated by tectonic and landslide sources.

A complete list of references consulted is provided in Section 9.

5.0 Hazard Profiles

This section identifies and profiles the hazards that have the potential to affect Haines Borough.

5.1 OVERVIEW OF A HAZARD ANALYSIS

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 sufficient magnitude. 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. Human and Technological, and Terrorism-related hazards are beyond the scope of this HMP Update.

Hazard profiling is accomplished by describing hazards in terms of their characteristics, history, location, extent (breadth, magnitude, and frequency), impact, and recurrence probability. Hazards are identified through the collection of historical and anecdotal information, review of existing plans and studies, and preparation of hazard maps of the study area. Hazard maps are used to determine the geographic extent of the hazards and to define the approximate boundaries of the areas at risk.

5.2 HAZARD IDENTIFICATION AND SCREENING

Requirements for hazard identification, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Risk Assessment: Identifying Hazards
Identifying Hazards
Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type of all-natural hazards that can affect the jurisdiction.
Element
▪ Does the updated plan include a description of the types of all-natural hazards that affect the jurisdiction?
Source: FEMA, 2015.

For the first step of the hazard analysis, on July 22, 2021, the Planning Team reviewed possible hazards that could affect the community of Haines Borough (Table 6). They then evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of the threat and the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected availability of information on the hazard. The 2015 *HMP Update* included identified flood/erosion, earthquakes, snow avalanches and landslides, tsunamis, and severe weather as potential hazards for Haines Borough. The 2018 *SHMP* requires the addition of changes in the cryosphere and includes avalanches. Per the 2018 *SHMP*, landslides are included as a Ground Failure hazard. Additionally, the Planning Team requested that wildfires be included as a potential hazard in the 2022 HMP Update. The 2022 list of potential hazards that are carried forward in this HMP

Update include: changes in the cryosphere, earthquake, flood/erosion, ground failure, severe weather, tsunami, and wildfire.

Table 6. Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Changes in the Cryosphere	Yes	The Borough is experiencing an increase in temperatures and is also susceptible to changes in the cryosphere as its geographical area includes glaciers and mountains where snow avalanches occur.
Earthquake	Yes	Haines Borough is located near the Charlotte-Fairweather fault system. After the Aleutian Island Chain, the Gulf of Alaska is the most seismically active region in the U.S. (Haines Borough, 2010). The SHMP identifies a high probability of earthquake occurrence to Haines Borough.
Flood/Erosion	Yes	Haines Borough has a Floodplain and Hazards Map and participates in the NFIP. The SHMP identifies a medium probability of flood/erosion occurrence to Haines Borough.
Ground Failure	Yes	Ground failure occurs in Haines Borough from landslides. The SHMP identifies a medium probability of ground failure occurrence to Haines Borough.
Severe Weather	Yes	Severe weather impacts Haines Borough with climate change/global warming and changing El Niño/La Niña Southern Oscillation (ENSO) patterns generating increasingly severe weather events such as winter storms, heavy or freezing rain, snow, and wind etc. The SHMP identifies a high probability of severe weather occurrence to Haines Borough.
Tsunami and Seiche	Yes	Tsunamis may pose a threat to low-lying areas in Haines Borough. The SHMP identifies a low probability of tsunami occurrence to Haines Borough.
Wildland/Conflagration Fires	Yes	While the soil conditions and abundant rainfall combine to make fires less likely than some Alaskan locations, the trend of warming temperatures will likely increase the potential of events in the future. The SHMP identifies a medium probability of wildland fire occurrence to Haines Borough.
Volcanoes	No	The Alaska Volcano Observatory identified the closest active volcano to Haines as being over 300 miles away.

5.3 HAZARD PROFILE

Requirements for hazard profiles, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Risk Assessment – Profiling Hazards
Profiling Hazards
Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the location and extent of all-natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.
Element
▪ Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the updated plan?
▪ Does the risk assessment identify the extent (i.e., magnitude, severity, or breadth) of each hazard addressed in the updated plan?
▪ Does the plan provide information on previous occurrences of each hazard addressed in the updated plan?
▪ Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the updated plan?
Source: FEMA, 2015.

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

- Hazard Characteristics;
    - Typical event characteristics; and
    - Potential climate change impacts are primarily discussed in the Severe Weather hazard profile but are also identified where deemed appropriate within selected hazard profiles.
- History (geologic as well as previous occurrences);
- Location;
- Extent (breadth, magnitude, and severity);
- Impact (general impacts associated with each hazard are described in the following profiles, and detailed impacts to Haines Borough residents and critical facilities are further described in Section 6 as part of the overall vulnerability summary for each hazard); and
- Recurrence probability statement of future events.

The hazards profiled for Haines Borough are presented in the rest of Section 5.3. They are placed in alphabetical order which does not signify the importance level or risk.

5.3.1 Cryosphere

5.3.1.1 Hazard Characteristics

The "cryosphere" is defined as those portions of Earth's surface and subsurface where water is in solid form, including sea, lake, and river ice, snow cover, glaciers, ice caps and ice sheets, and frozen ground (e.g., permafrost). The components of the cryosphere play an important role in climate. Snow and ice reflect heat from the sun, helping to regulate Earth's temperature. They also hold Earth's important water resources, and therefore, regulate sea levels and water availability in the spring and summer. The cryosphere is one of the first places where scientists are able to identify global climate change.

Related hazards to the cryosphere hazard include flooding/erosion and wildfires which also affect Haines Borough.

Hazards of the cryosphere can be subdivided into four major groups: glaciers; permafrost; sea ice; and snow avalanches. Of these four major groups, glaciers and avalanches occur in Haines Borough.

Glaciers

Glaciers are made of compressed snow, which has survived summer and transformed into ice. Over many years, layers of accumulated ice build into large, thickened ice masses. Due to the sheer mass of accumulated ice, glaciers flow like very slow rivers. Presently, glaciers occupy about 10% of the world's total land area, with most located in polar regions. Today's glaciers are much reduced from the last Ice Age, when ice covered nearly 32% of the land and 30% of the oceans. Most glaciers lie within mountain ranges that show evidence of a much greater extent during the ice ages of the past two-million years, and recent retreat in the past few centuries. Hazards related to glaciers include ice collapse (e.g., glacial calving and ice fall avalanche), glacial lake outburst flood, and glacial surge. Although there are multiple glaciers in Haines Borough, none are a hazard to the population or critical facilities and infrastructure. Glaciers were not included in the 2010 Legacy HMP or 2015 HMP Update and will not be included in this 2022 HMP Update.

Snow Avalanche

A snow avalanche is a mass of snow, ice, and debris that releases and slides or flows rapidly down a steep slope, either over a wide area or concentrated in an avalanche chute or track. Avalanches reach speeds of up to 200 miles per hour (mph) and can exert forces great enough to destroy structures and uproot or snap large trees. A moving avalanche may be preceded by an "air blast," which is also capable of damaging buildings. Snow avalanches commonly occur in the high mountains of Alaska during the winter and spring as the result of heavy snow accumulations on steep slopes.

Snow avalanche is a downhill mass movement of snow or fluidized snow. The damage caused by an avalanche varies based on the avalanche type, the consistency and composition of the avalanche flow, the flow's force and velocity, as well as the avalanche path. Their size, run-out distance, and impact pressure vary. Large avalanches have the potential to kill people and wildlife, destroy infrastructure, level forests, and bury entire communities. Significant avalanche cycles (multiple avalanches naturally releasing across an entire region) are generally caused by long periods of heavy snow, but avalanche cycles can also be triggered by rain-on-snow events, rapid warming in the spring, and earthquakes.

An avalanche releases when gravity-induced shear stress on or within the snowpack becomes larger than its shear strength. Triggers can be natural (e.g., rapid weight accumulation during or just after a snowstorm or rain event, warming temperatures, and seismic shaking) or artificial (e.g., human weight or avalanche-control artillery).

Terrain factors that influence avalanche release are slope angle, aspect, and curvature, as well as topography (terrain roughness). Avalanches are also controlled by vegetation cover and elevation, which are both factors in getting enough snow accumulation on the slope. Avalanches typically release on slopes greater than 25 degrees and less than 60 degrees; this is the slope range where the snow can accumulate enough to build a slab, but also where snow tends to remain in place without sluffing off due to gravity. It is important to remember that avalanche run-out (deposition) can occur on all slopes. Figure 4 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. The map includes regions that had little or no snow avalanche occurrence data and is therefore provisional until better data are available and new analysis methods and avalanche modeling can be applied.

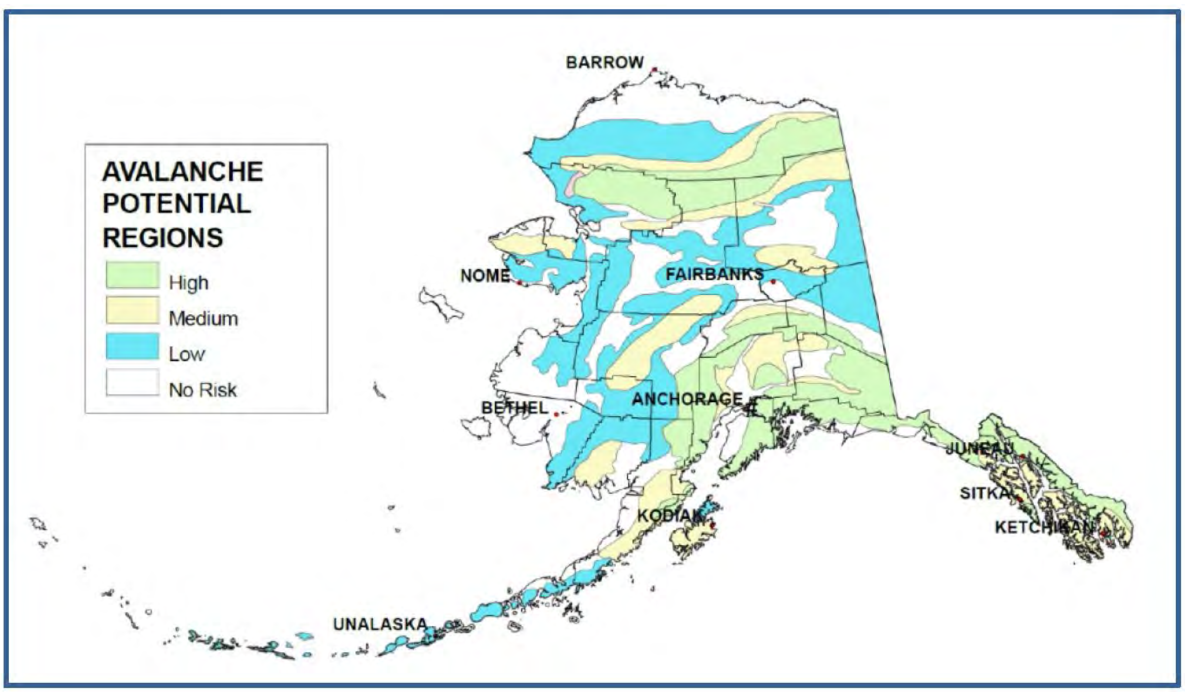

Figure 4. Map Depicting Alaska's Potential Snow-Avalanche Areas

New Alaska avalanche studies are currently being developed by the Division of Geological and Geophysical Survey (DGGS) and the University of Alaska Fairbanks (UAF). Figure 5 depicts potential snow avalanche release areas within a six-mile buffer of roads in Alaska. The modeling uses digital topographic information as input and determines the potential release zones based on geostatistical parameters (e.g., elevation, slope, and curvature) and land cover (e.g., trees). This is a preliminary model result that does not include weather or snowpack parameters, but more advanced studies that will incorporate these elements are planned (DHS&EM, 2018).

Alaska experiences many avalanches every year. The exact number is undeterminable as most occur in isolated areas and go unreported. Avalanches tend to occur repeatedly in localized areas and can sheer trees, cover communities and transportation routes, destroy buildings, and cause death. Alaska leads the nation in avalanche accidents per capita.

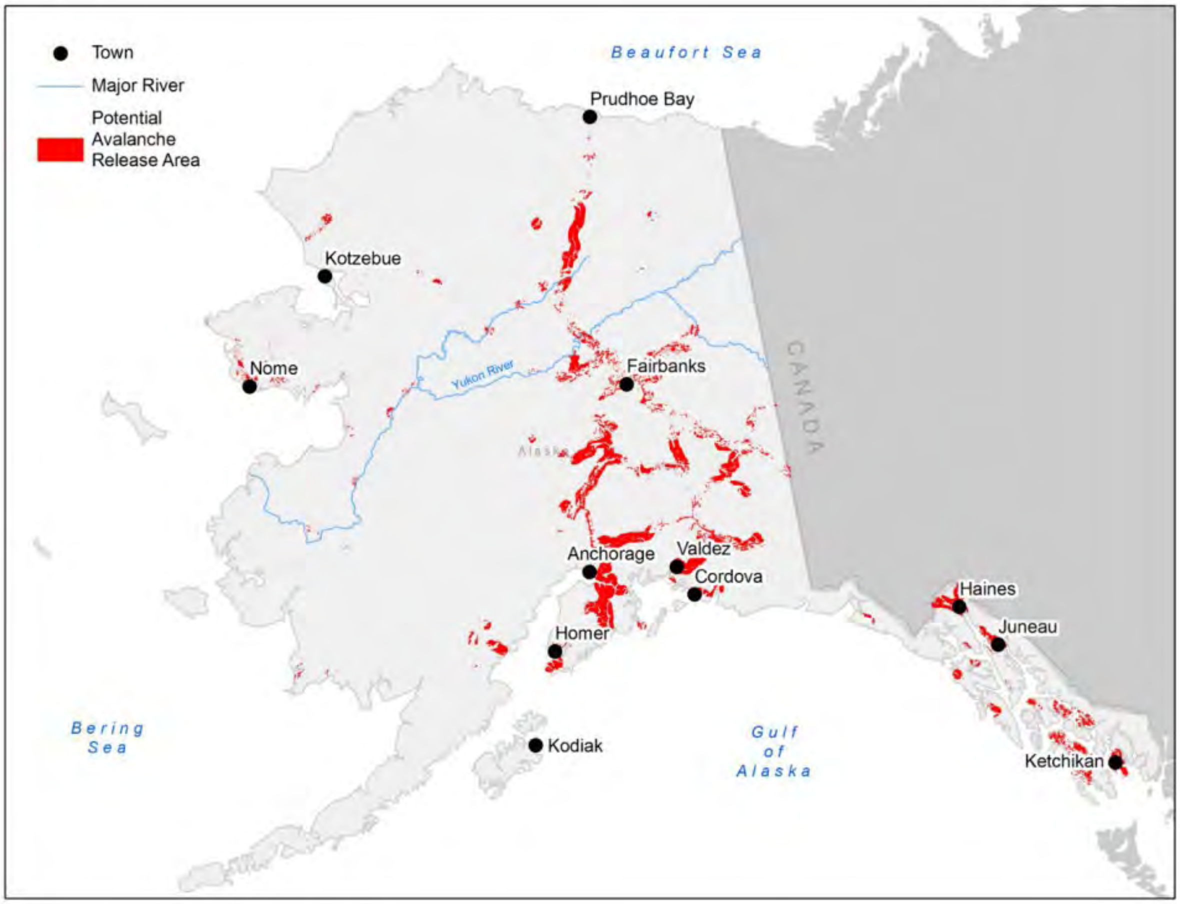

Figure 5. Potential Snow-Avalanche Release Areas

Avalanche Types

A snow avalanche is a swift, downhill-moving snow mass. The amount of damage is related to the type of avalanche, the composition and consistency of the material in the avalanche, the force and velocity of the flow, and the avalanche path. There are two main types of snow avalanches: loose snow and slab. Other types that occur in Alaska include: cornice collapse, ice, and slush avalanches.

Loose snow avalanches, sometimes called point releases, generally occur when a small amount of un-cohesive snow slips and causes more un-cohesive snow to go downhill. They occur frequently as small local cold dry 'sluffs', which remove excess snow (involving just the upper layers of snow), keeping the slopes relatively safe. They can be large and destructive, though. For example, wet loose snow avalanches occur in the spring and are very damaging. Loose snow avalanches can also trigger slab avalanches. Loose snow avalanches typically occur on slopes above 35 degrees, leaving behind an inverted V-shaped scar. They are often caused by snow overloading (common during or just after a snowstorm), vibration, or warming (triggered by rain, rising temperatures, or solar radiation).

Slab avalanches are the most dangerous type of avalanches. They happen when a mass of cohesive snow breaks away and travels down the mountainside. As it moves, the slab breaks up into smaller cohesive blocks. Slab avalanches usually require the presence of structural weaknesses within interfacing layers of the snowpack. The weakness exists when a relatively strong, cohesive snow layer overlies weaker snow or is not well bonded to the underlying layer. The weaknesses are caused by changes in the thickness and type of snow covers due to changes in temperature or multiple snowfalls. The interface fails for several reasons. It can fail naturally by earthquakes, blizzards, temperature changes or other seismic and climatic causes, or artificially by human activity. When a slab is released, it accelerates, gaining speed and mass as it travels downhill. The slab is defined by fractures. The uppermost fracture delineating the top line of the slab is termed the "crown surface", the area above that is called the crown. The slab sides are called the flanks. The lower fracture indicating the base of the slab is called the "stauchwall". The surface the slab slides over is called the "bed surface". Slabs can range in thickness from less than an inch to 35 feet or greater.

Cornice Collapse: A cornice is an overhanging snow mass formed by wind blowing snow over a ridge crest or the sides of a gulley. The cornice can break off and trigger bigger snow avalanches when it hits the wind-loaded snow pillow.

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. They are unrelated to temperature, time of day, or other typical avalanche factors.

Slush avalanches occur mostly in high latitudes such as in the Brooks Range. They have also occurred in the mountain areas of Alaska's Seward Peninsula and occasionally in the Talkeetna Mountains near Anchorage. Part of the reason they are more common in high latitudes is because of the rapid onset of snowmelt in the spring. Slush avalanches can start on slopes from 5 to 40 degrees but usually not above 25 to 30. The snowpack is totally or partially water saturated. The release is associated with a bed surface that is nearly impermeable to water. It is also commonly associated with heavy rainfall or sudden intense snowmelt. Additionally, depth hoar is usually present at the base of the snow cover. Slush avalanches can travel slowly or reach speeds over 40 mph. Their depth is variable as well, ranging from one foot to over 50 feet deep.

Alaska leads the nation in avalanche accidents per capita and experiences multiple fatalities each year due to this hazard. In addition to human risk, road closure due to avalanches is very costly. For example, a typical road closure with roughly 1,500 cubic feet of snow covering the road costs the Alaska Department of Transportation and Public Facilities (DOT&PF) approximately $10,000 to remove. In the winter of 1999 to 2000, unusually high snowfall from the Central Gulf Coast Storm fueled avalanches in Cordova, Valdez, Anchorage, Whittier, Cooper Landing, Moose Pass, Summit, the Matanuska-Susitna Valley, and Eklutna. Damages in these communities exceeded 11 million dollars, resulting in the first Presidentially-declared avalanche disaster in U.S. history.

5.3.1.2 *Climate Factors*

Climate has a major effect on cryosphere hazards because these hazards are so closely linked to snow, ice, and air and ground temperatures. Changes in climate can modify natural processes and increase the magnitude and recurrence frequency of certain geologic hazards (e.g., floods/ erosion), which if not properly addressed, could have a damaging effect on Alaska's communities and infrastructure, as well as on the livelihoods and lifestyles of Alaskans.

During the last several decades, Alaska has warmed twice as fast as the rest of the U.S. Some studies suggest that warming climate may increase avalanche risk due to changes in snow accumulation and moisture content, as well as loss of snowpack stability because of changing air temperature. Increased rain-on-snow event frequency is leading to an increase in avalanche hazards all across Alaska.

5.3.1.3 *Cryosphere Hazard History*

Alaska has a long history of snow avalanches. The Palm Sunday avalanche, April 3, 1898 is considered to be the deadliest event of the Klondike gold rush. The Chilkoot Trail, near Skagway, experienced multiple slides that day, including three with fatalities.

Late 1999 and early 2000 saw avalanches in Cordova, Valdez, Anchorage, Whittier, Cooper Landing, Moose Pass, Summit, Matanuska-Susitna Valley, and Eklutna from the Central Gulf Coast Storm. The most damaging avalanche occurred in Cordova, near Milepost 5.5 of the Copper River Highway and was approximately 0.5 mile wide. It resulted in one death, at least 10 damaged structures, and about 1 million dollars in damage. Avalanches had struck in that spot before, including one in 1971 (DHS&EM, 2018).

No disaster-level avalanche events have been recorded in Haines, although transportation impacts and infrastructure damage have been documented.

A brief summary from *Alaska's Changing Environment: Documenting Alaska's physical and biological changes through observations* is provided below (Thoman and Walsh, 2019).

- Temperatures have been consistently warmer than at any time in the past century.
- The growing season has increased substantially in most areas, and the snow cover season has shortened.
- Precipitation overall has increased. In Southcentral, annual precipitation since the 1990s has increased 3.4%. Flooding and erosion have increased.
- Recent years have brought many temperature extremes to Alaska, including the warmest year (2016), the warmest month (July 2019), and in places like Anchorage, the warmest day (July 4, 2019).
- Warmer springs and earlier snow melt have lengthened the wildfire season. Wildfire seasons with more than one million acres burned have increased 50% since 1990,

compared to the 1950 – 1989 period. The frequency of longer wildfire seasons has increased dramatically.

5.3.1.4 Location, Extent, Impact, and Recurrence Probability

Location

The greatest danger from snow avalanche is in the backcountry of Haines Borough. The community of Haines has been isolated from road closures due to snow avalanches. Loss of life and Infrastructure damage are potential concerns.

Extent

The entire state of Alaska is at risk of effects of climate change. Historical climate data shows that the average annual temperature in Alaska has warmed about 4°F since the 1950s and 7°F in winter. The growing season has lengthened by about 14 days. Models predict continued warming, including an increase in temperature by 1.5 to 5°F by 2030 and 5 to 18°F by 2100.

Impact

Avalanches have the potential to kill people and wildlife, destroy infrastructure, level forests, and bury entire communities. In many areas of the State, avalanches lead to lengthy closures of important transportation routes. The economic impacts of such avalanches, from impeding traffic to removing avalanche debris blocking access (Figure 6), can be significant at both the local and state levels.

Recurrence Probability

The summers of 2018 and 2019 were unusually hot. Summer 2020 was also warmer than usual. Warmer temperatures make for dryer conditions and increase the possibility of fires. Ocean temperatures have been warmer than normal which may have contributed to lower fish harvests during the fleet season than in the past.

Changes to the cryosphere in Haines Borough are occurring and will continue to do so. The probability of future events is highly likely based on a minimum annual occurrence. Highly likely equates to an event being probable within the calendar year or the event having up to one in one year’s chance to occur (1/1 = 100%).

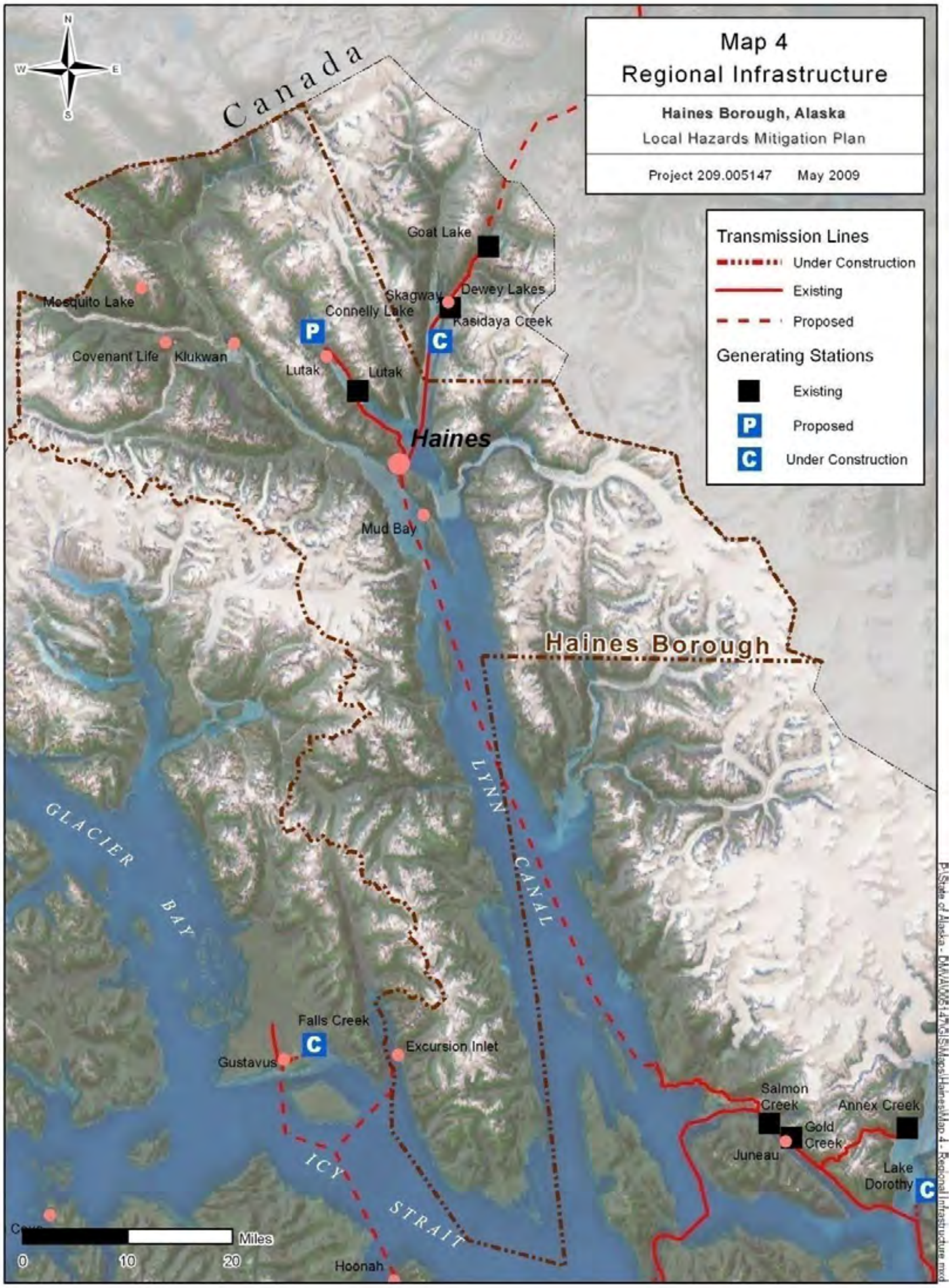

Figure 6. Regional Infrastructure

5.3.2 Earthquake

Alaska is one of the most seismically active regions in the world and is at risk of societal and economic losses due to damaging earthquakes. On average, Alaska has one “great” [magnitude (M) >8] earthquake every 13 years and one M 7-8 earthquake every year. Earthquakes have killed more than 130 people in Alaska during the past 60 years (DHS&EM, 2018).

