City and Borough of Yakutat Hazard Mitigation Plan Update

Photo Credit: Rootsweb, 2015

Prepared by

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City and Borough of Yakutat
Hazard Mitigation Plan

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Acronyms/Abbreviations

°F	Degrees Fahrenheit
ACCIMP	Alaska Climate Change Impact Mitigation Program
ACWF	Alaska Clean Water Fund
ADWF	Alaska Drinking Water Fund
AEA	Alaska Energy Authority
AEEE	Alternative Energy and Energy Efficiency
AFG	Assistance to Firefighters Grant
AHFC	Alaska Housing Finance Corporation
AICC	Alaska Interagency Coordination Center
AIDEA	Alaska Industrial Development and Export Authority
AK	Alaska
ALOS	Advanced Land Observing Satellite-2
ANA	Administration for Native Americans
ARC	American Red Cross
AVEC	Alaska Village Electric Cooperative
BIA	Bureau of Indian Affairs
CBY	City and Borough of Yakutat
CCP	Citizen Corps Program
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
CFP	Community Forestry Program
CGP	Comprehensive Grant Program
CRREL	Cold Regions Research and Engineering Laboratory
CVRF	Coastal Villages Region Fund
CWSRF	Clean Water State Revolving Fund
DCCED	Department of Commerce, Community, and Economic Development
DCRA	Division of Community and Regional Affairs
DEC	Department of Environmental Conservation
Denali	Denali Commission
DHS	Department of Homeland Security
DHS&EM	Division of Homeland Security and Emergency Management
DHSS	Department of Health and Social Services
DGGS	Division of Geological and Geophysical Survey
DMA 2000	Disaster Mitigation Act of 2000
DMVA	Department of Military and Veterans Affairs
DNR	Department of Natural Resources
DOE	Department of Energy
DOF	Division of Forestry
DOI	Division of Insurance
DOL	Department of Labor
DOT/PF	Department of Transportation and Public Facilities
DSS	Division of Senior Services
EOC	Emergency Operations Center
EMPG	Emergency Management Performance Grant

Acronyms/Abbreviations

EPA	Environmental Protection Agency
EQ	Earthquake
ER	Erosion
EWP	Emergency Watershed Protection Program
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FL	Flood
FMA	Flood Mitigation Assistance
FP&S	Fire Prevention and Safety
ft.	Feet
FY	Fiscal Year
g	Gravity
GF	Ground Failure
GIS	Geospatial Information System
Hazus	Hazard United States – Multi-Hazard Software
HMA	Hazard Mitigation Assistance
HMP	Hazard Mitigation Plan
HMGP	Hazard Mitigation Grant Program
HSGP	Homeland Security Grant Program
HUD	Housing and Urban Development
IBHS	Institute for Business and Home Safety
ICDBG	Indian Community Development Block Grant
IGAP	Indian General Assistance Program
IHBG	Indian Housing Block Grant
IHLGP	Indian Home Loan Guarantee Program
INAP	Indian and Native American Programs
IRS	Internal Revenue Service
Kts	Knots
LEG	Legislative Energy Grant
LEPC	Local Emergency Planning Committee
M	Magnitude
MDA	MacDonald Dettwiler and Associates Ltd.
MAP	Mitigation Action Plan
MGL	Municipal Grants and Loans
MMI	Modified Mercalli Intensity
mph	Miles Per Hour
msl	Mean Sea Level
NAHASDA	Native American Housing Assistance and Self Determination Act
NFIP	National Flood Insurance Program
NIMS	National Incident Management System
NOAA	National Oceanic and Atmospheric Administration
NRF	National Response Framework
NRCS	Natural Resources Conservation Service
NWS	National Weather Service

Acronyms/Abbreviations

PDM	Pre-Disaster Mitigation
PGA	Peak Ground Acceleration
PNP	Private Non-Profits
PRISM	Panchromatic Remote-sensing Instrument for Stereo Mapping
RCASP	Remote Community Alert Systems
RD	Rural Development
RL	Repetitive Loss
RurALCAP	Rural Alaska Community Action Program
SAFER	Staffing for Adequate Fire and Emergency Response
SBA	U.S. Small Business Administration
SHMP	Alaska State Hazard Mitigation Plan
SHSP	State Homeland Security Program
SOA	State of Alaska
Sq.	Square
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
US or U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VFA-RFA	Volunteer Fire Assistance and Rural Fire Assistance Grant
VSW	Village Safe Water
WARN	Warning, Alert, and Response Network
WX	Weather

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Section One provides a brief introduction to hazard mitigation planning, the grants associated with these requirements, and a description of this Hazard Mitigation Plan (HMP) Update.

This HMP updates the 2015 HMP that was developed for the City and Borough of Yakutat (CBY). CBY is a borough in Alaska and was the name of a former city within it. The name is Tlingit, Yaakwdáat but it originally derives from an Eyak name diya'quda't and was influenced by the Tlingit word yaakw. CBY covers an area about six times the size of the U.S. state of Rhode Island, making it one of the largest boroughs or counties in the U.S.

1.1 OVERVIEW

Hazard mitigation, as defined in Title 44 of the Code of Federal Regulations (CFR), Section §201.4, is "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." Many areas have expanded this definition to also include human-caused hazards. As such, hazard mitigation is any work done to minimize the impacts of any type of hazard event before it occurs. It 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. The implementation of the mitigation actions, which include long-term strategies that may include planning, policy changes, programs, projects, and other activities, is the end 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, State, Local, and Tribal governments are encouraged to take advantage of funding provided by Federal Hazard Mitigation Assistance (HMA) programs.

1.2 PLANNING REQUIREMENTS

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, Local, and Tribal entities to closely coordinate mitigation planning and implementation efforts. Additionally, it 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 and Tribal entities are described in detail in Sections §201.6 and §201.7. Locally- and Tribally- adopted and State- and FEMA- approved HMPs qualify jurisdictions for several HMA grant programs. This HMP Update for CBY 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, Local, and Tribal governments to undertake a risk-based approach to reducing 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, Local, and Tribal HMPs. This change also required participating National Flood Insurance Program (NFIP) communities' risk assessments and mitigation strategies to identify and address repetitively flood damaged properties.

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1.3 GRANT PROGRAMS WITH MITIGATION PLAN REQUIREMENTS

FEMA HMA grant programs provide funding to States, Tribes, and Local entities that have a FEMA-approved State, Tribal, or Local Mitigation Plan. Two of the grants are authorized under the Stafford Act and DMA 2000, while the remaining three are authorized under the National Flood Insurance Act (NFIA) and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act. Excerpts from FEMA's 2015 HMA Guidance, Part I, is as follows:

> *"The U.S. Department of Homeland Security (DHS) FEMA HMA programs present a critical opportunity to reduce the risk to individuals and property from natural hazards, while simultaneously reducing reliance on Federal disaster funds. On March 30, 2011, the President signed Presidential Policy Directive 8 (PPD-8): National Preparedness, and the National Mitigation Framework was finalized in May 2013. The National Mitigation Framework comprises seven core capabilities, including:*
>
> - *Threats and Hazard Identification;*
> - *Risk and Disaster Resilience Assessment;*
> - *Planning;*
> - *Community Resilience;*
> - *Public Information and Warning;*
> - *Long-Term Vulnerability Reduction; and*
> - *Operational Coordination.*
>
> *HMA programs provide funding for eligible activities that are consistent with the National Mitigation Framework's Long-Term Vulnerability Reduction capability. HMA programs reduce community vulnerability to disasters and their effects, promote individual and community safety and resilience, and promote community vitality after an incident. Furthermore, HMA programs reduce response and recovery resource requirements in the wake of a disaster or incident, which results in a safer community that is less reliant on external financial assistance.*
>
> *Hazard mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects. This definition distinguishes actions that have a long-term impact from those that are more closely associated with immediate preparedness, response, and recovery activities. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage. Accordingly, States, territories, federally-recognized tribes, and local communities are encouraged to take advantage of funding that HMA programs provide in both the pre- and post-disaster timelines.*
>
> *In addition to hazard mitigation, FEMA's Risk Mapping, Assessment, and Planning (Risk MAP) Program provides communities with education, risk communication, and outreach to better protect its citizens. The Risk MAP project lifecycle places a strong emphasis on community engagement and partnerships to ensure a whole community approach that reduces flood risk and builds more resilient communities. Risk MAP risk assessment information strengthens a local community's ability to make better and more informed decisions. Risk MAP allows communities to better invest and determine priorities for projects funded under HMA. These investments support mitigation efforts under HMA that protect life and property and build more resilient communities.*

The whole community includes children, individuals with disabilities, and others with access and functional needs; those from religious, racial, and ethnically diverse backgrounds; and people with limited English proficiency. Their contributions must be integrated into mitigation/resilience efforts, and their needs must be incorporated as the whole community plans and executes its core capabilities.

WHOLE COMMUNITY

A. HMA Commitment to Resilience and Climate Change Adaptation

FEMA is committed to promoting resilience as expressed in PPD-8: National Preparedness; the President's State, Local, and Tribal Leaders Task Force on Climate Preparedness and Resilience; the Administrator's 2011 FEMA Climate Change Adaptation Policy Statement (Administrator Policy 2011-OPPA-01); and the 2014–2018 FEMA Strategic Plan. Resilience refers to the ability to adapt to changing conditions and withstand and rapidly recover from disruption due to emergencies. The concept of resilience is closely related to the concept of hazard mitigation, which reduces or eliminates potential losses by breaking the cycle of damage, reconstruction, and repeated damage. Mitigation capabilities include, but are not limited to, community-wide risk reduction projects, efforts to improve the resilience of critical infrastructure and key resource lifelines, risk reduction for specific vulnerabilities from natural hazards and climate change, and initiatives to reduce future risks after a disaster has occurred.

FEMA is supporting efforts to streamline the HMA programs so that these programs can better respond to the needs of communities nationwide that are addressing the impacts of climate change. FEMA, through its HMA programs:

- *Develops and encourages adoption of resilience standards in the siting and design of buildings and infrastructure; and*
- *Modernizes and elevates the importance of hazard mitigation.*

FEMA has issued several policies that facilitate the mitigation of adverse effects from climate change on the built environment, structures and infrastructure. Consistent with the 2014–2018 FEMA Strategic Plan, steps are being taken by communities through engagement of individuals, households, local leaders, representatives of local organizations, and private sector employers and through existing community networks to protect themselves and the environment by updating building codes, encouraging the conservation of natural and beneficial functions of the floodplain, investing in more resilient infrastructure, and engaging in mitigation planning. FEMA plays an important role in supporting community-based resilience efforts, establishing policies, and providing guidance to promote mitigation options that protect critical infrastructure and public resources.

FEMA encourages better integration of Sections 404 and 406 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended (Stafford Act), Title 42 of the United States Code (U.S.C.) 5121 et seq., to promote more resilience during the recovery and mitigation process. FEMA regulations that implement Sections 404 and 406 of the Stafford Act allow funding to incorporate mitigation measures during recovery activities. Program guidance and practice limits Section 406 mitigation to the damaged elements of a structure. This limitation to Section 406 mitigation may not allow for a comprehensive mitigation solution for the damaged facility; however, Section 404 funds may be used to mitigate the undamaged portions of a facility.

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Recognizing that the risk of disaster is increasing as a result of multiple factors, including the growth of population in and near high-risk areas, aging infrastructure, and climate change, FEMA promotes climate change adaptation by:

- *Incorporating sea level rise in the calculation of Benefit-Cost Analysis (BCA);*
- *Publishing a new HMA Job Aid on pre-calculated benefits for hurricane wind retrofit measures, see HMA Job Aid (Cost Effectiveness Determination for Residential Hurricane Wind Retrofit Measures Funded by FEMA);*
- *Encouraging floodplain and wetland conservation associated with the acquisition of properties in green open space and riparian areas;*
- *Reducing wildfire risks;*
- *Preparing for evolving flood risk;*
- *Encouraging mitigation planning and developing mitigation strategies that encourage community resilience and smart growth; and*
- *Encouraging the use of building codes and standards (the American Society of Civil Engineers/Structural Engineering Institute [ASCE/SEI] 24-14, Flood Resistant Design and Construction) wherever possible" (FEMA, 2015b).*

1.3.1 Hazard Mitigation Assistance (HMA) Grant Programs

HMA grant program activities include:

Table 1-1 HMA Eligible Activities

Activities	HMGP	PDM	FMA
1. Mitigation Projects	✓	✓	✓
Property Acquisition and Structure Demolition	✓	✓	✓
Property Acquisition and Structure Relocation	✓	✓	✓
Structure Elevation	✓	✓	✓
Mitigation Reconstruction	✓	✓	✓
Dry Floodproofing of Historic Residential Structures	✓	✓	✓
Dry Floodproofing of Non-residential Structures	✓	✓	✓
Generators	✓	✓	
Localized Flood Risk Reduction Projects	✓	✓	✓
Non-localized Flood Risk Reduction Projects	✓	✓	
Structural Retrofitting of Existing Buildings	✓	✓	✓
Non-structural Retrofitting of Existing Buildings and Facilities	✓	✓	✓
Safe Room Construction	✓	✓	
Wind Retrofit for One- and Two-Family Residences	✓	✓	
Infrastructure Retrofit	✓	✓	✓
Soil Stabilization	✓	✓	✓
Wildfire Mitigation	✓	✓	
Post-Disaster Code Enforcement	✓		
Advance Assistance	✓		
5 Percent Initiative Projects	✓		

Table 1-1 HMA Eligible Activities

Activities	HMGP	PDM	FMA
Miscellaneous/Other[1]	✓	✓	✓
2. Hazard Mitigation Planning	✓	✓	✓
Planning Related Activities	✓		
3. Technical Assistance			✓
4. Management Cost	✓	✓	✓

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

(FEMA, 2015b)

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 Flood Mitigation Assistance (FMA) programs although competitive, rely on specific pre-disaster grant funding sources, share several common elements. The 2015 HMA Guidance provides the following programmatic information:

> *"HMGP is authorized by Section 404 of the Stafford Act, 42 U.S.C. 5170c. The key purpose of HMGP is to ensure that the opportunity to take critical mitigation measures to reduce the risk of loss of life and property from future disasters is not lost during the reconstruction process following a disaster.*
>
> *HMGP funding is available, when authorized under a Presidential major disaster declaration, in the areas of the State requested by the Governor. Federally-recognized tribes may also submit a request for a Presidential major disaster declaration within their impacted areas. The amount of HMGP funding available to the Applicant is based on the estimated total Federal assistance, subject to the sliding scale formula outlined in Title 44 of CFR Section 206.432(b) that FEMA provides for disaster recovery under Presidential major disaster declarations. The formula provides for up to 15% of the first $2 billion of estimated aggregate amounts of disaster assistance, up to 10% for amounts between $2 billion and $10 billion, and up to 7.5% for amounts between $10 billion and $35 billion. For States with enhanced plans, the eligible assistance is up to 20% for estimated aggregate amounts of disaster assistance not to exceed $35 billion.*
>
> *The Period of Performance (POP) for HMGP begins with the opening of the application period and ends no later than 36 months from the close of the application period.*
>
> *PDM is designed to assist States, territories, federally-recognized tribes, and local communities to implement a sustained pre-disaster natural hazard mitigation program to reduce overall risk to the population and structures from future hazard events, while also reducing reliance on Federal funding in future disasters. Congressional appropriations provide the funding for PDM.*
>
> *The total amount of funds distributed for PDM is determined once the appropriation is provided for a given fiscal year. It can be used for mitigation projects and planning activities.*
>
> *The POP for PDM begins with the opening of the*

The City and Borough of Yakutat does not currently participate in FEMA's National Flood Insurance Program (NFIP) and is, therefore, ineligible/eligible for Flood Mitigation Assistance (FMA) associated grant funding opportunities.

application period and ends no later than 36 months from the date of subapplication selection.

FMA is authorized by Section 1366 of the NFIA of 1968, as amended, 42 U.S.C. 4104c, with the goal of reducing or eliminating claims under the NFIP. FMA was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994. The Biggert-Waters Flood Insurance Reform Act of 2012 (Public Law 112-141) consolidated the Repetitive Flood Claims and Severe Repetitive Loss grant programs into FMA. FMA funding is available through the National Flood Insurance Fund (NFIF) for flood hazard mitigation projects as well as plan development and is appropriated by Congress. States, territories, and federally-recognized tribes are eligible to apply for FMA funds. Local governments are considered subapplicants and must apply to their Applicant State, territory, or federally-recognized tribe.

The POP for FMA begins with the opening of the application period and ends no later than 36 months from the date of subapplication selection" (FEMA, 2015b).

As the State Hazard Mitigation plan states:

"The [FMA] provides pre-disaster grants to State and Local Governments for planning and flood mitigation projects. Created by the National Flood Insurance Reform Act of 1994, its goal is to reduce or eliminate NFIP claims. It is an annual nationally competitive program. Residential and non-residential properties may apply for FMA grants through their NFIP community and are required to have NFIP insurance to be eligible. FMA grant funds may be used to develop the flood portions of hazard mitigation plans or to do flood mitigation projects. FMA grants are funded 75% Federal and 25% applicant.

The Biggert-Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) grant programs. Elements of these flood programs have been incorporated into FMA. The FMA program now allows for additional cost share flexibility:

- *Up to 100% Federal cost share for severe repetitive loss properties.*
- *Up to 90% Federal cost share for repetitive loss properties.*
- *Up to 75% Federal cost share for NFIP insured properties.*

The FMA program is available only to communities participating in the NFIP. In the State of Alaska, the Department of Commerce, Community, and Economic Development (DCCED) manages this program" (SHMP, 2018).

HMP Layout Description

The HMP consists of the following sections and appendices:

Section 1 Introduction

Defines what an HMP is, delineates federal requirements and authorities, and introduces the HMA program listing the various grant programs and their historical funding levels.

Section 2 Community Description

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

Section 3 Planning Process

Describes the HMP Update's planning process, identifies the Planning Team members, the meetings held as part of the planning process, and the key stakeholders within the Yakutat area. This section documents public outreach activities (support documents are located in Appendix D); including document reviews and relevant plans, reports, and other appropriate information data utilized for this HMP; HMP integration into other plans and actions needed to assure continued public participation; and their methods and schedule for keeping the plan current.

This section also describes the Planning Team's formal plan maintenance process to ensure that the HMP remains an active and applicable document throughout its five-year lifecycle. The process includes monitoring, reviewing, evaluating (Appendix F – Maintenance Documents), and updating the HMP; and implementation initiatives.

Section 4 Jurisdictional Adoption

Describes the community's HMP adoption process (support documents are located in Appendix C).

Section 5 Hazard Analysis

Describes the process through which the Planning Team identified, screened, selected, and prioritized the hazards for profiling in this 2019 HMP Update. The hazard analysis includes the characteristics, previous occurrences (history), location, extent, impact, and recurrence probability for each hazard. In addition, historical impact and hazard location figures are included when available.

Section 6 Vulnerability Assessment

Identifies CBY's potentially vulnerable assets—people, residential and nonresidential buildings, critical facilities, and critical infrastructure. The resulting information identifies the full range of hazards that the area could face and potential social impacts, damages, and economic losses. Land use and development trends are also discussed.

Section 7 Mitigation Strategy

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

In 2015, the Planning Team developed a list of mitigation goals and potential actions to address the risks facing CBY. Mitigation actions include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities. In 2019, each mitigation action was updated, and new mitigation actions were added. Hazards and mitigation actions were re-prioritized by the community.

Section 8 References

Lists reference materials and resources used in this HMP.

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Appendices

Appendix A: Delineates Federal, State, and other potential mitigation funding sources. This section will aid the community with researching and applying for funds to implement their mitigation strategy.

Appendix B: Provides the FEMA Local Mitigation Plan Review Tool, which documents compliance with FEMA criteria.

Appendix C: Provides the adoption resolution for the CBY.

Appendix D: Provides public outreach information, including newsletters, meeting agendas, presentations, and trip reports.

Appendix E: Contains the Benefit-Cost Analysis Fact Sheet used to prioritize mitigation actions.

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

Section Two provides CBY's location, geography, history, and demographic information.

2.1 LOCATION, GEOGRAPHY, AND HISTORY

Government

The City of Yakutat incorporated in 1948, with just over three-square miles within City limits. In September 1992, residents of the City of Yakutat voted to dissolve the City, and incorporate the 5,875 square mile Home Rule City and Borough of Yakutat, which stretched from the Alsek River on the southeast to Icy Bay on the west and Canada to the north. In 1997, CBY annexed the area from Icy Bay west to Cape Suckling. Today, the CBY is roughly the size of Vermont and encompasses approximately 7,650 square (sq.) miles of land and 1,809 sq. miles of water.

CBY is a unified single governmental unit with a Home Rule Charter.

Section 1.1 of the Home Rule Charter of CBY reads as follows:

> *"The Borough shall be a municipal corporation known as the "City and Borough of Yakutat." Whenever it deems it in the public interest to do so, the Borough may use the name "City and Borough of Yakutat Home Rule Borough"* (CBY, 2015).

The governing legislative body is an elected CYB Mayor and Assembly, with a Borough Manager.

Location

Yakutat is isolated among the lowlands along the Gulf of Alaska, 225 miles northwest of Juneau, 220 miles southeast of Cordova, and 367 miles southeast of Anchorage. The Borough is within and surrounded by the Tongass National Forest, Wrangell-St. Elias National Park and Preserve, and Glacier Bay National Park and Preserve. The community lies at the mouth of Yakutat Bay, one of the few refuges for vessels along this stretch of coast. The Hubbard and Malaspina Glaciers are nearby. Yakutat lies at approximately 59.546940° North Latitude and -139.727220° West Longitude. (Sec. 30, T027S, R034E, Copper River Meridian.) Yakutat is located in the Juneau Recording District. (CBY, 2015).

CBY is located on the north coast of the Gulf of Alaska. It is the only community of significant size for a nearly 400-mile long stretch of the coast between Cordova and Gustavus. Like most of southeast Alaska, Yakutat is relatively isolated with no road access.

Geography

The landscape in CBY is dramatic with high mountains, extensive icefields, glacial valleys, fjords, bays, rivers, forests, and wetlands. The landscape is constantly changing due to its location along the northern edge of the earth's Pacific Plate, the fact that the land is rising as it rebounds from the weight of former glaciers, and because the coastline is exposed to the full force of waves and the storms that roll in across the Pacific Ocean and hit land with full force (CBY, 2010).