It is not possible to predict the time and location of the next big earthquake, but the active geology of Alaska guarantees that major damaging earthquakes will continue to occur and can affect almost anywhere in the State. Scientists have estimated where large earthquakes are most likely to occur, along with the probable levels of ground shaking to be expected. With this information, as well as information on soil properties and landslide potential, it is possible to estimate earthquake risks in any given area.

Alaska earthquake statistics include:

- Alaska is home to the second-largest earthquake ever recorded (1964 Great Alaska Earthquake, M 9.2);
- Alaska has 11% of the world’s recorded earthquakes;
- Three of the eight largest earthquakes in the world occurred in Alaska; and
- Seven of the ten largest earthquakes in the U.S. were located in Alaska.

In addition to the 1964 Great Alaska Earthquake, since 1900, Alaska has had an average of:

- 45 M 5-6 earthquakes per year;
- 320 M 4-5 earthquakes per year; and
- 1,000 earthquakes located in Alaska each month.

Source: Alaska Earthquake Center (AEC)

5.3.2.1 Earthquake Characteristics

An earthquake is a sudden motion or trembling caused by a release of strain accumulated within or along the edge of 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 Earth’s interior (i.e., seismic waves) and along Earth’s surface (i.e., 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 Earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., up to 20 feet), 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 feet, but up to 100 feet), flow failures (massive flows of soil, typically hundreds of feet, 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 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 M. 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's 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. The MMI Scale consists of 12 increasing levels of intensity that range from imperceptible to 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 (g) (MMI, 2006).

M is the measure of the earthquake's strength. It is related to the amount of seismic energy released at the earthquake's hypocenter, the actual location of the energy released inside the earth. It is based on the amplitude of the earthquake waves recorded on instruments, known as the Richter magnitude test scales, which have a common calibration (Table 7).

5.3.2.2 History

Four major earthquakes have been linked to the Queen Charlotte-Fairweather fault system in the last century. In 1927, a magnitude 7.1 (Ms - surface wave magnitude) earthquake occurred in the northern part of Chichagof Island; in 1949, a magnitude 8.1 (Mw - moment magnitude) earthquake occurred along the Queen Charlotte fault near the Queen Charlotte Islands; in 1958, movement along the Fairweather fault near Lituya Bay created a magnitude 7.9 (Ms) earthquake, and in 1972, a magnitude 7.4 (Ms) earthquake occurred near Haines. The 1958 Lituya Bay earthquake, which was felt as far away as Seattle, Washington, caused a large rockslide, which deposited the contents of an entire mountainside into the bay. The gigantic wave that resulted from this rockslide scoured the shores of the bay down to bedrock and uprooted trees as high as 1,772 feet above sea level. Fishing boats were carried on the wave at a reported height of at least 99 feet over the spit at the entrance to the bay and tossed into the open ocean (Haines Borough, 2015).

The U.S. Geological Survey (USGS) identified 746 earthquakes greater than M 2.5 occurring within 100 miles of the Haines Borough. Table 8 lists 19 of those that reached or exceeded a M of 5.0. The largest one occurred on May 1, 2017, and measured M 6.3.

Table 7. Magnitude/Intensity/Ground-Shaking Comparisons

Modified Mercalli Intensity	Magnitude	Description	Perceived Shaking
I	1.0 – 2.0	Not Felt	Felt by very few people; barely noticeable.
II	2.0 – 3.0	Weak	Felt by a few people, especially on upper floors.
III	3.0 – 4.0		Noticeable indoors, especially on upper-floors, but may not be recognized as an earthquake.
IV	4.0	Light	Felt by many indoors, few outdoors. May feel like heavy truck passing by.
V	4.0 – 5.0	Moderate	Felt by almost everyone, some people awakened. Small objects moved. trees and poles may shake.
VI	5.0 – 6.0	Strong	Felt by everyone. Difficult to stand. Some heavy furniture moved, some plaster falls. Chimneys may be slightly damaged.
VII	6.0	Very Strong	Slight to moderate damage in well-built, ordinary structures. Considerable damage to poorly-built structures. Some walls may fall.
VIII	6.0 – 7.0	Severe	Little damage in specially-built structures. Considerable damage to ordinary buildings, severe damage to poorly-built structures. Some walls collapse.
IX	7.0	Violent	Considerable damage to specially-built structures, buildings shifted off foundations. Ground cracked noticeably. Wholesale destruction. Landslides.
X	7.0 – 8.0	Extreme	Most masonry and frame structures and their foundations destroyed. Ground badly cracked. Landslides. Wholesale destruction.
XI	8.0		Total damage. Few, if any, structures standing. Bridges destroyed. Wide cracks in ground. Waves seen on ground.
XII	8.0 or greater		Total damage. Waves seen on ground. Objects thrown up into air.

Table 8. Historical Earthquakes for Haines

Date	Time	Latitude	Longitude	Depth	Magnitude
9/1/2019	4:32:26	59.1033	-136.973	9.8	5
9/16/2017	23:38:02	59.8659	-136.794	6.55	5
5/1/2017	14:59:22	59.7953	-136.648	12.31	5
5/1/2017	14:21:13	59.7689	-136.682	10	5.7
5/1/2017	14:20:24	59.7772	-136.629	4.09	5.6
5/1/2017	14:18:15	59.8295	-136.704	2.53	6.3
5/1/2017	12:49:18	59.878	-136.838	8.11	5
5/1/2017	12:31:55	59.8209	-136.711	10	6.2
7/25/2014	10:54:50	58.3354	-136.971	10	6
6/4/2014	11:58:56	58.9804	-136.728	8.1	5.2
6/7/2009	23:24:35	58.7695	-136.658	4.7	5
1/6/2000	10:42:25	58.04	-136.87	1	6.1
6/24/1991	4:59:04	58.345	-136.859	0	5.6
7/11/1990	15:14:04	59.325	-136.47	10	5.5
11/14/1987	15:48:29	58.961	-135.241	5	5
9/15/1985	1:28:16	59.102	-136.423	1.9	5.9
7/10/1958	6:15:58	58.23	-136.712	10	7.8
3/9/1952	20:00:18	58.902	-136.942	10	6.1
11/16/1945	18:02:22	58	-136.5		5.6

5.3.2.3 Location, Extent, Impact, and Recurrence Probability

Location

The entire geographic area of Alaska is prone to earthquake effects. Furthermore, Haines Borough is located within a fairly active seismic zone with the Fairweather and the Queen Charlotte Faults in close proximity to the area. Minor faults include the Clarence Strait Fault and the Peril Strait Fault. The eastern ends of the Denali and Transition Faults are also present in southeastern Alaska. Figure 7 shows the locations of active and potentially active faults in Alaska.

Extent

Although major earthquakes occur relatively infrequently, the Borough remains vulnerable to significant damages from an earthquake.

"Alaska has changed significantly since the damaging 1964 earthquake, and the population has more than doubled. Many new buildings are designed to withstand intense shaking; some older

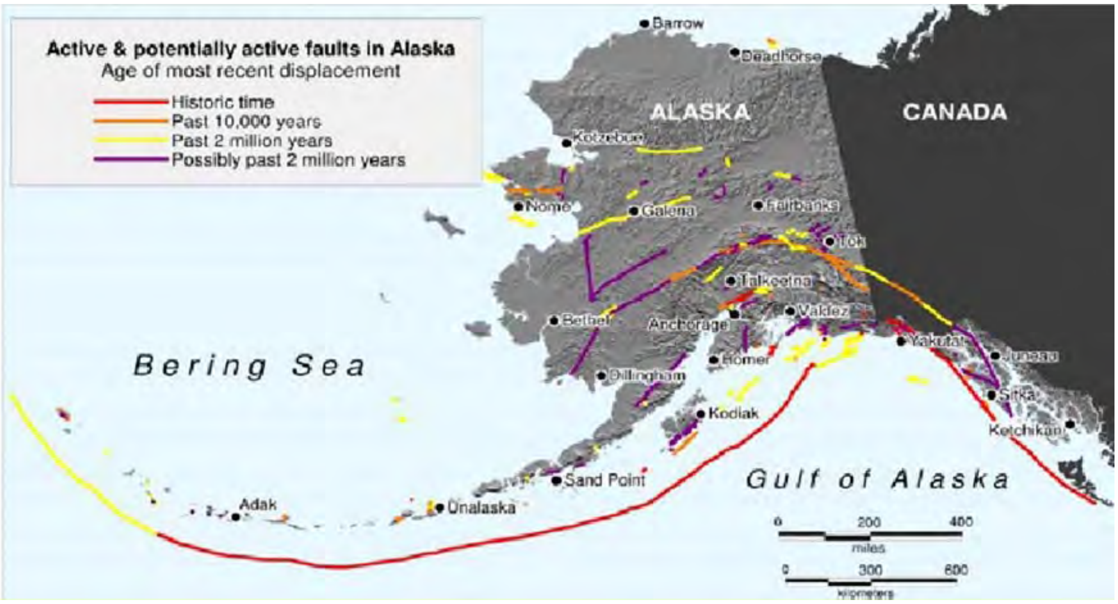

Figure 7. Active and Potentially Active Faults in Alaska

buildings have been reinforced, and development has been discouraged in some particularly hazardous areas.

Despite these precautions, and because practices to reduce vulnerability to earthquakes are not applied consistently in regions of high risk, future earthquakes may still cause life-threatening damage to buildings, cause items within buildings to be dangerously tossed about, and disrupt basic utilities and critical facilities.

FEMA estimates that with the present infrastructure and policies, Alaska will have the second highest average annualized earthquake-loss ratio (ratio of average annual losses to infrastructure) in the country. Reducing those losses requires public commitment to earthquake-conscious siting, design, and construction. The Seismic Hazards Safety Commission is committed to addressing these issues. Earthquake-risk mitigation measures developed by similar boards in other states have prevented hundreds of millions of dollars in losses and significant reductions in casualties when compared to other seismically active areas of the world that do not implement effective mitigation measures. The San Francisco (1989), Northridge (1994), and Nisqually (2001) earthquakes caused comparatively low losses as a result of mitigation measures implemented in those areas. Many of these measures were recommended by the states' seismic safety commissions."

Source: HAZUS 99 Estimated Annualized Earthquake Losses for the U.S., FEMA Report 66. September 2000. Via DHS&EM, 2018.

Impact

Impacts to Haines Borough such as significant ground movement that may result in infrastructure damage are expected. Moderate to severe shaking may be seen or felt based on past events. Impacts to future populations, residences, critical facilities, and infrastructure are anticipated to remain the same.

The varying degrees of damage associated with earthquakes are a direct result of the strong ground motions from seismic shaking. The objective classification of earthquake shaking at a point is based on ground accelerations. Ground accelerations (described as a percent of the acceleration of gravity, % g) are measured instrumentally and can be extrapolated between seismic stations after an earthquake occurs. Additionally, ground accelerations are described at different spectral wavelengths to describe the types of shaking that affect different building styles; for example, spectral wavelengths of 0.2 seconds affect short, rigid buildings whereas one second wavelengths affect multi-story structures.

Recurrence Probability

Because earthquakes are impossible to predict, scientists must use a unique approach in describing the hazards posed by earthquakes. Probabilistic Seismic Hazard Analyses (PSHAs) describe earthquake shaking levels and the likelihood that they will occur in Alaska. PSHAs are based on known, mapped geologic faults throughout Alaska and all background seismicity from unknown faults. The result is a visual representation of the PGA that has a certain percent chance of being exceeded in a given amount of time (usually 50 years). Figure 8 indicates that the USGS earthquake probability model places the probability of an earthquake within Haines Borough with a likelihood of experiencing strong shaking (0.4g to 0.6g PGA) with a 2% probability in 50 years, based on the USGS Alaska hazard model. A 2% probability in 50 years is the rare, large earthquake, and statistically, it happens on average every 2,500 years. The probability of future earthquake events is highly likely based on a minimum annual occurrence. Highly likely equates to an event being probable within the calendar year or the event having up to one in one year's chance to occur (1/1 = 100%).

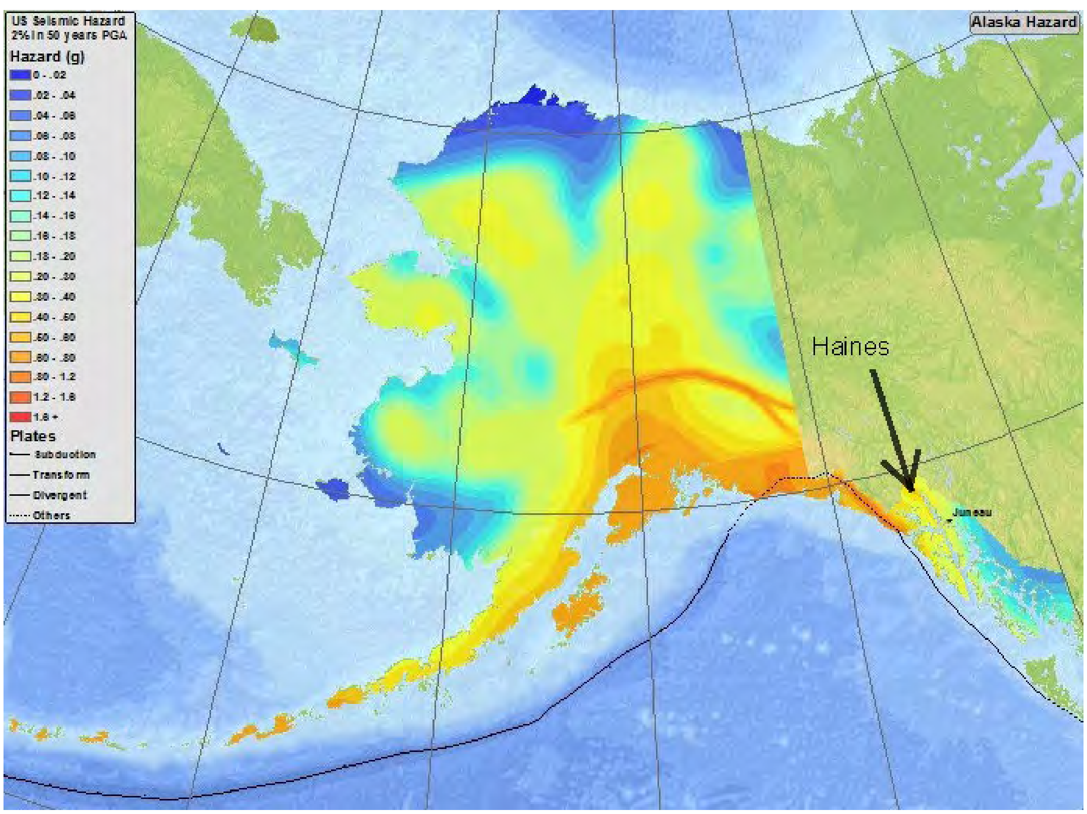

Figure 8. USGS Alaska Earthquake Hazard Model

5.3.3 Floods/Erosion

5.3.3.1 Characteristics

Approximately 6,600 miles of Alaska's coastline and many low-lying areas along Alaska's riverbanks are subject to severe flooding and erosion. Many of the problems are long-standing, although studies indicate that increased flooding and erosion are being caused in part by changing climate (DHS&EM, 2018). Flooding and erosion occur together in Haines Borough because of increased water currents that get raised above the normal coastline and riverbanks.

Flooding is the accumulation of water where usually none occurs or the overflow of excess water from a stream, river, lake, 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.

Primary types of flooding that occur in Haines Borough are: rainfall-runoff, snowmelt, and storm surge.

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.

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

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

Erosion

Erosion is a process that involves the gradual wearing away, transportation, and movement of land that threatens development and infrastructure. However, not all erosion is gradual and can occur quite quickly as the result of a flash flood, coastal storm, or other event. Erosion is a natural process, but its effects can be exacerbated by human activity.

Rivers constantly alter their course, changing shape and depth, trying to find a balance between the sediment transport capacity of the water and the sediment supply. This process, called riverine erosion, is usually seen as the wearing away of riverbanks and riverbeds over a period of time.

Riverine erosion is often initiated by high sediment loads or heavy rainfall. This generates high volume and velocity run-off which concentrates in the lower drainages within the river's catchment area. Erosion occurs when the force of the flowing water exceeds the resistance of the riverbank material. The water continues to increase its sediment load as it flows downstream. Eventually, the river deposits its sediment in slower moving sections. The river may eventually change course or develop a new channel. In less stable braided channel reaches, erosion and deposition are constant issues. In more stable meandering channels, erosion episodes may infrequently occur.

5.3.3.2 History

Haines Borough has been affected by six flooding disasters which are listed below (DHS&EM, 2021).

<u>33. Haines, January 25, 1985</u>: After prolonged and excessive rainstorms caused permanent damage to the sewer system, the Governor proclaimed a Disaster Emergency to provide funds to repair the system through a categorical public assistance grant.

<u>70. Haines, February 29, 1988</u>: Severe damage to streets occurred from flooding and runoff triggered by extremely heavy rainfall. The State made available $150,000 in disaster funds to assist in the repair of community streets.

<u>160. Haines Highway Disaster, August 14,1992</u>: This disaster was declared in order for the State DOT/PF to request $1.8 million in Federal Highway Administration emergency funds (under Title 23 U.S.C., Section 125) to repair damages relating to flooding of the Klehini River 30 miles north of Haines. No expenditure of State Disaster Relief Funds was required.

<u>98-190 Southeastern Storm</u>: On October 27, 1998, the Governor declared a disaster in the communities of Haines and the City and Borough of Juneau for the purposes of accessing federal highway administration funds after the worst two-day rainfall in 50 years occurred in Southeast Alaska on October 19-20, 1998. Over six inches of rain fell within a 48-hour period. As a result, extensive damage to many road systems and public, private and non-profits' properties were caused from mudslides and water erosion. On November 24, 1998, under the authority granted by Alaska Statute 26.23.020, the Governor amended his declaration of disaster in the City and Borough of Juneau, and the City and Borough of Haines, to include the Chilkat Indian Village (Community of Klukwan) in order for public (infrastructure) assistance to public property and individual and family grant assistance. The Governor also requested that the Small Business Administration declare an administrative declaration for physical disaster damages to provide low interest loans to businesses and private property owners. The total for this disaster was $1.12 million.

<u>06-216 2005 Southeast Storm (AK-06-216) declared December 23, 2005 by Governor Murkowski</u>: 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 severe damage and threat to life and property, with the potential for further damage. The following conditions existed 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 were 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 amount of assistance was $1.87 million.

AK-20-272 2020 December Southeast Storm declared by Governor Dunleavy on December 5, 2020: A very strong atmospheric storm impacted Southeast Alaska from December 1-2 with a series of other strong and moist weather fronts through December 8th. The atmospheric storm produced historic extreme precipitation in particular over the far northern inner channels including Haines, Alaska (Figure 9). The rainfall and snowmelt caused massive road infrastructure damage from runoff coming from Ripinsky Ridge that overwhelmed culverts and flooded areas away from steep terrain including portions of the Haines airport. There were also multiple debris flows along the Haines Highway, Lutak Road, Mud Bay Road, Mosquito Lake area. A deadly landslide occurred along Beach Road; two people lost their lives. A large landslide came down into Chilkat Lake and damaged homes. Residents were evacuated from numerous locations across the Haines area. Eight homes were destroyed, and at least 21 were inaccessible in the long term.

On December 1, precipitation moved into the region with snow levels slowly rising through the day with some minor accumulations at sea level but much more at higher elevations (34-59 inches) and along the Haines Highway (17.8 inches). The 24-hr precipitation amount of 5.49 inches on December 1 from the Haines Airport broke the all-time daily record from 1946 and was a 25 to 50-year return period for rainfall frequency. Looking at a rolling 24-hr rainfall total from December 1 through the 2 at 12pm, the max was 7.12 inches with a 100-150-year return interval (RI). The downtown Haines COOP station reported 6.62 inches which broke its all-time daily precipitation record from 2005 on December 2 (taken at 8 am). The Haines 40NW COOP reported 5.23 inches and broke i's all time daily precipitation record from 1999 and was a 25-year RI.

Figure 9. Floodwater in Haines, December 2020

Source: ADN, 2020a

5.3.3.3 Community Participation in the NFIP

Haines Borough participates in the NFIP (Table 9). The function of the NFIP is to provide flood insurance to homes and businesses located in floodplains at a reasonable cost. In trade, the Borough regulates new development and substantial improvements to existing structures in the floodplain. The program is based upon mapping areas of flood risk, and requires local implementation to reduce flood damage primarily through requiring the elevation of structures above the base (100-year) flood elevations.

Table 9. Haines Borough NFIP Status

CID	Initial FHBM Identified	Initial FIRM Identified	Current Effective Map Date	Reg-Emer Date	Tribal
020007	05/31/74	05/01/87	05/01/87(L) (Original FIRM by Letter – All Zone A, C, and X	02/02/05	No

Source: FEMA, 2021

Table 9 describes the Flood Insurance Rate Map (FIRM) zones. Figure 10 shows that all critical facilities for Haines Borough (Section 6) are located in the "A" flood zone (Haines Borough, 2010).

Table 10. FIRM Zones

Firm Zone	*Explanation*
A	Areas of 100-year flood; base flood elevations and flood hazard not determined.
AO	Areas of 100-year shallow flooding where depths are between one and three feet, average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one and three feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors are determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.
C	Areas of minimal flooding.
D	Areas of undetermined, but possible, flood hazards.

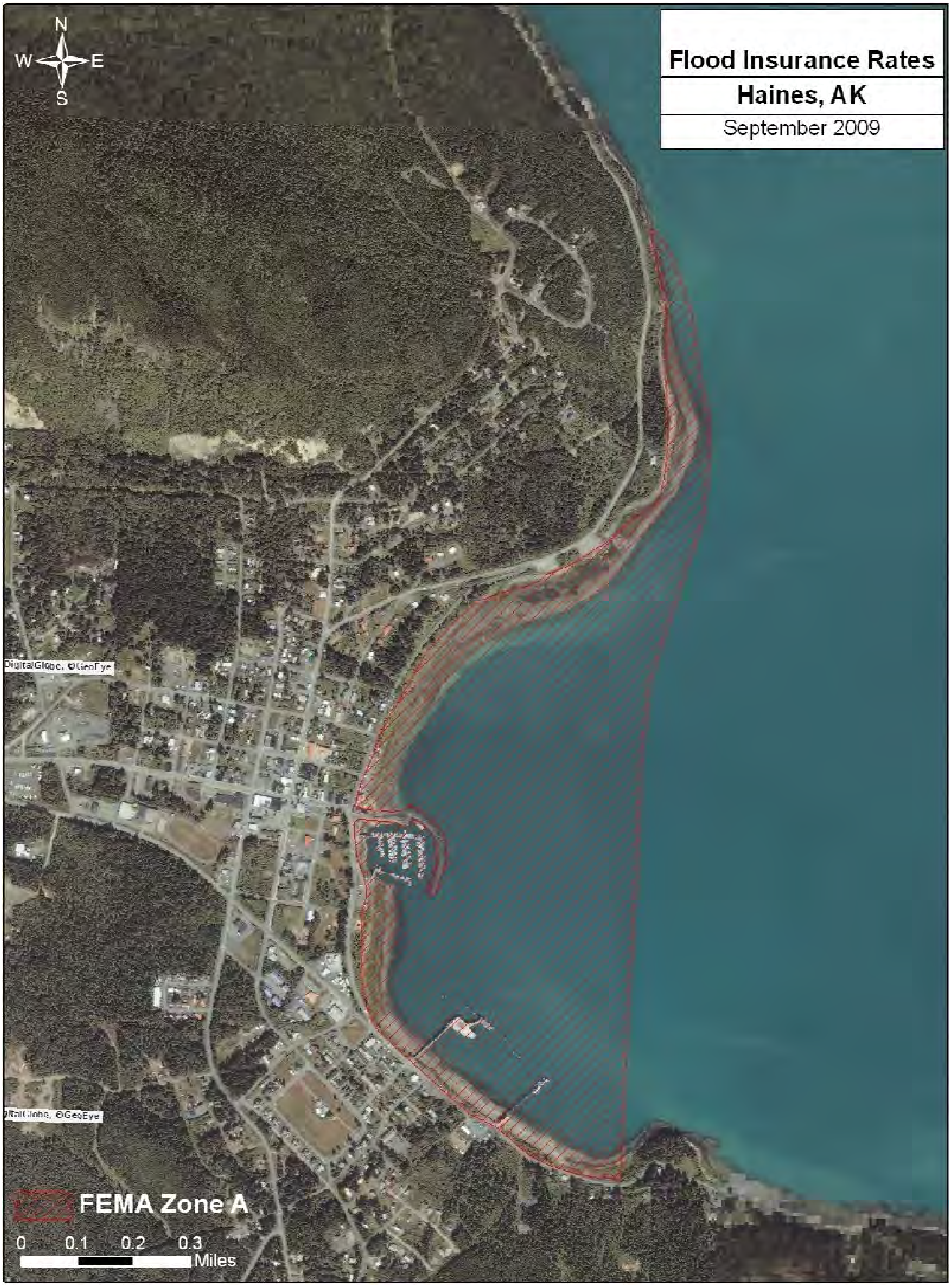

Figure 10. FEMA Flood Zone Map

Development permits for all new building construction, or substantial improvements, are required by the Borough in all A, AO, AH, and A-numbered Zones. Flood insurance purchase may be required in flood zones A, AO, AH, and A-numbered zones as a condition of loan or grant assistance. An elevation certificate is required as part of the development permit. The elevation certificate is a form published by FEMA that is required to be maintained by communities participating in the NFIP. According to the NFIP, local governments maintain records of elevations for all new construction, or substantial improvements, in floodplains and keep the certificates on file. Elevation certificates are used to:

1. Record the elevation of the lowest floor of all newly constructed buildings, or substantial improvement, located in the floodplain.
2. Determine the proper flood insurance rate for floodplain structures.
3. Local governments must ensure that elevation certificates are filled out correctly for structures built in floodplains. Certificates must include:
    - The location of the structure (tax parcel number, legal description, and latitude and longitude) and use of the building.
    - The FIRM panel number and date, community name, and source of base flood elevation data.
    - Information on the building's elevation.
    - Signature of a licensed surveyor or engineer.

The risk assessment in all HMPs approved after October 1, 2008 must also address NFIP-insured structures that have been repetitively damaged by floods. Under NFIP guidelines, repetitive loss structures include any currently insured building with two or more flood losses (occurring more than ten days apart) greater than $1,000 in any 10-year period since 1978. There have been no repetitive loss structures in Haines Borough.

5.3.3.4 Location, Extent, Impact, and Recurrence Probability

Location

<u>Flooding</u>

Extensive flood hazard areas exist throughout the floodplains of all riverine systems in the Haines Borough.

Sudden changes in main channel alignment and course are common as has occurred at Klukwan and the Tsirku River Fans. Sloughs, riverine islands, river deltas, and tributary channels are all subject to sudden flood immersion and scouring. As a result, existing lowland physical features are sometimes not considered permanent. Salmon and wildlife habitat, salmon enhancement project areas, and human developments in flood prone areas are continually subject to negative impacts from flooding (Haines Borough, 2015).

Flood hazard areas in the developed core area of the coastal district are well identified on the 1989 Floodplain and Flood Hazards Map of the Haines Borough and through FEMA. Flood and geophysical hazard areas in the Tanani Bay and Lutak Inlet areas are primarily within the

Johnson Creek, Mink Creek, and unnamed industrial water source drainages. In this area, some minor landslide and avalanche activity can also occur on higher slopes, especially in association with the deeply cut drainages of the three creeks (Haines Borough, 2015).

Seasonal storm winds can create wind damage, wind-driven water damage, and high runoff inundation. However, wind damage in the Haines coastal area is rare due to the semi-sheltered location of the community. Winds up to 40 knots in summer (southeasterly), and winter (northerly) can impact the community with occasional gusts to 60 knots. Related water damage is usually minor, but more frequent in areas where human development has encroached into natural drainages and floodplains. During periods of high seasonal rains and storm-driven high tides, the Haines area is subject to the effects of 100-year floods up to 25 feet above mean lower low water (MLLW) (Haines Borough, 2015).

Due to the semi-sheltered location of Haines, residents have reported that storm surges do not occur or cause minor water damage.

<u>Erosion</u>

The U.S. Army Corp of Engineers (USACE) Baseline Erosion Assessment identified Haines Borough in 2007 as a "Monitor Conditions Community" where significant impacts related to erosion were reported, but concluded that impacts were not likely to affect the viability of the community. The USACE concluded:

> *According to the community survey, erosion threatens areas in Haines and the Borough's satellite communities of Sawmill Creek and several other unnamed creeks near Lutak Inlet and Chilkat Peninsula. Conditions causing or contributing to erosion include natural river flow, heavy rainfall, flooding, and land development in the floodplain.*
>
> *In November 2005, a large flood caused blowouts of several culverts on Lutak Road along Lutak Inlet northwest of downtown Haines, and on Mud Bay Road southwest of town along Chilkat Inlet. Flood hazard areas (with accompanying erosion) exist extensively throughout the floodplains of all riverine systems in the area. In September 1967, the City had 6.5 inches of rainfall in a five-day period, which inundated the community, damaging the Haines Highway roadbed and several bridges.*
>
> *According to the community survey, erosion on Lutak Road causes yearly closures in several locations. Erosion near downtown Haines and the Borough's satellite communities threatens the Haines Highway and other roads, bridges, and houses. Threatened structures include dwellings; outbuildings and sheds; and the Haines Highway, and other roads. Some of these structures are 100 to 300 feet from erosion areas. Past measures to help reduce erosion damage include construction of riprap and gabions by DOT/PF. These measures are considered temporary and permanent measures to protective the roads are needed."*
> (USACE, 2009 and 2007).

Locations of the primary erosion hazards are shown on Figure 11.

Figure 11. Haines Erosion Location

Extent

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

The following factors contribute to 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 lakes and human-built features;
- Flood control feature existence;
- Flow velocity;
- Availability of sediment for transport, and the bed and embankment watercourse erodibility; and
- Location related to identified-historical flood elevation.

A variety of natural and human-induced factors influence the erosion process. River orientation and proximity to up and downstream river bends can influence erosion rates. Embankment composition also influences erosion rates, as sand and silt erode easily, whereas boulders or large rocks are more erosion-resistant. Other factors that may influence erosion include:

- Geomorphology;
- Amount of encroachment in the high hazard zone;
- Proximity to erosion-inducing structures;
- Nature of the topography;
- Density of development;
- Structure types along the embankment; and
- Embankment elevation.

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 in culverts, decreasing water conveyance and increasing loads which may cause feature overtopping or backwater damages; and

- Sewage, hazardous or toxic materials release, materials transport from the wastewater treatment plant, and storage tank 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.

In the event flooding were to occur in the lower-lying portions of Haines, including that from tsunami inundation, damage to roads and critical facilities (utilities and structures) could result, and sections of the community would be isolated from emergency services, medical care, and public safety; residents would also be isolated from local food supplies/commercial businesses, friends and family, and the community could be potentially cut off from the rest of the state of Alaska. During December 2020, this scenario became reality when the road to the airport became impassable, making medevac services from Haines impossible; a Coast Guard helicopter had to land in town to transport someone to a hospital (CBC News, 2020). This could result in an increased level of fear and social anxiety for residents during the flooding event and aftermath. In the event flooding occurred in the more remote recreational areas, there could be damage to residences and businesses, including remote recreational businesses, resulting in financial consequences and potential long-term losses to the community.

Flooding events, even for those properties unaffected directly, will suffer due to road closures, impacts to public safety (access and response capabilities), limited availability of perishable commodities, and isolation.

Impacts from erosion include loss of land and any development on that land. Erosion can cause increased sedimentation of river deltas and hinder channel navigation—affecting marine transport. Other impacts include reduction in water quality due to high sediment loads, loss of native aquatic habitats, and economic impacts associated with the costs of trying to prevent or control erosion sites.

Recurrence Probability

Based on the SHMP and past historical events, Haines Borough has a high probability of flooding and erosion. This means the hazard is present with a high probability of occurrence within the next ten years. Climate change may also play a part in increased flooding and erosion. Future populations of the Borough can expect to see flooding and erosion at the same or increased rates as current populations have experienced.

5.3.4 Weather (Severe)

5.3.4.1 Characteristics

Severe weather occurs throughout Alaska with extremes experienced in Haines Borough that includes thunderstorms, lightning, hail, heavy and drifting snow, freezing rain/ice storm, and high winds. Haines experiences periodic severe weather events such as the following:

- **Heavy Snow** generally means snowfall accumulating to four inches or more in depth in 12 hours or less or six 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 disrupt transportation, power, and communications.
- **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 winds can equal hurricane force but fall under a different classification because they are not cyclonic nor possess other characteristics of hurricanes. In Alaska, high winds (winds in excess of 60 mph) occur rather frequently over the coastal areas along the Bering Sea and the Gulf of Alaska.
- **Strong Winds** occasionally occur over the interior due to strong pressure differences, especially where influenced by mountainous terrain, but the windiest places in Alaska are generally along the coastlines.

5.3.4.2 History

The maritime climate near the ocean inlets quickly gives way to alpine and sub-arctic conditions up the mountain valleys. Because of its distance from the exposed coast, more northerly latitude, proximity to Interior regions, and local mountains, Haines Borough enjoys a climate which is characteristically drier than most of Southeast Alaska throughout the year. Average annual precipitation is about 50 inches in the townsite area with a greater percentage falling as snow than in most other parts of Southeast Alaska. Haines receives about 12 feet of snow per year with 27 feet falling at the Canadian border (Haines Borough, 2015).

The prevailing winds over Lynn Canal are northerly throughout much of the year except during the summer months when they are southeasterly, weaker, and more variable. Throughout the year, prevailing winds bring relatively warm, nearly saturated air into Southeast Alaska. In winter, a high-pressure area will frequently develop over northern British Columbia and the Yukon Territory while a strong low-pressure area is centered over the western Gulf of Alaska. The resulting large pressure gradient generates extremely strong winds that blow through the mountain passes and down Lynn Canal. The funneling effect of the mountains which surround Lynn Canal causes winds to be channeled in a northerly or southerly direction. Occasionally during the winter, extremely strong down slope winds occur. These winds may blow steadily at

20 to 30 mph with gusts occasionally over 50 mph. The mountains around the Chilkat-Chilkoot River valleys channel surface winds up and down river.

A long-term history of severe weather events was provided by Haines resident, Cynthia Jones, based on personal accounts recorded over the years. The following events caused significant damage to community infrastructure over 100 years ago:

- Date unknown: rockslide buried Chilkoot Lake village and many people. The Lake was shunned for many generations. When people began to forget, they rebuilt the villages.
- c. 1880: a landslide again buried a village at Chilkoot Lake, and many people lost their lives.
- c. 1882 or 83: The "worst storms in memory" occurred. Canoes were blown and dashed on the beach. The snow was so deep that people climbed out of second-story windows, and they would snowshoe over the ridgepoles of one-story houses without even realizing they were there. (Caroline Willard letter).
- January 11-12, 1890 brought several days of heavy snow/rain on top of four to six feet of snow at sea level. Buildings collapsed at Chilkat Cannery on the Peninsula. On January 11 and 12, a huge snow avalanche/landslide tore through Pyramid Harbor Cannery, destroying and damaging buildings and almost killing the caretakers. (Skagway in Days Primeval by J. Bernard Moore, 1968).
- 1911: Fire started from a steam-driven mill near today's Oslund Park and headed to town. (Anway biography by Bob Henderson).
- 1914 Landslide Klukwan: Dirt flowed down through village for several days (Mildred Sparks).
- 1915 Multiple fires threatened town from all directions. (Anway biography by Bob Henderson).

Haines Borough has been affected by five severe weather disasters which are listed below (DHS&EM, 2021).

33. Haines, January 25, 1985: After prolonged and excessive rainstorms caused permanent damage to the sewer system, the Governor proclaimed a Disaster Emergency to provide funds to repair the system through a categorical public assistance grant.

70. Haines, February 29, 1988: Severe damage to streets occurred from flooding and runoff triggered by extremely heavy rainfall. The State made available $150,000 in disaster funds to assist in the repair of community streets.

98-190 Southeastern Storm: On October 27, 1998, the Governor declared a disaster in the communities of Haines and the City and Borough of Juneau for the purposes of accessing federal highway administration funds after the worst two-day rainfall in 50 years occurred in Southeast Alaska on October 19-20,

1998. Over six inches of rain fell within a 48-hour period. As a result, extensive damage to many road systems and public, private and non-profits' properties were caused from mudslides and water erosion. On November 24, 1998, under the authority granted by Alaska Statute 26.23.020, the Governor amended his declaration of disaster in the City and Borough of Juneau, and the City and Borough of Haines, to include the Chilkat Indian Village (Community of Klukwan) in order for public (infrastructure) assistance to public property and individual and family grant assistance. The Governor also requested that the Small Business Administration declare an administrative declaration for physical disaster damages to provide low interest loans to businesses and private property owners. The total for this disaster was $1.12 million.

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 severe damage and threat to life and property, with the potential for further damage. The following conditions existed 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 were 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 amount of assistance was $1.87 million.

AK-20-272 2020 December Southeast Storm declared by Governor Dunleavy on December 5, 2020: A very strong atmospheric storm impacted Southeast Alaska from December 1-2 with a series of other strong and moist weather fronts through December 8th. The atmospheric storm produced historic extreme precipitation in particular over the far northern inner channels including Haines, Alaska. The rainfall and snowmelt caused massive road infrastructure damage from runoff coming from Ripinsky Ridge that overwhelmed culverts and flooded areas away from steep terrain including portions of the Haines airport. There were also multiple debris flows along the Haines Highway, Lutak Road, Mud Bay Road, Mosquito Lake area. A deadly landslide occurred along Beach Road; two people lost their lives. A large landslide came down into Chilkat Lake and damaged homes. Residents were evacuated from numerous locations across the Haines area. Eight homes were destroyed, and at least 21 were inaccessible in the long term.

Table 11 lists the relevant major storm events for Haines Borough in the last 20 years as recorded in the National Oceanic and Atmospheric Administration (NOAA) Storm Events Database. Each weather event may not have specifically impacted the Borough, but the event was included due to its identified regional zone.

Table 11. Severe Weather Events

Date	Event	Narrative
6-Jan-2000	Heavy Snow	Several hours of widespread moderate snow with heavy snow warning for the Haines area and a snow advisory for the remainder of the zone. The snow changed to rain. Haines Police Department reported 18-20 inches over a two-day period.
12-Jan-2000	Heavy Snow	A winter storm dumped 7 to 10 inches of snow in Haines.
16-Dec-2000	Heavy Snow	Some areas in the central and northern inner channels of Southeast Alaska received heavy snow as a low-pressure system in the Gulf of Alaska spread warm moist air over a shallow arctic airmass. Storm totals included 10 inches at Port Alexander, 8 inches in Wrangell, and 13 inches in Haines.
25-Dec-2000	Heavy Snow	Bands of snow showers dumped up to one foot of snow in Haines. Snowfall amounts varied from four inches in town to 12 inches at the Customs Station.
30-Jan-2001	Heavy Snow	Isolated pockets of cold air were maintained by drainage winds from British Columbia in both the Chilkat River Valley (near Haines) and the Portland Canal area (near Hyder), and the overrunning of warm maritime air caused locally heavy snow to occur. Heavy snow occurred along the Haines Road above an elevation of about 500 feet. A storm total of 15 inches was measured at the Customs Station.
25-Feb-2001	Heavy Snow	Six to eight inches of snow fell in less than 12 hours over the upper Chilkat Valley near the Canadian border.
22-Dec-2002	Heavy Snow	Heavy snow was reported by numerous trained spotters in Haines. Overall, 14-16 inches of snow fell in this 12-hour period.
30-Dec-2003	Heavy Snow	A 985-mb low moved to within 60 miles of Cape Fairweather and caused a moist southerly flow to develop across Southeast Alaska. Overrunning snowfall of 10 inches occurred in the community of Haines.
13-Jan-2004	Heavy Snow	A weak front lifted through the Northern Panhandle. Temperatures remained cold enough in the Haines area for a heavy overrunning snow event to occur. Weather spotters in Haines reported storm totals of 15 to 17 inches.
16-Jan-2004	Heavy Snow	A 994-mb low tracked up from the southern Gulf into the Yakutat area. The associated front spread heavy snowfall across the Northern Inner Channels and Northeast Gulf Coast. Rain occurred farther south. Storm snowfall totals included: 24 inches in Haines and 16 inches at Haines Customs.
5-Feb-2004	Heavy Snow	A 983-mb low tracking eastward across the northern Gulf of Alaska caused a moist southerly flow to develop over Southeast Alaska. Temperatures were cold enough over the extreme Northern Panhandle for heavy overrunning snowfall to occur. Storm snowfall totals included: 11 inches in Haines, 5 inches in Skagway, and 8 inches over stretches of the Klondike Highway.
6-Mar-2004	Heavy Snow	Observers at Haines Customs (40 NW on the Haines Highway) reported 14 inches of snow during this 24-hour period.
16-Dec-2004	High Wind	A 971-mb low, just off Cape Suckling, spread a strong front up through Southeast Alaska. High winds were able to surface in most locations and resulted in extensive damage, power and phone outages. The fast ferry Fairweather was severely damaged while returning from Haines to Juneau. Gale force sustained winds were occurring in Lynn Canal, and wave heights were estimated to be near 12 feet. Most Alaska Airlines flights in and out of Southeast Alaska were cancelled. Large, mature hemlock and spruce trees were downed in many communities. Fortunately, no injuries were reported.
27-Dec-2004	Heavy Snow	An overrunning snowfall event occurred in the Northern Panhandle. Yakutat reported 12.2 inches, Haines received 22 inches. Power outages and flight cancellations were the main impacts.
19-Jan-2005	Heavy Snow	A major overrunning precipitation event took place. In response to a low-pressure system approaching the Panhandle from the southwest, an arctic front moved down through Lynn Cana. This front ultimately stalled near Cape Spencer-Petersburg-Hyder line. The flow aloft turned southerly and spread deep low-level moisture up over this dome of arctic air in a classic overrunning pattern. The initial shot of heavy precipitation combined with the long duration overrunning, and resulted in a major winter storm. Heavy snow occurred in the Stephens Passage, Icy Strait, Lynn Canal, and Misty Fjords regions as well as along the Northeast Gulf Coast during this three-day event. Storm total snowfall amounts measured during this event: Haines 15 inches.
22-Jan-2005	Heavy	Heavy snow occurred in the Haines area due to overrunning of a dissipating arctic front.

	Snow	Downtown Haines received seven inches of snowfall, while the Haines Customs station on the Canadian Border measured 11 inches.
7-Nov-2005	Heavy Snow	With early season arctic air in place over the Northern Panhandle, a 992-mb low moved into the northern Gulf of Alaska. Heavy snowfall resulted. Some storm totals: Haines 13 inches, 8.5-mile Haines Highway 16 inches, and Haines Customs 14 inches.
20-Nov-2005	Heavy Rain	A week of record rainfall impacted much of Southeast Alaska. Historic seven-day precipitation records were set: Haines coop observer (downtown) 12.16 inches ending on 11/25. Disaster declarations were made in the communities of Juneau, Haines, Sitka, Hoonah, and Pelican totaling over $4 million. Early November high elevation snowpack ran-off during the warmup and helped contribute to the problems. As is typical during these extended periods of heavy rainfall in Southeast Alaska, the steep mountain slopes that run off into the channels experienced numerous landslides. Several homes were damaged by these landslides in the Juneau and Haines areas. Streams and creeks swelled to bankfull levels, though no river flooding was reported. Backed up culverts caused erosion beneath roadways. Major damage occurred on the Haines Road system due to this type of erosion. Flooded basements were also reported in many areas. Winds associated with the frontal passages complicated matters and caused widespread treefall throughout the Tongass National Forest. Numerous power outages were reported as well.
5-Feb-2006	Heavy Snow	A 962-mb Low lifted northward into Kodiak Island. The associated front caused overrunning heavy snowfall to develop in the extreme Northern Panhandle. Storm snowfall totals included: Haines U.S. Customs (Mile 40 near the border) 16.5 inches, White Pass (Klondike Highway) 12 inches, Skagway 8.5 inches, and Haines 7 inches.
13-Nov-2006	Heavy Snow	Explosive cyclogenesis took place over the Eastern Gulf with a storm rapidly deepening to 985-mb just off Sitka. More cold air aloft was continually pumped into this system from a strong upper ridge upstream driving NW flow aloft. A snowstorm as part of a Gulf of Alaska Low clobbered the Northern and Central Panhandle. The CO-OP observer in Haines measured 10 inches. Snow continued falling with 3.5 more new inches.
25-Dec-2006	Heavy Snow	Heavy Snow and High Wind Combination. It started with a weakening 980 MB Low over Middleton Island. To the south, a rapidly developing storm moved off the Queen Charlottes at 948-mb as a huge, mature, slowly weakening storm. Haines Customs CO-OP observer measured 8.5 inches new snow. Haines Customs measured 23 inches.
28-Dec-2006	Heavy Snow	High Wind and Heavy Snow Case: A 958-mb storm center moved into the Western Gulf with strong warm advection. Strong surface pressure gradients formed along the outer coast. Cold air remained in a fairly deep layer over the Northern Panhandle which finally warmed. This overrunning caused heavy snow in the higher elevations around the Northern end of Lynn Canal and into White Pass. Haines Customs CO-OP observed 19 inches of new snowfall.
30-Dec-2006	Heavy Snow	As a mature and weakening Low died out in Prince William Sound, a triple point low developed rapidly, causing heavy snow above Haines. Haines Customs CO-OP observer measured 14 inches new snow.
20-Jan-2007	Heavy Snow	A storm over the entire Gulf of Alaska had developed to 960-mb. Haines Customs CO-OP measured 14 inches of new snowfall.
23-Jan-2007	Heavy Snow	The arctic front persisted over the Central Panhandle. A series of weak Lows over the Southern and Central Gulf of Alaska continued to push warm air over the arctic front. Upslope conditions enhanced the snow in the Northern Panhandle. A spotter in Haines measured 18 inches of new snow with 24 inches storm total.
5-Mar-2007	Heavy Snow	The arctic front stalled over the southern-most part of the Panhandle and remained stationary for a couple of days. A Low developed off the Queen Charlotte Islands, sending warm moist air aloft over the arctic front. Haines Customs CO-OP measured 16 inches new snow. Downtown Haines had 10.5 inches on 3/5 and 17 inches on 3/6. Haines airport had a peak wind of 35 MPH on 3/6 and 41 MPH on 3/7. Visibility was measured frequently at or below 1/4 mile at the airport on 3/5 and 3/6.
21-Dec-2007	Heavy Snow	The arctic front remained stationary over central southeast Alaska. A 972-mb storm center was approaching from the southwest and moved onto the south coast. Haines customs observed 17 inches of new snow. Downtown Haines received 14.5 inches of new snow for the same time. A trained spotter in Haines observed 16.3 inches.
16-Mar-2008	Heavy Snow	A secondary gale force low developed to 982-mb over the central Gulf. The arctic front moved inland as this low approached, but there was enough cold air to cause over-running snow for some sections of the northern Panhandle. The COOP observer in Haines measured 20.8 inches

		of new snowfall.
22-Mar-2008	Heavy Snow	Unseasonable cold air aloft strengthened a system to 985-mb. A secondary low developed to 993-mb off the Queen Charlotte Islands with a series of strong fronts moving onto the southern SE Alaska coast. The Haines customs COOP observer measured 10.5 inches of new snowfall and 16.9 inches of new snowfall the next day.
28-Oct-2008	Winter Storm	Cold air moved into Northern Southeast Alaska due to a low-level north wind. Warm moist air was forced aloft over this colder air as a storm center moved into the Western Gulf which caused high coastal winds and locally heavy snow inland. The Haines COOP observer measured 13 inches of new snowfall.
1-Nov-2008	Heavy Snow	Warm moist air moved over the area aloft. Haines customs measured 21 inches of new snowfall. Haines cooperative observer downtown measured 8.6 inches of new snowfall.
8-Dec-2008	Heavy Snow	Arctic High pressure remained over the eastern Yukon which supported a stationary arctic front over the northern Panhandle. Rare blizzard conditions persisted over the Klondike Highway and Haines areas. Storm totals of snow ranged from around 9 inches to 18 inches. The highest wind estimate was 75 MPH.
26-Dec-2008	Heavy Snow	A secondary gale force low developed in the western Gulf of Alaska, and it became the main surface low in the central Gulf. This system caused a strong front to move over the Panhandle with plenty of moisture where it stalled. Storm total snow accumulations ranged from one to two feet. Haines was buried in this event. The downtown cooperative observer measured 17.3 inches of new snowfall and 12.7 inches of new snow the next day. Plows were busy with 30 inches of snow to remove.
4-Jan-2009	Blizzard	An arctic high was in place over northwest Canada and southeast Alaska. A weather system moved across the Gulf of Alaska and onshore of the southeast panhandle...creating an overrunning snow event and blizzard conditions over the northern Lynn Canal region. Light to moderate snowfall leading up to and through the event. Strong sustained north winds to 25 mph with gusts of 35 to 50 mph...and locally stronger along Lynn Canal south of Haines, reduced visibility to near zero for several periods during the afternoon and evening.
8-Jan-2009	Winter Storm	A very cold arctic air mass persisted across northwest Canada and southeast Alaska panhandle. Storm totals ranged between one to two feet. The Co-Op in Haines reported a daily snowfall of 16.8 inches and a storm total of 20.8 inches for the event. A spotter near Haines also reported 15 inches.
29-Jan-2009	Heavy Snow	A strong low developed over the southwestern Gulf of Alaska and moved northeast across the panhandle into northern British Columbia. Very strong southerly winds (60 to 80 mph gusts) were associated with the front as it moved over the southern half of the panhandle. One to three feet of snow fell over the northern Lynn Canal region with the low passage. A strong band of trailing snow showers impacted the north central panhandle with up to a foot of snow. Haines customs Co-op reported a storm total of 32 inches that occurred overnight.
7-Feb-2009	Heavy Snow	Very cold arctic air was in place over the northern half the panhandle and interior valleys near British Columbia. An event total of 17 inches was reported by the Haines Co-op. At least 2 trees were toppled due the weight of the snow.
11-Mar-2009	Heavy Snow	Before the event began, cold air was entrenched over the northern inner channels of Southeast Alaska panhandle. A strong low developed as it moved northeast over the Gulf of Alaska. Haines customs station reported an event total of 13 inches, and the Haines Co-op had a total of 14 inches.
13-Nov-2009	Heavy Snow	A storm force low from the North Pacific Ocean deepened to 952 MB near Middleton Island on the morning of Saturday 11/14. The associated front moved onshore and through Southeast Alaska by Saturday evening. This system brought strong winds and heavy snow to many regions of Southeast Alaska. Haines customs COOP observer measured 14.5 inches of new snow for 24 hours ending at 0700 AKST on 11/14.
16-Dec-2009	Heavy Snow	A complex low-pressure system was over the entire Gulf of Alaska on the night of 12/15. Low level cold air aided by a north wind persisted over northern SE Alaska into 12/18. Haines Customs measured 13.0 inches of new snowfall at 0700 AKST on 12/17 and 14.0 inches new at 0700 on 12/18. A storm total of around 16 inches was estimated for downtown Haines on the 12/17 by a spotter, but the snow rapidly turned to rain near sea level on the morning of 12/17.
17-Dec-2009	Winter Storm	A storm force low developed off the Queen Charlotte Islands down to 972 MB on Thursday afternoon 12/17 and moved rapidly northward under a southerly jet stream, making landfall around Icy Cape on the morning of 12/18. A strong front moved onto the SE Alaska coast on the morning of 12/18 causing wind gusts to 70 MPH for Prince of Wales Island. This same system