Yakutat 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. Between the Saint Elias Mountains and the Gulf of Alaska, there are gently

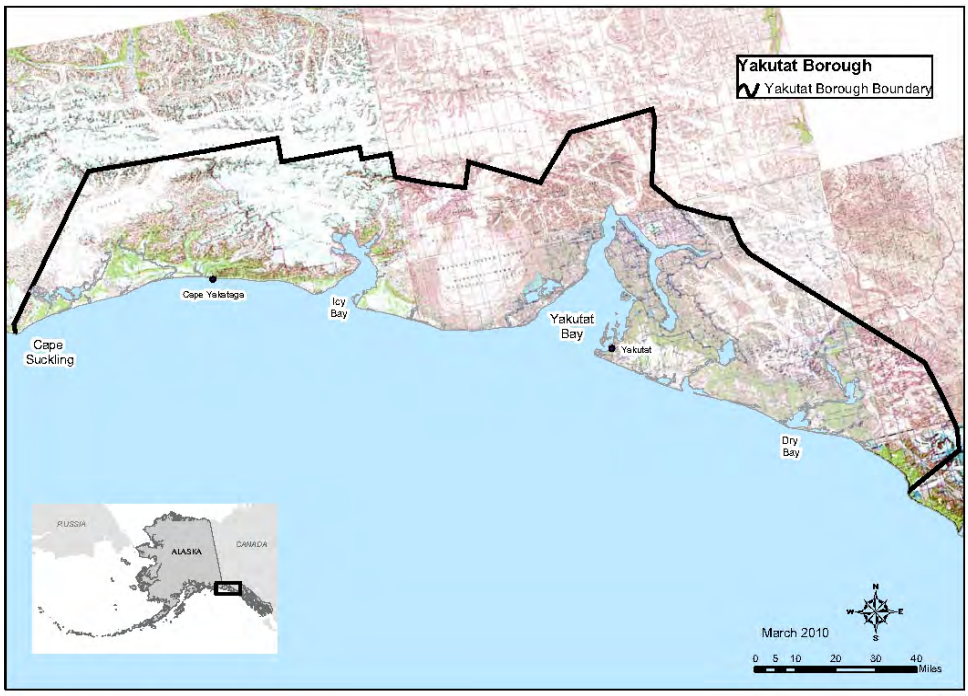


Figure 2-1 Yakutat's Location (Legacy HMP)

sloping outwash plains known as the Yakutat, Malaspina and Yakataga Forelands. The forelands are unique to this region and were formed during recent geologic times (CBY, 2010).

The abundant rainfall, mild temperatures, high water table, and gravel substrate make the Forelands especially productive spawning and rearing habitat for anadromous fish. All five salmon species (king, sockeye, pink, chum, and coho) are present in the area. The Alaska Department of Fish and Game has identified over 90 anadromous fish streams in CBY, between Cape Suckling and Cape Fairweather. Yakutat residents have a deep passion for their rich fish and wildlife and these natural resources provide outstanding commercial, subsistence and sport fishing, which are the backbone of the local economy (CBY, 2015).

The mountainous landscape found in much of CBY was shaped by the collision of two tectonic plates. These mountains are being constantly modified by glaciation, erosion, deposition, and wave, and wind action. The Saint Elias Mountains and its massive icefields run the length of the borough. This includes the Bering Glacier, part of the largest icefield in North America and the Hubbard Glacier, located on Yakutat Bay, which has a tidewater terminus over six miles wide and 92 miles long (CBY, 2015).

The position of land in relation to the sea level has fluctuated widely in the Yakutat area. While sudden uplifting and depression of land has been caused by tectonic events, the expansion and contraction of glaciers has had more gradual but equally significant effects. The recession of glaciers causes the land to rise slowly as the weight of glaciers is removed, although there is usually a time lag between melting and rebound. As of 1983, land in the Yakutat area had been emerging at an average rate of 0.21 inches per year. Theoretically, this rate of uplift could result

in an emergence of 10.5 inches in 50 years and create as much as 50 feet of new land in coastal areas where the slopes are very gentle.

History and Culture

Yakutat has a diverse cultural history. The original settlers are believed to have been Eyak-speaking people from the Copper River area who were conquered by the Tlingit. Yakutat means "the place where the canoes rest." In the 18th and 19th centuries, English, French, Spanish and Russian explorers came to the region. Fur traders were attracted by the region's sea otters. The Russian-American Company built a fort in Yakutat in 1805 to harvest sea otter pelts. Because the Russians would not allow local Tlingit access to their traditional fisheries, a Tlingit war party attacked and destroyed the post.

In 1884, the Alaska Commercial Company opened a store in Yakutat. By 1886, the black sand beaches in the area were being mined for gold. In 1889, the Swedish Free Mission Church had opened a school and sawmill in the area. The Stimson Lumber Company constructed a cannery, sawmill, store, and railroad, beginning in 1903. Most residents moved to the current site of Yakutat to be closer to this cannery, which operated through 1970. During World War II, a large aviation garrison and paved runway were constructed. Troops were withdrawn after the war, but the runway is still in use.

In 1970, Yakutat's cannery operators went bankrupt, the plant closed, and, until the community-operated cold storage plant and associated dock were completed in April 1971, welfare was a major source of income for many Yakutat fishermen. The community-owned cold storage operation continued to run until the processing and storage building burned down in 1977.

In the fall of 1993, the Yakutat Tlingit Tribe was officially recognized by the U.S. government as a tribal government. The Yakutat Tlingit Tribe has jurisdiction over lands outside the CBY, as far west as Cape Suckling.

The area maintains a traditional Tlingit culture with influences from the original Eyak, Athabascan, as well as Russian, English, and American traders and miners (DCRA, 2019).

Transportation and Facilities

Like most of Southeast Alaska, Yakutat is relatively isolated with no road or rail access. The airport has daily commercial jet service that directly connects with Juneau, Cordova, Anchorage, and Seattle. There are also air taxis and float plane services to Yakutat. The state owns two jet-certified runways; one is 6,475 feet (ft) long by 150 ft wide of concrete, and the other is 7,745 ft long by 150 ft wide of asphalt. The airport is located three miles southeast of town, and a seaplane base is available one-mile northwest. The U.S. Forest Service owns five airstrips in the vicinity, and the National Park Service operates one at East Alsek River. The Borough operates the state-owned boat harbor and the Ocean Cape Dock. Monti Bay is the only sheltered deep water port in the Gulf of Alaska. Barges deliver goods monthly during the winter and more frequently in summer.

The State Ferry serves Yakutat. However, severe seas in the Gulf of Alaska during winter months restrict the ferry service to summers only (DCRA, 2019).

Climate

Yakutat has a maritime climate characterized by relatively mild, often rainy weather. Summer temperatures range from 42 to 60 degrees Fahrenheit (°F); winter temperatures range from 17 to 39°F. Yakutat receives some of the heaviest precipitation in the state, averaging 155 inches, including 143 inches of snowfall.

2.2 DEMOGRAPHICS

According to the 2010 U.S. Census, the population in Yakutat has steadily increased between 1980 and 2010 to a high of 662. The 2010 U.S. Census recorded 662 residents, of which the median age was 40 years; indicating a moderately young population. The population is expected to remain steady because over half of the population is between "under 5" and 44 years of age. The male and female composition is approximately 49 and 51%, respectively. There are approximately 255 households with the average household having approximately three individuals. The most recent 2017 Department of Commerce, Community, and Economic Development (DCCED) certified population is 552 (DCCED, 2017). This population drop is partly due to the closure of the Icy Bay Logging Camp.

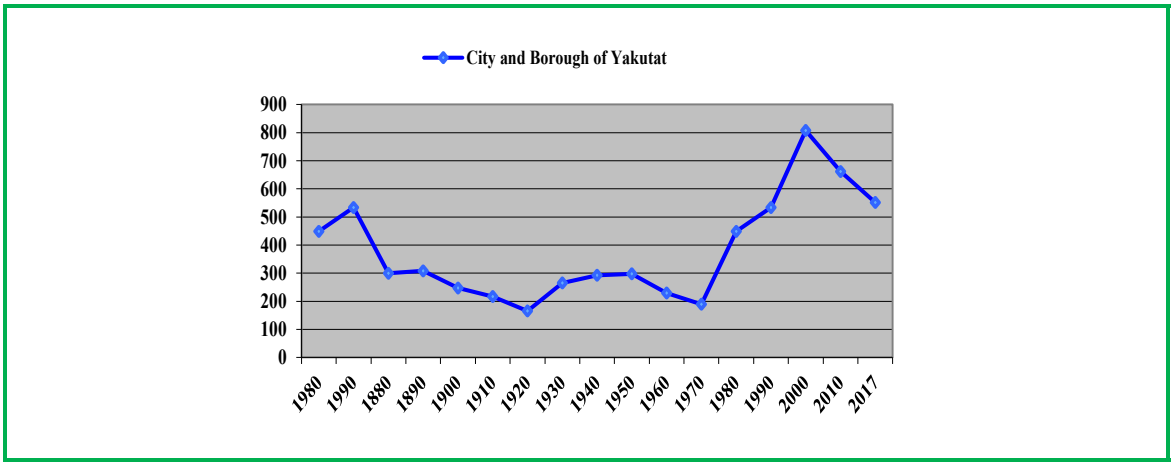


Figure 2-2 City and Borough of Yakutat's Historic Population

Source: DCRA, 2017

2.3 ECONOMY

Yakutat's economy is dependent on fishing, fish processing, and government. Many residents hold commercial fishing permits. Yakutat Seafoods is the major private employer. Recreational fishing opportunities, both saltwater and freshwater, are world-class. Most residents depend on subsistence hunting and fishing for food. Yakutat residents use a stretch of about 200 miles of coastline, most of it within CBY, for subsistence activities. Yakutat households harvested an average of 1,046 pounds of subsistence foods in 2000. Harvests of Native households averaged 1,274 pounds; non-Native household harvested 754 pounds. On a per capita basis, Yakutat residents harvested 385pounds of subsistence foods in 2000. Salmon, trout, shellfish, deer, moose, bear, and goats are also harvested.

According to the 2013-2017 ACES 5-year estimates, the median household income was $64,583 with a per capita income of $32,393. Approximately 3.4% of the population were reported to be living below the poverty level. The potential work force (those aged 16 years or older) in the Borough was estimated to be 548, of which 403 were actively employed.

Yakutat's economy is less diversified than the State as a whole. Yakutat is heavily dependent on government employment, which comprises 40% of the community's jobs. A comparison of the distribution of employment by industry in Yakutat and statewide shows some of the gross strengths and weaknesses of Yakutat's economy. Yakutat has more jobs in manufacturing which reflects the contribution commercial fishing and seafood processing industry make to the Yakutat economy. However, while still above the Statewide average in 2019, the percentage of jobs attributed to this sector in Yakutat is significantly less than in the late 1990s. Yakutat also has significantly fewer jobs in professional, education, and health services than the Statewide average (CYB, 2019).

Table 2-1 Yakutat's Largest Employers in 2019

Rank	Firm Name	Average Employment	Rank	Firm Name	Average Employment
1	Yakutat Community Health Center	32	8	Mallott's General Store	16
2	Yakutat Seafoods	31	9	State Government	14
3	City and Borough of Yakutat	29	10	YCC, Inc.	13
4	Federal Government	27	11	Yakutat Lodge	12
5	Yakutat Tlingit Tribe	20	12	Yakutat School District	12
6	Icy Bay Logging Camp/Mark Fairchild Trucking	18	13	Alaska Airlines	11
7	Glacier Bear Lodge	16	14	Yakutat Power	10

Source: CBY, 2019

Employment in Yakutat continues to be seasonal in nature. In 1997, the number of jobs in Yakutat doubled in the summer. This seasonal trend remains generally the same in 2008, with nearly double twice as many jobs in the summer months. The additional summer jobs tend to be processing and tourism related. Government jobs are mostly year-round.

There is one large seafood processing plant in Yakutat, Yakutat Seafoods, which employs approximately 31 people during the height of the season. Although some employees are not year-round residents, their spending at local businesses does add to the economy. Yakutat Seafoods currently process salmon, halibut and black cod.

Table 2-2 Commercial Fishing

Year	Number of Permit Holders	Number of Fishermen who Fished	Gross Earnings	Total Pounds Landed
2017	152	127	$5,799,559	3,222,000
2016	151	121	$4,294,100	2,472,412
2015	157	127	$3,846,893	2,581,727
2014	157	129	$4,230,748	2,883,659

2013	158	124	$5,534,439	3,575,561
2012	151	125	$3,971,601	2,371,912
2011	153	134	$4,437,922	3,036,026
2010	152	140	$4,261,421	3,236,462
2009	156	137	$2,374,205	2,225,685
2008	163	132	$3,266,507	2,167,409
2007	159	137	$3,218,027	2,352,615
2006	163	125	$2,559,788	2,006,779
2005	160	126	NA	NA
2004	156	119	$2,312,387	2,421,618
2003	153	117	NA	NA
2002	155	106	$1,103,378	2,682,319
2001	165	122	$1,430,601	2,932,101
2000	162	126	$1,372,739	1,805,955
1997	167	138	$3,278,024	3,838,869
1990	154	141	$4,137,486	3,329,745
Source: Alaska Commercial Fisheries Entry Commission, June 2019				

With successful and flourishing fishing and guiding related tourism, residents would like to see more non-consumptive tourism and recreation opportunities in CBY. This includes kayaking, canoeing, surfing, birding, photography, experiencing and understanding the region's rich Native culture and history, and hiking. Recreation activities available in the area include guided and unguided kayaking, camping, rafting, and hiking trips in the Alsek River, Harlequin Lake, around Yakutat Bay, the Hubbard Glacier, Icy Bay, Vitus Lake, along the north Gulf Coast, and in the mountains of Wrangell-St. Elias National Park and Preserve. Locally-owned businesses that provide and assist with these experiences, are an important goal for the community.

Cruise ships travel along the coast and into Yakutat and Disenchantment Bay and occasionally Icy Bay. There are not many cruise ships in Icy Bay when compared to Disenchantment Bay, but visitation is increasing. This is due in part to cruise ship limits in Glacier Bay National Park. Residents have raised concerns about the impact of cruise ship visitation on seals and other marine mammals and note that navigational safety is at issue since the entrance to Icy Bay is shallow. The number of cruise ships visiting the area has dropped from 41 in 2008 to 38 in 2009. Only 16 ships were scheduled to visit in the 2010 season. In 2019, that number has risen to 200. The Yakutat Tlinglit Tribe had a program that placed Yakutat residents on cruise ships to provide local interpretive programs and hopes to do so again in the near future.

According to the 2010 *Comprehensive Plan*, economic diversification should take advantage of Yakutat's assets and competitive advantages, listed below.

- Excellent airport and daily scheduled jet service to Juneau and Anchorage.
- A well-developed small boat harbor.
- Good working relationship between CBY, USFS, Yakutat Tlingit Tribe, and the Yak-Tat Kwaan; regular coordination meetings to share information.
- Rich fishery resources.
- An active seafood processing plant in town.
- Reputation for world-class sportfishing and related tourism infrastructure.

- The potential to become a leader in biomass-based and wave energy production.
- World-wide surfing destination.
- Abundant wood waste from commercial timber harvest.
- Extensive sand, gravel and mineral resources.
- Close-knit community capable of finding and implementing innovative solutions.
- A long-standing destination for University research in Yakutat Bay, Icy Bay, and the Bering Glacier areas. An opportunity to receive more economic benefit and convey research and data to local children and adults via a Yakutat Bay Marine Education Science Center.
- Unique landscape with great potential for non-consumptive tourism.

A new multi-purpose dock on the east side of Monti Bay was completed in 2019, and updates are planned to expand moorage for larger vessels.

Figure 2-3 depicts an aerial photograph of the Yakutat area.

Figure 2-3 Aerial Photograph of the Yakutat Area (Rootsweb, 2015)

Section Three 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. Outreach support documents and meeting information regarding the Planning Team and public outreach efforts are provided in Appendix F.

DMA 2000, and its implementing regulations, for the planning process include:

DMA 2000 Requirements
Local Planning Process §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 §201.6(b)(1): An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval; §201.6(b)(2): 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 §201.6(b)(3): Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information. §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. §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. §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.
1. REGULATION CHECKLIST
ELEMENT A. Planning Process
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1)) A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2)) A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1)) A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3)) A5. Is there discussion of how the community will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii)) A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating, and updating the mitigation plan within a 5-year cycle?) (Requirement §201.6(c)(4)(i))
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, March 2015.

3.1 OVERVIEW

The State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) provided funding and project oversight to LeMay Engineering & Consulting, Inc. to facilitate and guide Planning Team development and the 2019 HMP planning update process. CBY was sent an introductory email December 12, 2018, explaining the planning process and encouraging CBY to establish a local planning team and hold a planning team meeting.

The planning team examined the full spectrum of hazards listed in the 2018 State of Alaska Hazard Mitigation Plan (SHMP), the 2008 Legacy HMP, the 2015 HMP Update, and identified natural hazards the 2019 HMP Update would address. CBY 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 December 2018 through July 2019.

1. Organize resources: Members of the Planning Team identified resources, including staff, agencies, and local community members, who could provide technical expertise and historical information needed in the development of the 2019 HMP Update.
2. Monitor, evaluate, and update the plan: The Planning Team used their process that they developed in 2008 to ensure the 2015 and 2019 HMP Updates were monitored to ensure they were used as intended while fulfilling community needs. The Planning Team then used their process that was developed in 2008 to evaluate the HMP to compare how their decisions affected hazard impacts. They then shared their successes with community members during the 2019 HMP Update process to encourage support for mitigation activities and to provide data for incorporating mitigation actions into existing planning mechanisms and to provide data for the HMP's next five-year update.
3. Assess risks: The Planning Team identified the hazards specific to the Yakutat area and with the assistance of a hazard mitigation planning consultant (LeMay Engineering & Consulting, Inc.) 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. Develop a 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 2008 and 2015. Subsequently, in 2019, 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 in 2019.

3.2 PLANNING TEAM

Table 3-1 identifies the complete hazard mitigation Planning Team.

3-1 Hazard Mitigation Planning Team

Name	Title	Organization	Key Input
Rhonda Coston	CBY Planner	CBY	Planning Team Lead, HMP review.
Martha Indreland	Economic Development Coordinator	CBY	Planning Team Member, Local data input, and HMP review.
Kathy Jacobson, Chair	Commissioner	Planning and Zoning (P&Z) Commission	Planning Team Member, Local data input, and HMP review.
Samson Demmert	Commissioner	P&Z Commission	Planning Team Member, Tribal data input, and HMP review.
Mary Ann Porter	Commissioner	P&Z Commission	Planning Team Member, Tribal data input, and HMP review.
Teresa Swanson	Commissioner	P&Z Commission	Planning Team Member, Federal data input, and HMP review.
Timothy Grzskoviak	Commissioner	P&Z Commission	Planning Team Member, Local data input, and HMP review.
Jennifer LeMay, PE, PMP	Hazard Mitigation Planner	LeMay Engineering & Consulting, Inc.	Project Manager, responsible for 2019 HMP Update, project coordination, and final product review.
Rick Dembroski	PDM Grant Manager	State of Alaska, DHS&EM	Grant Manger.
Brent Nichols, CFM	State Hazard Mitigation Officer	State of Alaska, DHS&EM	Provides State Approval.

3.3 PUBLIC & AGENCY INVOLVEMENT

LeMay Engineering & Consulting, Inc. extended an invitation to individuals and entities identified on the project mailing list described the planning process and announced the upcoming CBY's planning activities.

The announcement was emailed to relevant academia, nonprofits, and local, state, and federal agencies on June 24, 2019. The following agencies were invited to participate and review the HMP:

- Yakutat Tlingit Tribe;
- Yak-tat Kwaan;
- Yakutat School District;
- National Weather Service (NSW);
- Federal Aviation Administration (FAA);
- Alaska Department of Transportation and Public Facilities (DOT/PF);
- National Park Service (NPS) – Glacier Bay and Wrangell St. Elias;
- Alaska Department of Fish & Game; and
- U.S. Forest Service (USFS) – Yakutat District.

Table 3-2 lists the community's public involvement initiatives focused to encourage participation and insight for the 2019 HMP Update effort.

Table 3-2 Public Involvement Mechanisms

Mechanism	Description
Public Notice #1	In May 2019, CBY distributed a public notice introducing the upcoming public meeting.
Newsletter #1 Distribution (June 8, 2019)	In June 2019, CBY posted a newsletter introducing the upcoming planning activity. The newsletter encouraged the Borough to provide hazard and critical facility information. It was posted at Borough offices, bulletin boards, local stores, and on the Borough's website to enable the widest dissemination.
Public Meeting, June 13, 2019	Notice of the June 13, 2019 meeting was posted according to public notice procedures, which included posting at Borough offices.
Newsletter #2 Distribution (June 24, 2019)	In June 2019, CBY distributed Newsletter #2 that described the availability of the 2019 HMP Update for review and the kick-off of a 30-day public comment period. The newsletter encouraged comments and input. It was posted at Borough offices, bulletin boards, local stores, and on the Borough's website to enable the widest dissemination.
30-Day Public Comment Period	The public comment period was held from June 24 to July 24, 2019.
Public Meeting, July 18, 2019	Notice of the July 18, 2019 meeting was posted according to public notice procedures, which included posting at Borough offices.

Initial contact was made with the CBY on December, 12, 2018, with the CBY Planner being very excited they were included within DHS&EM's Pre-Disaster Mitigation grant and the prospect of updating the HMP. The CBY quickly formed the Planning Team and began directing HMP data acquisition efforts.

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. The risk assessment was completed after the community asset data was collected by the Planning Team during 2019 which identified the assets that are exposed and vulnerable to specific hazards. The Planning Team evaluated these facilities and their associated risks to facilitate creating a viable or realistic risk analysis and subsequent vulnerability assessment for the CBY.

The Planning Team presented a summary of the HMP Update as an agenda item during the regularly scheduled CBY Assembly meeting on July 18, 2019.

3.4 Review and Analysis of the 2015 HMP Update

The 2015 HMP Update was revised as described below.

Section 1. ***Introduction***: updated explanation of the plan update process.

Section 2. ***Community Description***: updated and expanded community information, including State data.