		brought heavy snow to the Haines area during the early morning hours of 12/18 due to warm air overrunning. Haines Customs measured 11.0 inches of new snow for 24 hours ending at 0700 AKST on 12/18. Frequent winds to 40 MPH were observed at the Haines Airport during this storm.
22-Dec-2009	Winter Storm	A 1036 MB arctic High-pressure system was over the Yukon on 12/22 with cold air in gap flow for northern SE Alaska. Warm moist air began to overrun this cold outflow resulting in heavy snow for several areas in the Northern Panhandle. Gap winds increased during the night of 12/22 as the high-pressure cell began to rebuild. A 982 MB gale force low then moved into the central Gulf on the morning of 12/23 to further increase the pressure gradients and move in warm moist air at mid-levels throughout the day for more snow and wind on 12/24. One spotter had a storm total of 16 inches that had compacted.
7-Jan-2010	Winter Storm	Cold arctic air was being held in place over the northern portion of Lynn Canal. South flow in the lower levels of the atmosphere was moving warm moist air over the panhandle. This resulted in a burst of heavy snow in Haines in the morning hours of 1/7, before it warmed sufficiently to change the snow to liquid, however persistent cold air at the surface continued through the morning of 1/8, so the rain was freezing on the surface in Haines causing minor ice accumulations. The coop observer in Haines reported an accumulation of 7.4 inches of snow at 0800 AKST on 1/7. Freezing rain began at the Haines ASOS began at 1318 AKST and continued over night to roughly 0800 on 1/8.
10-Jan-2010	Heavy Snow	Cold arctic air from northwest Canada moved into to the northern panhandle behind an arctic cold front to the northern panhandle through the 12th. Haines Coop observer reported the following snow totals at 8 am AKST on the 11th 18 inches, on the 12th 16 inches, and 13th 5.2 (3-day total 39.2 inches). Haines Custom station coop reported 8 inches the morning of the 12th (7 am AKST), and 6.5 inches. Also, a spotter near Haines reported the morning of the 13th reported a total snowfall over the event of 47 inches.
5-Feb-2010	Winter Storm	Warm air aloft moved over a relatively cold pool of air that was trapped in Northern Lynn Canal on 2/6 and 2/7. This resulted in heavy snowfall for the farther NW portion of the Chilkat Highway. Haines Customs observed 12.2 inches of new snow at 0800 AKST on 2/6 and an additional 5.2 inches on 2/7. Haines airport observed freezing rain at times through this period.
5-Mar-2010	Winter Storm	A hurricane force low down to 956 MB developed near Dutch Harbor on 3/4 and was supported by very cold air aloft. This storm center tracked to South Central AK on 3/5 and set the North Pacific storm track from the SW into the Panhandle due to very persistent winds aloft. A multitude of fronts and developing waves moved from the Gulf of Alaska into SE Alaska through 3/10 bringing both snow and high winds. The Haines area was hit hard by this winter storm. On the afternoon of 3/5 near white-out conditions were reported by several spotters, Snow accumulated to 8.5 inches by 0700 AKST on 3/6. Numerous wind gusts to 40 MPH were observed though 3/6.
12-Mar-2010	Winter Storm	Warm moist air aloft moved over the cooler temperatures in SE Alaska on 3/12 which caused heavy snowfall for most of the northern sections. This snow was followed by a rapidly developing storm moving up from the SW over the Gulf of Alaska on 3/12 and 3/13. A strong front associated with this front moved onto the coast on 3/13. The downtown Haines COOP observer measured 11.9 inches of new snow for 24 hours ending at 0800 AKST on 3/13. Haines Customs measured 9.0 inches new snow on 3/13 and 17.5 new on 3/14.
13-Mar-2010	Winter Storm	Warm moist air aloft moved over the cooler temperatures in SE Alaska on 3/12 which caused heavy snowfall for most of the northern sections. Haines Customs measured 17.5 inches of new snow for 24 hours ending at 0700 AKST on 3/14. Spotters at lower elevations had highly variable amounts.
23-Mar-2010	Winter Storm	Arctic air moved over the northern Panhandle from a 1017 MB high over the Yukon Territory on the night of 3/21. Haines Customs measured 15.0 inches of new snow by 0700 AKST on 3/24 and downtown had a total of 20.0 inches new snowfall.
1-Nov-2010	Heavy Snow	A major winter storm had explosive development well south of Kodiak on Halloween. The deepest that the storm got was 940 MB. On 11/1, a very strong front associated with this storm moved onto the coast of SE Alaska. Warm moist air moving over colder air in the northern Lynn Canal area caused heavy snow especially for higher elevations. Haines Customs on the Chilkat Highway received 17 inches of new snow though 0700 AKST on 11/2.
28-Nov-2010	Winter Storm	Arctic high pressure remained over the NW Territories as a storm force low moved into the central Gulf of Alaska. A strong associated front moved onto the coast of SE Alaska on the night of 11/29. This system brought heavy snow to northern Lynn Canal and high winds to the coastal

		areas. Haines Customs measured 14 inches of new snowfall for 24 hours ending at 0700 AKST on 11/29. Various amounts were measured around the town of Haines with some rain mixed in. Winds to 30 mph were observed with poor visibility on the Chilkat highway. Near white out conditions occurred at times along the highway. This event lasted around two days.
17-Jan-2011	Winter Storm	The arctic front remained stationary over the north central panhandle on the night of 1/17 into the morning of 1/18. Haines COOP measured 7.0 inches new snow overnight on the morning of 1/18 as did one spotter. Haines Airport had visibility down to 3/4 mile in snow and peak winds of 26 KT during the night.
19-Feb-2011	Winter Storm	All of SE Alaska was in cold air with the arctic front offshore on 2/18. A moderate gale center moved into the western Gulf of Alaska, which was just enough to cause the front to move over the Panhandle for heavy snow on the night of the 18th into the afternoon of the 20th. Haines Customs measured 6.5 inches of new snow at 0700 AKST 2/20 which occurred during the afternoon of 2/19. Downtown Haines measured 8.2 inches of new snow. Haines Airport measured visibility as low as 1/2 mile in snow with peak winds at 34 KT at the height of the storm.
12-Nov-2011	Winter Storm	A triple point low developed over the Western Gulf of Alaska on the afternoon of Friday 11.11. This system developed to hurricane force wind the strongest winds along the outer coast as the low center moved eastward on Saturday 11.12. Warm moist air was forced aloft over cooler air at the surface causing some heavy amounts of snow for the Yakutat and Haines areas. Downtown Haines spotter measured 11.0 inches of new snow on the morning of 11.12. Haines Customs measured 12.0 inches.
13-Nov-2011	Winter Storm	A moderate strength low become nearly stationary over the Eastern Gulf on the afternoon of 11.13. The arctic front linked up into this system also becoming stationary through Lynn Canal. Although this system weakened through 11.15, moisture and warm air aloft kept moving over the northern and central Panhandle to cause heavy snowfall. This pattern persisted until the afternoon of the 15th when the front linked to a new storm in the western Gulf which moved into the central Gulf bringing gale force winds and blizzard conditions near Haines. Downtown Haines got 12.1 inches of new snowfall overnight.
15-Nov-2011	Winter Storm	A moderate strength low become nearly stationary over the Eastern Gulf on the afternoon of 11.13. The arctic front linked up into this system also becoming stationary through Lynn Canal. Although this system weakened through 11.15, moisture and warm air aloft kept moving over the northern and central Panhandle to cause heavy snowfall. This pattern persisted until the afternoon of the 15th when the front linked to a new storm in the western Gulf which moved into the central Gulf bringing gale force winds and blizzard conditions near Haines. Downtown Haines measured 18 inches of new snow on the morning of 11.16. Haines customs measured 9.5 inches of new snow. Visibility was as low as 1/4 mile BEFORE the wind started to get very strong later on 11.16.
16-Nov-2011	Blizzard	A moderate strength low become nearly stationary over the Eastern Gulf on the afternoon of 11.13. The arctic front linked up into this system also becoming stationary through Lynn Canal. Although this system weakened through 11.15, moisture and warm air aloft kept moving over the northern and central Panhandle to cause heavy snowfall. This pattern persisted until the afternoon of the 15th when the front linked to a new storm in the western Gulf which moved into the central Gulf bringing gale force winds and blizzard conditions near Haines. Haines Airport had gusts to 51 KT, and white out conditions on the afternoon of 11.16.
21-Nov-2011	Winter Storm	A storm force complex of low centers across the entire Gulf of Alaska starting on 11.20 sent warm moist air aloft over an arctic front over the northern Panhandle. Due to the southern position of the low centers, cold air near the surface kept filtering into the northern Panhandle from the north which reenforced the snowfall. By the afternoon on 11.23 enough warm air from aloft finally replaced the low-level cold air near the surface to end significant snow. Downtown Haines measured 12.8 inches of new snowfall on the morning of 11.22.
27-Nov-2011	Winter Storm	A storm force low in the Western Gulf of Alaska caused a strong warm front to move onto the Eastern Gulf Coast early on the morning of 11.28. The arctic front was stationary over Lynn Canal at the time. This setup caused heavy snow for the Yakutat area, Pelican, Elfin Cove, and Haines. Downtown Haines measured 21.5 inches of new snow on the morning of 11.28 and the snow changed to rain in the afternoon. Visibility at the airport was as low as 1/4 mile and a peak wind was measured at 30 KT. Haines Customs got 8.0 inches of new snow.
21-Dec-2011	Winter Storm	A hurricane force low began to develop in the North Pacific on the afternoon of 12.21 with warm moist air aloft moving over cooler air near the surface for the Northern Lynn Canal area.

		By the early morning of 12.22 this storm extended into the Central Gulf of Alaska with very strong surface pressure gradients for very strong winds over the entire Panhandle while continuing to cause heavy snow. Haines Customs measured 6.5 inches of new snow at 0700 AKST 12.22. Town got rain, but the wind peaked at 35 KT at the Airport during the event.
26-Dec-2011	Winter Storm	On the afternoon of 12.25 a moderate gale developed over the North Pacific. This gale became a full storm force low by early morning of 12.26 covering the entire Gulf of Alaska. This system brought heavy snow to the Haines area on 12.26 and 12.27 while causing strong winds for the outer coast and southern Panhandle. By the afternoon of 12.26 the central pressure had fallen to 960 MB near Middleton Island with hurricane force gusts. This system rapidly weakened on the evening of 12.26 but continued to cause heavy snow for Haines. Haines Customs measured 18 inches new snowfall for 24 hours ending at 0700 on 12.27. Downtown got 12.5 inches. Visibility was down to one half mile in snow and wind peaked to 39 KT at the airport.
1-Jan-2012	Winter Storm	A storm covering the entire Gulf of Alaska on 1.1 caused heavy snow, storm force winds and rain into 1.2. Snow amounts varied from 6 inches to a foot for most northern sections and wind gusts up to 60 MPH were observed. Downtown Haines COOP observer measured 16.1 inches of new snow on the morning of 1.2. Haines customs near the Canadian border measured 42.0 inches of new snow on the morning of 1.2.
3-Jan-2012	Winter Storm	Another monster storm covered the entire Gulf of Alaska on 1.3 with several low centers and complex frontal systems. A storm force low center moved north along the eastern Gulf coast during the early morning hours on 1.4 causing high winds for Prince of Whales Island and the Clarence Strait area. The storm weakened with a main surface low forming in the northern Gulf on the afternoon-evening of 1.4 but heavy snow persisted in the Haines area into 1.5. Downtown Haines got a storm total of 15.6 inches of new snow during this storm while Haines Customs measured 13.0 inches storm total.
10-Jan-2012	Winter Storm	A classic Pineapple Express of strong south flow aloft loaded with moisture was aimed at Prince William Sound on January 10th. Low level cold air remained over the northern sections of SE Alaska which caused heavy snow near Yakutat and Haines on the 10th through the 11th. Downtown Haines measured 10.8 inches of new snowfall on the morning of January 11th and got an additional inch that afternoon. Haines Customs 7.5 inches new then 4.0 inches that afternoon.
21-Jan-2012	Winter Storm	A high-pressure system had built into the Yukon and B.C. as a 965 MB storm force low moved into the central Gulf of Alaska. Downtown Haines woke up to 15.7 inches of new snow on 1.22. Estimated winds along the east side of town were up to 50 MPH. Haines Customs observed 11 inches of new snow. Visibility at Haines airport was as low as 1/4 mile with gusts to 20 MPH there.
24-Jan-2012	Heavy Snow	With one strong low center parked in the western Gulf, another system developed SW of Dixon Entrance and made landfall near cape Spencer on the morning of 1.25 and merged with the original storm center. Downtown Haines got a storm total of 31.6 inches of new snow during this storm. Haines Customs got 18.0 inches.
30-Jan-2012	Winter Storm	A moderate strength low moving into the eastern Gulf of Alaska brought heavy snow to the Haines area during the night of 1.30. The Haines area had storm totals ranging from 8 to 11 inches with this event. Up the highway Haines customs only got 8.0 inches.
3-Feb-2012	High Wind	A monster storm developed in the western Gulf of Alaska on Wednesday 2.1. This hurricane force low deepened to 944 MB off Sand Point early in the morning then continued north slightly weakening to 953 MB near Kodiak Wednesday evening. A secondary low developed on the front well off Vancouver Island on Thu afternoon on 2.2 becoming 964 MB in the central Gulf of Alaska by early morning on 2.3. This storm brought hurricane force winds to all of SE Alaska and a few areas of heavy snow. Measured gust 64 MPH at 0854 AKST 2.3. No damage reported.
7-Mar-2012	Winter Storm	A frontal system moved onto the coast on the morning of March 7th then stalled over the northern Panhandle into the 8th. Heavy snow was observed for Yakutat and Northern Lynn Canal but there were no reports of damage. The southern Panhandle had some storm force wind with this event. A spotter on the Chilkat Peninsula got 15 inches overnight and Downtown got 12.1. At 1345 another spotter came in with 17.4 inches so far. By 1830 observations showed that the snow had changed to rain and new snow was compacting.
30-Oct-2012	Heavy Snow	Warm, moist air associated with a 994 MB low in the central Gulf of Alaska moved over the Northern Panhandle on the night of Tuesday October 30th and the morning of Wednesday October 31st. The upper Chilkat Highway got over a foot of new snow. Haines Customs measured 14 inches of new snow on the morning of October 31st.

14-Dec-2012	Winter Storm	A 969 MB storm center moved into the eastern Gulf of Alaska on the afternoon of 12/14 which was the beginning of quite a pattern change for SE Alaska. This system pumped warm moist air over trapped cold air that remained over the Chilkat Highway at the Canadian Border NW of Haines. Although Downtown Haines did not get much snow, Haines Customs got a dump of 17 inches by 0700 on the morning of 12/15.
11-Dec-2013	Winter Storm	Low pressure with an associated frontal system in the Gulf was assisted by a large stream of tropical moisture which moved over the Panhandle. An upper level trough dropping in from the north brought cold air caused heavy snow, significant winds and for the Klondike Highway a blizzard with low visibility. Haines area reported 12.5 inches of snow, with blowing and drifting.
13-Dec-2013	Winter Storm	A 974 MB storm force low moved into the central Gulf of Alaska on the afternoon of Dec 13 with lots of warm moist air moving over the arctic front which was located near Berners Bay. By the afternoon of the 14th a secondary low moved into the eastern Gulf making landfall near Cape Fairweather then redeveloped over the Yukon overnight. The flow regime became southwest on the 15th with some cooler air. Downtown Haines got 14 inches of new snow from this storm. Haines Customs got 11.5 inches of new snowstorm total.
19-Dec-2013	Winter Storm	A 993 MB gale force triple point low moved into the central Gulf of Alaska on the morning of the 19th forcing warm moist air over cold air at the surface in the Panhandle. This system brought heavy snow to much of SE Alaska including the northern Panhandle, Yakutat, and Hyder. Haines Customs reported storm total of 8 inches by compaction. Storm total 11.9 inches for downtown Haines.
24-Dec-2013	Winter Storm	A 988 MB Storm Force low moved into the central Gulf of Alaska on Christmas Eve and forced warm moist air over cold air at the surface this caused brief heavy snow for the northern most Panhandle. Haines spotter #10 south of Haines got 18 inches storm total and continued light snow.
14-Jan-2014	High Wind	First snow, then wind for the Lynn Canal area. From Jan 13th through 15th a frontal system approached the northern Panhandle which created a strong overrunning and 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. Peak wind 53 MPH and 54 MPH.
13-Feb-2014	Winter Storm	Low pressure (960mb) located over the western Gulf near remained stationary through 2/14 and the associated front drove moisture into the Yakutat area and Northern Panhandle. This warmer, moist air produced significant snowfall across the region and some wind. Travel was impeded. Haines spotter reported storm total of 10.3 inches of snow.
15-Feb-2014	Winter Storm	Low pressure (960mb) located over the western Gulf near remained stationary through 2/14 and the associated front drove moisture into the Yakutat area and Northern Panhandle. This warmer, moist air produced significant snowfall across the region and some wind. Travel was impeded. 17 inches snow for a 24-hour total at Haines Customs.
7-Mar-2014	Winter Storm	A 970 MB storm force low moved into the southern Gulf on March 7th driving warm moist air to overrun cold air at the surface for the Haines area and the Haines Highway. Storm totals of 24 to 40 inches of new snow were measured.
1-Jan-2015	Winter Storm	Cold air in the Chilkat valley persisted as a warm front moved over the area from the south with moisture aloft causing heavy snow on the Haines Highway on New Year's Day. Areas of freezing drizzle preceded the heavy snow Downtown. Haines Customs had a storm total of 13 inches. Nearly an inch of water storm total was observed Downtown Haines.
28-Jan-2015	Winter Storm	Strong high pressure built over the northern Yukon on Jan 28th with the arctic front over northern Lynn Canal. Warm moist air moved over the Haines area on the evening of the 28th causing heavy snow. No damage was reported. A trained spotter at Downtown Haines measured 9.6 inches new snow at 0800 AKST on January 29th. Kensington Mine measured 14 inches of new snow around noon on the 29th. No damage reported.
8-Feb-2015	Winter Storm	The arctic front stalled over the central Panhandle on Feb 7th as warmer moist air aloft moved over the area. Six inches to a foot of new snow fell over the area, but no damage was reported. There was some lower wind chills and strong wind with this snow which made visibility poor at times. Downtown Haines got 13.0 inches measured for the storm total. No damage reported.
11-Mar-2015	Winter Storm	A gale force low moved into the Eastern Gulf of Alaska on the evening of 3/11 forcing warm moist air to move over relatively cooler air near the surface in the Northern Lynn Canal area. This caused heavy snow and somewhat windy conditions, but no damage was reported. Heavy snow changed to moderate rain late in the afternoon on 3/12 which caused difficult snow removal as usual. Haines Customs got a storm total of 25 inches of new snow through the

		afternoon of 3/12. Downtown Haines measured 14.4 inches storm total with drifting snow that may have lowered the amount.
12-Nov-2015	Winter Storm	Wintry weather affected the Panhandle on November 11th and 12th. On the 11th, west wind aloft brought snow showers and significant wind. The situation changed rapidly on the 12th as a deep storm force low to 961 MB moved into the central Gulf. The combination of the rapid moving systems caused some heavy snow in the Lynn Canal area while causing high wind for Prince of Wales Island and the Ketchikan area. Haines Customs on the Haines Highway observed 14 inches storm total snowfall by noon on the 12th. No damage reported but plowing operations along the Haines Highway were intense.
29-Nov-2015	Winter Storm	A strong front that was spawned from a massive low-pressure system in the Western Gulf approached the outer coast on the night of the 27th. This caused a several day snowstorm mainly along higher elevations in the Northern Lynn Canal area due to the arctic front becoming stationary about the latitude of Skagway. Haines Customs measured 12.5 inches storm total new snow for this event. No damage reported. Alaska DOT was very busy plowing snow from the roads.
21-Dec-2015	Winter Storm	A weak overrunning snow pattern set up for the Northern Lynn Canal area during the evening of 12/21. The arctic front remained in the area during the early morning of the 22nd. Haines Customs got 11.5 inches storm total snowfall. The Haines Highway got 8 inches storm total snowfall, and the Klondike Highway only got 3-4 inches.
21-Jan-2016	Winter Storm	Arctic air lingered along the northern border of the Panhandle as a gale force low in the central Gulf weakened. An associated occluded front provided just enough lift to cause heavy snow for the Haines area and Haines Highway on 1/21. Haines Customs measured a storm total of 16 inches of new snow for this storm.
25-Jan-2016	Winter Storm	Warm moist air moving from the south aloft, moved over cold air at the surface over the northern panhandle and the Misty Fjords areas. Haines customs measured 14 inches of new snow from 1/24 2300 to 1/26 noon. The main impact was intense snow removal operations for both the City and Borough of Haines and State DOT along the Haines Highway.
4-Feb-2016	Winter Storm	Another in a series of weather systems moving up from the south along the outer coast caused strong winds and a couple of areas of heavy snow to SE Alaska. No damage was reported, but snow removal operations were intensified on the Haines Highway. Haines Customs reported 10.5 inches at 7:40 am on 2/4 and another 9 inches on 2/5. Storm total for the Haines Highway was 21.5 inches including 2 inches on 2/3.
24-Feb-2016	Winter Storm	A warm front moving up from the south moved over the Northern Lynn Canal driving warm moist air over cold air at the surface. This cause brief heavy snows for both the Klondike & Haines Highways. Haines Customs measured 12 inches of new snowfall overnight. No damage was reported but snow clearing operations by DOT was intense.
29-Nov-2016	Winter Storm	An arctic front had become established over the Panhandle on 11/27 & 11/28. At the same time a storm force low developed well southwest of the Panhandle and moved rapidly toward the out coast while developing. The result was a radical pattern shift with a 964 MB storm off the coast con 11/29 that brought warm moist air over the arctic front while also causing high wind. Haines Customs measured 16 inches new snow. Trees came down and snow was hard to remove, but no significant damage was reported.
2-Dec-2016	Winter Storm	A really strong storm developed in the southern Gulf of Alaska on the afternoon of 12/1 down to 968 MB. Not only did this bring a slug of warm air to the Panhandle but also strong pressure gradients for a lot of windy places. By Friday morning 12/2 this monster deepened to 962 MB off Cape Decision then went inland that night through Icy Strait which is a windy track for any storm. By Saturday morning 12/3 the remnants of the storm reestablished the arctic front over Lynn Canal for a bunch of snow in the north. Haines Customs reported 14.5 inches of snow. Miraculously damage was limited to downed trees, power outages, and transportation disruptions.
7-Dec-2016	Winter Storm	The arctic front had become established over northern SE Alaska on 12/5 with very high pressure extending into the upper Yukon. A moderate low developed in the central Gulf which was a set up for snow on 12/6 & 12/7. New 8.3 inches measured at Haines Co-Op at 8 PM Wed 12/7. Storm total 17.8 inches measured at Mud Bay Spotter #4 as of 2330 Wed 12/7. No damage reported. Impact was snow removal.
11-Feb-2017	Winter Storm	Strong SSW flow aloft ahead of an occluded front on 2/10 brought snow, high winds, and even blizzard conditions to the Panhandle. As the front moved onshore on 2/11, warm air overrunning very cold air at the surface caused the snow to accumulate rapidly. White Pass was

		closed, and snow combined with wind gusts over 60 mph caused road and marine problems throughout SE Alaska. Some locations measured over a foot of new snowfall. Mud Bay spotter measured 16 inches storm total new snow for this event. Downtown Haines measured 13.8 inches. Customs didn't get very much snow. Lutak Road had a power outage for 24 hours. A 38 FT fishing vessel sank in the harbor weighted down by the snow dump. Snow removal was also a big impact.
12-Mar-2017	Winter Storm	On 3/12 the arctic front was over the central Panhandle as another in a series of storms moved northward from off the Pacific Northwest. By the afternoon of 3/12 the storm center had deepened to 981 MB off Dixon Entrance forcing warm moist air over the arctic air in place. The result was heavy snow for most of the Panhandle into 3/13 and lingering snow into 3/14. The impact was intense snow removal for storm totals up to 20 inches on top of an already deep snowpack. This was a setup for avalanches later that week.
9-Jan-2018	High Wind	Strong arctic high pressure had built into the Yukon Territory up to 1037 MB on 1/9 and 1/10. Very strong outflow winds were reported in Downtown Haines up to 60 mph causing damage on the afternoon of 1/9. The Marine Exchange observation recorded gusts to 60 MPH for the Haines Harbor (Downtown) on the afternoon of 1/9. Local newspaper reported that a ski rack was torn off a car and went through the window of a downtown business. Other damage was reported.
12-Jan-2018	Winter Storm	A strong warm front advanced over the Panhandle with a very cold air mass still in place. |This combined with an upper-level disturbance moving in from NW. Significant snow amounts occurred before the warm air advection changed the snow over to rain late 1/12 to early 1/13. Snow amounts ranged from an inch to 6 inches overnight. Downtown Haines COOP measured a storm total of 8.7 inches. No significant damage was reported. Impact was snow removal followed by rain and freezing rain on roads.
10-Mar-2018	Winter Storm	Cooler air inland along the Haines Highway with continued light northwest surface winds kept the temperatures from warming during warm moist air overrunning. Storm total snow 16.0 inches at Haines Customs. Impact was snow removal by DOT.
15-Dec-2018	Winter Storm	A strong front moved up to the southern coast on the evening of 12/15. The kept cold air over upper Lynn Canal but also caused snow. The Haines Road got up to 17 inches of new snow, but the Klondike Highway got very little due to downslope winds. Impact was snow removal and poor driving conditions on the Haines Road. No damage was reported.
22-Apr-2019	High Wind	A Deepening storm center tracked into the Eastern Gulf on Sunday evening 4/21 then stalled in the NE Gulf through Mon morning. Gusts to 60 MPH occurred during the afternoon of 4/22 in Haines Harbor. No damage was reported.
17-Aug-2019	High Wind	An unusual wind event hit Haines on the afternoon of 8/17. A low-pressure system at 1003 MB moved into Dixon Entrance but there was a 1042 MB high over northern Alaska. A strong northerly blew at Haines. Eldred Rock got to 60 mph, but the Downtown Haines observation from the Marine Exchange was only 30 mph. Minor damage was reported at Haines.
5-Dec-2019	Winter Storm	Warm moist air aloft was lifted over cold air at the surface over the northern Lynn Canal area on the morning through the evening of 12/5. This resulted in significant, new snowfall ranging 6 to 13 inches over 12 hours. The impacts were snow removal for the towns and highway system.
18-Dec-2019	Heavy Snow	An overrunning snow event for the Chilkat Valley including Haines. Final 2-day totals in the Haines area were 12 to 15.5 inches.
16-Jan-2020	High Wind	A Taku Mountain Wave developed with good cross mountain flow and cold air moving over mountains from the Canadian interior. Marine Exchange sensor at the Haines Harbor measured numerous gusts over 60mph due to strong northerly outflow. Peak gust measured was 85 mph.
18-Jan-2020	Heavy Snow	General overrunning snow event occurred most of January 19th around Haines along the peninsula south of Haines to Mud Bay. Snow began in the evening of the 18th and continued for about 24 hours. By 10 am 9.5 inches had been reported by a spotter in Mud Bay, and by the end of the event, 17 inches of snow had fallen. Lesser amounts fell in along the Haines Highway.
23-Jan-2020	Heavy Snow	Two systems merged to cause a long duration overrunning snow event over the Haines area. Haines area spotters measured between 12 to 16 inches of snow.
25-Jan-2020	Heavy Snow	A front associated with a low tracking up from the north Pacific caused very heavy snowfall rates over the northern panhandle. This was the continuation of multiple days' worth of snow from separate events. Heavy snow continued through the next day with some short periods of blizzard conditions and 3-foot drifts. Total snowfall for the event was in excess of 22 inches area wide. COOP station at Haines Customs reported 22 inches at 7am on the 26th and another 18 inches by the next day. The storm ended with a short period of freezing rain as winds shifted to