Section 3. ***Planning Process***: updated this section to reflect 2019 public process including newsletters, public meetings, and 2019 Planning Team.

Section 4. ***Plan Adoption***: 2019 resolutions and dates.

Section 5. ***Hazard Profile Analysis***: reviewed hazard identification and risk assessment for earthquakes, flooding, ground failure, tsunami and wildfire, adding 2015 to 2019 descriptions and data. Also added changes in the cryosphere as a hazard per the 2018 SHMP.

Section 6. ***Vulnerability Analysis***: analyzed vulnerability with 2019 critical facilities and infrastructure tables.

Section 7. ***Mitigation Strategy***: reviewed 2015 mitigation goals and actions and added new goals and actions for the 2019 Mitigation Action Plan. Provided progress updates of actions implemented after the 2015 HMP Update.

Section 8. ***References***: revised to reflect the 2019 Update.

The 2015 Planning Team did not fully complete their designated annual HMP reviews or plan maintenance activities. Therefore, it became a primary consideration to update the 2015 HMP to include all hazards that have, or could potentially have, impacted the community during the 2015 HMP Update's five-year lifecycle.

Table 4 delineates Planning Team-identified HMP components that necessitated an information update. The Team determined how community changes, construction and infrastructure conditions, climate change impacts, and population increases or decreases have influenced hazard risks and/or facility vulnerabilities.

The 2019 HMP Update process included inviting new and existing stakeholders to review the existing HMP to determine what was accomplished versus what was intended to accomplish.

Pertinent section data provided the foundation for completing the 2019 HMP Update as identified within Table 3-3.

Table 3-3 HMP Review and Update Needs Determination

2015 HMP Section	2015 HMP Items to be Updated	Status: F: Fulfilled NF: Not Fulfilled	2019 HMP Identified items for Deletion	Newly Identified Items to be Added for HMP Compliance	New Action Commitment
Planning Process	• Planning process • Planning team membership • Mitigation resource list • Public outreach initiatives • Plan Maintenance Activities • Plan Review Obligations	• NF: Did not complete annual HMP reviews • NF: Continued Plan Development	• None	• Refine plan maintenance processes and responsibilities.	• Planning Team will begin to hold review meetings and strive to integrate HMP initiatives into other plans, ordinances, and resolutions.

Table 3-3 HMP Review and Update Needs Determination

2015 HMP Section	2015 HMP Items to be Updated	Status: F: Fulfilled NF: Not Fulfilled	2019 HMP Identified items for Deletion	Newly Identified Items to be Added for HMP Compliance	New Action Commitment
Hazard Profile Update	• Update hazard profile and new event history • Profile newly identified hazard risks	• NF: Update hazard profile and new event history	• Mitigation projects that were deleted or combined due to similarity	• Identify new hazards. • Develop new Mitigation Action Plan (MAP). • Update existing hazards' impacts.	• Delineate new actions within the MAP.
Risk Analysis and Vulnerability Assessment	• Asset inventory • Vulnerability analysis & summaries	• NF: Identify development and land use changes	• None	• Develop asset inventory. • Determine infrastructure vulnerabilities. • Determine residential structure vulnerabilities. • Identify repetitive loss properties as appropriate.	• Fill data gaps. • Locate scientific information to augment these data. • Delineate climate change scenario in future development analysis.
Mitigation Strategy	• Determine existing mitigation actions status. • Define mitigation action, implement-ation successes or barriers.	• NF: Did not track project implementation process	• Delete completed, combined, or deleted actions. • Implemented & non-relevant mitigation actions.	• Identify existing 2015 mitigation plan actions' status. • Identify new mitigation actions for newly identified hazard implementation. • Develop community specific capability assessment(s).	• Annually review action's status and feasibility.

3.5 Incorporation of Existing Plans and Other Relevant Information

During the planning process, the Planning Team reviewed and incorporated information from existing plans, studies, reports, and technical reports (Table 3-4) into the 2019 HMP Update. The following were available from various sources and were reviewed and referenced where applicable for the HMP's jurisdictional information, hazard profiles, and vulnerability assessment.

Table 3-4 Documents Reviewed

Existing plans, studies, reports, ordinances, etc.	Contents Summary (How will this information improve mitigation planning?)
CBY Comprehensive Development Plan, 2010	Implementation examples.
CBY Coastal Zone Management Plan, 1996	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.
USGS Earthquake Probability Mapping	Hazard probability mapping products.
DCCED/DCRA, Yakutat Community Profile (April 2019)	Current socio-economic data.
State of Alaska Hazard Mitigation Plan (SHMP), 2018	Defined statewide hazards and their potential locational impacts.
U.S. Army Corps of Engineers, Erosion Information Paper, - Yakutat, Alaska, September 20, 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.
U.S. Army Corps of Engineers, Floodplain Manager's Reports, Community Specific 2011; Updates in 2014 and 2015	Defined the area's historical flood impacts.
Suleimani, E.N., Nicolsky, D.J., and Koehler, R.D., Tsunami Inundation Maps for Yakutat, Alaska: Alaska Division of Geological & Geophysical Surveys Report of Investigation 2016-2, 2016	Evaluated potential tsunami hazards for Yakutat and numerically modelled the extent of inundation from tsunami waves generated by tectonic and landslide sources.
Suleimani, E.N., Nicolsky, D.J., and Koehler, R.D., Potential Maximum Permanent Flooding, Yakutat, Alaska, 2018	Tsunami inundation map.

A complete list of references is provided in Section 8.

3.6 PLAN MAINTENANCE

This section describes a formal plan maintenance process to ensure that the 2019 HMP Update remains an active and applicable document. It includes an explanation of how the CBY Planning Team intends to organize their 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 here:

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

3.6.1 Implementing HMP Precepts

DMA 2000, and its implementing regulation for HMP implementation through existing planning mechanisms, include:

DMA 2000 Requirements
Incorporation into Existing Planning Mechanisms §201.6(b)(3): Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.
1. REGULATION CHECKLIST
ELEMENT A Planning Process (Continued)
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information?
Source: FEMA, March 2015.

Once the 2019 HMP Update is community-adopted and receives FEMA's final approval, each Planning Team Member ensures that the HMP, in particular each Mitigation Action Project, is incorporated into existing planning mechanisms whenever possible. Each member of the Planning Team is committed to undertake 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 subsection.
- 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.

3.6.2 Continued Public Involvement

DMA 2000, and its implementing regulation for continued public involvement, consist of:

DMA 2000 Requirements
Continued Public Involvement §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.
1. REGULATION CHECKLIST
ELEMENT A Planning Process (Continued)
A5. Is there discussion of how the community will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))
Source: FEMA, March 2015.

The CBY 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 CBY Planning Office. An address and phone number of the CBY Planner to whom people can direct their comments or concerns will also be available at the CBY Planning Office and City Hall.

The Planning Team will continue to 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 CBY-sponsored events, outreach programs, and public mailings. Any public comments received regarding the HMP will be collected by the CBY Planner, included in the annual report, and considered during future HMP updates.

A table is set up at Family Fishing Day on a Saturday in June each summer, operated in conjunction with the USFS, to detail tsunami, earthquake, and other hazard education, provide information and detail mitigation efforts. Community surveys (Appendix F) will be handed out and collected at this event; and completed surveys will be given to the CBY Planner to store until the five-year update of the HMP.

3.6.3 Monitoring, Reviewing, Evaluating, and Updating the HMP

DMA 2000, and its implementing regulation for monitoring, reviewing, evaluating, and updating the HMP, include:

DMA 2000 Requirements
Monitoring, Evaluating, and Updating the Plan §201.6(c)(4)(i): The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process. §201.6(d)(3): A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit if for approval within five years in order to continue to be eligible for mitigation project grant funding.
1. REGULATION CHECKLIST
ELEMENT A. Planning Process (Continued)
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating, and updating the mitigation plan within a five-year cycle?)
Source: FEMA, March 2015.

This section provides an explanation of how CBY's Planning Team intends to organize their efforts to ensure that improvements and revisions to the 2019 HMP Update occur in a well-managed, efficient, and coordinated manner.

The following three process steps are addressed in detail here:

1. Review and revise the HMP to reflect development changes, project implementation progress, project priority changes, and resubmit.
2. HMP resubmittal at the end of the plan's five-year life cycle for State and FEMA review and approval.
3. Continued mitigation initiative implementation.

3.6.3.1 Monitoring the HMP

The HMP was prepared as a collaborative effort. To maintain momentum and build upon previous hazard mitigation planning efforts and successes, CBY's Planning Team will continue to use the Planning Team to monitor, review, evaluate, and update the 2019 HMP Update. Each authority identified in the Mitigation Action Plan (MAP) matrix (Table 7-8) will be responsible for implementing the Mitigation Action Plan and determining whether their respective actions were effectively implemented. The Director of Public Safety and CBY Planner (or designee) will

serve as the primary points of contact and will coordinate local efforts to monitor, evaluate, revise, and tabulate, HMP actions' status.

3.6.3.2 Reviewing the HMP

The Planning Team will review their success for achieving the HMP's mitigation goals and implementing the MAP's activities and projects during the annual review process.

During each annual review, each agency or authority administering a mitigation project will submit a Progress Report (Appendix F) to the Planning Team. The report will include the current status of the mitigation project, including any project changes, a list of identified implementation problems (with appropriate strategies to overcome them), and a statement of whether the project has helped achieve the appropriate goals identified in the plan.

3.6.3.3 Evaluating the HMP

The Annual Review Questionnaire (Appendix F) provides the basis for future HMP evaluations by guiding the Planning Team with identifying new or more threatening hazards, adjusting to changes to, or increases in, resource allocations, and garnering additional support for HMP implementation.

The CBY 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:

- Determine authorities, outside agency, stakeholders, and residents' participation in the HMP implementation success.
- Identify notable risk changes for each identified and newly-considered natural or human-caused hazards.
- Consider land development activities and related programs' impacts on hazard mitigation.
- MAP implementation progress (identify problems and suggest improvements as necessary).
- Evaluate HMP local resource implementation for HMP identified activities.

3.6.3.4 Updating the HMP

In addition to the annual review, the Planning Team will update the HMP every five years. This sub section explains how they will review, evaluate, and explain implementation successes.

DMA 2000 Requirements
Reviewing, Evaluating, and Implementing the Plan §201.6(d)(3): A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit if for approval within five years in order to continue to be eligible for mitigation project grant funding.
1. REGULATION CHECKLIST
ELEMENT A. Planning Process (Continued)

D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))
Source: FEMA, March 2015

The CBY's Planning Team did not as a group review the 2015 HMP Update during four of its five-year life. Individuals did review the 2015 HMP in 2017 and 2018, although a report was not completed. In 2018, CBY recommitted to annually reviewing the HMP and completing an Annual Review Questionnaire (Appendix F) as described in Section 3.5.3.2. This will facilitate updating the HMP every five years (or when significant changes occur).

A complete Annual Review Questionnaire will enable the Team to identify possible changes (successes, failures, and roadblock experiences) in the HMP MAP by refocusing on new or more threatening hazards, resource availability, and acquiring stakeholder support for the HMP project implementation.

No later than the beginning of the fourth year following HMP adoption, the Planning Team will undertake the following activities:

- Request grant assistance from DHS&EM to update the HMP (this can take up to one year to obtain and one year to update the plan).
- Ensure that each authority administering a mitigation project will submit a Progress Report to the Planning Team.
- Develop a chart to identify those HMP sections that need improvement, the section and page number of their location within the HMP describing the proposed changes.
- Thoroughly analyze and update the natural hazard risks:
    - Determine the current status of the mitigation projects.
    - Identify the proposed MAP Actions (projects) that were completed, deleted, or delayed. Each action should include a description of whether the project should remain on the list, be deleted because the action is no longer feasible, or reasons for the delay.
    - Describe how each action's priority status has changed since the HMP was originally developed and subsequently approved by FEMA.
    - Determine whether the project has helped achieve the appropriate goals identified in the HMP.
    - Describe whether the community has experienced any barriers preventing them from implementing their mitigation actions (projects) such as financial, legal, and/or political restrictions, and stating appropriate strategies to overcome them.
    - Update ongoing processes, and change the proposed implementation date/duration timeline for delayed actions that the CBY still desires to implement.
    - Prepare a "new" MAP matrix for the CBY.
- Prepare a new Draft HMP Update.
- Submit the Draft HMP Update to the DHS&EM and FEMA for review and approval

3.6.3.5 Formal State and FEMA HMP Review

Completed HMPs do not automatically qualify the CBY for mitigation grant program eligibility until they have been reviewed and adopted by the CBY and received State- and FEMA- final approval.

Upon completion, the CBY (or its contractor) will submit the Draft HMP Update to the DHS&EM for initial review and preliminary approval. Once any corrections are made, DHS&EM will forward the Draft HMP Update to FEMA for their review and conditional approval.

The CBY are represented in this HMP and meet the requirements of Section 322 of DMA 2000 and 44 CFR §201.6(c)(5), respectively.

The CBY Mayor and CBY Manager, with assistance from the State Hazard Mitigation Officer (SHMO) and the State Hazard Mitigation Advisory Committee (SHMAC), are responsible for monitoring, evaluating, and updating the 2019 CBY HMP Update in accordance with 44 CFR §201.6. Its respective council will monitor the 2019 HMP Update to evaluate progress and update the plan every five years, or within 90 days of a Presidential Declared Disaster (as required), to reflect changes in State or Federal law. The HMP Annual Progress Report, the Hazard Mitigation Plan Annual Evaluation Forms, and the Community Survey are plan review tools (see Appendix F).

Upon completion, the CBY (or its contractor) will submit the draft HMP to the DHS&EM for initial review and preliminary approval. When all corrections are made, DHS&EM will forward the HMP to FEMA for their review and conditional approval.

Once the plan has fulfilled all FEMA criteria, the CBY will pass a formal HMP Adoption Resolution. A copy will be sent to FEMA through DHS&EM for final HMP approval.

FEMA's final approval assures the CBY is eligible for applying for appropriate mitigation grant program funding. The CBY (or its contractor) will include a final copy of the FEMA-approval letter within the 2019 HMP Update.

Section Four is included to fulfill CBY's HMP adoption requirements.

4.1 JURISDICTIONAL ADOPTION

DMA 2000, and its implementing regulations for governing body formal HMP adoption, include:

DMA 2000 Requirements
Local Plan Adoption **§201.6(c)(5):** [The 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 or Planning and Zoning Commission).
1. REGULATION CHECKLIST
ELEMENT E. Plan Adoption
E1. Does the plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval?) (Requirement §201.6(c)(5))
Source: FEMA, March 2015.

CBY is represented in this 2019 HMP Update; this HMP Update meet the requirements of the 2018 SHMP and Section 322 of DMA 2000, and 44 CFR §201.6(c)(5), respectively.

The CBY Assembly adopted the 2019 HMP Update on November 7, 2019 and submitted the final 2019 HMP Update to FEMA for formal approval. A scanned copy of the formal adoption is included in Appendix C.

Section Five identifies and profiles the hazards that could affect CBY.

5.1 OVERVIEW

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

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

DMA 2000, and its implementing regulations for hazard identification, are defined below:

DMA 2000 Requirements
Identifying Hazards §201.6(c)(2)(i): The risk assessment shall include a] description of the type, 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.
1. REGULATION CHECKLIST
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT
B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction? B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? B4. Does the Plan address NFIP-insured structures within the jurisdiction that have been repetitively damaged by floods?
Source: FEMA, March 2015.

5.2 HAZARD IDENTIFICATION AND SCREENING

This is the first step of the hazard analysis. The 2015 Planning Team reviewed seven possible hazards that could affect the CBY and determined that six hazards pose a great threat to the area: earthquake, flood/scour, ground failure, severe weather, tsunami, and wildland/tundra fire. The 2019 Planning Team reviewed the six hazards from 2015. Per the 2018 SHMP, changes in the cryosphere was added as an additional hazard. Also, conflagration fire was added as part of the wildland/tundra fire hazard. They then evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of their 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 (Table 5-1).

The 2019 Planning Team determined that seven hazards pose a great threat to the area: changes in the cryosphere, earthquake, flood/scour, ground failure, severe weather, tsunami, and wildland/tundra and conflagration fire; some of which are influenced by increasing changing climate conditions such as late ice formation, early thaw conditions, and increased, lack, or inconsistent rain.

Table 5-1 Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Natural Hazards		
Earthquake	Yes	The Fairweather fault, whose closest segment is about 33 miles to the northeast of CBY, is the closest fault. From the historic record of earthquakes, other active faults, including those that moved during the September 1899 earthquakes, are inferred to exist, but they have not as yet been located and possibly either have not ruptured the surface or are concealed by glaciers or large bodies of water. In fact, after the Aleutian Island Chain, the Gulf of Alaska is the most seismically active region in the U.S. (CBY, 2010).
Flood (Riverine and/or coastal-related floods and resultant erosion)	Yes	Snowmelt run-off and rainfall flooding occurs during spring thaw and the fall rainy season. Events occur from soil saturation. Several minor flood events cause damage. Severe damages occur from major floods. CBY experiences river flooding/break-up/ice run-up, and riverine erosion along the area's rivers, streams, and creek embankments from high-water flow, riverine high-water ice flows, wind, surface runoff, and boat traffic wakes.
Ground Failure (Avalanche, Landslide/Debris Flow)	Yes	Ground failure occurs throughout Alaska from avalanches and landslides.
Severe Weather (Cold, Drought, Rain, Snow, Wind, etc.)	Yes	Severe weather impacts the CBY with climate change/global warming and changing El Niño/La Niña Southern Oscillation (ENSO) patterns generating increasingly severe weather events such as winter storms, heavy or freezing rain, thunderstorms, and with subsequent secondary hazards such as riverine or coastal storm surge floods, landslides, snow, and wind.
Tsunami (Seiche)	Yes	Tsunamis pose a threat to the CBY from local and/or distant events.
Volcano	No	Volcano-generated ash does not pose a threat to the CBY.
Fire	Yes	Wildland and conflagration fires pose a threat to the CBY.
Cryosphere	Yes	Subsidence and permafrost are the primary hazards causing houses to shift due to ground sinking and upheaval, and high ground water melting the permafrost. These hazards can also result in the damage or destruction of critical facilities. Portions of the community could be cut off from critical facilities and infrastructure. Services could be disrupted for an extended period.

5.3 HAZARD PROFILES

DMA 2000, and its implementing regulations for hazard profiles are described below.

DMA 2000 Requirements
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 recurrence probability.
1. REGULATION CHECKLIST
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT
B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction? (Requirement §201.6(c)(2)(i)) B2. Does the Plan include information on previous occurrences of hazard events and on the recurrence probability?
Source: FEMA, March 2015.

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

- Characteristics (Type);
  - Potential climate change impacts are primarily discussed in the Severe Weather hazard profile but are also identified where deemed appropriate within each hazard profile.
- History (Previous Occurrences);
- Location;
- Extent (breadth, magnitude, and severity);
- Impact (Section 5 provides general impacts associated with each hazard. Section 6 provides detailed impacts to the CBY's residents and critical facilities); and
- Recurrence Probability.

NFIP-insured Repetitive Loss Structures are addressed in Section 6.0, Vulnerability Analysis.

The hazards profiled for the Yakutat area are presented throughout the remainder of Section 5.3. The presentation order does not signify their importance or risk level.

5.3.1 Earthquake

5.3.1.1 Characteristics

Approximately 11% of the world's earthquakes occur in Alaska, making it one of the most seismically-active regions in the world. Three of the ten largest quakes in the world since 1900 have occurred here. Earthquakes of magnitude (M) 7 or greater occur in Alaska on average of about once a year; M 8 earthquakes average about 14 years between events.

An earthquake is a sudden motion or trembling caused by a release of strain accumulated within or along the edge of the earth's tectonic plates. The effects of an earthquake can be felt far

beyond the site of its occurrence. Earthquakes usually occur without warning, and after only a few seconds, can cause massive damage and extensive casualties. The most common effect of earthquakes is ground motion, or the vibration or shaking of the ground during an earthquake.

Ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. An earthquake causes waves in the earth's interior (i.e., seismic waves) and along the 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 the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., up to 20 ft), as can the length of the surface rupture (e.g., up to 200 miles).

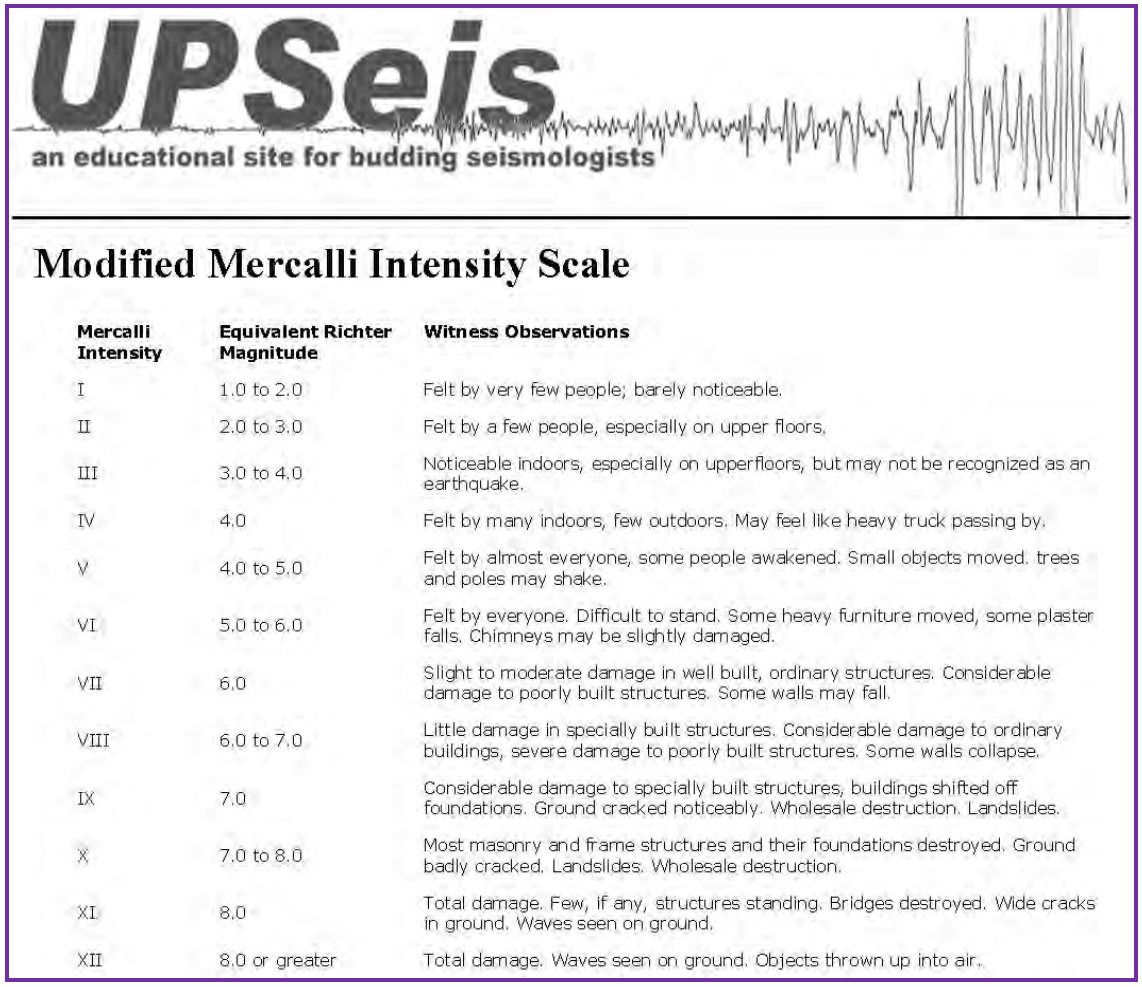
Liquefaction occurs when seismic waves pass through saturated granular soil, distorting its granular structure, and causing some of the empty spaces between granules to collapse. Pore water pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Liquefaction causes lateral spreads (horizontal movements of commonly 10 to 15 ft, but up to 100 ft), flow failures (massive flows of soil, typically hundreds of ft, but up to 12 miles), and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property.

Landslides/Debris Flows occur as a result of horizontal seismic inertia forces induced in the slopes by the ground shaking. The most common earthquake-induced landslides include shallow, disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes completely saturated with water. Once the soil liquefies, it loses the ability to hold together and can flow downhill at very high speeds, taking vegetation and/or structures with it. Slide risks increase after an earthquake during a wet winter.

The severity of an earthquake can be expressed in terms of intensity and magnitude. Intensity is based on the damage and observed effects on people and the natural and built environment. It varies from place to place depending on the location with respect to the earthquake epicenter, which is the point on the earth's surface that is directly above where the earthquake occurred. The severity of intensity generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. The scale most often used in the U.S. to measure intensity is the Modified Mercalli Intensity (MMI) Scale. As shown in Figure 5-1, 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).

Magnitude (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 (see Figure 5-1).



Modified Mercalli Intensity Scale

Mercalli Intensity	Equivalent Richter Magnitude	Witness Observations
I	1.0 to 2.0	Felt by very few people; barely noticeable.
II	2.0 to 3.0	Felt by a few people, especially on upper floors.
III	3.0 to 4.0	Noticeable indoors, especially on upperfloors, but may not be recognized as an earthquake.
IV	4.0	Felt by many indoors, few outdoors. May feel like heavy truck passing by.
V	4.0 to 5.0	Felt by almost everyone, some people awakened. Small objects moved. trees and poles may shake.
VI	5.0 to 6.0	Felt by everyone. Difficult to stand. Some heavy furniture moved, some plaster falls. Chimneys may be slightly damaged.
VII	6.0	Slight to moderate damage in well built, ordinary structures. Considerable damage to poorly built structures. Some walls may fall.
VIII	6.0 to 7.0	Little damage in specially built structures. Considerable damage to ordinary buildings, severe damage to poorly built structures. Some walls collapse.
IX	7.0	Considerable damage to specially built structures, buildings shifted off foundations. Ground cracked noticeably. Wholesale destruction. Landslides.
X	7.0 to 8.0	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.

Figure 5-1 Modified Mercalli Intensity

Source: MMI, 2015

5.3.1.2 History

Many of the prominent faults in the Yakutat Region are thought to be active. An active fault, in general, is considered to be a type of fault along which continuous or intermittent movement is taking place; motion may be abrupt or, in some cases, may be very slow. The active fault nearest to Yakutat on which historic surface displacements have been measured is the Fairweather fault, whose closest segment is about 33 miles to the northeast. From the historic record of earthquakes, other active faults, including those that moved during the September 1899 earthquakes, are inferred to exist, but they have not as yet been located and possibly either have not ruptured the surface or are concealed by glaciers or large bodies of water (USGS, 1975).

Yakutat Bay Region 1889 Earthquake

In September 1899, the Yakutat Bay region was shaken by a series of major earthquakes, the most violent of which were felt at all settlements within a radius of 400 kilometers. Several heavy shocks occurred on September 4 and 10, but the main earthquake that caused great topographic changes occurred at 21:41 Coordinated Universal Time (UTC), September 10, 1899.

A U.S. Geological Survey (USGS) team did not study the region until six years after the shocks, but the topographic changes were obvious. Dead barnacles and other shellfish were found everywhere, and several uplifted beaches were observed. A maximum uplift of 14.5 meters occurred on the west coast of Disenchantment Bay, and changes of five meters or more affected a large area. Subsidence of as much as two meters was observed in a few areas. Phenomena observed included surface faulting, avalanches, and fissures, spouting from sand craterlets, and slight damage to buildings. A destructive tsunami 10.6 meters in height occurred in Yakutat Bay, and tsunamis also were observed at other places along the Alaskan coast.

The earthquake altered the regimen of glaciers in the area. The shattering of Muir Glacier started the rapid discharge of icebergs and the later retreat of this and other ice tongues in Glacier Bay. Avalanching resulted in the later advance of at least nine glaciers in Yakutat Bay and perhaps many others in more remote regions. Some severely crevassed glacier fronts, which were found six years later, had taken several years for the fractured parts to reach the sea. The first earthquake on September 10 lasted 90 seconds and was heavier at Yakutat than that of September 4 (00:22 UTC). It was strong enough to throw people off their feet at Disenchantment Bay. The main earthquake on September 10, 1889, was felt over a largely unsettled region; the total felt area in unknown. Prospectors camped on Disenchantment Bay felt over 50 shocks on September 10, two of which were strong. Residents at Yakutat village also described as severe two of the many shocks observed that day. Ten or more earthquakes were felt in the Coast and Geodetic Survey camp near the Copper River delta, and several of them were violent. Several shocks were also felt on September 10 in the Chugach Mountains near Prince William Sound; five were reported about 300 kilometers to the northeast on the Yukon River; and several were felt to the southeast at Juneau and Skagway. Many large aftershocks occurred in September and the following months (USGS, 2008).

USGS identified 139 earthquakes occurring within 100 miles of the CBY. Table 5-2 lists 18 of those that exceeded a M of 5.0. The largest one occurred on July 17, 2014 and measured M6.0.

Table 5-2 Yakutat's Historical Earthquakes since 1978

Date	Time	Latitude	Longitude	Depth	Magnitude
7/17/2014	11:49:33	60.3491	-140.333	10	6
1/9/2007	15:49:33	59.42	-137.118	10	5.7
2/11/2005	21:29:34	60.11	-139.348	11.7	5
2/11/2005	21:00:23	60.104	-139.343	15	5.5
11/4/2000	17:49:27	58.772	-138.988	23.5	5.2
5/2/2000	23:59:18	59.737	-139.396	10	5.4
9/17/1992	22:16:16	60.035	-140.496	12.2	5.4
8/6/1989	13:17:43	59.939	-140.475	10	5.4
6/6/1988	15:01:29	58.765	-138.032	10	5.3

Table 5-2 Yakutat's Historical Earthquakes since 1978

Date	Time	Latitude	Longitude	Depth	Magnitude
1/9/1985	19:28:21	60.289	-140.744	14.7	5.7
7/15/1983	7:48:59	60.299	-140.872	11.9	5.1
6/28/1983	3:25:17	60.219	-141.287	18.5	5.9
5/3/1982	10:14:14	60.117	-141.115	11.1	5
5/2/1982	15:35:59	60.119	-141.18	12.6	5.1
6/30/1980	18:07:39	60.01	-141.047	13	5
4/20/1979	12:49:07	60.315	-140.872	15	5.3
3/2/1979	9:34:46	60.365	-140.704	2	5.4
3/1/1979	7:08:54	60.628	-141.235	11	5.4

(USGS, 2019)

North America's strongest recorded earthquake occurred on March 27, 1964, in Prince William Sound measuring M9.2 and was felt by many residents throughout Alaska. Yakutat experienced severe ground motion from this historic event. However, the Planning Team stated that very few experienced ground shaking from the November 3, 2002 M7.9 Denali Earthquake.

5.3.1.3 Location, Extent, Impact, and Recurrence Probability

Location

The entire geographic area of Alaska is prone to earthquake effects. As such, CBY is located within a fairly active seismic zone with the Fairweather and the Queen Charlotte Faults in close proximity to the area. Figure 5-2 shows the locations of active and potentially active faults in Alaska.

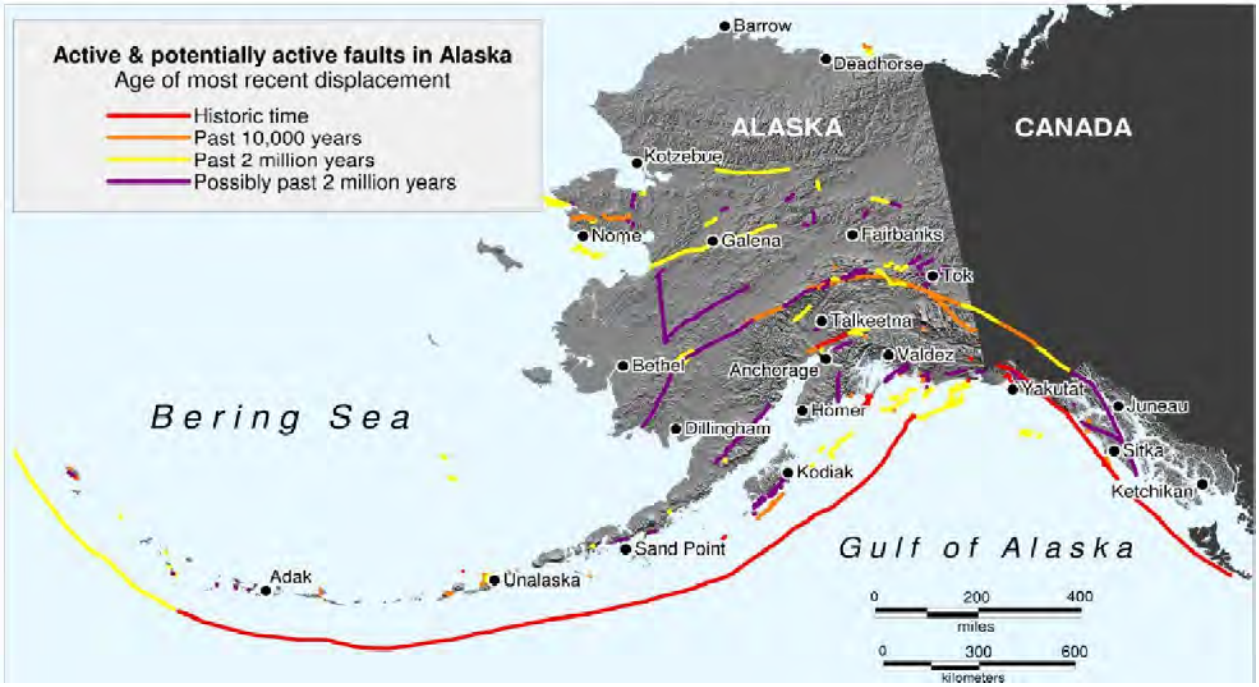


Figure 5-2 Active and Potentially Active Faults in Alaska

Source: DGGS, 2009

Extent

Earthquakes felt in the CBY area have exceeded M 5.0 18 times from 1979-2019.

"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 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 the basic utilities and critical facilities that we take for granted.

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 United States, FEMA Report 66. September 2000. Via DHS&EM, 2018.

Impact

Impacts to the CBY community 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.

Recurrence Probability

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.

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 5-3 indicates that the USGS earthquake probability model places the probability of an earthquake within CBY with a likelihood of experiencing strong shaking (0.6g to 0.8g 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.

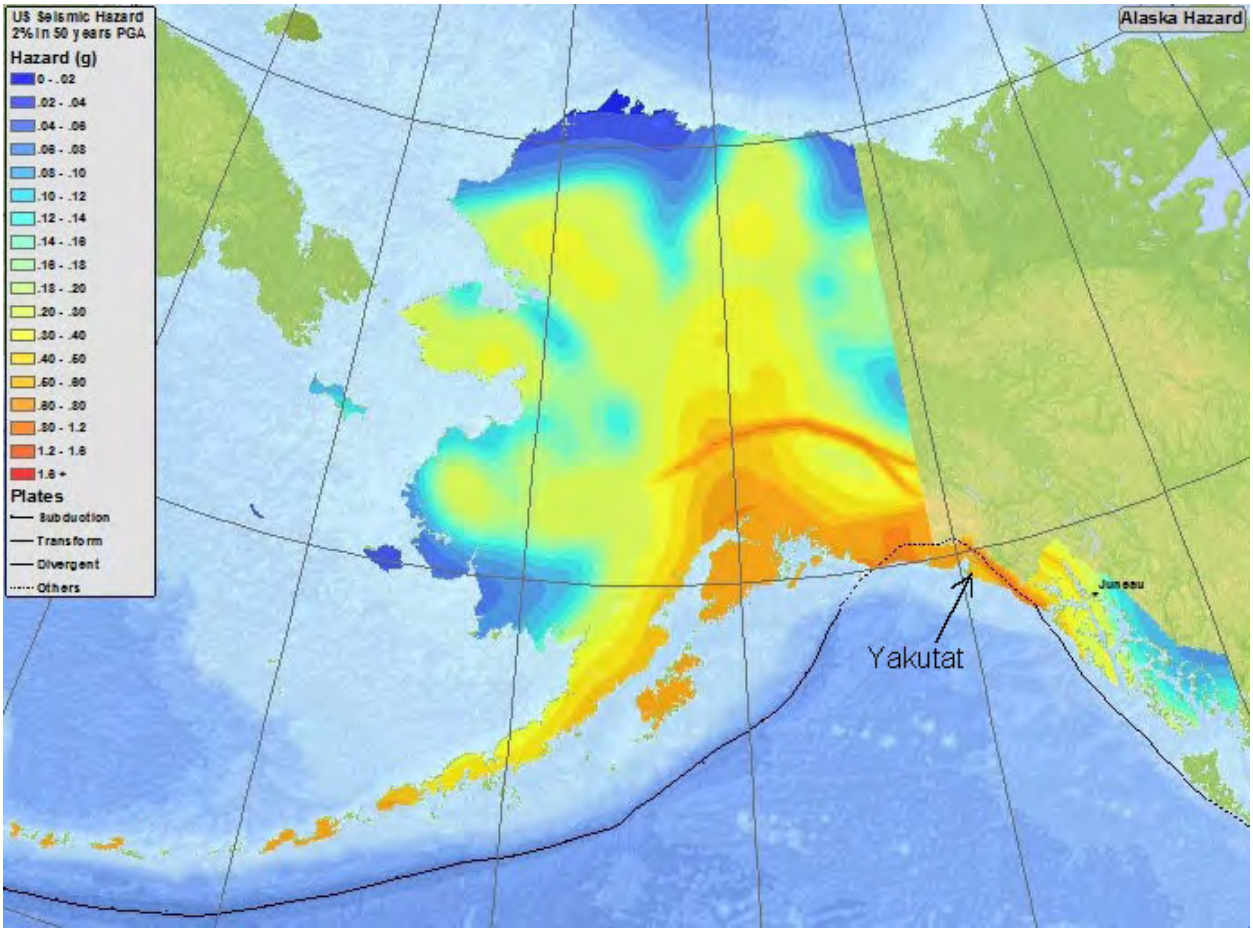


Figure 5-3 City and Borough of Yakutat's Earthquake Probability (USGS, 2019)

5.3.2 Flood/Erosion

5.3.2.1 Characteristics

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

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

Primary types of flooding that occur in the CBY are: rainfall-runoff, snowmelt, ice jam, storm surge, and ice override floods.

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.

Ice-Jam floods occur when warming temperatures and rising water flows causes the ice to break-up and disconnect from the embankment. The large ice chunks begin to flow and move down river. The ice does not flow easily, often impacting with adjacent blocks, resulting in occasional ice jams. Some ice jams quickly break apart; however, larger jams occur which create small dams, causing the water to exert increasing pressure on the jam creating a damming effect. Water subsequently begins to build depth and often overtops adjacent embankments which flood upstream communities.

When the ice-jam breaks, the built-up water rushes downstream with great force. Ice blocks scour the embankment, destroying infrastructure such as fuel headers, barge landings, and boat mooring structures. Large house-sized ice blocks may even be driven above the embankment, destroying any structure in its path. Communities are virtually helpless against such devastation.

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

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

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

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

Glacial Dam Outburst Flood. Glaciers are dynamic, growing and receding with changing climate conditions, and pose a significant threat to Alaska's communities. They generate large avalanches and glacial lake dam outburst flooding.

> *"The major hazard presented by glacier dammed lakes is catastrophic flooding which occurs when the ice dams fail. In many places, flooding occurs annually; there are many exceptions and the situations change rapidly from one year to the next. It should be noted that large quantities of water can also be stored in or under glaciers and may create serious floods even though no surface lake is visible."* (Mayo et al, 1971)

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

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

Land surface loss results from high flowing surface water across roads due to poor or improper drainage. These events typically occur from rain and snowmelt run-off.

Erosion

Erosion is a process that involves the gradual wearing away, transportation, and movement of land. However, not all erosion is gradual. It can occur quite quickly as the result of a flash flood, coastal storm, or other event. Most of the geomorphic change that occurs in a river system is in response to a peak flow event. Erosion is a natural process, but its effects can be exacerbated by human activity.

Erosion is a problem in developed areas where the disappearing land threatens development and infrastructure. Three main types of erosion affect human activity in Alaska:

- Coastal erosion;
- Riverine erosion; and
- Wind erosion.

Erosion rarely causes death or injury. However, erosion causes the destruction of property, development, and infrastructure. In Alaska, coastal erosion is the most destructive, riverine erosion a close second, and wind erosion a distant third.

Coastal Erosion

The forces of erosion are embodied in waves, currents, and winds on the coast. Surface and ground water flow, and freeze-thaw cycles may also play a role. Not all of these forces may be present at any particular location. Coastal erosion can occur from rapid, short-term daily, seasonal, or annual natural events such as waves, storm surge, wind, coastal storms, and flooding, or from human activities including boat wakes and dredging. The most dramatic

erosion often occurs during storms, particularly because the highest energy waves are generated under storm conditions.

Coastal erosion may also be due to multi-year impacts and long-term climatic change such as sea-level rise, lack of sediment supply, subsidence, or long-term human factors such as aquifer depletion or the construction of shore protection structures and dams.

Attempts to control erosion though shoreline protective measures such as groins, jetties, seawalls, or revetments, can lead to increased erosion. This is because shoreline structures eliminate the natural wave run-up and sand deposition processes and can increase reflected wave action and currents at the waterline. The increased wave action can cause localized scour both in front of and behind structures and prevent the settlement of suspended sediment.

Land surface erosion results from flowing water across road surfaces due to poor or improper drainage during rain and snowmelt run-off which typically result from fall and winter sea storms.

Storms systems along coasts produce high winds that in turn generate large waves and currents. Storm surges can temporarily raise water levels by as much as 23 feet, increasing the vulnerability of shorelines and floodplains to changes to tidal ranges in rivers and bays, and changes in sediment and nutrient transport which drive beach processes.

The retreat of sea ice facilitates storm damage to shorelines in the Yakutat, to the extent that communities may be required to relocate inland at very substantial cost.

Riverine Erosion

Deposition is the accumulation of soil, silt, and other particles on a river bottom or delta. Deposition leads to the destruction of fish habitat and presents a challenge for navigational purposes. Deposition also reduces channel capacity, resulting in increased flooding or bank erosion.

Floodwaters pose a health hazard by picking up contaminants and disease as they travel. Outhouses, sewers, septic tanks, and dog yards are all potential sources of disease transported by floodwaters. Lack of a water source is a significant concern for flood victims, especially if the flood has been extensive enough to contaminate the public water supply. In such a case, outside bottled water is at times the only source of clean water.

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 such as dams or reservoirs. 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.

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, damage to public utilities (fuel headers and electric and water/wastewater utilities), and economic impacts associated with the costs of trying to prevent or control erosion sites.

The primary impact from erosion is the loss of land and anything on it. Erosion may increase sedimentation of river deltas and hinder channel navigation. Other impacts include reduction in water quality due to high sediment loads, loss of native aquatic habitats, damage to public utilities (fuel headers and electric and water/wastewater utilities), and economic impacts associated with the costs of trying to prevent or control erosion sites.

Event Recurrence Intervals

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

5.3.2.2 History

There are three types of flood hazards in Yakutat: voluminous rainfall, snow and glacier melt, and glacier-dammed lake release flooding. Due to the sheltered location of Yakutat, residents have reported that storm surges do not occur within the CBY.

River flooding occurs in the region as a result of a large input of water to the drainage basin in the form of rainfall, snowmelt, glacier melt, or a combination of these inputs. In the Yakutat area, as well as most coastal areas of Southcentral and Southeast Alaska, the floods due to snowmelt are typically lower in magnitude than those due to rainstorms in late summer or fall. Glacier melt is typically largest in late summer; increasing the potential magnitude of late summer rainfall floods in glacial streams.

Glacier Lake Flooding

In late May or early June 2002, the Hubbard Glacier pushed a moraine across the seaward entrance to Russell Fjord and began to restrict the tidal exchange between Disenchantment Bay and Russell Fjord. By early June, the moraine formed Russell Lake. The lake level rose at an average rate of more than 0.8 feet per day due to large amounts of runoff and glacial melt in the basin. By late July, the dam completely sealed off the lake and by 3 a.m., August 14, real-time USGS water gage data revealed the water level in the lake had peaked at about 61 ft above sea level and had begun to drop rapidly, creating the second largest glacial lake outburst in recorded world history.