		the south. The Haines Borough declared a public safety emergency the following day, closing all public buildings and schools for snow removal.
28-Jan-2020	Heavy Snow	Rapidly deepening low-pressure system with an occluding front caused high winds with damage over the southern inner channels and outer coast. As it moved northward overrunning heavy snow fell over the northern panhandle. This was the first of two strong storms back-to-back. Haines Customs measured 22.3 inches of snow falling primarily between midnight and 7am, then estimated another 6 inches before it changed to rain at 1025am. Approximately a 12-hour event with 28.3 inches of snow. Snow changed to rain near town much earlier.
25-Feb-2020	Heavy Snow	An east to west frontal band moved northward over the region spreading snow across the northern Lynn Canal region. Multiple reports of heavy snow in and around Haines as well along the highway to the customs Station. Snowfall of 6 to 8 inches had fallen by early morning on the 25th, and by the morning of the 27th the Haines Customs Station reported a two-and-a-half-day total of 26 inches and the COOP observer in Haines had received 21.9 inches.
8-Apr-2020	Heavy Snow	Low pressure moved NE into the northern Gulf of Alaska. The associated warm front and long fetch of moisture reached the panhandle during the nighttime hours, causing heavy snow over the Yakutat, Haines and Skagway areas. Dry air in place ahead of the system allowed temperatures to cool enough for snow. Spotters and the COOP Observer in the Haines area measured 6 to 7.5 inches of wet snow before it changed to rain. Along the hillside, up to 320 feet in elevation, measurements of 10 to 13 inches were reported. Haines Customs measured 5.5 inches.
1-Nov-2020	Blizzard	Deep low pressure tracked northward along the outer coast causing impacts across Southeast Alaska beginning Halloween night through November 2nd. High Winds were felt over the outer coast and heavy rain caused rivers to rise out of their banks across the southern half of Southeast Alaska with minor impacts. The ground was already saturated by moderate to heavy rain leading up to November 1 and 2 with amounts ranging from 5 to 9 inches. Multiple mudslides occurred near steep terrain after rain amount of 3.5 inches over 36 hrs along with wet antecedent soil conditions, The Haines ASOS reported heavy snow and visibility quickly falling to 1/4 mile at the beginning of the event. Meanwhile the wind was already reporting gusts of around 30 mph and marine points further south were reporting much higher winds. These conditions continued into the next morning with the ASOS exceeding wind gusts of 35 mph after 1 AM. Haines DOT reported blizzard conditions, blowing and drifting snow on the highway. Haines Customs reported 14 inches of snow in 24 hours and the Co-Op and spotters around town and Mud Bay measured 16 to 22 inches with mention of blowing and drifting snow.
1-Dec-2020	Heavy Snow	A large plume of concentrated moisture or Atmospheric River (AR) with an associated low-pressure system moved across the Pacific Ocean and transported tropical moisture from the southwest which impacted Southeast Alaska (SEAK) from December 1st through December 2nd. This event brought widespread significant, and sometimes historic record setting rainfall to locations across Southeast Alaska. Rainfall amounts were as high as over 15 at Little Port Walter with most other locations reporting 5 to 12 over the 2 days. Juneau, Skagway and Haines airports broke their all-time daily precipitation record on December 1st along with the all-time 2 day total when both days are combined. Rainfall intensity recurrence intervals ranged from a 50 to 200 year event when looking at 6,12,24,48 hour time periods. In some locations the precipitation started out as snow, minor accumulations but then changed quickly over to moderate/heavy rain. Significant snowfall did occur mainly at high elevations and along the Haines and Klondike highways before transition to rain as temperatures rose above freezing all the way up to 6000 feet with the impacting warm front. Snow accumulations were very impressive from December 1st into the 2nd with 18 at 800 feet near the Haines US customs border station and a staggering 59 at 2560 feet on Mount Ripinski above Haines. There was persistent precipitation that occurred the previous weeks to keep the soils on the wet side. The heavy precipitation and warm temperatures melted snow that had already accumulated on the ground at sea level then as the snow level climbed above the mountain top this increased the amount of runoff significantly from the mountains. All the excess runoff resulted in significant and in places record flooding of roads and homes, erosion that damaged roads and infrastructure, and widespread mass wasting events such as landslides and debris flows. Most of these impacts were reported to have started in the early morning hours of December 2nd and persist into December 3rd or longer. The northern half of Southeast Alaska saw most if not all of these impacts with a few specific rivers, Salmon River in Gustavus and Jordan Creek in Juneau,

		seeing record river stage values. Widespread damaging debris flows impacted Juneau, Skagway and Haines that took out roads, destroyed homes and caused 2 fatalities in Haines. To go along with the heavy precipitation there was also very strong damaging winds as the waves moved along the front over the panhandle. These strong winds damaged power lines from falling trees. In total there were about 7 communities (Haines, Juneau, Skagway, Gustavus, Hoonah, Tenakee Springs, and Hyder) that declared a disaster from this event. U.S. Border Patrol at Haines Customs measured 12.8 inches of heavy wet snow.
1-Dec-2020	Debris Flow	As the atmospheric river moved over the far north central inner channels of Southeast Alaska it produced significant amount of precipitation from December 1st-2nd. Heavy to moderate rainfall persisted over 48 hours with the highest amounts coming during the afternoon hours of December 1 through late morning of December 2nd. By mid-morning on December 1st, near 2 of precipitation already fell. The snow levels were low at the start of the event with a few inches at sea level in Haines but as much as 12 was reported at 800 feet by the Haines40NW COOP and 20 at the 2500-foot Flower Mt SNOTEL site by the morning of December 1st. Closer to Haines, the Ripinski ridge weather station at 2560 feet reported an estimated snow accumulation of near 59 from before the warm air moved into the area. The snow level rose rapidly through the evening of December 1st to be above the mountain tops by the early morning hours of December 2nd. This warming at elevation melted the fresh snow that fell with Ripinkis Ridge losing close to 30 and Flower Mt losing near 20 by the afternoon of December 2nd. By the end of December 1st, the Haines airport reported a 24 hour precipitation amount of 5.49 which was a 25 to 50 year event and broke the all-time daily precipitation record from 1946. The Haines COOP reported at 7am AKST on December 2nd a 24-hour amount of 6.62 which also broke the all-time daily precipitation record from 2005. Haines40NW COOP along the Haines Hwy reported at 7am AKST on December 2nd a 24-hour precipitation amount of 5.23 a new all-time daily precipitation record beating out 1999 and a 25 year event. From December 1st to the 2nd precipitation amounts from the downtown Haines COOP were 8.54, Haines Airport 10.26, a 200-500 year event, and the Haines40NW COOP 8.12, a 50-100 year event, were all time 48 hours precipitation records. From December 1st to 3rd 10 to 10.50 of precipitation fell from downtown Haines to the Haines border with a 100-to-200-year event. All of this heavy rainfall and snow melt produced significant impacts in the Haines area. In the early hours of December 2 after all-time record rainfall, saturated soils, and a deep snowpack, a second impulse of heavy precipitation moved over the area, and the snow level rose above 2500ft. The rising snow level began to melt the fresh snowfall at high elevation to produce significant amount of runoff that overwhelmed drainage ditches and culverts. The intense runoff began to erode the roads at the base of Ripinski Ridge and by day break there was significant infrastructure damage to all roads near Ripinski ridge which left Piedad Rd, Cathedral View Dr, Allen Rd, Comstock Rd, 4th ave, Young Rd to name a few that were impassable as the roads were washed away from erosion. There was also significant flooding away from the steep terrain from poor drainage not keeping up with the amount of runoff. Up to 4 feet of water flooded the Haines Hitch-Up RV park along with flooding across places at the Haines airport essentially closing it down to flights. To go along with the major road infrastructure damage there were a number of significant major debris flows from the intense precipitation, super saturated soils and strong winds to help trigger the slides that blocked roads and damaged homes near steep terrain. Haines was cut off from the Canadian Border and the airport due to debris flows blocking the Haines Hwy. There were also multiple debris flows along Lutak Rd that damaged the Lutak fuel Dock, blocked the road in multiple locations and isolated residence in a subdivision at the end of the road. A few homes at the end of Lutak Rd we significantly damaged from debris flows coming down behind their homes with one getting pushed off its foundation, another with debris in the house and another with minor damage. Mud Bay Rd was blocked by a debris flow which isolated another part of town. A large avalanche came down into Chilkat Lake out the Haines Hwy that damaged a few homes. Residence in the affected areas and other locations near steep terrain were evacuated to emergency shelters throughout the morning of December 2. Heavy rain continued into the afternoon hours and around 130pm AKST a massive landslide occurred along Beach Rd that took out a 200-yard section of the road, destroyed 2 homes while causing major damage to another. One of the destroyed homes was not occupied but the other had to 2 people inside. The 2 people perished from the landslide or what the geologist are calling a geologic mass wasting event. There were about a half dozen homes on the south side of the slide that were evacuated due to the threat of another very large landside. It continued to be very wet with

		freezing levels going up and down to keep increase runoff not just from the precipitation but also from snow melt for the next week with a 7-day total of 14.85 which is a near 150-year event. The continue precipitation on the super saturated soils kept the threat of more debris flows high through December 7th. There were some minor movements of a home near an old landslide from 2012 called the slump area. This was one of the most impactful flooding and debris flow event since 2005 or ever and the data backups extreme impacts. The city of Haines declared a disaster for this event from the widespread and extensive infrastructure damage, 2 homes destroyed, 7 homes with major damage, 16 homes with minor damage with another 12 home adversely affected from the area damage and the 2 deaths. The governor of Alaska also declared a disaster emergency for Southeast Alaska from the impacts of this event.
17-Dec-2020	Heavy Snow	A strong gale force low impacted Southeast Alaska producing widespread precipitation. Colder temperatures in the northern section of the panhandle allowed for heavy snowfall amounts to accumulate. Trained Spotter in Haines reported 12 inches of new snow at 8:30 am.
19-Dec-2020	Heavy Snow	A strong gale force low impacted Southeast Alaska producing widespread precipitation. Colder temperatures in the northern section of the panhandle allowed for heavy snowfall amounts to accumulate. Trained spotter reported 11.5 inches of snow in the last 19 hours.
23-Dec-2020	Heavy Snow	A strong front with damaging southerly winds and a long fetch of moisture moved over SE Alaska on Wednesday the 23rd. A wave formed along the front and caused moisture and winds to last the longest over the southern inner channels and Hyder. U.S. Customs at Haines highway border control station reported 14.4 inches of fresh snow at 7 am on December 23rd.
5-Jan-2021	Heavy Snow	A low-pressure system tracked northward with its associated front extending out over the eastern gulf and outer coast. E to SE winds increased with the front, then shifted to the south in the late afternoon and decreased. Haines United States Border Control Customs Station reported 12 inches of snow in 24 hours at around 8 pm.
9-Jan-2021	Winter Storm	A cold front quickly moved across northern Lynn Canal. Temperatures remained cold enough to cause heavy snow across the highways, while warm temperatures limited snow amounts along coastal cities. United States Border Patrol Customs Station on Haines highway reported 23 inches of new snowfall in 24 hours.
15-Mar-2021	Heavy Snow	A strong low-pressure system brought snow across the Icy Strait corridor and north. Quickly accumulating snow was measured throughout the northern panhandle. Trained spotter in Haines reported a storm total of 19 inches.

5.3.4.3 Location, Extent, Impact, and Recurrence Probability

Location

Haines Borough experiences periodic severe weather impacts. The most common to the area is heavy precipitation or excessive snowfall. A severe weather event would create an area-wide impact and could damage structures and potentially isolate Haines from the rest of the State.

Extent

Extreme weather could result in a critical situation in Haines. Injuries and/or illness could result from excessive rainfall or snowfall, and with high winds, cause shutdown of critical facilities, damage property and isolate Haines.

Impact

The intensity, location, and the land's topography influence a severe weather event's impact within Haines Borough. Extreme weather events such as rain, snow, wind or combinations of these conditions may immobilize transportation (e.g., all transportation: air, boat, road; even snow machine, and ATV traffic stops). Impacts can range from unfortunate to catastrophic. Essential supply deliveries, emergency response, medical transport, and critical emergency activities cannot resume until the weather clears and the population can move about safely.

Recurrence Probability

Alaska will continue to experience diverse and seasonal weather events. Increased rain is becoming more likely with climate change. Climate change is causing extremes of both heat and cold, resulting in unpredictability in how current and future residents prepare. Severe winter storms and rain events occur annually; therefore, the probability of a severe winter storm impacting the Borough is highly likely based on an annual occurrence. Highly likely equates to an event being probable within the calendar year or the event having up to one in one year's chance to occur (1/1 = 100%).

5.3.5 Tsunami/Seiche

5.3.5.1 Characteristics

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 one to three 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 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 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 locally-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.

There are three types of tsunamis:

Tsunami Types

Tele-tsunamis are observed at places 621 miles from their source. In many cases, tele-tsunamis can allow for sufficient warning time and evacuation. There is a slight risk in the western Aleutians and some parts of Southeast Alaska. Most tele-tsunamis that reached Alaska have not caused damage. In fact, Massacre Bay on Attu Island has historically received tele-tsunamis with less than one-foot recorded amplitudes.

Only one tele-tsunami has caused damage in Alaska; the 1960 Chilean tsunami. Damage occurred to pilings at MacLeod Harbor, Montague Island and on Cape Pole, Kosciusko Island where a log boom broke free.

Volcanic tsunamis result from a debris flow such as the 1883 event when a debris flow from the Saint Augustine volcano triggered a tsunami that inundated Port Graham with waves 30 feet high. Other volcanic events may have caused tsunamis, but there is not enough evidence to report that conclusively. Many volcanoes have the potential to generate tsunamis.

Seismically-generated local tsunamis typically occur along the Aleutian Arc. Other locations could potentially include the back arc area in the Bering Sea and the eastern boundary of the Aleutian Arc plate. They generally reach land within 20 to 45 minutes.

Landslide-generated tsunamis generally occur from a submarine or subaerial landslides which can generate large tsunamis. Subaerial landslides have more kinetic energy associated with them so they trigger larger tsunamis. An earthquake usually, but not always, triggers this type of landslide, and they are usually confined to the originating bay or lake location such as the historical 1958 Lituya Bay event and the more recent October 2015 700 foot-high landslide wave Taan Fjord event in Icy Bay. Very large landslide areas have been observed in surrounding mountains frequently in the past five years. Some have been notable enough to register on earthquake monitoring equipment thousands of miles from Haines.

Seiche waves oscillate in partially or totally enclosed water bodies. They are caused by earthquakes, underwater landslides, atmospheric disturbances or avalanches and can last from a few minutes to a few hours. The first wave can occur within a few minutes, giving virtually no warning time. The resulting effect is similar to bathtub water sloshing repeatedly from side to side. The reverberating water continually causes damage until the activity subsides. The factors for effective warning are similar to a local tsunami. Communities near large lakes, such as Lake Iliamna, may be vulnerable to seiche activity following an earthquake.

5.3.5.2 History

Notable tsunamis in Alaska include those resulting from the 1964 earthquake, a 1958 tsunami resulting from earthquake-induced ground failure in Lituya Bay in 1958, a 1946 earthquake-induced tsunami near Unimak Bay which destroyed the Scotch Cap lighthouse, and the 1957 Pacific-wide, earthquake-generated tsunami in the Aleutian trench impacted the western U.S. coastline and other pacific locations. A 1994 local submarine landslide-induced tsunami caused one fatality in Skagway.

There has been at least one confirmed volcanically-triggered tsunami in Alaska. In 1883, a debris flow from the Saint Augustine volcano (located on the west side of Lower Cook Inlet, approximately 60 miles east of, but on the other side of a mountain range) triggered a tsunami that inundated Port Graham with waves 30 feet high. Other volcanic events in Alaska may have caused tsunamis, but there is not enough evidence to report that conclusively.

Activities that provide mitigation against tsunami damages are usually related to removing vulnerable populations; providing protective shoreline shelters; and designating tsunami safe areas, alert and warning activities, and public education.

Haines has not been struck by a damaging tsunami in recent history; however, they, like several southeast Alaska communities, have experienced debris from distant tsunamis such as the 2011 Japan tsunami. Tsunamis are unpredictable and can occur with little warning. All communities with a tsunami risk listed should be considered at risk whether they have a recorded instance of tsunami damages or not.

On January 23, 2018, a 7.9 magnitude earthquake occurred near Kodiak, and a tsunami warning was issued. However, a tsunami did not occur in Haines Borough. The community did successfully evacuate using a door-to-door notification system as well as the police chief driving throughout the community notifying residents with a bullhorn. A tsunami evacuation center has been set up at the airport.

5.3.5.3 Location, Extent, Impact, and Recurrence Probability

Location

Tsunamis are very unpredictable. Distant source tsunamis can only be predicted once they are generated, and then only have a warning time of an hour or less. Locally-generated tsunamis, such as landslide or volcanically- induced tsunamis happen very suddenly and cannot be predicted at all.

Figure 12 depicts the tsunami hazard by community developed by the National Tsunami Warning Center. The map designated Haines as having a low tsunami hazard.

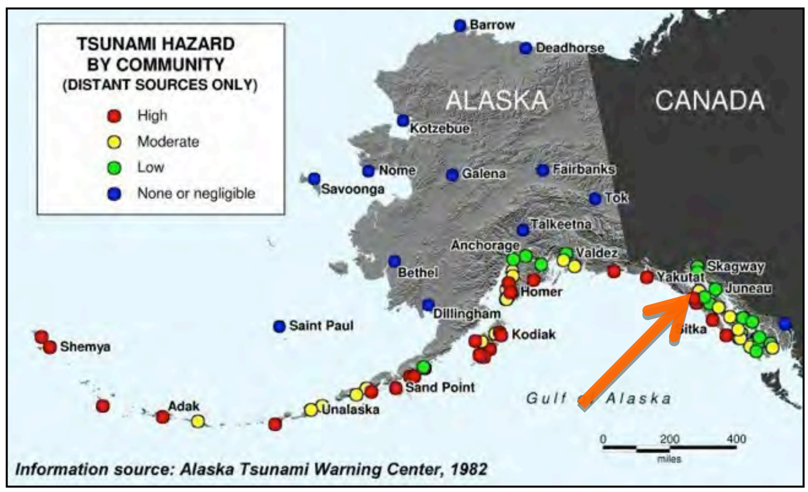

Figure 12. Tsunami Hazard Communities

Extent

Alaska Department of Natural Resources scientists completed surveys in 2018, and Figures 13 and 14 show the results of inundation mapping for Haines and Portage Cove from tectonic and landslide sources.

Major tsunami effects from earthquakes near, or outside, the region is less likely due to the location of Haines Borough at the end of a long fjord. Haines's location 100 miles up the Lynn Canal, with sheltering from the Chilkat Islands and Peninsula, will tend to dissipate the energy of distant oncoming tsunami shock waves. The Anchorage earthquake of 1964, with its destructive tsunami effects in the outside waters coastal zone, created only several additional tidal bounces in the upper Lynn Canal of magnitude close to the normal daily tidal extremes at the time.

A tsunami in Haines could be of a limited extent. Haines has been designated by DHS&EM and DGGS as having a low potential for a Pacific-wide tsunami. It is possible for an event that could cause injuries and property damage.

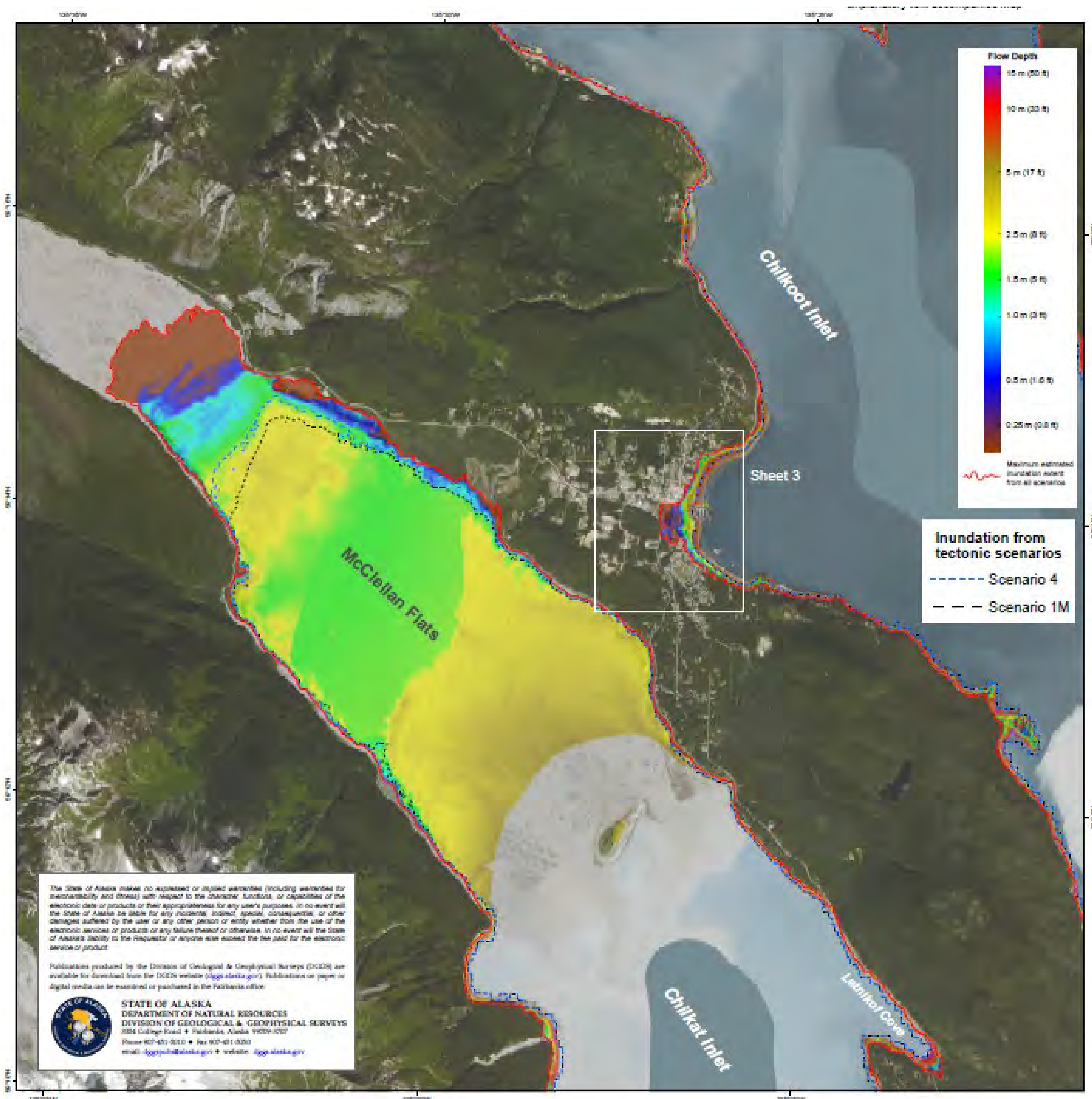

Figure 13. Maximum Estimated Tsunami Inundation, Haines, Alaska

Impact

A tsunami event in Haines could damage infrastructure that is located along the shoreline in the community, and within the flood zones described above. A tsunami event in Haines could isolate the community from other areas of the State and cause widespread damage.

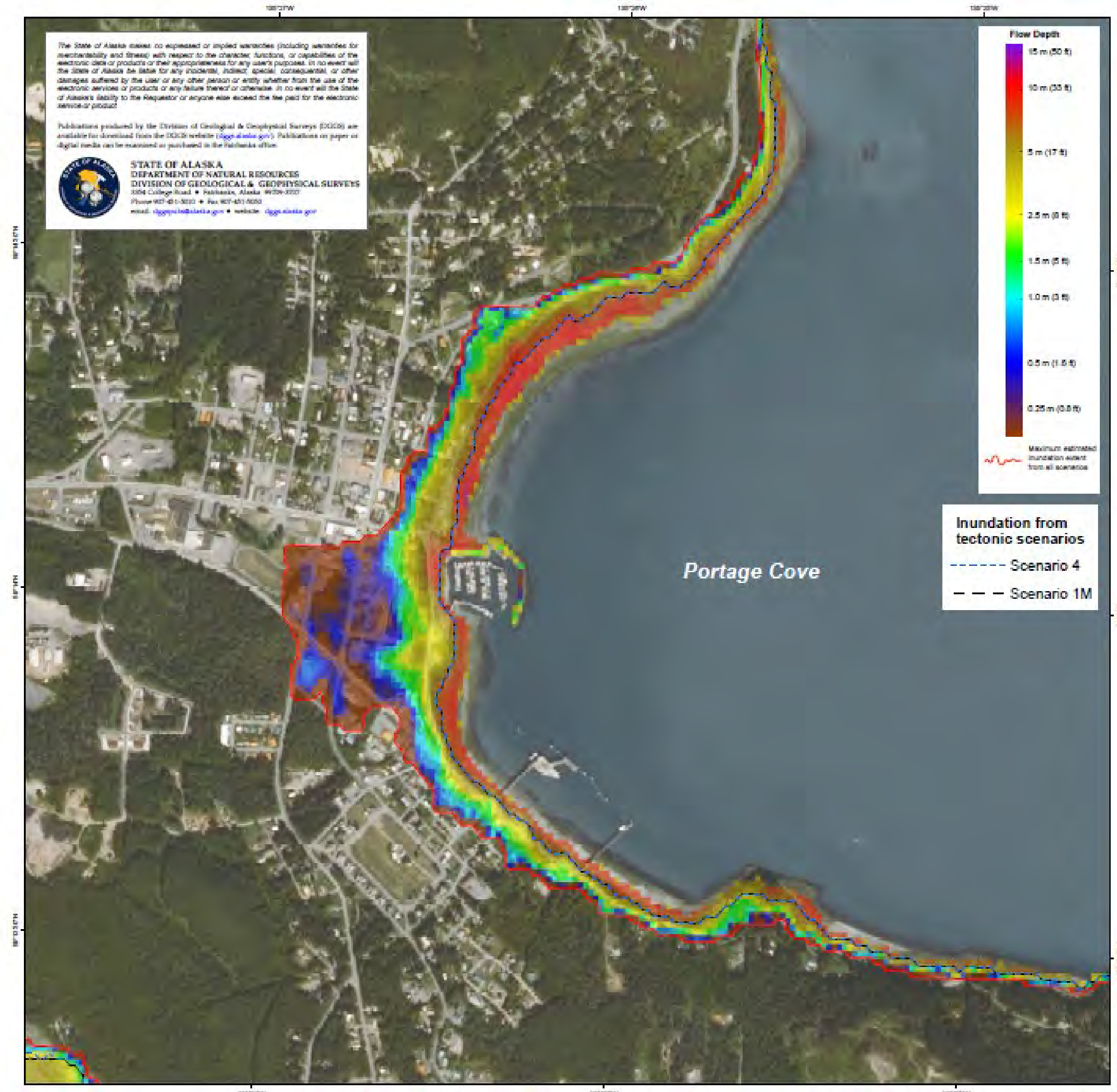

Figure 14. Maximum Estimated Tsunami Inundation, Portage Cove, Haines, Alaska

Early warning could mitigate some of the impacts. However, the devastating Indonesian tsunami of 2004 illustrated how difficult it is to provide advance warning of even active tsunamis. Many communities could not be reached in time to warn them of the threat.

On January 23, 2018, a 7.9 M earthquake occurred near Kodiak, and a tsunami warning was issued. However, a tsunami did not occur in Haines Borough although small (under six-inch) waves were observed visually. Luckily, both warnings were unnecessary as tsunamis did not actually occur, but Alaskan communities should be aware that advance warning of tsunami waves may not reach them when necessary. Therefore, it is important for all communities to be watchful for tsunami warning signs, especially when an earthquake or volcanic eruption occurs.

One earthquake can trigger multiple landslides and landslide-generated tsunamis. Low tide is a factor for submarine landslides because low tide leaves part of the water-saturated sediments exposed without the water's support. "Loading" generally causes an area's instability from added weight such as large structures, or added fill material used to reclaim land for future development.

Recurrence Probability

Based on history and the location of Haines Borough at the end of a long fjord, it is unlikely that a tsunami will occur. Unlikely equates to the event having less than 10% chance of occurring.