Perhaps the greatest hazard associated with Russell Lake will result if the Hubbard Glacier dam does not fail, and Russell Lake fills indefinitely. Eventually, the lake will overtop the saddle separating Russell Fjord from the Situk River basin. If the outflow from Russell Fjord basin drains through the Situk River, erosion of a new, larger channel will influence the landscape and aquatic habitat downstream.

Hubbard Glacier, Alaska 1986

The USGS website https://earthshots.usgs.gov/earthshots/Hubbard-article has available satellite images which show the vicinity of Yakutat Bay, Hubbard Glacier, and Russell Fjord. Russell Fjord is the narrow body of saltwater connected to the bay and extending southeast.

The Hubbard Glacier lies where Russell Fjord meets the bay. In May 1986, the Hubbard Glacier surged down from the mountains, blocking the outlet of Russell Fjord and creating "Russell Lake". All that summer, the new lake filled with runoff; its water level rose 82 ft, and the decrease in salinity threatened its sea life.

Around midnight on October 8, 1986, the dam began to give way. In the next 24 hours, an estimated 187.1 billion cubic ft of water gushed through the gap, and the fjord was reconnected to the ocean at its previous level.

The fjord could become dammed again, and, perhaps permanently. If this happens, the fjord could overflow its southern banks and drain through the Situk River instead, threatening trout habitat and a local airport.

5

The following is an excerpt of a journal article written by two USGS scientists explaining this phenomenon.

> *"**ABSTRACT:** In late May 1986, the advancing Hubbard Glacier blocked the entrance to Russell Fjord near Yakutat, Alaska, creating a large ice-dammed lake. Runoff from the surrounding glaciated mountains raised the level of the lake to about 25 m above sea level by 8 October, when the ice dam failed. As Hubbard Glacier continues its advance, the ice dam is expected to re-form, perhaps blocking the fjord permanently.*
>
> *Should that occur, "Russell Lake" could drain southward into the "Old Situk Creek" channel, **endangering an important fishery and inundating traditional native-use lands and the area around Yakutat Airport.***

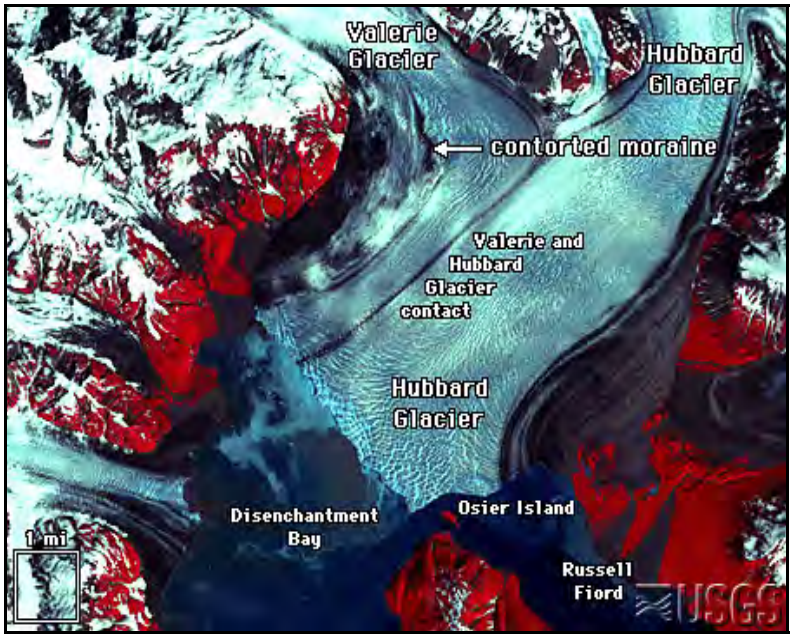


Figure 5-4 Hubbard Glacier (USGS, 1988)

Remote sensing offers one method to monitor this large tidal glacier system, particularly the glacier activity that would portend the re-closure of Russell Fjord. This paper presents the results of evaluating Landsat Thematic Mapped data of the Hubbard Glacier collected on 7 August 1985 and 11 September 1986, as well as multispectral scanner data collected on 24 August 1979. These data were registered, enhanced, and reviewed to evaluate the multitemporal aspects related to the glacial advance. In addition, techniques for determining the area of glacial ice change were investigated" (USGS, 1988).

The following is an email correspondence from Roman J Motyka, Research Associate Professor at the Geophysical Institute University of Alaska, Fairbanks.

"Technical Memorandum September 4, 2007

To: George Kalhi, Army Corp of Engineers

Thank you for the August 31 07 photos of the push moraine that has recently appeared in front of the Hubbard Glacier terminus near Gilbert Point. The appearance of this moraine so early in the fall is very disconcerting. As you know, the push moraine now isolates this section of the terminus from calving processes, allowing it to advance. Ice speeds here are on the order of 4 to 7 meters per day so a closure this winter is within the realm of possibility and certainly heightens the probability of a closure next spring.

The location of the push moraine is worrisome. In our previous work on documenting bathymetry in the vicinity of Gilbert Point, we identified a reef that extends towards the terminus face (Motyka and Truffer, 2007; Motyka, 2006). The push moraines that caused the closure in spring 2002 occurred in approximately the same location. These moraines were blocked by this shallow reef as the glacier continued its spring advance, causing the closure.

It is my opinion that the situation at Gilbert Point deserves detailed monitoring and that the community of Yakutat should be apprised of the situation. Monitoring should include:

1. Detailed bathymetry at Gilbert Point and the gap, particularly around the recently emerged push moraine, at the earliest possible date by UAF, CRREL, and ACE.

2. Continued laser ranger monitoring of the gap width by CRREL.

3. Use of RadarSat images to monitor the status of the Hubbard Glacier terminus by GI-UAF.

4. Acquisition of Quick Bird and/or ALOS PRISM high resolution images when possible (CRREL and GI-UAF).

5. Periodic photo over flights of the terminus, at least monthly. (USFS and/or US NPS?).

In the past, Bruce Molnia of the USGS was able to get information from classified DOD images. He should be contacted to see whether this arrangement can be continued" (University of Alaska, Fairbanks, 2007 End of Technical Memorandum).

The legacy HMP reported the following historical flood and break-up events (Table 5-3).

Table 5-3 Historical Flood and Break-up History in Yakutat

Break-Up Date	Flooded	Break-Up Date	Flooded
May 13, 1960	No	May 1, 1980	No
May 19, 1961	No	May 5, 1981	No
May 19, 1962	Yes	May 15, 1982	No
May 17, 1963	Yes	May 9, 1983	Yes
May 30, 1964	Yes (Latest Worst Flood)	May 13, 1984	No

Table 5-3 Historical Flood and Break-up History in Yakutat

Break-Up Date	Flooded	Break-Up Date	Flooded
May 14, 1965	No	May 21, 1985	No
May 12, 1966	No	May 14, 1986	No
May 5, 1967	No	May 8, 1987	Yes
May 17, 1968	Yes	May 8, 1988	Yes
May 5, 1969	No	May 5, 1989	Yes
May 11, 1970	No	May 2, 1990	No
May 21, 1971	Yes	May 4, 1991	Yes (Deepest ever at Matters Store)
May 18, 1972	Yes	May 21, 1992	No
May 17, 1973	No	April 27, 1993	No
May 5, 1974	No	May 1, 1994	Yes
May 15, 1975	Yes	April 29, 1995	Yes (Extensive)
May 8, 1976	Yes	May 5, 1996	No
May 13, 1977	No	May 1, 1997	No
May 2, 1978	No	April 17, 1998	No (Earliest Ever)
April 28, 1979	No	--	--

5.3.2.3 Location, Extent, Impact, and Recurrence Probability

Location

There are a number of large glacial river systems and their tributaries in CBY where flooding and flood-related erosion occurs. Two that have been identified by the Project Team include the Situk and Alsek Rivers, both important for their fishery resources and recreation use, private and commercial. The entire community is at risk from a flooding event.

The Planning Team indicated that Yakutat experiences minor flooding impacts; most of which occur from rainfall and snowmelt run-off. Water collects in low terrain depressions and may rise to just below a structure's first step with no water intrusion on the first floor.

Yakutat's Erosion Problems

The U.S. Army Corp of Engineers (USACE) Baseline Erosion Assessment included the Yakutat area, and the report listed the area as having a "Minimal" erosion threat. The Yakutat Erosion Information Paper dated September 20, 2007 reported the following erosion problems or issues:

> *"Erosion and flooding have recently become an important issue in the community. Erosion problems are reported in four areas. The first is at nearby Russell Fjord which is dammed periodically by the Hubbard Glacier. When the Hubbard Glacier advances enough to cross Russell Fjord, it forms an ice dam that can fill Russell Fjord until the ice dam breaks or the rising water overtops the low mountains that form the western wall of the fjord. Either conclusion to the ice damming process can cause outburst flooding and erosion. Ice damming closed Russell Fjord in 1996 and 2002.*
>
> *A second area of concern is the Monti Bay coast near developed areas of Yakutat. The low-lying sand-silt beaches of the south shoreline are susceptible to erosion. Islands and navigation improvements shelter part of the community, but even the sheltered beaches*

can be eroded by locally-generated waves. The community survey reports the active erosion area is 5 to 15 feet wide and 6 to 30 feet high and estimates the rate of erosion is ½ to 2 feet per year. Erosion is also occurring by the Ocean Cape dock next to the fish camp buildings and in a section of washed-out road.

A third erosion area is inland from Yakutat, where unnamed streams in the Lost River basin, the Situk River basin, and Ahrnklin River basin are eroding the Forest Highway about 3 miles before its terminus at Harlequin Lake and at other locations from Mile 12 to 24. There also is a subdivision development where the sides of the roads are washing out from local runoff.

A fourth erosion area is the beaches from Dry Bay to Ocean Cape. As glaciers recede, the glaciers leave behind large lakes which are catching sediment as it is transported downriver. This is what is happening at Alsek Lake on the Alsek River. Alsek River, along with the Dangerous River, are likely the major contributors of sediments to Yakutat's beaches. If the beaches fail to accumulate, they will erode back which appears to have begun occurring three years ago. If the erosion cuts into the beach dunes, it will eventually begin the process of saltwater intrusion into several important estuaries, drastically cutting local salmon production" (USACE, 2009 and 2007).

The USACE provided the attached aerial photo (Figure 5-5) displaying Yakutat's erosion impact sites. The USACE has done no follow up reports on Yakutat's erosion impacts as of 2019. A follow up report is needed.

Figure 5-5 Yakutat Erosion Locations (USACE, 2007)

Extent

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

The following factors contribute to riverine flooding frequency and severity:

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

The Yakutat area does not experience severe riverine flooding, but the area faces an ever-looming threat of a Hubbard Glacier-formed lake-related dam burst event.

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 Yakutat, 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. 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.

The USACE's Erosion Assessment describes the area's threat as:

> *"**Potential Damages***
>
> *If Hubbard Glacier causes the Russell Fjord to overflow into the Situk River and nearby waterways, the resultant flooding and erosion could substantially impact the ecology and economy of the area. Fishing, timber resources, recreation, and tourism economy in this area, including large native allotment parcels and a fishing lodge in the Situk River watershed would be threatened.*
>
> *Wind and wave action are eroding the coast in front of the city hall during winter storms. Erosion threatens a home and an adjacent outbuilding 30 to 50 ft from the shore and another home 80 to 100 ft from shore. The road past the inland subdivision is eroded during heavy rains and could be washed out. There is no alternative access to the subdivision. If the Forest Highway was lost to advancing erosion, rivers in the area and Harlequin Lake would be inaccessible, causing an economic loss of revenue generated by recreational and personal-use fisheries"* (USACE, 2009 and 2007).

Recurrence Probability

There is no data identifying a 500-year (0.2 percent chance of occurring in a given year) flood threat in the Yakutat area.

5.3.3 Ground Failure

5.3.3.1 Characteristics

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

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

indiscriminate development of sloping ground, or the creation of cut-and-fill slopes in areas of unstable or inadequately stable geologic conditions.

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

- Earthquake ground movement can trigger events ranging from rock falls and topples to massive slides;
- Intense or prolonged precipitation can cause slope over-saturation and subsequent destabilization failures such as avalanches and landslides; 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 miles per hour (mph) for several miles. Other types of flows include debris avalanches, mudflows, creeps, earth flows, debris flows, and lahars.

Lateral Spreads are a type of landslide 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, seasonally-frozen ground, and permafrost are often agents of ground failure (see Sections 5.3.1 and 5.3.7). 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.

5.3.3.2 History

During September 1889, the Yakutat Bay region was shaken by a series of major earthquakes, the most violent of which were felt at all settlements within a radius of 249 miles. Several heavy shocks occurred on September 4 and 10, but the main earthquake that caused great topographic changes occurred at 21:41 UTC, September 10, 1889.

A USGS team did not study the region until six years after the shocks, but the topographic changes were obvious. The ground failure impacts included a maximum uplift of 47.6 ft that occurred on the west coast of Disenchantment Bay, and changes of 16.4 ft or more affected a large area. Subsidence of as much as 6.6 ft was observed in a few areas.

Phenomena observed included surface faulting, avalanches, and fissures spouting from sand craterlets, and slight damage to buildings.

5.3.3.3 Location, Extent, Impact, and Recurrence Probability

Location

Figure 5-6 shows the location figure from the 2018 State of Alaska HMP.

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 (see Figure 5-7).

Impact

Impacts associated with ground failure include surface subsidence, infrastructure, building, and/or road damage. Ground failure does not typically pose a sudden and catastrophic hazard; however, landslides and avalanches may. Ground failure damage occur 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.

CBY's 2010 Comprehensive Plan described the area's threat from natural events as,

> *"**4.1 Natural Environmental Analysis.***
>
> *A large portion of the borough is subject to physical conditions that limit and guide how development in the coastal zone can occur. The landscape of the borough experiences glaciation and modification by erosion, deposition, wave and wind action, and some minimal tectonic uplift. In addition, the borough is potentially subject to natural hazards that include earthquake**, ground instability,** tsunamis, seafloor instability, and faulting. Glacial advancement and retreat, outburst flooding, waves from calving ice, heavy snows, poor soils, and avalanches are also concerns…"* (Yakutat, 2010).

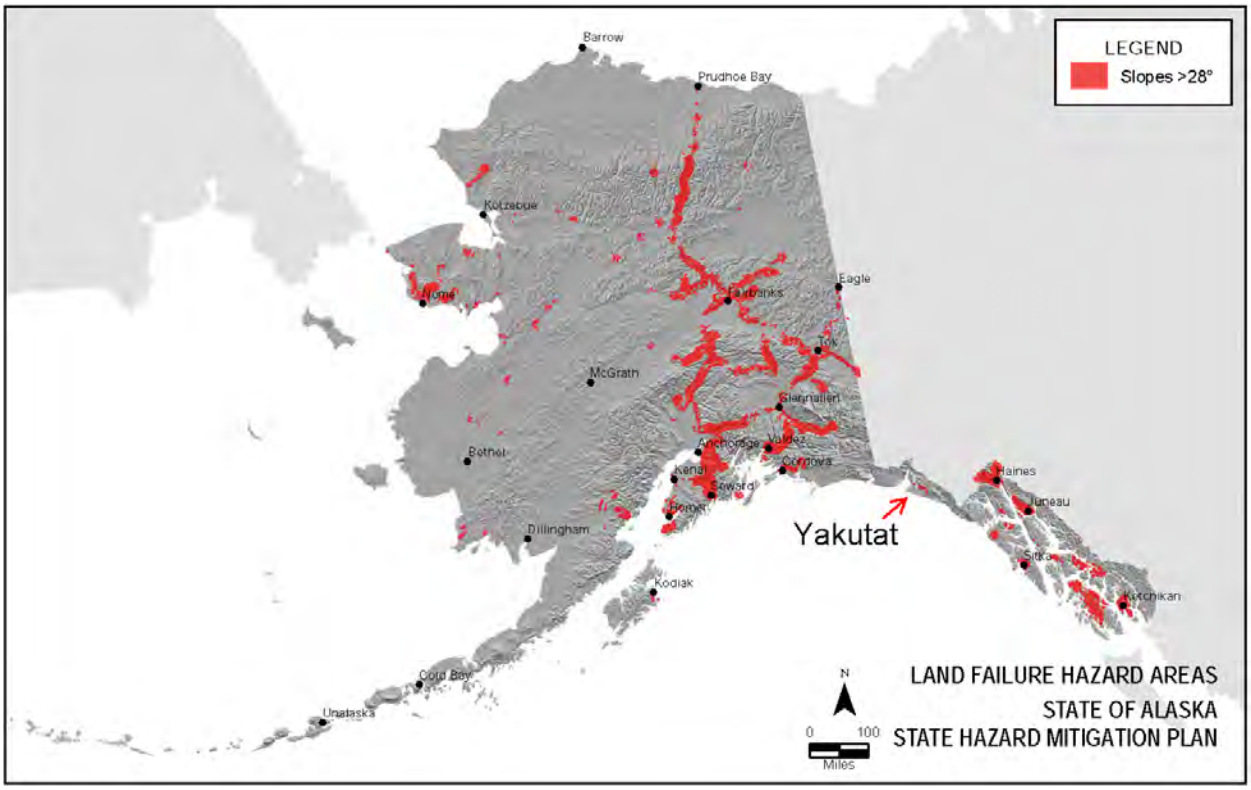


Figure 5-6 Yakutat Land Failure Location

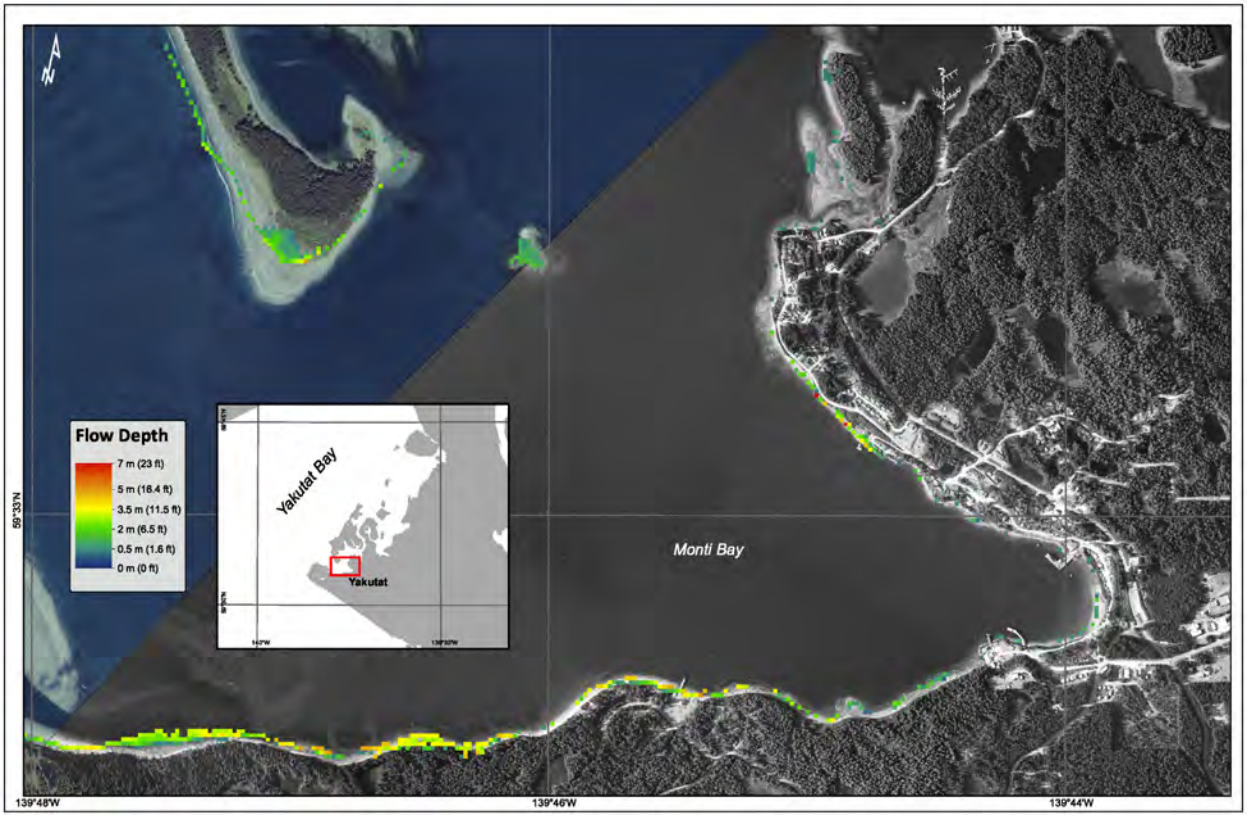


Figure 5-7 Maximum Composite Flow Depths Over Dry Land in Yakutat for Landslides

Recurrence Probability

Even though there are few written records defining ground failure impacts for the Yakutat area, there are areas that have annually recurring landslides, avalanches, and ground failure damages throughout the community impacting structures, roads, harbor areas, and the airport.

5.3.4 Severe Weather

5.3.4.1 Characteristics

Severe weather occurs throughout Alaska with extremes experienced by CBY that includes thunderstorms, lightning, hail, heavy and drifting snow, freezing rain/ice storm, extreme cold, and high winds. The area experiences periodic severe weather events such as the following:

Climate Change influences the environment, particularly historical weather patterns. Climate change and El Niño/La Niña Southern Oscillation (ENSO) influences create increased weather volatility such as hotter summers (drought) and colder winters, intense thunderstorms, lightning, hail, snowstorms, freezing rain/ice storms, and high winds.

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

storm surge) and severe winter storms. Therefore, increased awareness and understanding how ENSO events potentially impact Alaska's vastly differing regional weather is necessary.

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

Heavy Rain occurs rather frequently over the coastal areas along the Gulf of Alaska. Heavy rain is a severe threat to Yakutat.

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. Heavy snow is a severe threat to Yakutat.

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

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

Extreme Cold varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme". In Alaska, extreme cold usually involves temperatures between -20°F to -60°F. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold accompanied by wind exacerbates exposure injuries such as frostbite and hypothermia.

High Winds occur in Alaska when there are winter low-pressure systems in the North Pacific Ocean and the Gulf of Alaska. Alaska's high winds can equal hurricane force but fall under a different classification because they are not cyclonic nor possess other hurricane characteristics. In Alaska, high winds (winds greater than 50 mph) occur rather frequently over coastal areas. High winds are a severe threat to Yakutat.

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

below-freezing temperature. These supercooled raindrops freeze on contact when they strike the ground or other cold surfaces.

Snowstorms happen when a mass of very cold air moves away from the polar region. As the mass collides with a warm air mass, the warm air rises quickly, and the cold air cuts underneath it. This causes a huge cloud bank to form, and as the ice crystals within the cloud collide, snow is formed. Snow will only fall from the cloud if the temperature of the air between the bottom of the cloud and the ground is below 40°F. A higher temperature will cause the snowflakes to melt as they fall through the air, turning them into rain or sleet. Similar to ice storms, the effects from a snowstorm can disturb a community for weeks or even months. The combination of heavy snowfall, high winds, and cold temperatures pose potential danger by causing prolonged power outages, automobile accidents, and transportation delays, creating dangerous walkways, and through direct damage to buildings, livestock, crops, and other vegetation. Buildings and trees can also collapse under the weight of heavy snow.

Note: Winter storm floods are discussed in Section 5.3.2.

Figure 5-8 displays Alaska's annual rainfall map based on Parameter-elevation Regressions on Independent Slopes Model (PRISM) that combines climate data from the National Oceanic and Atmospheric Administration (NOAA) and Natural Resources Conservation Service (NRCS) climate stations with a digital elevation model to generate annual, monthly, and event-based climatic element estimates such as precipitation and temperature.

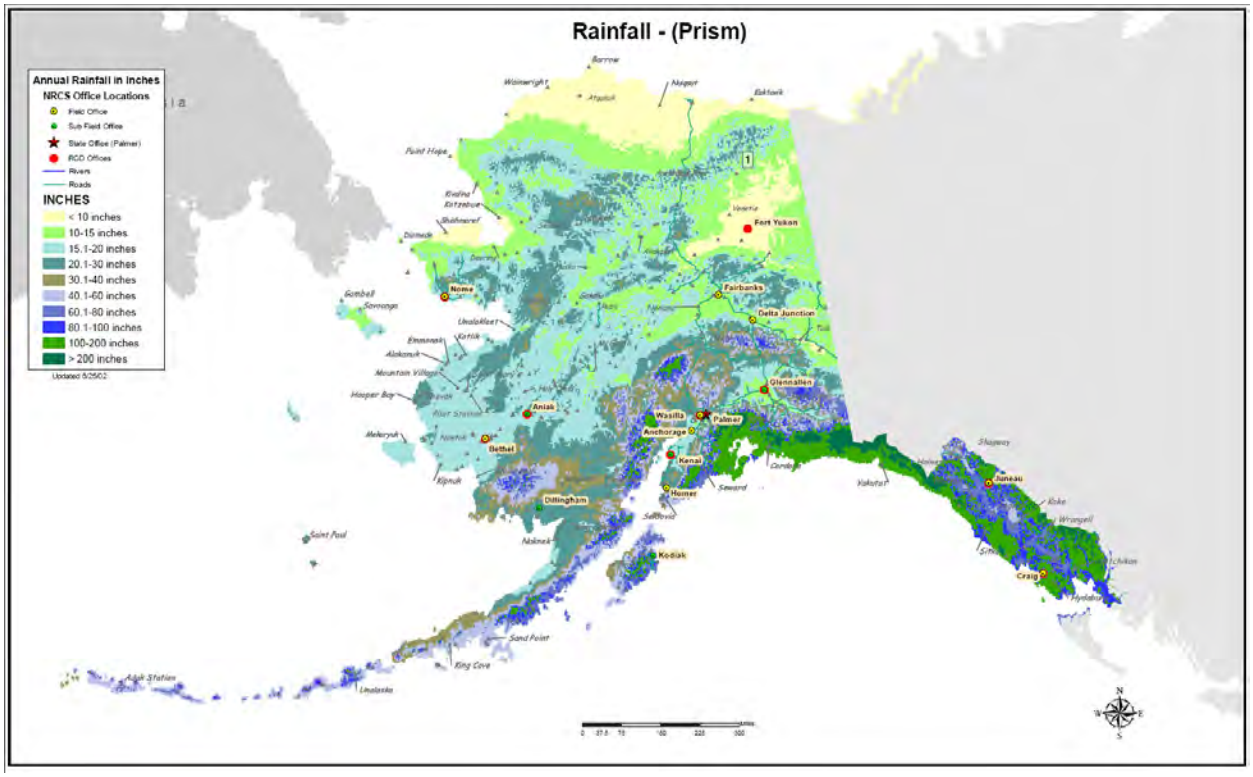


Figure 5-8 Statewide Rainfall Map

(PRISM, 2012)

5.3.4.2 History

The Yakutat area is continually impacted by severe weather events. Hurricane force wind, freezing rain, high winds, and cold typically have damaging results.

Climate Change. The University of Alaska Fairbanks (UAF) Arctic Climate Impact Assessment (ACIA) describes weather changes and how they impact Alaska:

> *"**18.3.3.1. Changes in climate***
>
> *Alaska experienced an increase in mean annual temperature of about 2 to 3ºC between 1954 and 2003…Winter temperatures over the same period increased by up to 3 to 4ºC in Alaska and the western Canadian Arctic, but Chukotka experienced winter cooling of between 1 and 2 ºC…*
>
> *The entire region, but particularly Alaska and the western Canadian Arctic, has undergone a marked change over the last three decades, including a sharp reduction in snow-cover extent and duration, shorter river- and lake ice- seasons, melting of mountain glaciers, sea-ice retreat and thinning, permafrost retreat, and increased active layer depth. These changes have caused major ecological and socio-economic impacts, which are likely to continue or worsen under projected future climate change. Thawing permafrost and northward movement of the permafrost boundary are likely to increase slope instabilities, which will lead to costly road replacement and increased maintenance costs for infrastructure. The projected shift in climate is likely to convert some forested areas into bogs when ice-rich permafrost thaws. Reduced sea-ice extent and thickness, rising sea level, and increases in the length of the open-water season in the region will increase the frequency and intensity of storm surges and wave development, which in turn will increase coastal erosion and flooding…*
>
> *18.3.3.4. Impacts on people's lives*
>
> *Traditional lifestyles are already being threatened by multiple climate-related factors, including reduced or displaced populations of marine mammals, seabirds, and other wildlife, and reductions in the extent and thickness of sea ice, making hunting more difficult and dangerous. Indigenous communities depend on fish, marine mammals, and other wildlife, through hunting, trapping, fishing, and caribou/reindeer herding. These activities play social and cultural roles that may be far greater than their contribution to monetary incomes. Also, these foods from the land and sea make significant contributions to the daily diet and nutritional status of many indigenous populations and represent important opportunities for physical activity among populations that are increasingly sedentary…"* (ACIA, 2015).

DHS&EM's Disaster Cost Index records the following severe weather disaster events which may have affected the area:

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

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

***12-238 2012 Prince William Sound Winter Storm declared by Governor Parnell on February 9, 2012.** Beginning in mid-December, 2011 and continuing through January 2012, the City of Cordova and Prince William Sound area began receiving snowfall that put them on a pace to approach or break record seasonal precipitation accumulations. On December 12, the City of Cordova began working in emergency snow removal status. The Cities of Valdez and Yakutat had been facing similar challenges. Avalanches across roadways and extreme conditions limited or cut off access to airports and other critical infrastructure and endangered public, private, and commercial facilities throughout the communities.*

The Yakutat area is historically impacted by severe weather events due to their location within a maritime climate area, which is characterized by cool summers, mild winters, and heavy year-round precipitation. This type of climate is typical of the southeastern and southern coastal areas of Alaska where the ocean exerts a modifying influence and causes relatively low seasonal and diurnal temperature variations.

The proximity to the ocean and the frequent lows, which develop or move out of the Gulf of Alaska result in heavy precipitation in the Yakutat area. According to the USACE, the design snow load factor for Yakutat should be 100 pounds per square foot, the highest in the state. (In anecdotal information from weather forecasters who study Yakutat, the snow load factor should actually approach closer to 150 pounds per square foot). In practical terms, it means that people have to guard against excessive snow accumulations on roofs, boats, and airplanes. Table 5-4 summarizes Yakutat's weather extremes from 1949-2019.

Table 5-4 Historical Yakutat Weather Data

Yakutat Airport, Alaska 1949-2019

	Daily Extremes				Monthly Extremes			
	High (F°)	Date: dd/yyyy or yyyymmdd	Low (F°)	Date: dd/yyyy or yyyymmdd	Highest Mean (F°)	Year	Lowest Mean (F°)	Year
January	55	14/1981	-22	22/1952	40.7	1981	6.7	1969
February	54	07/1963	-20	05/1969	37.9	1977	16.5	1979
March	59	18/1981	-20	08/1972	39.5	1981	22.3	1967
April	71	30/1995	4	02/1952	41.5	1980	28.8	1972
May	79	21/1963	21	01/1972	50.8	1981	37.6	1971
June	87	10/1995	29	04/1971	53.4	2004	44.3	1965
July	84	21/1955	35	14/1968	56.6	1993	50.2	1965
August	88	15/2004	29	24/1974	57.0	1997	48.5	1969
September	77	04/1957	21	28/1971	53.6	1995	43.8	1992
October	63	01/1967	6	24/1966	45.9	1980	35.7	1966
November	55	14/1976	-6	15/1966	40.5	2002	20.6	1985
December	52	08/1960	-24	30/1964	36.7	1989	15.8	1964

Table 5-4 Historical Yakutat Weather Data

Yakutat Airport, Alaska 1949-2019

	Daily Extremes				Monthly Extremes			
	High (F°)	Date: dd/yyyy or yyyymmdd	Low (F°)	Date: dd/yyyy or yyyymmdd	Highest Mean (F°)	Year	Lowest Mean (F°)	Year
Annual	88	20040815	-24	19641230	43.6	1981	34.6	1966

5.3.4.3 Location, Extent, Impact, and Recurrence Probability

Location

The entire Yakutat area experiences periodic severe weather impacts. The most common to the area are high winds, severe winter storms, and heavy snowfall.

Extent

The entire area is equally vulnerable to the effects of severe weather. Yakutat has a maritime climate characterized by relatively mild, often rainy weather. Yakutat receives some of the heaviest precipitation in the state, averaging 155 inches, including 142 inches of snowfall.

Impact

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

Heavy snow can immobilize a community by bringing transportation to a halt. Until the snow can be removed, airports and roadways are impacted, even closed completely, stopping the flow of supplies and disrupting emergency and medical services. Accumulations of snow can cause roofs to collapse and knock down trees and power lines. Heavy snow can also damage light aircraft and sink small boats. A quick thaw after a heavy snow can cause substantial flooding. The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts on CBY.

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

Aircraft may be grounded due to extreme cold and ice fog conditions, cutting off access as well as the flow of supplies to communities. Long cold spells can cause rivers to freeze, disrupting shipping and increasing the likelihood of ice jams and associated flooding.

Recurrence Probability

High winds, rain, snow, and storm surge will continue to occur annually in CBY.

5.3.5 Tsunami

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 ft.

The actual height of a tsunami wave in open water is generally only one to three ft 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 ft 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-ft 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 ft 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 Yakutat.

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.

TsunamiReady Community

Yakutat is a NOAA recognized TsunamiReady Community and StormReady Community. The fact that Yakutat has taken the proactive step of being a TsunamiReady Community and StormReady Community will potentially lessen the damage to the community and reduce the risk to area residents and visitors. These requirements were recently updated in 2018.

Table 5-5 lists the guidelines that Yakutat met to become a Tsunami Ready community.

Table 5-5 Guidelines to be a TsunamiReady Community

Guidelines Defined
Guideline 1: Communications and Coordination
• Established 24-hour Warning Point (WP).
• Established Emergency Operations Center (EOC).
Guideline 2: Tsunami Warning Reception
• Number of ways for EOC/WP to receive NWS tsunami messages. (If in range, one must be NWR receiver with tone alert; NWR-SAME is preferred).

Table 5-5 Guidelines to be a TsunamiReady Community

Guidelines Defined
Guideline 3: Local Warning Dissemination
• Number of ways EOC/WP can disseminate warnings to public.
• NWR - SAME receivers in public facilities.
• For borough WPs, borough communication network that ensures information flow among communities.
Guideline 4: Community Preparedness
• Number of annual tsunami awareness programs.
• Designate/establish tsunami shelter/area in safe zone.
• Designate tsunami evacuation areas and evacuation routes, and install evacuation route signs.
• Provide written, locally-specific, tsunami hazard response material to the public.
• Schools: Encourage tsunami hazard curriculum, practice evacuations (if in hazard zone), and provide safety material to staff and students.
Guideline 5: Administrative
• Formal tsunami hazard operations plan.
• Biennial meeting between emergency manager and NWS.
• Visit by NWS official to community at least every other year.

(NOAA, 2014)

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 ft high. Other volcanic events in Alaska may have caused tsunamis, but there is not enough evidence to report that conclusively.

Figure 5-9 2011 Japanese Tsunami Flotsam (CNN, 2011)

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.

Yakutat 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 (Figure 5-9). 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 Yakutat. 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. Only one person was missed. A tsunami evacuation center has been set up at the airport.

5.3.5.3 Location, Extent, Impact and Recurrence Probability

5

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 5-10 depicts the tsunami hazard by community developed by the National Tsunami Warning Center. The map designated Yakutat as having a high tsunami hazard.

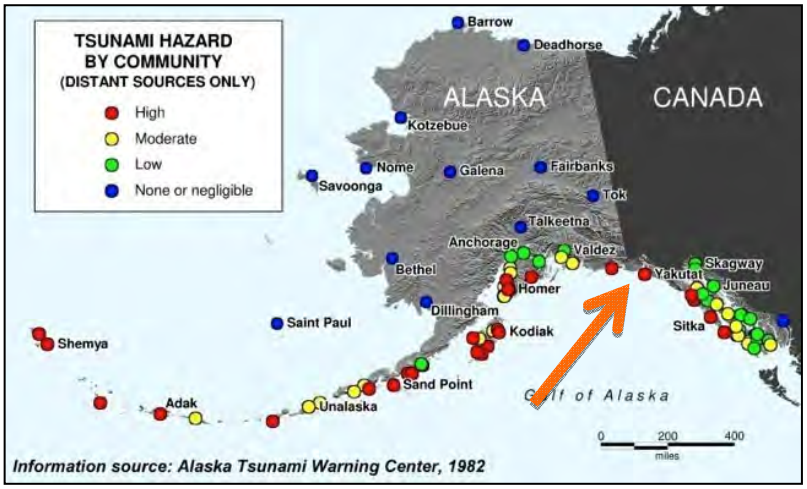


Figure 5-10 Tsunami Hazard Communities

Extent

The breadth, magnitude, and severity of a tsunami will depend on each specific event. If CBY is actually struck by a damaging tsunami, the area can count on experiencing an extremely damaging event (see Figure 5-11). A distant-source tsunami that damages one community is very likely to also strike other communities on the same coast.

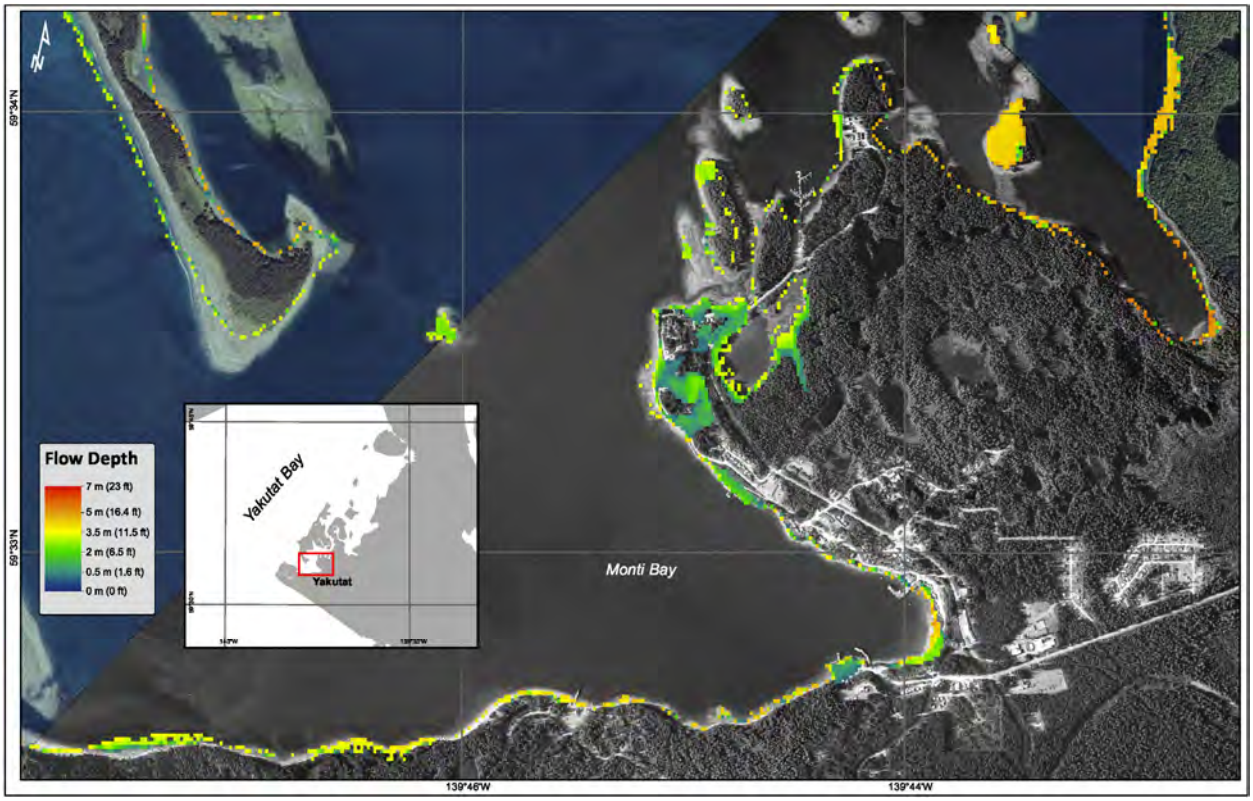


Figure 5-11 Maximum Composite Potential Inundation for Yakutat

Impact

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.

A similar situation exists in rural Alaska as demonstrated by the tsunami warning of 2007, which did not reach targeted communities in time to warn them of a potential tsunami. 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 Yakutat 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.

Recurrent Probability

Based on the history of tsunamis in the Yakutat area, a tsunami could occur.

5.3.6 Wildland and Conflagration Fire

5.3.6.1 Characteristics

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

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

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

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

Weather is the most variable factor affecting wildland fire behavior. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity. Climate change increases the susceptibility of vegetation to fire due to longer dry seasons. By contrast, cooling and higher humidity often signal reduced wildland fire occurrence and easier containment.

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

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

Conflagration fires are especially large and destructive fires that causes devastation in areas where wood structures are built close together. These types of fire 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 collapse, 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.

Many wildland firefighters are neither equipped nor trained for structure fires. Structural fire suppression within defined service areas is the responsibility of volunteer fire departments. When wildland firefighters encounter structure, vehicle, dump, or other non-vegetative fires during the performance of their wildland fire suppression duties, firefighting efforts are often limited to wildland areas.

5.3.6.2 History

Wildland fires occur in every state in the country, and Alaska is no exception. Each year between 600 and 800 wildland fires, mostly between March and October, burn across Alaska causing extensive damage.

The Alaska Interagency Coordination Center (AICC) identified four wildland fires that occurred since 1939 (Table 5-6, Figure 5-12) that occurred within 50 miles of CBY. There have been no conflagration fires.

Table 5-6 AICC Fires within 50 miles of Yakutat since 1939

Fire Name	Fire Year	Estimated Acres	Latitude	Longitude	Specific Cause
Strawberry Point	1993	5	59.4500	-139.5833	Campfire
Strawberry Point	2002	2	59.4333	-139.5667	Cooking/Warming Fire
Strawberry Point	2010	0.2	59.4333	-138.5666	Trash Burning
Camp 1	2011	0.1	59.4994	-139.7405	Campfire
Camp 1 Beach Fire	2016	0.1	59.4977	-139.7422	Campfire

(AICC, 2019)

In 2019, an atv with firefighting equipment was added to Setac Camp at Strawberry Point. Twice in recent years, grass has caught on fire, and the fire has been contained quickly before a forest fire could start.