5.3.6 Ground Failure

5.3.6.1 Hazard Characteristics

Ground failure describes landslide, subsidence, and unstable soils gravitational or other soil movement mechanisms. Soil movement influences can include rain, snow, and/or water saturation-induced landslides; as well as from seismic activity, 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 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, 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; and
- Climate change-related drought conditions may increase wildfire conditions where a wildland fire consumes essential stabilizing vegetation from hillsides, significantly increasing runoff and ground failure potential.

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

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

Slides, the more accurate and restrictive use of the term landslide, refers to a mass movement of material, originating from a discrete weakness area that slides from stable underlying material. A *rotational slide* occurs when there is movement along a concave surface; a *translational slide* originates from movement along a flat surface.

Debris Flows arise from saturated material that generally moves rapidly down a slope. A debris flow usually mobilizes from other types of landslide on a steep slope, then flows through confined channels, liquefying and gaining speed. Debris flows can travel at speeds of more than 35 mph for several miles. Other types of flows include mudflows, creeps, earth flows, debris flows, and lahars.

Lateral Spreads are a type of landslide that generally occurs on gentle slope or flat terrain. Lateral spreads are characterized by liquefaction of fine-grained soils. The event is typically triggered by an earthquake or human-caused rapid ground motion.

Falls are the free-fall movement of rocks and boulders detached from steep slopes or cliffs.

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

Complex is any combination of landslide types.

In Alaska, earthquakes and seasonally-frozen ground are often agents of ground failure. 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 roadbeds;
- 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.

5.3.6.2 Climate Factors

Studies show that changing climate conditions can increase the frequency of fast-moving, catastrophic landslides. Alaska's warming surface temperatures are impacting slope stability and increasing a variety of ground failure risks. Warming climate has caused many areas to become unstable, and future warming will increase landslide risk.

Population growth and the expansion of settlements and lifelines over potentially hazardous areas are increasing the likelihood of landslide impacts. Additionally, increased water from thawing amplifies the potential for ground failure slides, flows, and creep.

5.3.6.3 Related Hazards

Ground failure is associated with many other hazards because these hazards can directly initiate mass movement or destabilize slopes, making them more susceptible to failure. For example,

- Flooding can add weight to a surface (through water and sediment), causing it to be overloaded and unstable.
- Erosion can remove material at the base of a steep slope, resulting in loss of lateral support.
- Shaking from earthquakes commonly initiates a variety of ground failures.

5.3.6.4 Hazard History

Two landslide events have been recorded in Haines Borough in the past decade. One slow-moving landslide damaged homes and public infrastructure in January 2012.

> *Commencing on January 16, 2012, and continuing, a geological event occurred in the Haines Borough. The hillside immediately above the Lutak Road approximately ¾ mile from Haines, slowly moved downhill, undermining and cracking homes, public utilities, and transportation infrastructure along portions of the Oceanview and Lutak Roads, and Front Street. The Haines Borough, along with State and contracted engineers, monitored the slope and evaluated potential steps to address the issue. On February 3, the Haines Borough adopted Resolution 12-02-330 declaring a local disaster and requesting state assistance for repairs and temporary housing* (Haines Borough, 2015).

In December 2020, a record-breaking rainfall triggered dozens of landslides throughout the Haines Borough, including a large landslide down Battery Hill, approximately 600 feet wide and 2,500 feet long, that swept through the Beach Road residential neighborhood, killing two residents. The initial devastation of the landslide was compounded by continuing bad weather; uncertainty about slope stability led to restricted road access to homes, furthering hindering recovery efforts described by local residents and news reports.

> *About 50 households have evacuated, and Haines officials over the weekend told many more to be prepared to leave at a moment's notice. The Coast Guard remained on the ground to assist with landslide evacuations as needed, Fullerton said.*
>
> *Geologists hired by the borough and dispatched by the State also stayed to continue to study area hillsides, working to determine whether additional landslides are likely.*
>
> *A flash flood watch was in effect for Haines through 4 p.m. Tuesday. Borough officials said they want to repair as many utilities as possible before freezing weather arrives midweek.*
>
> *Nearly a week after the first landslides, some homes remained vacant, their interiors wrecked by mud or water. Some roads were still impassable, and waterfalls cascaded down normally dry cliffs. Mud and slush sucked at boots, and even in untouched homes,*

residents have packed bags in case of emergency evacuation.

Continued heavy rainfall has caused what one displaced resident, Greg Schlachter, described as "fatigue on all different levels."

"There'd be fatigue in this scenario even if the weather was fine right now because there'd be such a massive cleanup effort around town," Schlachter said. "But it was blowing 40 mph today and raining an inch an hour at times. The road crews can't stop plugging culverts, let alone rebuild the roads." (ADN, 2020b).

Evacuations lead to months-long displacement of Beach Road residents as slope stability was assessed for a decision about putting in a temporary road access.

State and local officials in Haines are hiring a consultant to assess ongoing hazards caused by a landslide that swept across Beach Road. Meanwhile, some displaced residents say they're still cut off from their properties and in the dark about what comes next.

They're checking their property on foot. Debris still blocks the road, and homes have been cut off from the power grid.

The Haines Borough closed the 2,000-foot stretch of Beach Road affected by the slide due to safety concerns. Initially, it threatened to prosecute anyone entering the closed area. After meeting with residents, Mayor Douglas Olerud decided that Beach Road residents may cross — but only at their own risk.

The Haines Borough and DOT/PF are contracting a geotechnical engineering consultant to assess the landslide hazard and see if a temporary road is even feasible.

Aerial surveys of the slide revealed a large crack in the hillside above Beach Road. During a meeting to update Beach Road residents last week, Deanne Stevens with the Alaska Division of Geological and Geophysical Surveys said there are still questions about the kind of risk it poses.

"At this point, with the little bit of data that we have, we can't say if it's towards the smaller end of the possible spectrum or towards the larger end. We also don't know if it does fail, what's the actual nature of how it will fail? Which way will it tip if it goes? Will it go down the same route as the Beach Road slide or will it go off to the south?" Stevens said (KHNS, 2021).

Location

There are various ground failure locations throughout Haines Borough. A map is being developed to indicate these locations (Section 7.4).

Extent

The damage magnitude could range from minor with some repairs required and little to no damage to transportation, infrastructure, or the economy to major if a critical facility (such as the airport) were damaged, and transportation was affected. Lives were lost in 2020.

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 may. Ground failure damage occurs from improperly designed and constructed buildings that settle as the ground subsides, resulting in structure loss or expensive repairs. It may also impact buildings, communities, airfields, as well as road design costs and location. To avoid costly damage to these facilities, careful planning and location and facility construction design is warranted.

Haines' 2012 Comprehensive Plan described the area's threat from landslide events as,

> *Landslides occur frequently in Haines, but rarely impact development. Landslides occur on or adjacent to steep slopes where unconsolidated soils, talus deposits, and overburden overlay bedrock or impermeable soils. Most are small, and occur away from currently developed and inhabited areas. Landslides and mixed mud and debris occur during or after periods of extreme precipitation. Small landslide and debris accumulations occur along the steep mountain front north and northwest of Haines, and along the fjord walls of the Chilkoot and Lutak Inlets. In the late 1890s, a landslide virtually eliminated a Native village at 19-mile Haines highway. Rock slides from this same area impact the Haines Highway annually requiring cleanup. Stabilization in this area is needed as the highway is improved* (Haines Borough, 2012).

In 2020, two lives were lost. The community has been forever changed by the landslide.

Recurrence Probability

Ground failure impacts for the Haines area may recur annually, impacting residential and public structures and roads. The probability of another landslide due to the effects of changes in the cryosphere impacting the Borough is highly likely based on an annual occurrence. Highly likely equates to an event being probable within the calendar year or the event having up to one in one year's chance to occur (1/1 = 100%).

5.3.7 Wildfire and Conflagration Fires

During the five-year period spanning 2013 through 2018, over 82 fire-related fatalities were recorded in Alaska. Also during that time, the State declared over 3,077 fire-related emergencies or disasters. Firefighter and public safety are the primary concern of each local and fire response agency. In Alaska, thousands of acres burn every year in 300 to 800 fires, primarily between the months of March and October. According to the Alaska Interagency Coordination Center (AICC), 7,815,368 acres were burned from 2013 to 2017. This figure consisted of the 2,408 wildland fires that started throughout that same time period. This is an average of 3,246 acres per wildland fire (DHS&EM, 2018).

For the purposes of profiling this hazard, fires are characterized by their primary fuel sources into two categories:

- Wildland fire, which consumes natural vegetation.
- Community fire conflagration, which propagates among structures and infrastructure.

Fires in the Borough tend to be rare although may increase with climate change.

5.3.7.1 Hazard Characteristics

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

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

- Topography: As slope increases, the rate of wildland fire spread increases. South-facing slopes are also subject to more solar radiation, making them drier, and thereby, intensifying wildland fire behavior. However, ridgetops may mark the end of wildland fire spread since fire spreads more slowly or may even be unable to spread downhill.
- Fuel: The type and condition of vegetation plays a significant role in the occurrence and spread of wildland fires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the "fuel load"). The ratio of living to dead plant matter is also important. Climate change is deemed to increase wildfire risk significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel load continuity, both horizontally and vertically, is also an important factor.
- Weather: The most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity. By contrast, cooling and higher humidity often signal reduced wildland fire occurrence and easier containment. Climate change increases the susceptibility of vegetation to fire due to longer dry seasons.

The frequency and severity of wildland fires is also dependent on other hazards, such as lightning, drought, human causes, and infestations. If not promptly controlled, wildland fires may grow into an emergency or disaster. Even small fires can threaten lives and resources and destroy improved properties; they can also impact transportation corridors and/or infrastructure. In addition to affecting people, wildland fires may severely affect livestock and pets. Such events may require emergency water/food, evacuation, and shelter.

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

Wildland urban interface (WUI) fires are very difficult to control. Complicating factors are wind, temperature, slope, proximity of structures, and community firefighting capability, as well as building construction and contents. Additional factors facing response efforts are hazardous substance releases, structure collapses, water service interruptions, unorganized evacuations, and loss of emergency shelters. Historical national conflagration examples include the Chicago City Fire of 1871 and the San Francisco City Fire following the 1906 earthquake. In 2018, the deadliest and most destructive wildfire in California encompassed 20,000 acres, killed 85 people, and almost completely incinerated the town of Paradise. The fire was sparked by transmission lines owned by Pacific Gas & Electric. Dry vegetation and high winds caused extreme rates of spread.

5.3.7.2 Fire Management in Alaska

Alaska has a Master Cooperative Wildland Fire Management and Stafford Act Response Agreement. As a result, fire management is the responsibility of three agencies: Division of Forestry (DOF), BLM (through the Alaska Fire Service), and U.S. Forest Service (USFS). Each agency provides firefighting coverage for a portion of the State regardless of land ownership. These agencies have cooperated to develop a state-wide interagency wildland fire management plan. Wildland fire suppression in the upper Lynn Canal is the responsibility of the State of Alaska DOF in cooperation with all local Fire Departments.

Alaska's statutory wildfire season normally begins on April 1 and ends on August 31. Extension of the fire season under State law means that small- and large-scale burn permits are required for open debris burning or the use of burn barrels through September 30. With several wildfires burning in Southcentral Alaska in 2019 and high fire danger persisting due to continued warm, dry conditions, the DNR Commissioner announced that Alaska's statutory wildfire season in 2019 would be extended from August 31 to September 30. This was the first time the fire season was extended since 2006 legislation shifted the five-month season to start and finish one month earlier. The one-month extension was necessary to ensure public safety. While acreage burned in the 2019 fire season falls well below the record season of 2004, when approximately 6.6 million acres burned, it marked the fifteenth time in 80 years of records that Alaska saw more than two million acres burn in a single season. During the 2019 fire season, 682 fires burned more than 2.5 million acres in Alaska.

5.3.7.3 Climate Factors

According to the Global Climate Change Impacts in the U.S., published in 2009 by the U.S. Global Change Research Program, "Under changing climate conditions, the average area burned per year in Alaska is projected to double by the middle of this century. By the end of this century, area burned by fire is projected to triple under a moderate greenhouse gas emissions scenario and to quadruple under a higher emissions scenario" (DHS&EM, 2018).

Since 1990, Alaska has experienced nearly twice the number of wildfires per decade compared to a period from 1950 to 1980. Additionally, the sparsely-populated arctic region experienced only three wildfires over 1,000 acres

5.3.7.4 History

Soil conditions and abundant rainfall combine to make wildland fires relatively small in Haines

Borough. A review of historic wildland fire data on the Alaska Interagency Coordination Center website shows only one wildland fire of significant size (i.e., “2005” fire). However, input from community members identified half a dozen large wildland fires that occurred over the past 50 years in the Borough. Some of these fires were large enough to require firefighting crews be brought in from outside the region.

5.3.7.5 Location, Extent, Impact, and Recurrence Probability

Location

Haines Borough has a very high to extreme risk for wildland fires (Figure 15) according to the 2018 SHMP. As it is widely populated with spruce, birch, and cottonwood trees, there is ample fuel available for wildland fires throughout the Borough (DOT&PF, 2006). Although spruce bark beetles have not yet impacted forests in Haines Borough to the extent seen in other areas of the State, there is concern that prevalence of beetle-killed trees may increase, particularly as ambient temperatures continue to warm.

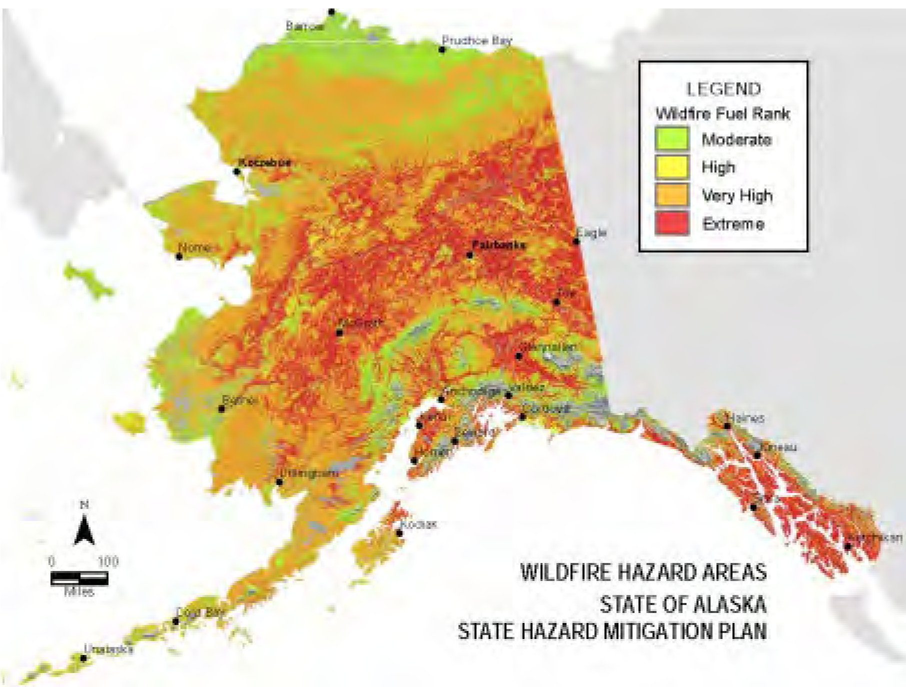

Figure 15. Wildland Fire Risk

Extent

Generally, the core fire season for the Borough is from June 1st to July 31st. Rain typically starts in the late summer and early fall, which reduces the chance of fire ignitions. However, various other factors, including humidity, wind speed and direction, fuel load and type, and topography can contribute to the intensity and spread of fires. The common causes of fires in Alaska include lightning strikes and human negligence.

Fuel, weather, and topography influence fire behavior. Fuel (e.g., slash, dry undergrowth, flammable vegetation) determines how much energy the fire releases, how quickly the fire spreads, and how much effort is needed to contain the fire. Weather is the most variable factor. High temperatures and low humidity encourage fire activity while low temperatures and high humidity retard fire spread. Wind affects the speed and direction of fire spread. Topography directs the movement of air, which also affects fire behavior. When the terrain funnels air, as happens in a canyon, it can lead to faster spreading. Fire also spreads up slope faster than down slope. The fuels in Haines Borough are mostly thick, green forests of black cottonwood, birch, and Sitka spruce. Spruce forests, whether live or dead, are both flammable and provide radiant heat and ember spot fires that advance fire through air convection.

Impact

As of November 23, 2019, wildfires burned more than 2.68 million acres during the 2019 wildfire season in Alaska. The cost of fighting 2019's Alaska wildfires topped $300 million, and State and Local officials say the final tally may not be known for years (ADN, 2019). This total does not include the cost to Alaskans who saw their land torched and their homes burned. Through November 21, Alaska DOF recorded $224.9 million in firefighting expenses for 2019. The U.S. Department of Interior reported $72 million. The USFS—an agency of the U.S. Department of Agriculture—reported $7 million in expenses through November 18, 2019.

Impacts of a wildland fire that interfaces with the population center could grow into an emergency or disaster if not properly controlled. A small fire can threaten lives, homes, resources, and destroy property. In addition to impacting people, wildland fires may severely impact livestock and pets. Such events may require emergency watering and feeding, evacuation, and alternative shelter.

Indirect impacts of fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, thus increasing flood potential, harming aquatic life, and degrading water quality. Haines Borough is surrounded by highly flammable spruce forest through which fire travels quickly. Fire could destroy the entire community of Haines, especially if the fire is wind-driven. Additionally, the community could easily be cut off from egress as there is only one road connecting Haines to the Haines Junction, Yukon, Canada via the Haines Highway. If fire causes this road to be impassible, there is no way for residents to evacuate the community.

Recurrence Probability

Increased community development, fire fuel accumulation, and weather pattern uncertainties indicate that the probabilities of wildfire may increase in the future. The probability of future events in Haines Borough is moderate based on a 1 in 10-year occurrence.

6.0 Vulnerability Analysis

6.1 OVERVIEW OF A VULNERABILITY ANALYSIS

A vulnerability analysis predicts the extent of exposure that may result from a given hazard event and its impact intensity within the Haines Borough. This qualitative analysis provides data to identify and prioritize potential mitigation measures by allowing the Borough to focus attention on areas with the greatest risk. A vulnerability analysis is divided into three focus areas:

1. Asset Inventory;
2. Vulnerability and Losses from Identified Hazards; and
3. Development Changes and Trends.

DMA 2000 requirements for developing risk and vulnerability assessment initiatives are described below.

DMA 2000 Requirements: Risk Assessment, Assessing Vulnerability, Overview
Assessing Vulnerability: Overview **§201.6(c)(2)(ii):** The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of: **§201.6(c)(2)(ii)(A):** The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas; **§201.6(c)(2)(ii)(B):** An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate. **§201.6(c)(2)(ii)(C):** Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.
Element ▪ Does the updated plan include a description of the jurisdiction's vulnerability to each hazard? ▪ Does the updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard? ▪ Does the updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas? ▪ Does the updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas? ▪ Does the updated plan estimate potential dollar losses to vulnerable structures? ▪ Does the updated plan describe the methodology used to prepare the estimate?
Source: FEMA, 2015.

6.2 ASSET INVENTORY, VULNERABILITY, AND LOSSES

6.2.1 Asset Inventory

Assets that may be affected by hazard events include population (for community-wide hazards), residential buildings, and critical facilities and infrastructure. Assets are grouped into two structure types: critical infrastructure and residential properties. The assets and associated values throughout the Borough are identified and discussed in detail in the following subsections.

6.2.1.1 *Population and Building Stock*

Population data for Haines was obtained from the 2019 U.S. Census's estimates and the DCCED. The U.S. Census reports Haines Borough's total population at 2,518, and the 2019 DCRA-certified data showed a population of 2,516 residents (Table 12).

Table 12. Estimated Population and Building Inventory

Population		Residential Buildings	
2019 Census	**DCRA, 2019 Data**	**Total Building Count**	**Total Value of Buildings**
2,518	2,516	1,691	U.S. Census: $429,514,000 Haines: $591,850,000

Sources: U.S. Census 2019, and 2019 DCRA population data. U.S. Census listed median housing value at $254,000.

The Planning Team determined that the average structural replacement value of all single-family residential buildings is $350,000.

The Planning Team stated that residential replacement values are generally understated because replacement costs exceed 2019 U.S. Census structure estimates due to material purchasing, barge or airplane delivery, and construction in rural Alaska. The Planning Team estimates an average 30 feet by 40 feet (1,200 sq. ft) residential structure costs $350,000. A total of 1,691 single-family residential buildings were considered in this analysis.

Of the 1,909 residents aged 16 and over in 2019, 1,240 were employed. According to the U.S. Census Bureau's *2015-2019 American Community Survey 5-Year Estimates,* the Median Household Income was $58,059 with a margin of error +/- $11,237, and the per capita income is $31,731 +/-$4,336.

The total value of property in Haines has been decreasing slowly over time (Table 13).

Table 13. Taxable Real Property in Haines Borough

Year	Taxable Value of Residential Property	Number of Dwellings	Average Value per Dwelling
2019	$363,775,393	2,660	$136,758
2018	$346,641,900	*2,650* (est)*	*$130,808*
2017	$347,097,000	*2,640* (est)*	*$131,476*
2016	$337,606,400	*2,625* (est)*	*$128,612*
2015	$327,681,800	2,608	$125,645

Source: DCCED/DCRA, 2021b

6.2.1.2 *Critical Infrastructure*

Critical infrastructure is defined as a facility that provides essential products and services to the general public, such as preserving the quality of life while fulfilling important public safety, emergency response, and disaster recovery functions. Critical facilities and infrastructure for the Borough are profiled in this HMP Update and include the following (Table 14):

- Government facilities: Borough administrative offices, departments, or agencies;
- Emergency Response: police department and firefighting equipment;
- Educational facilities, including K-12;
- Health Care facilities: hospitals, medical clinics, congregate living health, residential and continuing care, and retirement facilities;
- Community gathering places: community and youth centers; and
- Utilities: electric generation, communications, water and wastewater treatment, and landfills.

Critical facilities were identified in the 2015 HMP Update, and the Planning Team confirmed there have been no changes (Table 14). Table 14 identifies each asset's vulnerability to identified natural hazards such as a low, moderate, or high vulnerability to a specific natural hazard. Figure 16 shows some of the critical facilities from the 2015 HMP Update. The Borough does not have any updated maps that show other critical facilities not on this original figure. Dollars values are provided for Borough-owned structures and have not changed since the 2015 HMP Update. Table 15 summarizes the results of the vulnerability analysis.

Table 14. Haines Borough Critical Facilities

Facility Type	Facility	Address	Latitude	Longitude	Estimated Value	Building Type	Cryosphere	Earthquake	Flood/Erosion	Ground Failure	Severe Weather	Tsunami	Wildfire
Government	ADFG (No. 2 on Fig. 16)	Haines Hwy/Main St						M			H		
	Borough Office (No. 11 on Fig. 16)	S 3rd Ave			$1,523,080	Frame		H			H	L	
	Human Resources				$200,000	Frame		H			H		
	DOT (No. 17 on Fig. 16)	Union St						H	M		H		
	Public Works Shop	N 5th Ave						H			H		
	Maintenance Shop				$450,000	Frame		H			H		
	New Maintenance Shop (No. 24 on Fig. 16)				$1,186,800	Metal Frame		H			H		
	FAA Tank/ Inst Bldg				$1,649,952	Mixed		H			H		
	Post Office (No. 23 on Fig. 16)	Haines Highway						H	M		H	L	
	Court/DMV												
Transportation	Airport (No. 1 on Fig. 16)	Haines Hwy/Airport Rd	59.2438292	-135.5235375				H	M		H		
	Haines Highway						H	H	H	H	H		H
	Small Boat Harbor (No. 20 on Fig. 16)	N Front St						H			H	L	
	Letnikof Boat Harbor							H			H	L	
	Port Chilkoot Dock (No. 25 on Fig. 16)	Portage St			$5,565,000	Frame		H	M		H	L	
	Port Chilkoot Dock Bathroom	Portage St			$376,500	Frame		H	M		H	L	
	Haines/Skagway Ferry and State Ferry Terminal (No. 26 on Fig. 16)	Beach Rd						H			H	L	
	Harbor Restrooms				$160,000	Frame		H			H		
	Lutak Dock							H			H	L	
	CIA Dock							H			H	L	
[illegible]	Public Safety Bldg	Haines Hwy/S 2nd Ave			$4,820,000	Frame		H			H	L	

Facility Type	Facility	Address	Latitude	Longitude	Estimated Value	Building Type	Cryosphere	Earthquake	Flood/Erosion	Ground Failure	Severe Weather	Tsunami	Wildfire
	(Police /Fire Department) (No. 21 on Fig. 16)												
	Fairgrounds (Evacuation Center)							H			H		
	Mosquito Lake Firehall				$1,064,500	Non-Combust		H			H		
Education	Head Start (No. 4 on Fig. 16)	Spruce Grove Rd						H	M		H		
	Mosquito Lake School							H			H		
	Haines School (No. 9 on Fig. 16)	Haines Hwy						H			H		
Medical	Clinic (No. 19 on Fig. 16)	S 1st Ave						H	M		H	L	
Community Facilities	Laundromat (No. 3 on Fig. 16)	Haines Hwy						H			H		
	Salvation Army/Food distribution							H			H		
	Veterans Village (No. 5 on Fig. 16)	Dalton St						H			H		
	Eagle's Nest Motel							H			H		
	ANB Hall							H			H		
	Fort Seward							H			H		
	Olerud's Supermarket (No. 7 on Fig. 16)	Main St						H			H		
	Aspen Hotel (No. 10 on Fig. 16)	Main St						H			H		
	Bank (No. 12 on Fig. 16)	Main St						H			H	L	
	Mountain Market (No. 13 on Fig. 16)	Main St						H			H	L	

Facility Type	Facility	Address	Latitude	Longitude	Estimated Value	Building Type	Cryosphere	Earthquake	Flood/Erosion	Ground Failure	Severe Weather	Tsunami	Wildfire
	APT office (No. 14 on Fig. 16)	Main St						H			H		
	Public Library (No. 15 on Fig. 16)	S 3rd Ave			$4,023,400	Frame		H			H	L	
	Haines Assisted Living (No. 16 on Fig. 16)	Union St						H			H		
	IGA Supermarket (No. 18 on Fig. 16)	S 3rd Ave						H	M		H	L	
	Senior Citizens Center (No. 22 on Fig. 16)	Mission St						H	M		H	L	
	CIA Office							H			H		
	Tesoro gas station							H			H		
	Bigfoot Auto							H			H		
	2nd Ave Service Station							H			H		
	Captains' Choice Motel							H			H		
	KNHS Public Radio (No. 27 on Fig.16)	Tower Rd						H			H		
	Ice House				$637,680	Frame		H			H		
	Chilkat Center				$7,230,900	Mixed		H			H		
	Museum				$3,358,025	Frame		H			H		
	Natatorium (Pool)				$3,791,260	Steel Frame		H			H		
	Library				$4,023,400	Frame		H			H		
	Tlingit Park Restroom				$75,000	Frame		H			H		
	Visitor Center Restroom				$192,000	Frame		H			H		
	Visitor Info Center				$265,614	Frame		H			H		
Utility Facilities	Light & Power (No. 6 on Fig. 16)	Dalton St						H			H		
	Alascom/AT&T (No. 8 on Fig. 16)	Main St						H			H		
	Delta Western Tank Farm							H	H		H		

Facility Type	Facility	Address	Latitude	Longitude	Estimated Value	Building Type	Cryosphere	Earthquake	Flood/Erosion	Ground Failure	Severe Weather	Tsunami	Wildfire
	Sewer Control Bldg				$1,099,400	Mixed		H			H		
	Sewer Treatment Plant				$9,716,427	Mixed		H			H		
	Sewer Shop Building				$272,400	Mixed		H			H		
	Water Treatment Plant				$2,690,642	Mixed		H			H		
	Community Waste Solution (Landfill)							H	H		H		
	Barnett Dr, Pump House				$150,000	Frame		H			H		
	Young Rd Pump House				$110,000	Frame		H			H		

Figure 16. Critical Infrastructure

Table 15. Hazard Vulnerability Analysis

	Earthquake	Severe Weather	Tsunamis	Wildland & Conflagration Fires	Ground Failure	Flood/ Erosion	Changes to the Cryosphere
History	High	High	Low	Low	Moderate	Moderate	Low
Vulnerability	High	High	Low	Low	Moderate	High	High
Probability	Highly Likely	Highly Likely	Unlikely	Moderate	Highly Likely	High throughout a few likely hazard areas	Low throughout most of Borough with a few highly likely hazard areas
Location	Structures within the developed areas of the Borough have the most intense probabilities. Much of the Borough is undeveloped.	Entire Borough	Area adjacent to the coastline	Entire Borough	Structures within the developed areas of the Borough have the most intense probabilities. Much of the Borough is undeveloped.	Flooding is in valley of developed areas. Erosion for water is river, creek, and stream banks.	Certain slopes throughout the Borough are well-known avalanche areas.
At-Risk Pop.	In general, the entire Borough is at risk depending on the community's location to the known fault lines.	In general, the entire Borough is at risk regardless of location. Severe weather is non-discriminating.	Tsunami inundation maps show extents (Figures 13 and 14).	Some areas within the Borough have higher propensities to fire based on forests. Fire could occur in other areas. Generally, rainfall is sufficient, but changes to the cryosphere could present high temperatures and less moisture.	Maps are currently being developed.	Special flood hazard areas show areas vulnerable to flooding.	This is very difficult to quantify.
At-Risk Buildings							
At-Risk Building Value							

	Earthquake	Severe Weather	Tsunamis	Wildland & Conflagration Fires	Ground Failure	Flood/ Erosion	Changes to the Cryosphere
Risk Assessment							
Consequence to People	Injuries or death from structural collapse; fires; secondary diseases due to poor sanitation.	Injuries or death from structural collapse, prolonged exposure to low temperatures. Injury caused by flying debris; hardship due to disruption of vital services, transportation, utilities.	Injuries or deaths, loss of shelter, disruption of vital services such as medical, water, sewer, power, and transportation.	Injuries or death due to fire, heat, smoke and structure collapse.	Possible loss of shelter, injury or death.	Damage or loss of shelter, hardship due to disruption of transportation. Loss of some medical services.	Injury & death, hardship due to disruption of essential services, loss of shelter.
Consequence to Property	Structural damage to buildings, fuel supplies, communications, utilities, emergency facilities.	Damage to roofs, utility lines, disruption of fuel and essential supplies, disruption of communications.	Damage to structures, roads, and utilities.	Structural damage to buildings, loss of critical facilities, loss of power lines.	Loss or damage of structures, vehicles, roads.	Water erosion undercuts foundations, footings, and stream banks. Flooding can close roads and cause contamination.	Downed utility lines, damage to structures, vehicles & equipment.
Consequence to Environment	Alteration of landforms, water degradation due to fuel spills; fire, landslides.	Possible damage to flora & fauna.	Damage to flora & fauna; degradation of water quality.	Pollution of streams and lakes, loss of vegetative cover; injury & death of fauna.	Damage to whatever land was destroyed.	Pollution of streams and lakes.	Damage to flora & fauna; degradation of water quality.

6.2.1.3 Historical Properties

The State of Alaska defines cultural resources as historic, prehistoric, and archaeological remains, from existing buildings to fossils that provide information about the culture of people or natural history. Cultural resources can include traditions and memories of the longtime residents of an area, and, in fact, can include the people themselves. In general, there are three types of cultural sites: archaeological sites, historic sites (both native and non-native from the period of exploration and early settlement), and generally, more industrial sites corresponding with the period of U.S. influence.

Given thousands of years of Tlingit habitation and gold rush and early military history in the area, it is not surprising that there are many sites within the Borough with historic and cultural values. Land use and development must protect historic and cultural values. Some of these sites are:

1. Fort William H. Seward (an Historic District and a National Historic Landmark);
2. Deishu Village site;
3. Tlingit Park and historic cemetery;
4. T'anani Village Site and Nukdik/Tanani Beach site;
5. Anway Homesite historic structure and property;
6. Yandeist'akye' historic Native settlement;
7. Chilkat River and Chilkoot River and Lake historic sites such as cache and house pits, hooligan pits, garden areas and graves;
8. Dalton Cache and Dalton Trail and
9. Eldred Rock Lighthouse.

The Alaska Heritage Resource Survey of the Alaska Office of History and Archaeology tracks sites in the Haines Borough vicinity. Few of these sites have been thoroughly investigated, and most are listed only for their potential significance. Fort William H. Seward is listed on the National Register of Historic Places, which means it is afforded special consideration and protection. Additional sites may be considered for eligibility in the future. Because of the risk of disturbance of historic sites, the Office of History and Archaeology does not allow the locations of these sites to be listed for the general public.

6.2.1.4 Future Critical Facilities and Infrastructure

Among the most anticipated of future facilities in Haines Borough is a replacement of the Public Safety Building, which would include space for Fire, Police, Jail, Dispatch, and EMS. Other potential new community buildings, as described in the Haines Borough Facilities Master Plan, include the Senior Center and Chilkat Valley Preschool.

6.2.2 Data Limitations

The vulnerability estimates provided herein use the best data currently available, and the methodologies applied the 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, and critical facilities and infrastructure to the identified hazards. It was beyond the scope of this HMP 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 updates of the HMP.

6.3 LAND USE AND DEVELOPMENT TRENDS

Haines Borough encompasses 2,344 square miles of land and 382 square miles of water. Two thirds of the land is owned by the federal government, almost one-third by the State of Alaska, and about 2% is either privately owned or Borough land. For simplicity, this HMP Update refers to public land as being owned by its managing agency, even though technically the land is owned by "the people" and managed on their behalf by the public agency. The lack of private land in Southeast Alaska impedes the ability of the region, including Haines Borough, to accommodate private sector activity. In contrast to the U.S. as a whole, where approximately 60% of the land base is owned privately or by local government, only 3% of the land in Southeast Alaska and 1.3% of Haines land is in this category (Tables 16 and 17).

Table 16. Haines Borough Land Ownership

Land Owner	Percent	Acres
Federal Government (Total)	66.0%	993,364
Bureau of Land Management	14.5%	217,465
US Forest Service	51.5%	775,345
Other	0.1%	554
State (Total)	32.3%	486,033
AMHT	0.5%	6,132
UA	1.0%	15,110
Private (total)	1.3%	19,769
Borough (total)	0.3%	5,047
Borough	0.1%	1,880
Pending	0.2%	3,167
Total	100%	1,505,621

Source: Haines Borough, 2012

Table 17. Haines Borough Land Status vs. U.S. and Alaska

Land Owner	US	Alaska	Southeast Alaska	Haines
Federal	31%	65%	95%	66%
State	9%	24%	2%	32%
Local Govt & Private (including Native Corp)	60%	11%	3%	1.6%

Source: Haines Borough, 2012

The federal government is by far the largest landowner in the Borough with about 66% of the land base (Table 17). Federal land is managed by both the U.S. Forest Service (USFS) and the Bureau of Land Management (BLM). Federally-owned lands in or near town include the 220-acre U.S. Army Tank Farm and the Fuel Dock facility at Lutak Inlet, the U.S. Post Office on the

Haines Highway, and the Federal Aviation Administration (FAA) tower site located on FAA Road.

The next largest landowner in the Borough is the State of Alaska, with about one-third of the land base (Figure 17). The Haines State Forest, at 268,000 acres, is one of only three state forests in Alaska and a unique asset for the area. The Haines State Forest is managed by Alaska Department of Natural Resources (DNR) and covers large areas of the Chilkat, Klehini and Ferebee River Valleys. It is managed for multiple uses, with some areas emphasizing recreation and scenic values and other areas emphasizing commercial timber harvest. The Haines State Forest Management Plan was updated in 2003. DNR regularly issues an updated five-year timber sale schedule and focuses on small timber sales harvest and pre-commercial thinning activities.

Other significant State land is the 48,000 acres Chilkat Bald Eagle Preserve, which stretches along the Chilkat, Klehini and Chilkoot Rivers. It is managed under a Plan adopted in 2003 for the protection of the eagles and their habitat, but does allow for other non-conflicting uses. There are seven state recreation areas in the Borough: the 9,837-acre Chilkat State Park, Chilkoot Lake State Recreation Site, Mosquito Lake State Recreation Site, Portage Cove State Recreation Site, Chilkat Islands State Marine Park, Sullivan Island State Marine Park, and St. James Bay Marine Park. The State also owns, and ADNR manages, significant tideland areas within the Borough, mainly along Chilkoot and Lutak Inlet. These tidelands are classified by the state as Commercial/Industrial and are open for leasing.

University of Alaska-owned land is scattered throughout the Borough. Some of these parcels have been subdivided and sold as residential lots, including the Letnikof Estates Subdivision on the Chilkat Peninsula and others in the Mosquito Lake and Porcupine areas. The University actively manages its land for revenue generation. Alaska Mental Health Trust-owned land includes parcels on Mt. Riley, along the Haines Highway near the border and on the upland side of Lutak Road. To date, the Alaska Mental Health Trust has not pursued sale or development of their holdings in the Haines Borough, although their mission is to generate revenue from their land holdings to support mental health programming in Alaska.

Private landowners (including Native allotments) own approximately 20,000 acres or 1.3% of the Borough land base.

Most Haines Borough land is within the former City of Haines with the exception of four parcels out Haines Highway – the 5-acre gravel pit out by Big Boulder Creek, the 13-acre school and fire house on Mosquito Lake Road, 5 acres at Emerson Field Park at the intersection of Haines Highway and Mosquito Lake Rd., and a 34-acre parcel just past the Wells Bridge around Milepost 25. The largest tracts of Borough land are 450 acres on the west side of Mt. Riley and 100 acres north of Skyline Estates.

Borough subdivisions where land was sold to private parties for housing include 13 view lots in the Carr’s Cove Subdivision and the 50 lot Skyline Subdivision north of the downtown area above Highland Estates. Other Borough lands in town are reserved for public use and include school facilities on 16-acres between Main Street and the Haines Highway, road right-of-way, parks, and several municipal facilities. Also, most of the tidelands in Portage Cove are Borough owned.

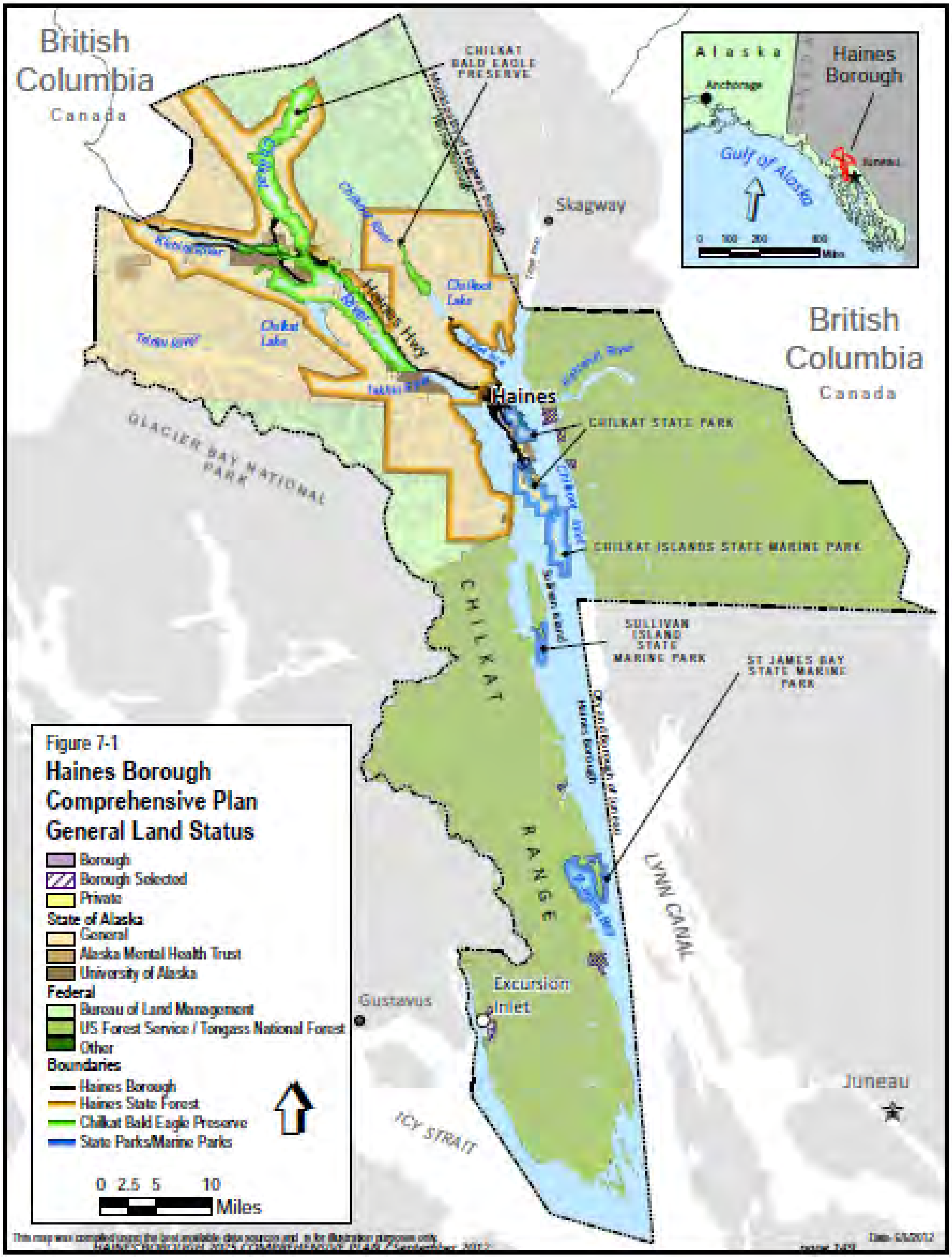

Figure 17. Land Use

Source: Haines Borough, 2012

Haines Borough critical infrastructure is primarily located within Haines. The Borough offers a wide range of public utilities and facilities, including public drinking water, wastewater collection and treatment, a community landfill, power generation, a full range of public safety services, recreational facilities, and general administration. The Haines Borough School District provides public education. The Haines Clinic provides local medical services; the Southeast Regional Health Consortium provides community health services in Haines and Klukwan. Other government services include libraries, a post office, and a police/fire department.

Development Trends

From the Borough's 2012 *Comprehensive Plan*,

> *Future Growth Maps with 10 specific Land Designations to guide growth over the next 20 years are presented. Future population and housing growth, utility and infrastructure needs, economic development opportunities, the physical and environmental character of the land base, residents' views, land owner's interests and more were taken into account as future growth direction and these maps were prepared.*
>
> *Proposed development projects should be compatible with and follow the direction set out on the Future Growth Maps and in this Comprehensive Plan. The Planning Commission and the Assembly will use these maps and this plan when they make land use and development decisions, including permit reviews, zoning and rezoning.*
>
> *This Comprehensive Plan and the Future Growth Maps lay out vision and broad intent, they establish areas of emphasis and direction, not regulation. The Comprehensive Plan and Future Growth Maps do not prohibit or allow certain type of development - that is the role of zoning, subdivision and other municipal codes. However, permits and proposals are routinely reviewed for compatibility with the direction, desired land use, and preferences established on the Future Growth maps and in this Plan. Zoning and capital investments are made in conjunction with this direction. Thorough this comprehensive planning process, the Haines community's broad public interest is defined and expressed and the rationale established to direct certain types of land uses to (and away from) particular areas. Haines Borough also expects that the direction for growth and land use set out here will be implemented by State and Federal regulators as they review proposals for leases, approvals and permits.*
>
> *The Haines Borough Comprehensive Plan recognizes the rights of large public landowners to manage their land under their own broad land use designations and rules crafted through public processes and captured in plans such as the Tongass Land Management Plan, Haines State Forest Plan and Chilkat Bald Eagle Preserve Plan. The Haines Borough's Land Designations generally follow the guidelines that the large public landowners have established, as the Borough and its residents actively participated in these planning efforts. There are a few areas*

where the Borough's Future Growth Land Designation and accompanying narrative in this chapter express specific community concerns in order to influence other public landowners as they establish conditions or design projects so that impacts of concern to the Borough and its residents can be avoided or minimized.

Haines Borough also recognizes the rights of private land owners to use their land without undue restriction.

The boundaries or "lines" between Land Designations on the Future Growth Maps are "soft" at this scale and level of planning. Desired types of land use and growth, and preferences for how differing land values are balanced and weighted, are clear and can be captured in a distinct Land Designation. But, the location of the exact boundary between neighboring Land Designations is not precise. More site specific review of projects and zoning will be needed as questions arise. The intent is not to preclude a proposed project that is close to the boundary between two Land Designations, rather, the Planning Commission and Assembly will "step back" and consider the "big picture" intent for the area, for the Land Designation, and then the details of the project, lease or zoning request.

The Haines Comprehensive Plan Future Growth Land Designations are:

1. *Residential*
2. *Rural Settlement*
3. *Commercial*
4. *Industrial/Light Industrial*
5. *Waterfront Development*
6. *Park, Recreation or Open Space*
7. *Remote or Special Areas/Critical Habitat*
8. *Multiple – Recreation Emphasis*
9. *Multiple – Resource Use Emphasis*
10. *Resource Development*

Borough land developments in the future will consist of housing and mixed-use construction.

7.0 Mitigation Strategy

This section outlines the four-step process for preparing a mitigation strategy including:

1. Developing Mitigation Goals;
2. Identifying Mitigation Actions;
3. Evaluating Mitigation Actions; and
4. Implementing Mitigation Action Plans.

Within this section, the Planning Team reviewed and added to the mitigation goals and potential mitigation actions developed in the 2010 HMP and 2015 HMP Update.

7.1 DEVELOPING MITIGATION GOALS

Requirements for local hazard mitigation goals, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy – Local Hazard Mitigation Goals
Local Hazard Mitigation Goals
Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to identified hazards.
Element
▪ Does the updated plan include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards?
Source: FEMA, 2015.

The exposure analysis results developed in Section 6 were used as a basis for developing mitigation goals and potential actions. Mitigation goals are general guidelines that describe what areas Haines Borough would like to focus on in terms of hazard and loss prevention. In 2021, Haines Borough added two goals to its list of mitigation goals from 2015 (Table 18). In 2021, Haines Borough renamed its snow avalanche goal to changes in the cryosphere.

Table 18. Mitigation Goals

No.	Goal Description
RENAMED CC-1	Reduce the possibility of damage and losses due to changes in the cryosphere (CC).
EQ-2	Reduce structural vulnerability to earthquake (EQ) damage.
FL-3	Reduce flood (FL) and erosion damage and loss possibility.
NEW GF-4	Reduce ground failure (GF) damage and loss possibility.
SW-5	Reduce structural vulnerability to severe weather (SW) damage.
T-6	Reduce vulnerability, damage, or loss of structures from tsunami or seiche (T).
NEW WF-7	Reduce vulnerability of structures from wildland fires (WF).

Key:
CC = Changes in the cryosphere
EQ = Earthquake
FL = Flood
GF = Ground Failure
SW = Severe Weather
T = Tsunami
WF = Wildfire

7.2 IDENTIFYING MITIGATION ACTIONS

Requirements for the identification and analysis of mitigation actions, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy - Identification and Analysis of Mitigation Actions
Identification and Analysis of Mitigation Actions
Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.
Element
▪ Does the updated plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard? ▪ Do the identified actions and projects reduce the effects of hazards on new buildings and infrastructure? ▪ Do the identified actions and projects reduce the effects of hazards on existing buildings and infrastructure?

In 2010 and 2015, the Planning Team assessed the potential mitigation actions to carry forward into the mitigation strategy. Mitigation actions are activities, 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 structural projects. In 2021, the Planning Team evaluated mitigation actions were proposed in prior plans and added new mitigation actions as appropriate. These revised mitigation actions will be implemented during the five-year life cycle of this 2022 HMP Update. The Planning Team placed particular emphasis on projects and programs that reduce the effects of hazards on both new and existing buildings and infrastructure. These potential projects are listed in Table 19.

Table 19. Mitigation Goals and Potential Actions

Supports Goal No.	Description	Status: Complete, Deferred, Deleted, Selected, Ongoing	Explain Status Change Considered, Selected or Ongoing	Action Description
CC-1	Reduce the possibility of damage and losses due to changes in the cryosphere.	O	No action has been taken due to lack of resources and capacity. Haines Borough hired a planner in 2021. Studies are currently in progress by UAF and DGGS forecasting damage probability for ground failure. Verify these studies will include avalanche forecasting.	**From 2015 HMP Update:** S/A-1: Prohibit new construction in avalanche areas. **Update in 2021:** CC-1: Currently, there are no building codes in Haines Borough. Reword action to: Rewrite Comprehensive Plan and Title 18 to prohibit new construction in avalanche areas. *Seek possible private property buyout grants.
		D	The 2021 Planning Team deleted this action due to it requiring an environmental study and engineering and structural design.	**From 2015 HMP Update:** S/A-2: Utilize appropriate methods of structural avalanche control. **Update in 2021:** CC-2. Utilize appropriate methods of structural avalanche control. This action will be deleted in the 2027 HMP Update.
		O	Need to confirm what action has been completed utilizing prior avalanche history and slope properties.	**From 2015 HMP Update:** S/A-3: Determine if there are any homes in an avalanche path. **Update in 2021:** CC-3. Determine if there are any homes in an avalanche path.
		O	Need to confirm what signs have been installed; more needed on roadways	**From 2015 HMP Update:** S/A-4: Install warning signage in mapped avalanche areas. **Update in 2021:** CC-4. Install warning signage in mapped avalanche areas.
		O	Action reviewed and retained. Ongoing public outreach by the Avalanche Center in town.	**From 2015 HMP Update:** S/A-5: Educate public about avalanche hazards. **Update in 2021:** CC-5. Educate public about avalanche hazards.
E-2	Reduce structural vulnerability to earthquake. damage.	O	Action retained for 2022 HMP Update. Add to EOP development.	**From 2015 HMP Update:** E-1. Identify buildings and facilities that must be able to remain operable during and following an earthquake event. **Update in 2021:** No action has been taken due to lack of resources. The Planning Team would like to add this action to EOP development.
		O	Need to contract a specialized engineering firm.	E-2. Perform an earthquake vulnerability assessment of the identified buildings and facilities.
		O	Action retained for 2022 HMP Update. Earthquake drill exercise was conducted in August	E-3. Conduct mock emergency exercises to identify response vulnerabilities.

Supports Goal No.	Description	Status: Complete, Deferred, Deleted, Selected, Ongoing	Explain Status Change Considered, Selected or Ongoing	Action Description
			2021.	
		D	The 2021 Planning Team deleted this action because it is infeasible to apply to private residences.	E-4. Nonstructural mitigation projects (i.e., assessing methods for securing building contents such as installing bookshelf tie-downs, improving computer servers' resistance to earthquakes, and moving heavy objects to lower shelves, etc.).
FL-3	Reduce flood and erosion damage and loss possibility.	O	Engineering study needed >$50,000 1 – 5 years	FL-1. Identify Drainage Patterns and Develop a Comprehensive Drainage System.
		O	Dollar cost unknown, >$50,000 1 – 5 year implementation	FL-2. Structure Elevation and/or Relocation.
		O	FEMA insurance maps are in process	FL-3. Updated FIRM Haines Maps.
		O	Information provided to public on Borough website	FLD-4. Public Education.
		O	Need documentation; activity is in progress	FLD-5. Consider obtaining a CRS rating to lower flood insurance rates.
		O	NFIP insurance is current as of 2021 and maintained.	FLD-6. Continue to obtain flood insurance for all Borough structures, and continue compliance with NFIP.
		O	By ordinance 18.120.060, all structures must comply with the current floodplain map.	FLD-7. Review requirements in Comprehensive plan and Title 19 that all new structures be constructed according to NFIP requirements and set back from the rivers and shoreline to lessen future erosion concerns and costs.
4 (GF)	Reduce ground failure damage and loss possibility. (*Previous actions related to snow/avalanche are now included with Changes in Cryosphere*)	S	New action added in 2021	GF-1. Complete studies currently in progress by UAF and DGGS, forecasting damage probability
		S	New action added in 2021	GF-2. Evaluate study recommendations for implementation
		S/O	New action added in 2021; Mountain Hubb app is in use	GF-3. Public Education
		S	New action added in 2021	GF-4. Review planning requirements in Comprehensive Plan and Title 18 for new construction
5 (SW)	Reduce structural vulnerability to severe weather damage.	O	Retained for 2021 HMP as S/W-1. Timeline 1-3 years.	SW-1 formerly SW-2. Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.
		O	Action completed in 2010, but continues annually. Action retained for 2021 HMP.	SW-2. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability
		C/O	Action is publicly advised	SW-3. Encourage weather resistant

Supports Goal No.	Description	Status: Complete, Deferred, Deleted, Selected, Ongoing	Explain Status Change Considered, Selected or Ongoing	Action Description
			but not ordered.	building construction materials and practices.
		S/O	New action added in 2021; Weather Station on top of Mt. Ryley is up and transmitting	SW-4. Consider installing additional weather stations
6 (T)	Reduce vulnerability, damage, or loss of structures from tsunami or seiche.	O	Action retained for 2021 HMP. Timeline 3-5 years.	T-1. Install siren, lights and signs at both ends of town for Tsunami and other hazardous warnings
		C	Completed, Aspects of program are present (i.e., warning systems, EOP, public mtgs)	T-2. Consider Participation in the Tsunami Ready Community Designation
		C	DGGS completed mapping in 2018	T-3. Inundation Mapping
		O	Action retained for 2021 HMP. Timeline 3-5 years.	T-4. Update Haines Emergency Operations Guide, as needed
		S	New action added in 2021	T-5. Include Nixle as public notification mechanism.
7 (WF)	Reduce vulnerability of structures from wildland fires (WF).	S/O	New action added in 2021	WF-1. Public education on fire safety.
		S/O	New action added in 2021	WF-2. Encourage the creation of firebreaks and use of other FireWise techniques.
		S	New action added in 2021	WF-3. Consider development of Community Wildfire Protection Plan

7.3 EVALUATING AND PRIORITIZING MITIGATION ACTIONS

The requirements for the evaluation and implementation of mitigation actions, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions
Implementation of Mitigation Actions
Requirement: §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.
Element
- Does the updated mitigation strategy include how the actions are prioritized? - Does the updated mitigation strategy address how the actions will be implemented and administered? - Does the updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits? - Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?
Source: FEMA, 2015.