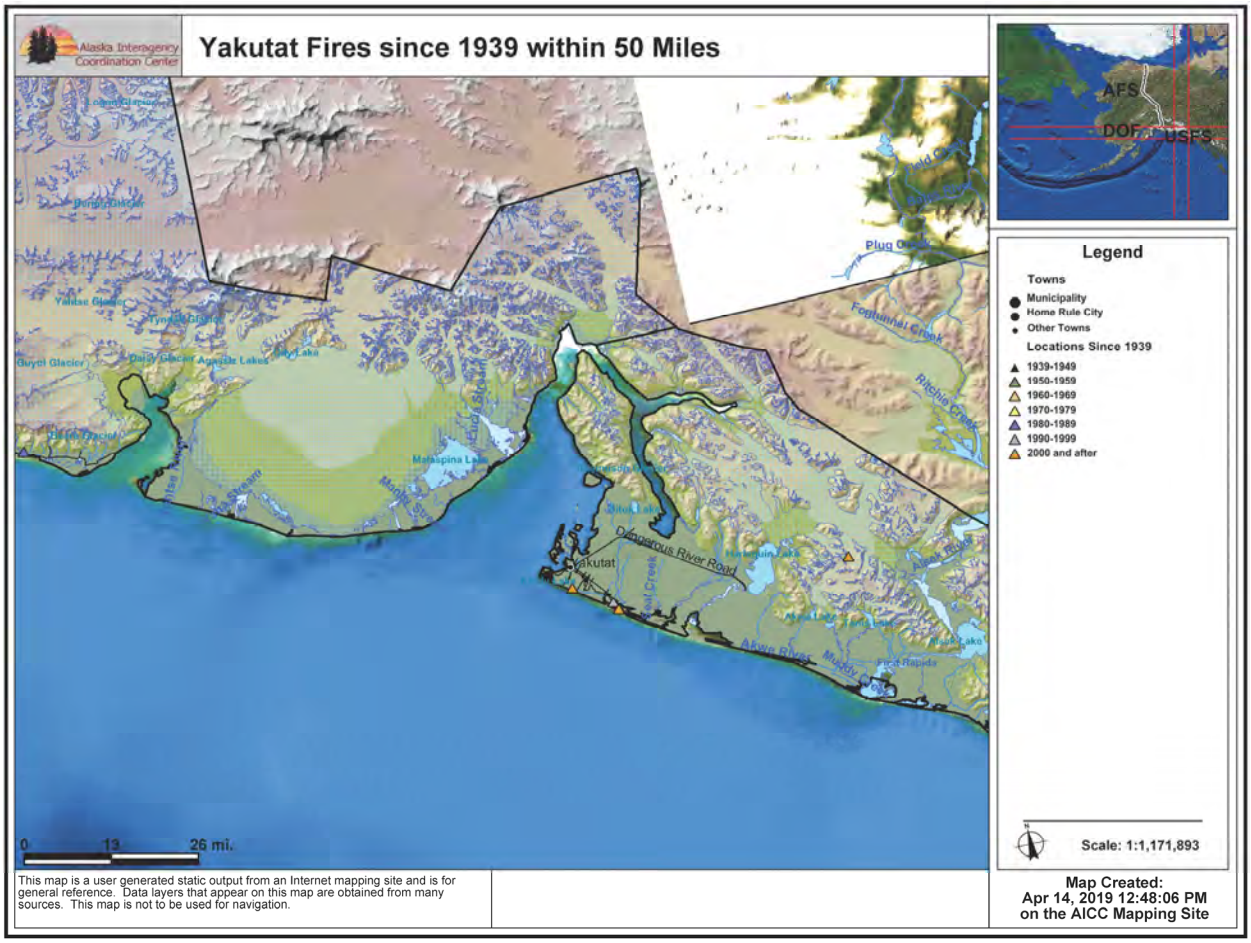


Figure 5-12 Yakutat's Historical Wildfire Locations (AICC, 2019)

5.3.6.3 Location, Extent, Impact, and Recurrence Probability

Location

Under certain conditions, fires may occur near Yakutat when weather, fuel availability, topography, and ignition sources combine. Since fuels data is not readily available, for the purposes of this HMP Update, all CBY areas are considered to be vulnerable to wildland fire impacts.

Extent

Generally, fire vulnerability dramatically increases in the late summer and early fall as vegetation dries out, decreasing plant moisture content and increasing the ratio of dead fuel to living fuel. However, various other factors, including humidity, wind speed and direction, fuel load and fuel type, and topography can contribute to the intensity and spread of wildland fires. The common causes of wildland fires in Alaska include lightning strikes and human negligence.

Fuel, weather, and topography influence wildland fire behavior. Fuel 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.

Impact

Impacts of a wildland or conflagration fire that interfaces with the population center of the CBY could grow into an emergency or disaster if not properly controlled. A small fire can threaten lives and resources and destroy property. In addition to impacting people, 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.

Fire is recognized as a critical feature of the natural history of many ecosystems. It is essential to maintain the biodiversity and long-term ecological health of the land. The role of wildland fire as an essential ecological process and natural change agent has been incorporated into the fire management planning process, and the full range of fire management activities is exercised in Alaska, to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social consequences on firefighters, public safety and welfare and natural and cultural resources threatened. In Alaska, and within 50 miles of the CBY, the natural fire regime is characterized by a return interval of approximately 150 years due to their tundra and rain forest vegetation and gently rolling topography.

Recurrence Probability

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

Climate change and flammable vegetation species are prolific throughout Alaska's forests and tundra locations. Fire frequency may increase in the future as a result. As the climate warms, wildland and conflagration fires are more likely to occur in midsummer.

5.3.7 Changes in the Cryosphere

5.3.1.7 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) (Figure 5-13). The components of the cryosphere play an important role in climate. Snow and ice reflect heat from the sun, helping to regulate the 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 include flooding, erosion, and permafrost which all affect the CBY.

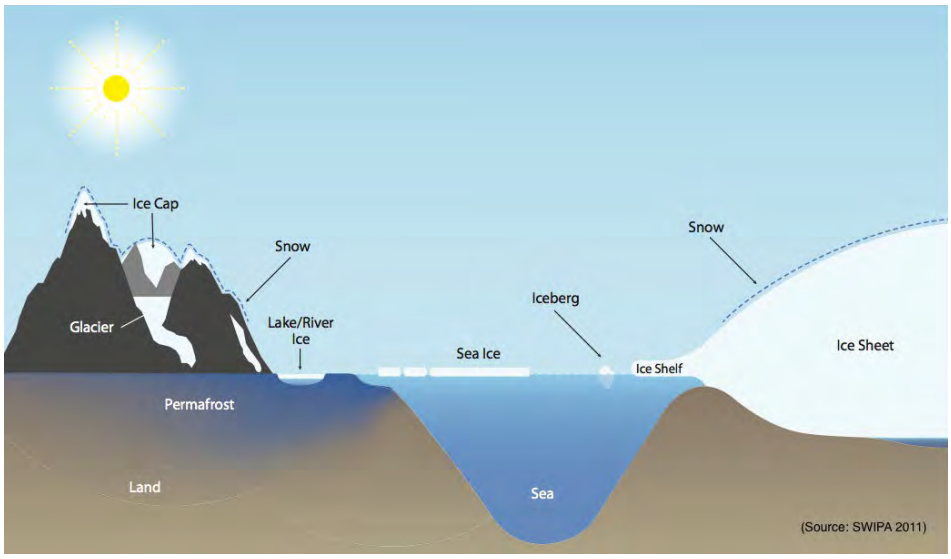


Figure 5-13 Cryosphere Components Diagram

Source: DHS&EM, 2018

Hazards of the cryosphere can be subdivided into four major groups:

- Glaciers;
- Permafrost and periglacial;
- Sea ice; and
- Snow avalanche.

Of these four major groups, all but sea ice applies to CBY.

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 the accumulated ice, glaciers flow like very slow rivers. Presently, glaciers occupy about 10% percent 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.

Permafrost and periglacial hazards are caused by the effects of changing perennially frozen soil, rock, or sediment (known as permafrost) and the landscape processes that result from extreme

seasonal freezing and thawing. Permafrost is found in nearly 85% of the state. It is thickest and most extensive in Arctic Alaska north of the Brooks Range; present virtually everywhere and extending as much as 2,000 feet below the surface of the Arctic Coastal Plain. Southward from the Brooks Range, permafrost becomes increasingly thinner and more discontinuous, broken by pockets of unfrozen ground known as taliks, until it becomes virtually absent in Southeast Alaska, with the exception of pockets of high-elevation alpine permafrost.

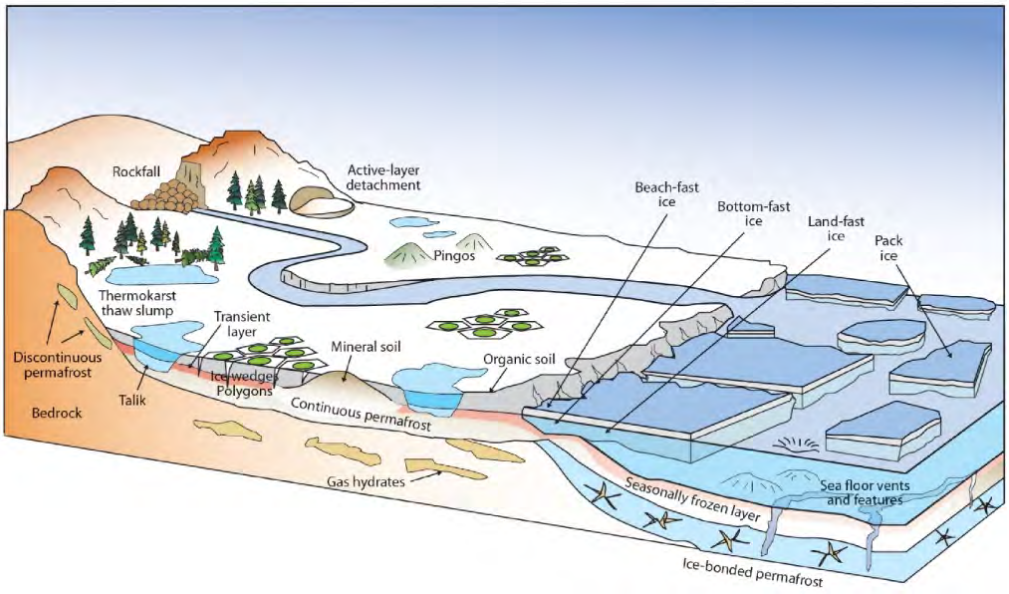


Figure 5-14 Schematic Diagram Associating Landscape, Permafrost, and Sea Ice

These features are closely associated in northern latitudes. Source: SWIPA

In the U.S., the presence of widespread permafrost results in classes of geologic hazards, which are largely unique to Alaska. Permafrost is structurally important to the soils of Alaska, and thawing causes landslides, ground subsidence, and erosion as well as lake disappearances, new lake development, and saltwater encroachment into aquifers and surface waters.

Sea ice is frozen ocean water that forms, grows, and melts in the ocean (Figure 5-14). Sea ice grows during the winter and melts during the summer, but some sea ice remains all year in certain regions. Risks associated with human activities and ice processes are the greatest in the Arctic and sub-Arctic regions because of the prevalence of sea ice in those high latitudes. Hazards from sea ice include threats to shipping from running into ice; equipment or personnel breaking through ice when it is used as a seasonal platform for development activities; ice push (ivu) and gouging of the land or seafloor; and slush ice build-up that can clog intake valves.

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 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.

Alaska is particularly vulnerable to cryosphere hazards, as much of its social and economic activity is connected to the existence of snow, ice, and permafrost.

Glaciers

Ice Collapse hazards result from large ice chunks breaking off from a glacier, either through glacial calving or as an ice fall avalanche. These hazards are almost impossible to predict and, in contrast to most other hazards in the cryosphere environment, they can happen independently of weather (e.g., heavy precipitation and rapid warming). In Alaska, ice collapses have on multiple occasions been triggered by earthquakes. Depending on the volume of ice collapse, these hazards can have tremendously devastating effects and can cause additional hazards, such as flooding and snow avalanches.

Glacial Calving is the breaking away of a mass of ice from a near-vertical ice face along the terminus of a glacier, often into a large body of water. Glacier calving can be accompanied by a loud cracking or booming sound as the blocks of ice break loose and crash into the water. The entry of the ice into the water can cause large, sometimes hazardous, waves that can swamp boats and inundate nearby shores. In July 2015, a M 6.3 earthquake occurred 120 miles west of Bear Glacier in Kenai Fjords, triggering a one-mile swath of ice to calve from the glacier and generating waves (a local tsunami) throughout the lagoon.

Ice Fall Avalanches are triggered by new or existing cracks (crevasses) in the glacier ice that allow chunks of a glacier to detach and fall down the slope as a mass of broken ice. Similar to cornice collapses (see Snow Avalanche), the mass of these ice falls often triggers snow avalanches on the slope below as they hit the snowpack. Ice fall avalanches are unrelated to precipitation, temperature, or other typical snow avalanche factors.

Glacial Lake Outburst Floods, also known as jökulhlaups, occur when water is rapidly released from a glacial lake due to the sudden failure of an ice or moraine dam, or to water overtopping the dam as a result of waves caused by mass wasting (landslide) of nearby unstable slopes that cause a landslide-generated tsunami. In the glacial system, ponds may form wherever water can be retained and drainage restricted, resulting in five glacial lake types (Figure 5-15):

A. *Ice-marginal lake:* forms alongside a glacier when a tributary valley or distributary glacier gets dammed by the main trunk of a valley glacier or outlet glacier;

B. *Proglacial lake:* forms at the terminus of a valley glacier or outlet glacier;

C. *Supraglacial lake:* forms in depressions on top of a glacier;

D. *Englacial lake:* forms within a glacier in enlarged conduits and cavities in the ice; and

E. *Subglacial lake:* forms underneath a glacier in a topographic depression, or by damming of subglacial debris; subglacial volcanic or geothermal activity can also cause a subglacial lake to form.

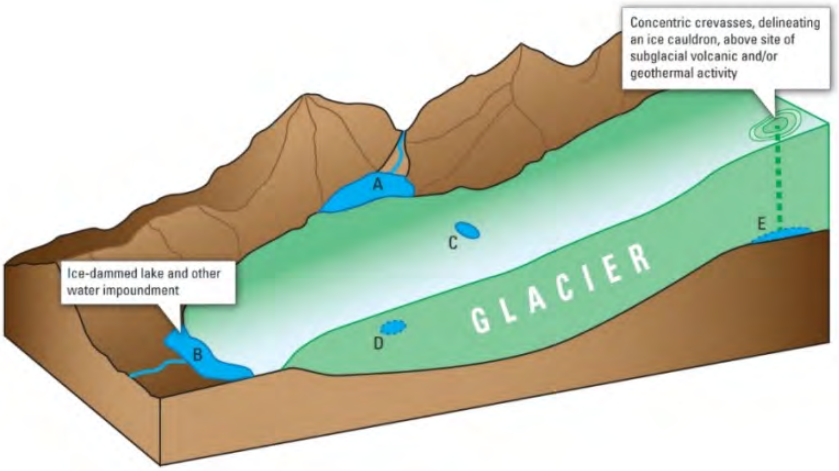


Figure 5-15 Glacial Lake Formation Diagram

Shows the possible locations of impounded water that can form glacial lakes and potentially generate outburst floods. Source: USGS, 2018

Outburst floods can be incredibly destructive; depending on the water volume released and downstream topography, outburst floods can cause extensive damage to downstream infrastructure and threaten public safety. Through collaboration between state agencies, universities, and local cities, a monitoring program has been established in Alaska for ice-dammed lakes at Bear Glacier in the Kenai Mountains, Valdez Glacier in the Chugach Mountains, Russell Lake at Hubbard Glacier in the Saint Elias Mountains near CBY (see Figure 5-16), and the Suicide Basin at Mendenhall Glacier in the Coast Range.

Glacier Surge is when a glacier periodically undergoes a brief phase (typically lasting one to four years) of rapid flow, called a surge. Surges are generally interspersed with longer periods (typically 10–100 years) of near-stagnation. During a surge, a large volume of ice is displaced downstream at speeds of up to several yards per hour into an ice-receiving area, and the affected portion of the glacier is chaotically crevassed (i.e. cracked). In the interval between surges, the ice reservoir is slowly replenished by snow accumulation and normal ice flow, and the ice in the receiving area is greatly reduced by ablation (i.e. the natural removal of ice through melting, calving, and sublimation). A surging glacier can advance quickly and override the ground in front of it, destroying anything in its path and potentially damming water flow to create a glacial lake that is a potential source of outburst flooding. Surging glaciers can also be particularly dangerous after surging because highly crevassed glacier snouts are unstable and subject to a higher incidence of calving and ice fall avalanches.

Figure 5-16 Hubbard Glacier at 100 yards of Gilbert Point in June 2007.
Photo: George Kalli of the U.S. Army Corps of Engineers took this photo in May 2007.

Permafrost and Periglacial

In the periglacial environment, the effects of freezing and thawing drastically modify the ground surface. Types of modification include the displacement of soil materials, migration of groundwater, and the formation of unique landforms. Many periglacial regions are underlain by permafrost that strongly influences geomorphic processes acting in these parts of the world.

Permafrost, defined as ground with a temperature that remains at or below freezing (32°F or 0°C) for two or more consecutive years, can include rock, soil, organic matter, unfrozen water, air, and ice. Regions with permafrost are typically categorized by % of surface area underlain by permafrost (Figure 5-18): continuous (>90%), discontinuous (50-90%), sporadic (10-50%), and isolated (<10%) permafrost. Bodies of ice can occur in permafrost, including pore ice, segregated ice, tabular ice, and ice wedges, among others. Large bodies of ground ice are referred to as massive ground ice. Permafrost with a high volume of ice is called ice rich permafrost.

Permafrost does not underlie the populated area, but is definitely a concern in the National Park Service Area and Tongass National Forest (Figure 5-17).

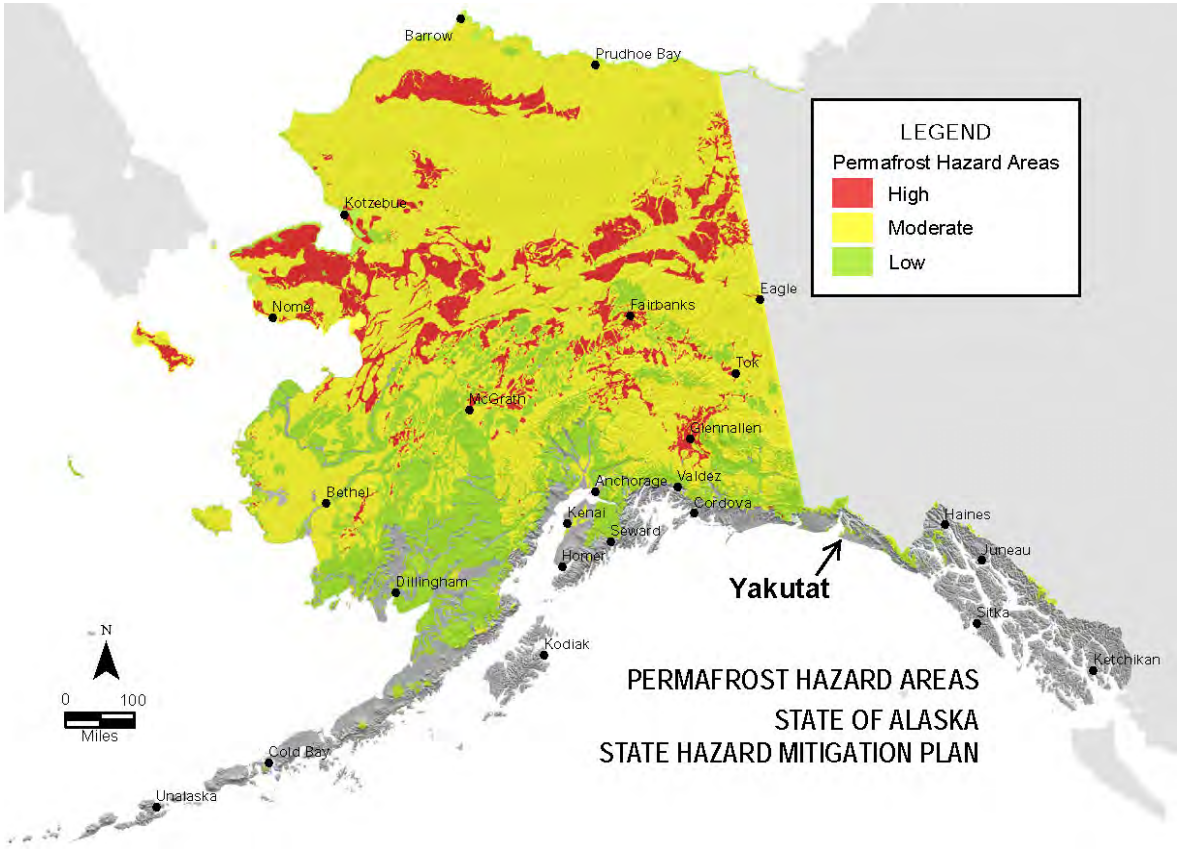


Figure 5-17 Permafrost Hazard Areas Map

Source: DHS&EM, 2018

Permafrost provides a stable foundation for structures and infrastructure in cold-climate regions as long as the temperature of the frozen ground is well below freezing. A major hazard of warming and thawing permafrost is that ground ice degrades, and the soil surface collapses. Fluctuations in temperature over the seasons also cause the ground to move as the upper layers freeze (i.e., ice lens formation) and thaw (i.e., loss of ice). Segregated ice lenses may form under wet conditions as the ground freezes, especially in fine-grained soils such as silt or clay. Upon thawing, ground ice can cause an excess of liquid water that cannot be stored in the soil and needs to flow out of the soil as gravity consolidates the soil after thawing.

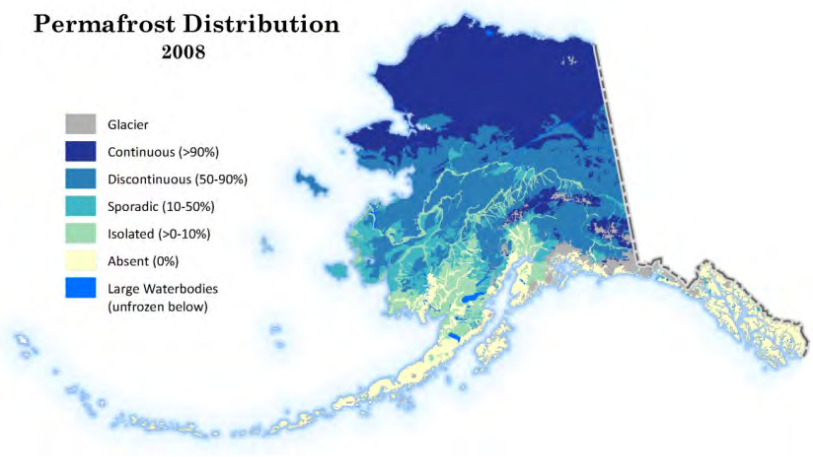


Figure 5-18 Permafrost Distribution Map

Permafrost temperatures throughout Alaska are showing warming trends; as permafrost approaches the freezing point (32°F), it becomes increasingly unstable and prone to collapse. Unstable permafrost requires very little trigger to initiate degradation.

Snow Avalanche

A snow avalanche is a downhill mass movement of snow. 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). There are four distinct avalanche types in Alaska that occur under varying snowpack and weather conditions. Each avalanche type is named based on its snow release characteristics:

- Cornice collapse;
- Loose snow avalanche;
- Slab avalanche; and
- Slush avalanche/flow.

Cornice Collapse occurs when an overhanging snow mass breaks, separates, or is released. Cornices form on ridge crests or shoulders adjacent to gullies due to wind blowing the snow. The cornice is an indicator of predominant wind directions, as the cornice is formed on the lee (i.e., downwind) side of topographic features. Over time, the cornice can develop weaknesses in its

structure and its attachment to the slope may fail. A cornice collapse often triggers a loose snow or slab avalanche as it adds sudden and significant stress onto the snowpack below.

Loose Snow Avalanches, also known as point releases, initiate with a small amount of non-cohesive (loose) snow and quickly grow larger as they move downhill and entrain more snow. This type of avalanche typically carries relatively small amounts of powder snow and virtually no other debris. However, a loose snow avalanche may trigger a larger slab avalanche on the same slope.