The Planning Team evaluated and prioritized each of the mitigation actions in 2015 to determine which actions would be included in the Mitigation Action Plan. The Mitigation Action Plan represents mitigation projects and programs to be implemented through the cooperation of multiple entities in the Borough. To complete this task, the Planning Team first prioritized the hazards that were regarded as the most significant within the community.

The Planning Team reviewed the simplified social, technical, administrative, political, legal, economic, and environmental (STAPLEE) evaluation criteria (shown in Table 20) 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 and costs and, where available, the technical feasibility. A detailed cost-benefit analysis is anticipated as part of the application process for those projects the Borough chooses to implement.

Table 20. Evaluation Criteria for Mitigation Actions

Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE)

Evaluation Category	Discussion "It is important to consider…"	Considerations
Social	The public support for the overall mitigation strategy and specific mitigation actions.	Community acceptance Adversely affects population
Technical	If the mitigation action is technically feasible and if it is the whole or partial solution.	Technical feasibility Long-term solutions Secondary impacts
Administrative	If the community has the personnel and administrative capabilities necessary to implement the action or whether outside help will be necessary.	Staffing Funding allocation Maintenance/operations
Political	What the community and its members feel about issues related to the environment, economic development, safety, and emergency management.	Political support Local champion Public support
Legal	Whether the community has the legal authority to implement the action, or whether the community must pass new regulations.	Local, State, and Federal authority Potential legal challenge
Economic	If the action can be funded with current or future internal and external sources, if the costs seem reasonable for the size of the project, and if enough information is available to complete a FEMA Benefit- Cost Analysis.	Benefit/cost of action Contributes to other economic goals Outside funding required FEMA Benefit-Cost Analysis
Environmental	The impact on the environment because of public desire for a sustainable and environmentally healthy community.	Effect on local flora and fauna Consistent with community environmental goals Consistent with local, state, and Federal laws

In 2015, the Planning Team prioritized each of the selected mitigation actions that were chosen to carry forward into the Mitigation Action Plan. The Planning Team considered the STAPLEE criteria along with each hazard's history, extent, and probability to determine each potential action's priority. A rating system based on high, medium, or low was used. 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.

Prioritizing the mitigation actions in the Mitigation Action Plan Matrix was completed in 2022 to provide the Borough with an approach to implementing the Mitigation Action Plan. Table 21 defines the mitigation action priorities.

7.4 IMPLEMENTING A MITIGATION ACTION PLAN

Table 21 shows the Borough's Mitigation Action Plan Matrix and contains mitigation actions according to the Borough's priorities and provides details on how each mitigation action will be implemented and administered. Updates for each mitigation action proposed in 2015 are also provided in Table 21.

Table 21. Haines Borough's Mitigation Action Plan Matrix

Action	Description	Priority	Responsible Entity	Potential Funding Source	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
Changes in Cryosphere (CC)						
CC-1	Prohibit new construction in avalanche areas. **Update in 2021:** Rewrite Comprehensive Plan and Title 18 to prohibit new construction in avalanche areas. *Seek possible private property buyout grants.	High	Planner in conjunction with Borough Mayor and Assembly	Borough Budget	2027	B/C: Life/Safety issue/Risk reduction; Benefit to entire community TF: This project is feasible using existing staff skills, equipment, and materials. Studies are currently in progress by UAF and DGGS forecasting damage probability for ground failure. Verify these studies will include avalanche forecasting.
CC-2	**Update in 2021:** Utilize appropriate methods of structural avalanche control. This action will be deleted in the 2027 HMP Update.	Not Applicable.				
CC-3	**Update in 2021:** Determine if there are any homes in an avalanche path. Confirm what action has been completed utilizing prior avalanche history and slope properties.	High	Planner	Borough Budget	2027	B/C: Life/Safety issue/Risk reduction; Benefit to entire community TF: This project is feasible using existing staff skills, equipment, and materials. Studies are currently in progress by UAF and DGGS forecasting damage probability for ground failure. Verify these studies will include avalanche forecasting.
CC-4	**Update in 2021:** Need to confirm what signs have been installed; more needed on roadways. Install warning signage in mapped avalanche areas.	High	Planner	Borough Budget, ADOT	2027	B/C: Provides a clear warning without a language barrier. Life/Safety issue/Risk reduction; Benefit to entire community. TF: This project is feasible using existing staff skills, equipment, and materials.

Action	Description	Priority	Responsible Entity	Potential Funding Source	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
CC-5	**Update in 2021:** CC-5. Educate public about avalanche hazards. This action has been implemented by the Avalanche Center and is ongoing.	High	Avalanche Center	501(C)(3)	Ongoing	B/C: Life/Safety issue/Risk reduction; Benefit to entire community TF: This project is feasible using existing staff skills, equipment, and materials.
Earthquakes						
E-1	Identify buildings and facilities that must be able to remain operable during and following an earthquake event. **Update in 2021:** No action has been taken. The Borough is committed to implementing this action in this Update cycle.	Medium	Planner	Borough, BRIC	2027	B/C: Life/Safety issue/Risk reduction Benefit to entire community State assistance available TF: This project may require a contractor.
E-2	Perform an earthquake vulnerability assessment of the identified buildings and facilities. **Update in 2021:** No action has been taken. The Borough is committed to implementing this action in this Update cycle.	Medium	Planner	Borough, BRIC	2027	B/C: Benefit to entire community Risk reduction Benefit to entire community State assistance available TF: This project is feasible using existing staff skills, equipment, and materials. Acquiring contractor expertise may be required for large facilities.
E-3	Conduct mock emergency exercises to identify response vulnerabilities.	Medium	Planner	Borough	Ongoing	Life/Safety issue/Risk reduction Benefit to entire Borough TF: This project is feasible using existing staff skills, equipment, and

Action	Description	Priority	Responsible Entity	Potential Funding Source	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
	Update in 2021: This action has been implemented and is ongoing.					materials.
E-4	Nonstructural mitigation projects (i.e., assessing methods for securing building contents such as installing bookshelf tie-downs, improving computer servers' resistance to earthquakes, and moving heavy objects to lower shelves, etc.). **Update in 2021:** This action has been implemented for the Borough. This action will be deleted in the 2027 Update.	Not Applicable.				
Flood/Erosion						
FL-1	Identify Drainage Patterns and Develop a Comprehensive Drainage System. **Update in 2021:** No action has been taken. The Borough is committed to implementing this action in this Update cycle.	Medium	Planner	Borough	2027	B/C: Benefit to entire community Property damage reduction TF: This project is feasible using existing staff skills, equipment, and materials.
FL-2	Structure Elevation and/or Relocation.	Medium	Planner	FEMA	2027	B/C: Life/Safety project Benefit to government facilities and

Action	Description	Priority	Responsible Entity	Potential Funding Source	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
	Update in 2021: No action has been taken. The Borough is committed to implementing this action in this Update cycle.					private properties. TF: Specialized skills and assistance from contractors will be needed for this action to be accomplished.
FL-3	Update FIRM Haines Maps. **Update in 2021:** In July 2021, community stated that updated FIRMs are in progress.	Medium	Planner	FEMA		B/C: Federal and/or state funding available. Benefit of protecting property values and accurate flood insurance rates. TF: Specialized skills and assistance from contractors will be needed for this action to be accomplished.
FL-4	Public Education. **Update in 2021:** The Borough provides information to the public through its website.	Medium	Planner	Borough	Ongoing	B/C: DCRA / DHS&EM funding may be available. Could be done annually. Inexpensive <$1,000. TF: This project is feasible using existing staff skills, equipment, and materials.
FL-5	Consider obtaining a CRS rating to lower flood insurance rates. **Update in 2021:** The Borough stated this is in progress.	Medium	Planner	Borough		High capability by Borough to do on an annual basis to reduce NFIP insurance for entire community. TF: This project is feasible using existing staff skills, equipment, and materials.
FL-6	Continue to obtain flood insurance for all Borough structures. **Update in 2021:** The Borough is in compliance with the	Medium	Planner	Borough	Annually	B/C: High capability by Borough to do on an annual basis. Public benefit to have all “at risk” buildings insured through NFIP. Inexpensive, approx.$3,000/year. TF: This project is feasible using

Action	Description	Priority	Responsible Entity	Potential Funding Source	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
	NFIP.					existing staff skills, equipment, and materials.
FL-7	Review requirements in Comprehensive Plan and Title 19 that all new structures be constructed according to NFIP requirements and set back from rivers and shoreline to lessen future erosion concerns and costs.	Medium	Planner in conjunction with the Borough Manager, Planning Commission, Assembly	Borough	2024	B/C: Prevention is less expensive than mitigation action. TF: This project is feasible using existing staff skills, equipment, and materials.
Ground Failure						
GF-1	**New in 2021:** Complete studies currently in progress by UAF and DGGS, forecasting damage probability.	High	Planner	FEMA DHS&EM	2022-2023	B/C: Life/Safety project Benefit to government facilities and private properties. TF: Specialized skills and assistance from contractors will be needed for this action to be accomplished.
GF-2	**New in 2021:** Evaluate recommendations from studies (see GF-1) for implementation.	High	Planner	Borough DHS&EM	2022-2024	B/C: Benefit to entire community Risk reduction TF: Specialized skills and assistance from contractors will be needed for this action to be accomplished.
GF-3	**New in 2021:** Public Education	Medium	Planner	Borough DHS&EM	Annually	B/C: DCRA / DHS&EM funding may be available. Could be done annually. Inexpensive <$1,000 Cost: Staff time TF: This project is feasible using existing staff skills, equipment, and materials.
GF-4	**New in 2021:** Review planning requirements in Comprehensive Plan and Title 18 for new construction.	Medium	Planner in conjunction with the Borough Manager,	Borough	2027	B/C: Benefit to entire community Risk reduction TF: This project is feasible using existing staff skills

Action	Description	Priority	Responsible Entity	Potential Funding Source	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
			Planning Commission, Assembly			
Severe Weather						
SW-1	Research and consider instituting the National Weather Service program "Storm Ready." **Update in 2021:** Haines is a "Storm Ready" community.	Mitigation action complete.				
SW-2	Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc. **Update in 2021:** This mitigation action was implemented in 2010 and is ongoing annually.	Medium	Planner	Borough	Ongoing	B/C: Life/Safety issue Risk reduction Benefit to entire community Inexpensive Annual event Cost: Staff time TF: This project is feasible using existing staff skills, equipment, and materials.
SW-3	Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability. **Update in 2021:** This mitigation action was implemented and is ongoing.	Medium	Planner	Borough NOAA DHS&EM	Annually	B/C: Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available TF: This project is feasible using existing staff skills, equipment, and materials.
SW-4	Encourage weather resistant building construction materials and practices. **Update in 2021:**	Low	Planner	Borough	Annually	B/C: Risk and damage reduction. Benefit to entire community. TF: This project is feasible using

Action	Description	Priority	Responsible Entity	Potential Funding Source	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
	Action is publicly advised but not ordered as the Borough doesn't have jurisdiction.					existing staff skills, equipment, and materials.
SW-5	**New in 2021:** Consider installing additional weather stations. Weather station on top of Mt. Ryley is installed and transmitting.	High	Planner	Borough DHS&EM	2022-2027	B/C: Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available TF: This project is feasible using existing staff skills, equipment, and materials.
Tsunami						
T-1	Install siren, lights, and signs at both ends of town for Tsunami and other hazardous warnings. **Update in 2021:** The planner will work with DHS&EM for funding.	Medium	Planner	DHS&EM	2023	B/C: Life/Safety Project State assistance available TF: This project is feasible using existing staff skills, equipment, and materials.
T-2	Consider Participation in the Tsunami Ready Community Designation. **Update in 2021:** Completed and ongoing.	Medium	Planner	Borough	Ongoing	B/C: Life/Safety Project State assistance available TF: This project is feasible using existing staff skills, equipment, and materials.
T-3	Inundation Mapping. **Update in 2021:** Completed in 2018.	Not applicable.				
T-4	Update Haines Emergency Operations Guide, as needed. **Update in 2021:**	High	Planner	Borough DHS&EM	2022-2027	B/C: Life/Safety issue/Risk reduction Benefit to entire community State assistance available Cost: >$20,000

Action	Description	Priority	Responsible Entity	Potential Funding Source	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
	No action has been taken due to lack of resources.					TF: This project is feasible using existing staff skills, equipment, and materials. Specialized skills and assistance from contractors will be needed for this action to be accomplished.
T-5	**New in 2021:** Include Nixle as public notification mechanism.	High	Planner	Borough	2022-2027	B/C: Life/Safety issue/Risk reduction Benefit to entire community TF: This project is feasible using existing staff skills, equipment, and materials.
Wildland Fire						
WF-1	**New in 2021:** WF-1. Public education on fire safety.	Medium	Fire Chief	Borough	Ongoing	B/C: Life/Safety issue/Risk reduction Benefit to entire community TF: This project is feasible using existing staff skills, equipment, and materials.
WF-2	**New in 2021:** WF-2. Encourage the creation of firebreaks and use of other FireWise techniques.	Medium	Fire Chief	Borough	Ongoing	B/C: Life/Safety issue/Risk reduction Benefit to entire community TF: This project is feasible using existing staff skills, equipment, and materials.
WF-3	**New in 2021:** WF-3. Consider development of Community Wildfire Protection Plan.	Medium	Fire Chief	Borough	2023	B/C: Life/Safety issue/Risk reduction Benefit to entire community State assistance available Cost: >$20,000 TF: This project is feasible using existing staff skills, equipment, and materials.

8.0 Plan Maintenance

This section describes a formal plan maintenance process to ensure that the HMP Update remains an active and applicable document. It includes an explanation of how the Borough intends to organize its efforts to ensure that improvements and revisions to the HMP Update occur in a well-managed, efficient, and coordinated manner.

The following three process steps are addressed in detail:

1. Monitoring, evaluating, and updating the HMP;
2. Implementation through existing planning mechanisms; and
3. Continued public involvement.

8.1 MONITORING, EVALUATING, AND UPDATING THE HMP

The requirements for monitoring, evaluating, and updating the HMP, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Monitoring, Evaluating, and Updating the Plan
Monitoring, Evaluating and Updating the Plan
Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.
Element ▪ Does the updated plan describe the method and schedule for monitoring the plan, including the responsible department? ▪ Does the updated plan describe the method and schedule for evaluating the plan, including how, when, and by whom (i.e., the responsible department? ▪ Does the updated plan describe the method and schedule for updating the plan within the five-year cycle?
Source: FEMA, 2015.

This 2022 HMP Update was prepared as a collaborative effort among the Planning Team and LeMay Engineering & Consulting, Inc. To maintain momentum and build upon previous hazard mitigation planning efforts and successes, The Borough will continue using the Planning Team to monitor, evaluate, and update the HMP. Each authority identified in Table 21 will be responsible for implementing the Mitigation Action Plan. The Borough Planner will serve as the primary point of contact and will coordinate local efforts to monitor, evaluate, and revise the HMP.

The Borough Planner will conduct an annual review during the anniversary week of the plan's official FEMA approval date to monitor the progress in implementing the HMP Update, particularly the Mitigation Action Plan. As shown in Appendix E, the Annual Review Worksheet will provide the basis for possible changes in the HMP Mitigation Action Plan by refocusing on new or more threatening hazards, adjusting to changes to resource allocations, and engaging additional support for the HMP implementation. The Borough Planner 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:

- Participation of authorities and others in the HMP implementation;
- Notable changes in the risk of natural or human-caused hazards;
- Impacts of land development activities and related programs regarding hazard mitigation;
- Progress made with the Mitigation Action Plan (identify problems and suggest improvements as necessary); and
- The adequacy of local resources for implementation of the HMP Update.

A system of reviewing the progress on achieving the mitigation goals and implementing the Mitigation Action Plan activities and projects will also be accomplished during the annual review process. During each annual review, each authority administering a mitigation project will submit a Progress Report to the Planning Team. As shown in Appendix E, the report will include the current status of the mitigation project, including any changes made to the project, the identification of implementation problems and appropriate strategies to overcome them, and whether or not the project has helped achieved the appropriate goals identified in the plan.

In addition to the annual review, the Planning Team will update the HMP every five years. To ensure that this update occurs, in the fourth year following adoption of the HMP, the Planning Team will undertake the following activities:

- Request grant assistance for DHS&EM to update the HMP (this can take up to one year to obtain and one year to update the plan).
- Thoroughly analyze and update the risk of natural and human-made hazards.
- Provide a new annual review (as noted above), plus a review of the three previous annual reviews.
- Provide a detailed review and revision of the mitigation strategy.
- Prepare a new Mitigation Action Plan for the Haines Borough.
- Prepare a new Draft HMP Update.
- Submit an updated HMP to the DHS&EM and FEMA for approval.
- Submit the FEMA-approved plan for adoption by the Borough Assembly.
- Return an adoption resolution to DHS&EM and FEMA to receive formal approval.

8.2 IMPLEMENTATION THROUGH EXISTING PLANNING MECHANISMS

Requirements for implementation through existing planning mechanisms, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Incorporation into Existing Planning Mechanisms
Incorporation into Existing Planning Mechanisms Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate. Element ▯ Does the updated plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan? ▯ Does the updated plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate? ▯ Does the updated plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate? *Source: FEMA, 2015.*

After the adoption of the HMP, each Planning Team Member will ensure that the HMP, in particular each Mitigation Action Project, is incorporated into existing planning mechanisms. Each member will achieve this incorporation by undertaking the following activities.

- Conduct a review of the community-specific regulatory tools to assess the integration of the mitigation strategy. These regulatory tools are identified in the following capability assessment section.
- Work with pertinent community departments to increase awareness of the HMP and provide assistance in integrating the mitigation strategy (including the Mitigation Action Plan) into relevant planning mechanisms. Implementation of these requirements may require updating or amending specific planning mechanisms.

8.3 HAINES BOROUGH CAPABILITY ASSESSMENT

This capability assessment reviews the technical and fiscal resources available to Haines Borough (Table 22). This section outlines the resources available for mitigation and mitigation related funding and training.

Table 22. Haines Regulatory Tools

Regulatory Tools (Ordinances, codes, plans)	Existing Yes/No?	Comments (Year of most recent update; problems administering it, etc.)
Comprehensive Plan	Yes	2012 Community Development Plan; explains land use initiatives and natural hazard impacts.
Economic development plan	Yes	Part of 2012 Community Development Plan.
Capital improvements plan	Yes	Generated annually.
Land Use Plan	Yes	2012 Community Development Plan.
Emergency Operations Guide	Yes	
Building code	Yes	2012 Community Development Plan.
Zoning ordinances	Yes	Borough Code.
Subdivision ordinances or regulations	Yes	Borough Code.
Site plan review requirements	Yes	
Special purpose ordinances (floodplain management, stormwater management, hillside or steep slope ordinance, wildfire ordinances, hazard setback requirements)	Yes	Borough Code.

Federal Resources

The Federal government requires local governments to have an HMP and appropriate updates 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 the 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.
    - 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.
    - The FEMA Hazard Mitigation Assistance (HMA Unified Guidance, June 1, 2010. The guidance introduces the five HMA grant programs, funding opportunities, award information, eligibility, application and submission information, application review process, administering the grant, contracts, additional program guidance, additional project guidance, and contains information and resource appendices (FEMA, 2009).

- FEMA also administers emergency management grants and firefighter grant programs such as:
    - Emergency Management Performance Grant (EMPG). 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 NIMS implementation as a condition for receiving funds. Requires 50% match.

- 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.

- Department of Homeland Security provides the following grants:
  - Homeland Security Grant Program (HSGP), State Homeland Security Program (SHSP) are 80% pass 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 National Incident Management System (NIMS), and the National Response Framework (NRF). Must ensure at least 25% of funds are dedicated towards law enforcement terrorism prevention-oriented activities.
  - Citizen Corps Program (CCP). 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.
  - Emergency Operations Center (EOC) This program is intended to improve emergency management and preparedness capabilities by supporting flexible, sustainable, secure, strategically located, and fully interoperable 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.
- U.S. Department of Commerce's grant programs include:
  - Remote Community Alert Systems (RCASP) 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. This program is a contributing element of the Warning, Alert, and Response Network (WARN) Act.
  - 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.

- Department of Agriculture (USDA). Disaster assistance provided includes: 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.
- Department of Energy (DOE), 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.
- 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.
- 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.
    - 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.
- Department of Health and Human Services (DHHS), 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 the method of application.

- Department of Housing and Urban Development (HUD). 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.
    - 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.
    - 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.
    - Department of Housing and Urban Development, Community Development Block Grants (HUD/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.
- Department of Labor (DOL), Employment and Training Administration, Disaster Unemployment Assistance. 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.
    - 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 (INAP) funds grant programs that provide training opportunities at the local level for this target population.
- U.S. Department of Transportation, Hazardous Materials Emergency Preparedness Grant. 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, and encourage a comprehensive approach to emergency training and planning by incorporating the unique challenges of responses to transportation situations, through planning and training. Requires a 20% local match.

- 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 (IRS), 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.
- Natural Resources Conservation Service (NRCS) has several funding sourcesto fulfill mitigation needs. Further information is located at:
    - The Emergency Watershed Protection Program (EWP). This funding source 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.
    - Wildlife habitat Incentives Program (WHIP). This is a voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and Indian land.
    - Watershed Planning. NRCS watershed activities in Alaska are voluntary efforts requested through conservation districts and units of government and/or tribes. The watershed activities are led locally by a "watershed management committee" that is comprised of local interest groups, local units of government, local tribal representatives and any organization that has a vested interest in the watershed planning activity. This committee provides direction to the process as well as provides the decision-making necessary to implement the process. Technical assistance is provided to the watershed management committee through a "technical advisory committee" comprised of local, state and federal technical specialist. These specialists provide information to the watershed management committee as needed to make sound decisions. NRCS also provides training on watershed planning organization and process.
- U.S. Small Business Administration (SBA) Disaster Assistance provides information concerning disaster assistance, preparedness, planning, cleanup, and recovery planning.
    - SBA may provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. Requests for SBA loan assistance should be submitted to DHS&EM.

- United States Army Corps 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.

State Resources

- DHS&EM 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.

  DHS&EM also provides mitigation funding resources for mitigation planning on their Web site.

- Division of Senior Services (DSS): Provides special outreach services for seniors, including food, shelter, and clothing.
- Division of Insurance (DOI): Provides assistance in obtaining copies of policies and provides information regarding filing claims.
- Department of Military and Veterans Affairs (DMVA): Provides damage appraisals and settlements for VA-insured homes, and assists with filing of survivor benefits.
- DCRA within the DCCED. DCRA 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 department also administers programs for State "distressed" and "targeted" communities.

- Department of Environmental Conservation (DEC). The DEC 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.
  - The Division of Water's Village Safe Water 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 State of Alaska's Village Safe Water (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, 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 ADWF. The division is fiscally responsible to the 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.
  - 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.

- 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.

- The DNR's Department 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.
- DOF also manages various wildland fire programs, activities, and grant programs such as the FireWise Program, Community Forestry Program (CFP), Assistance to Fire Fighters Grant (AFG), Fire Prevention and Safety (FP&S), Staffing for Adequate Fire and Emergency Response Grants (SAFER), and Volunteer Fire Assistance and Rural Fire Assistance Grant (VFA-RFA) programs.

Other Funding Sources and Resources

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

- FEMA, http://www.fema.gov - includes links to information, resources, and grantsthat communities can use in planning and implementation of sustainable measures.
- American Planning Association (APA), 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 (IBHS), http://ibhs.org - an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters.
- American Red Cross (ARC). 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.
- 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.
- 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.
    - 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.

- Rasmuson Foundation Grants. The Rasmuson foundation invests both in individuals and well-managed 501(c)(3) organizations dedicated to improving the quality of life for Alaskans.

  The Foundation seeks to support not-for-profit organizations that are focused and effective in the pursuit of their goals, with special consideration for those organizations that demonstrate strong leadership, clarity of purpose and cautious use of resources.

  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.

Local Resources

The Haines Borough has a number of planning and land management tools that will allow it to implement hazard mitigation activities. The resources available in these areas have been assessed by the Planning Team and are summarized below in Tables 23 and 24.

Table 23. Haines' Administrative and Technical Resources

Staff/Personnel Resources	Yes / No	Department/Agency and Position
Development and land management practices	Yes	Borough Planner
Planner or engineer with an understanding of natural and/or human-caused hazards.	Yes	Borough Planner
Floodplain Manager	Yes	Borough Planner
Surveyors	Yes	The Borough hires licensed surveyors.
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards.	Yes	Borough Planner
Personnel skilled in Geospatial Information System (GIS) and/or Hazards Us-Multi Hazard (Hazus-MH) software	Yes	
Scientists familiar with the hazards of the jurisdiction	No	The Borough works with BLM, Alaska Fire Service/AICC (ADNR), USFWS, ADFG, ADOT&PF.
Emergency Manager	Yes	Borough Planner
Finance (Grant writers)	Yes	Contract Grant Writer, Borough Manager, staff
Public Information Officer	Yes	Borough Mayor and Borough Manager

Table 24. Financial Resources for Hazard Mitigation

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	Limited funding, can exercise this authority with voter approval.
Community Development Block Grants	Limited funding, can exercise this authority with voter approval.
Capital Improvement Projects Funding	Limited funding, can exercise this authority with voter approval.
Authority to levy taxes for specific purposes	Limited funding, 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.
Hazard Mitigation Grant Program (HMGP)	FEMA funding which is available to local communities after a Presidentially-declared disaster. It can be used to fund both pre- and post-disaster mitigation plans and projects.
Pre-Disaster Mitigation (PDM) grant program	FEMA funding which available on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects only.
Flood Mitigation Assistance (FMA) grant program	FEMA funding which is available on an annual basis. This grant can be used to mitigate repetitively flooded structures and infrastructure to protect repetitive flood structures.
United State Fire Administration (USFA) 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.

8.4 CONTINUED PUBLIC INVOLVEMENT

The requirements for continued public involvement, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Continued Public Involvement
Continued Public Involvement
Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.
Element
▪ Does the updated plan explain how continued public participation will be obtained?
Source: FEMA, 2015.

The Borough is dedicated to involving the public directly in the continual reshaping and updating of the HMP. A paper copy of the HMP and any proposed changes will be available at the Borough Office. An address and phone number of the Borough Planner to whom people can direct their comments or concerns will also be available at the Borough Office.

The Planning Team will also identify opportunities to raise community awareness about the HMP and the hazards that affect the area. This effort could include attendance and provision of materials at Borough-sponsored events, outreach programs, and public mailings. Any public comments received regarding the HMP will be collected by the Borough Planner, included in the annual report, and considered during future HMP updates. On an annual basis, the Borough will mail community surveys (see Appendix E) to the public to gauge local opinion regarding hazard statuses.

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