A ***Slab Avalanche*** releases as a block of cohesive snow when snow particles have stuck together to form one or more resistant layers. There is a wide range of slab characteristics possible, running the gamut from "soft" slab (weakly cohesive snow) to "hard" slab (very cohesive snow), and from "storm" slab (release of recently deposited storm snow), to "persistent" and "deep persistent" slab (release of a slab that failed on a weak layer deeper down in the snowpack). Due to their large release masses, and because more snow is picked up along the way (snow entrainment), slab avalanches are the most destructive avalanche type. Human encounters with even small-sized slab avalanches are often fatal.

Slush Avalanches are fast-moving mixtures of snow and water. They release in isothermal snowpacks (snow temperature throughout the snowpack is 32°F) when liquid water permeates the snowpack and dramatically weakens the intergranular bond. Slush avalanches, therefore, typically occur in northern Alaska during the spring when warm temperatures and strong solar radiation quickly warm up the snowpack. Slush avalanches can release on slopes as gentle as 20 degrees. Their release is often slower than other avalanche types, but as the slushy snow runs downhill, they can reach speeds over 40 mph. Smaller, more fluid avalanches with higher water content are commonly referred to as slush flows.

An avalanche path comprises three main parts: starting zone, track, and run-out zone (Figure 5-19). Local topography determines the shape and size of each part. Steep gullies that contain a stream or creek in the summer often function as avalanche paths in the winter, but avalanches also release and run on simple and complex open slopes.

The *starting zone* is also called the release area. This is the upper part of the avalanche path, where snow accumulates (creating a slab or point source release area), and the avalanche begins its downhill movement. Starting zones are commonly located in the headwaters of a drainage where snow is accumulated on lee-side aspects of topographic features. Starting zones on open slopes are more difficult to identify. Sometimes multiple starting zones join into one track (e.g., several creeks funneling into one major gully).

The *track* is the middle part of the path, where the avalanche transports the released snow downhill to the deposition (runout) zone. The avalanche accelerates and reaches its maximum velocity in the track, and can also pick up more snow, adding to its mass. The track can be comprised of both confined gullies and unconfined open slopes. Tracks can also branch onto adjacent slopes, creating successive avalanches.

The *run-out zone* is the bottom part of the path, where the avalanche slows down and deposits debris. The avalanche impact pressure, which is a function of its snow density, volume (i.e., mass), and velocity, determines the amount of damage the avalanche could potentially cause.

This measure is used for designing mitigation structures to protect infrastructure and buildings that are located in an avalanche risk zone.

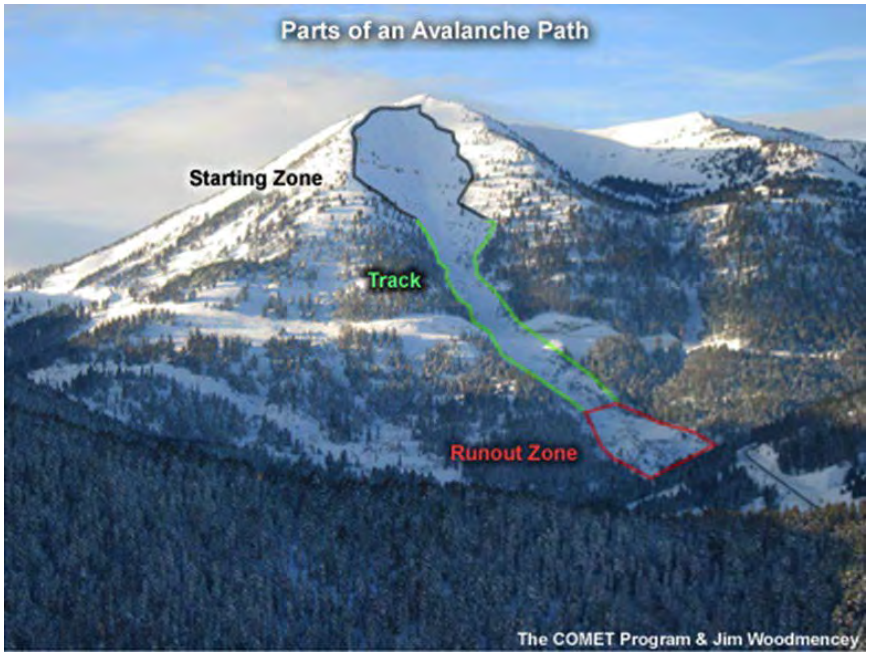


Figure 5-19 Parts of an Avalanche Path

Source: Cooperative Program for Operational Meteorology, Education, and Training [COMET®]
http://www.comet.ucar.edu/who_about_us.php

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 5-20 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.

New Alaska avalanche studies are currently being carried out by the State of Alaska Division of Geological & Geophysical Surveys and UAF. Figure 5-21 depicts potential snow avalanche release areas within a 6-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.

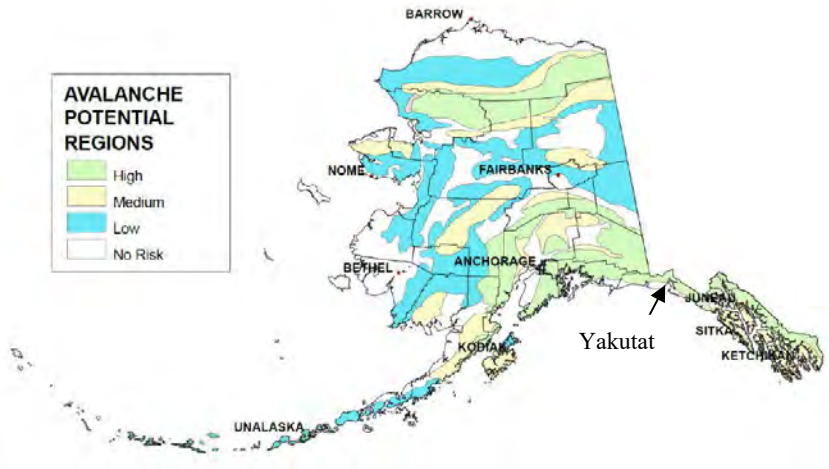


Figure 5-20 Map Depicting Alaska's Potential Snow-Avalanche Areas
Source: Hackett and Santeford, 1980

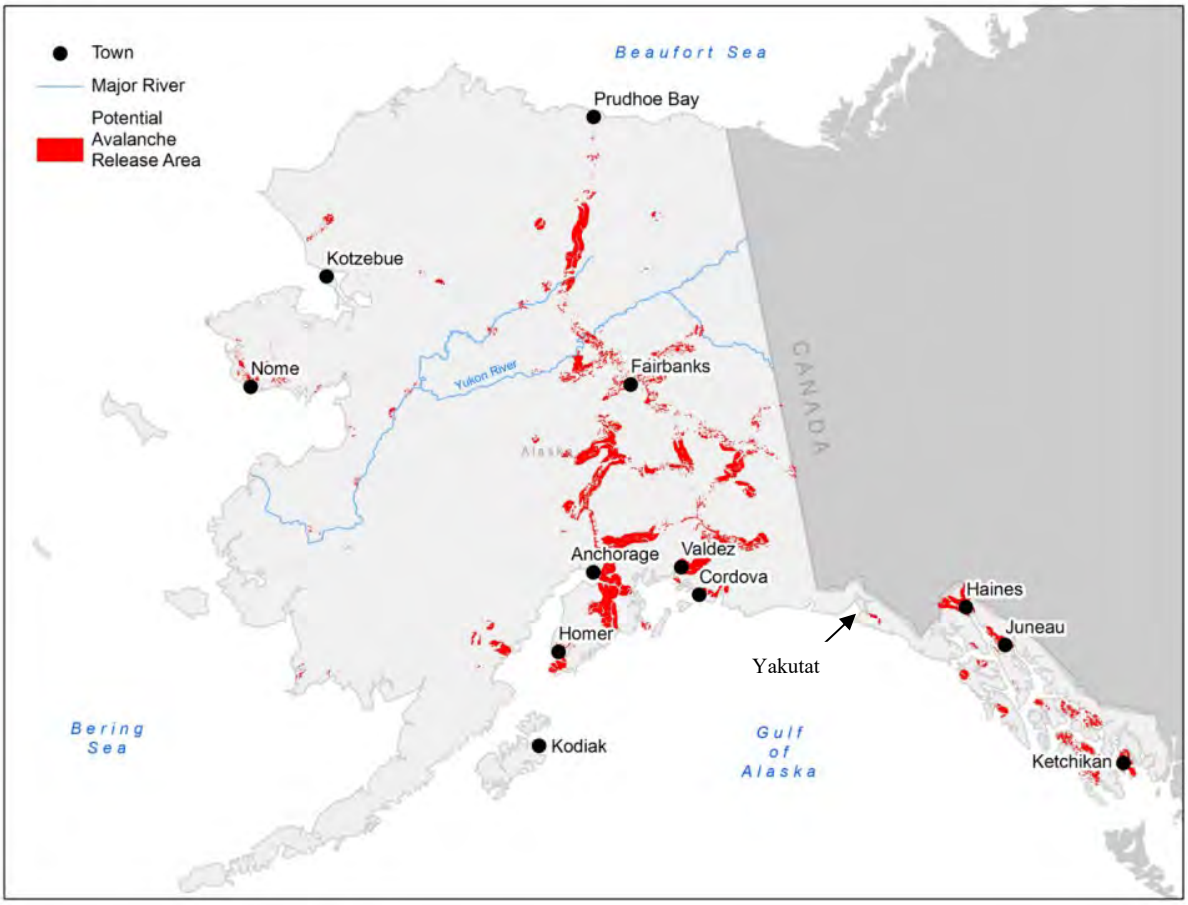


Figure 5-21 Potential Snow-Avalanche Release Areas
Source: DGGS 2018

Numerous snow avalanches occur in Alaska every year due to abundant avalanche-susceptible terrain and large amounts of snowfall. Multiple communities are at risk of avalanche hazards every winter, some of which can be particularly destructive. The most recent extreme avalanche event took place near Valdez in January 2014, after a mid-winter rain event that triggered many full-depth wet snow avalanches throughout Southcentral Alaska. This avalanche blocked the only road connection to Valdez and dammed a river in Keystone Canyon.

Alaska is sparsely populated with most development concentrated in relatively few areas. The exact number of avalanches release annually is undeterminable. However, snow avalanches cause more fatalities in Alaska than any other natural hazard (Figure 5-22). Alaska leads the nation in avalanche accidents per capita and experiences multiple fatalities each year due to this hazard.

Figure 5-22 Alaska's Weather-Related Fatalities 1998–2018
Source: Data from NWS, http://www.nws.noaa.gov/om/hazstats.shtml

5.3.7.2 Climate Factors

Climate has a major effect on cryosphere hazards because these hazards are so closely linked to snow, ice, and permafrost. Changes in climate can modify natural processes and increase the magnitude and recurrence frequency of certain geologic hazards (e.g., floods, erosion, and permafrost thaw), 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. Permafrost is at an increased risk of thawing as a result of climate change. The major climatic factor leading to warming and thawing permafrost is an increase in air temperatures. Another important factor is the potential increase in snow depth predicted by the majority of climate models. Snow insulates permafrost from low winter temperatures, which leads to an increase in ground temperatures and diminishes permafrost stability. When soils are warm, permafrost becomes unstable and is sensitive to catastrophic collapse in conjunction with flooding and erosion. Even in non-ice-rich soils, process-driven models show more material is available for erosion and transport when the soil is thawed, which leads to increased exposure of underlying or

adjacent frozen material to thermal and physical stressors.

Human-induced ground warming can often degrade permafrost much faster than natural degradation caused by a warming climate. Permafrost degradation can be caused by constructing warm structures on the ground surface, allowing heat transfer to the underlying ground. Under this scenario, improperly designed and constructed structures can settle as the ground subsides, resulting in loss of the structure or expensive repairs. Permafrost is also degraded by damaging the insulating vegetative ground cover, allowing the summer thaw to extend deeper into the soil, causing subsidence of permafrost.

The BLM took over the USGS's Bering Glacier research camp in 1997. Known as the largest glacier in North America, measuring 118 miles long and 2,200 square miles, the Bering Glacier is revealing a wealth of scientific information. The glacier is in rapid retreat, which is ideal for research.

5.3.7.3 Cryosphere Hazard History

Glacial Lake Outburst Floods

Russell Ice-Dammed Lake at Hubbard Glacier, Saint Elias Mountains

Hubbard Glacier and Russell Fjord are located north of Yakutat in the Saint Elias Mountains, Southeast Alaska. Earth's two largest recorded outburst floods occurred when the Hubbard Glacier ice-and-moraine dam breached, catastrophically releasing impounded water from Russell Lake. Hubbard Glacier is the largest tidewater glacier in North America, covering an area of ~1,460 square miles. In contrast to most glaciers in Alaska, Hubbard Glacier has advanced ~1.5 miles since 1895. Russell Fjord has no other outlet to the ocean than through Disenchantment Bay. Russell ice-dammed lake forms intermittently during times of glacial advance when Hubbard Glacier blocks the channel linking Russell Fjord and Disenchantment Bay at Gilbert Point. Outburst floods from Russell Lake have occurred when the ice dam has been breached, for example, in 1986 and 2002. Peak discharges during these events ranged from 1.9 million cubic feet per second to 3.7 million cubic feet per second. Glacial lake outburst floods from Russell Lake have the potential to cause major socio-economic consequences to the community of Yakutat, commercial and sport fisheries, and tourist and shipping industries, as well as impact sea life in the area.

5.3.7.4 Location, Extent, Impact, and Recurrence Probability

Location

Cryosphere hazards can impact any place in Alaska where water occurs seasonally or permanently in solid form, including permafrost and snow cover in CBY.

According to Permafrost Characteristics Map of Alaska (Figure 5-23) developed for the National Snow and Ice Data Center/World Data Center for Glaciology (Jorgenson et al 2008), shows that Yakutat has isolated or sporadic permafrost (Jorgensen et al, 2008).

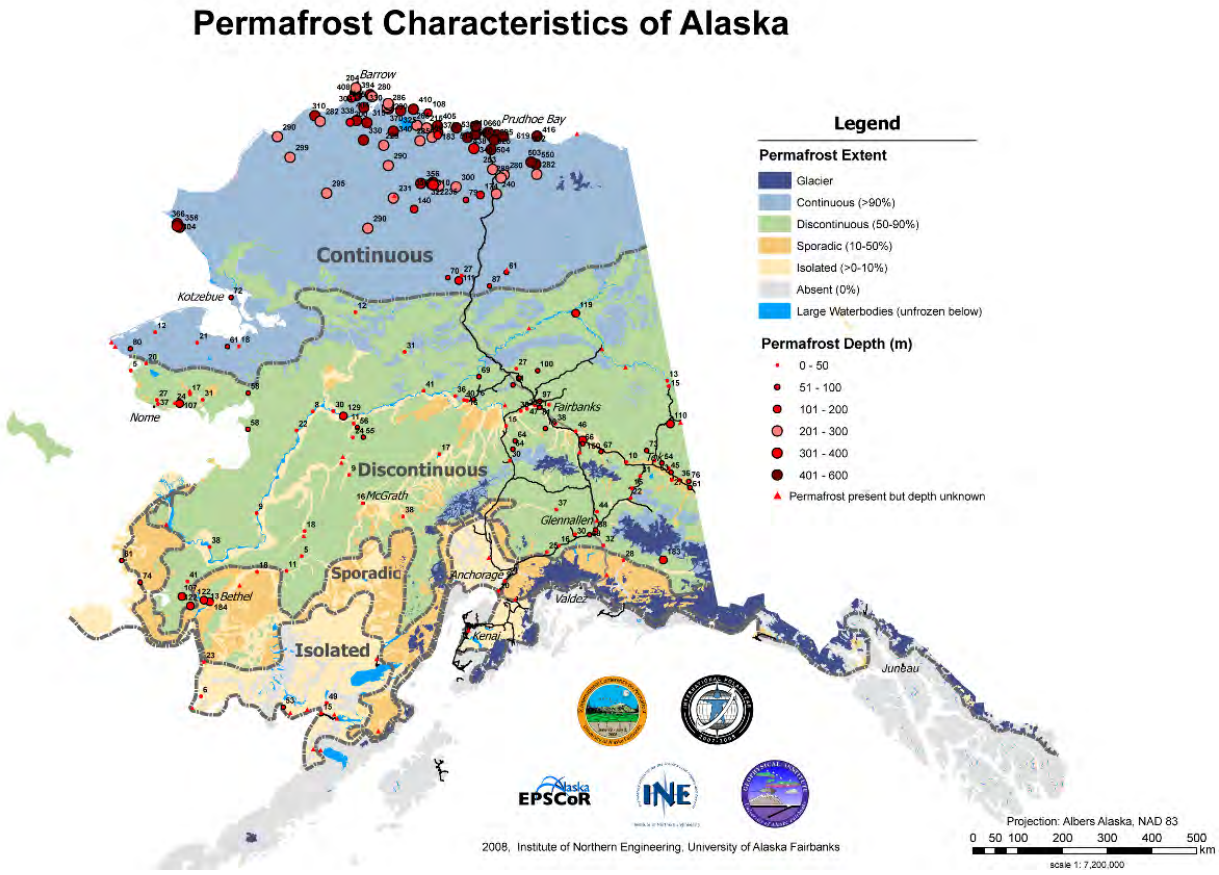


Figure 5-23 Permafrost Characteristics of Alaska (Jorgenson et al 2008)

Extent

Permafrost is found beneath nearly 85% of Alaska. Thawing causes ground subsidence, flooding, and erosion. 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.

Impacts

Permafrost impacts include a full range of damage from comparatively minor bending or buckling of manmade features due to heterogeneous movement, to complete destruction of infrastructure and buildings due to catastrophic ground failure. Permafrost has generated comparatively slow ongoing phenomena in the past, but warming climate is expected to increase the breadth, magnitude, and frequency of damaging permafrost collapse.

Impacts associated with degrading permafrost include surface subsidence, infrastructure, structure, and/or road damage. Permafrost does not pose a sudden and catastrophic hazard, but improperly designed and constructed structures can settle as the ground subsides, resulting in loss of the structure or expensive repairs. Permafrost restricts use of the ground surface, and affects the location and design of roads, buildings, communities, pipelines, airfields, and bridges.

To avoid costly damage to these facilities, careful planning and design in the location and construction of facilities is warranted.

Avalanches could occur, but there is no map of avalanche hazards for CBY.

Recurrence Probability

CBY residents are noting that the temperature is warming.

Section Six outlines the vulnerability process for determining potential losses for the community from various hazard impacts.

6.1 OVERVIEW

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

1. Asset Inventory;
2. Exposure Analysis for Current Assets;
3. Repetitive Loss Properties;
4. Land Use and Development Trends;
5. Vulnerability Analysis Methodology;
6. Data Limitations;
7. Vulnerability Exposure Analysis; and
8. Future Development.

DMA 2000, and its implementing regulations for current assets, and area future development initiative vulnerability assessment include:

DMA 2000 Recommendations
Assessing Risk and Vulnerability, and Analyzing Development Trends §201.6(c)(2)(ii): The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP-insured structures that have been repetitively damaged by floods. 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 … 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.
1. REGULATION CHECKLIST
ELEMENT B. Risk Assessment, Assessing Vulnerability, Analyzing Development Trends
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))
B4. Does the Plan address NFIP-insured structures within each jurisdiction that have been repetitively damaged by floods?
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))
Source: FEMA, March 2015.

Vulnerability assessment requirements include:

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

Table 6-1 lists CBY's infrastructures' hazard vulnerability synopsis.

Table 6-1 Vulnerability Overview

Hazard	Area's Hazard Vulnerability			
	Percent of Jurisdiction's Geographic Area	Percent of Population	Percent of Building Stock	Percent of Critical Facilities and Utilities
Earthquake	50%	50%	50%	50%
Flood/Erosion	30%	20%	5%	5%
Ground Failure	50%	50%	50%	50%
Severe Weather	50%	50%	50%	50%
Tsunami	5%	5%	5%	5%
Wildland Fire	30%	30%	30%	30%
Changes in the Cryosphere	5%	5%	5%	5%

6.2 LAND USE AND DEVELOPMENT TRENDS

6.2.1 Land Use

Table 6-1 summarizes the Borough of Yakutat's land status. Approximately 97% of the land within the Borough is owned and managed by either the Federal or State government. Only 2.2% of the land base is privately-owned, and less than 0.43% is owned by CBY. The large public landowners in the Borough are the National Park Service (Glacier Bay National Park and Preserve, Wrangell-St. Elias National Park and Preserve), USFS (Tongass National Forest), the Bureau of Land Management (BLM), and the State of Alaska (including the Alaska Mental Health Trust and the Yakataga State Game Refuge). Major private sector land owners include the Yak-Tat Kwaan, Inc., Chugach Alaska Corporation, and Sealaska Corporation. The Yakutat Tlingit Tribe and hundreds of private citizens, including those who own Native Allotments, are the private land owners within CBY. There is a small remote community at Cape Yakataga, and

in the summer, the population of the Tsiu River and Alsek River at Dry Bay area's swell with sport and commercial fishermen. Three Native Corporations also have significant land holdings. One area of town is classified as airport land use. These percentages underscore why it is so important to residents that the State and Federal government coordinate with CBY and why it is important to carefully plan and make good use of the limited private and CBY-owned land (CBY, 2010).

Table 6-2 Yakutat Borough Land Status

Land Owner	Percent	Acres
Federal Government (all)	88.21%	4,409,877
National Park Service	50.8%	2,541,502
US Forest Service	24.0%	1,197,638
Bureau of Land Management	10.6%	531,545
State-selected (still owned by federal govt)	0.9%	43,469
Native Corporation-selected (still owned by federal govt)	1.9%	95,723
State (all)	9.12%	456,055
CBY	0.43%	21,500
Private (all: includes Native Corporation, Native Allotments and other private)	2.24%	112,084
Total	**100%**	**4,999,516**
Source: CBY, 2010		

The CBY owns and manages approximately 21,500 acres, including:

- 4,197 acres in the Yakutat townsite (former City) (a few acres have been sold since 2015);
- A 5,464-acre tract along the coast between Cape Suckling and the Seal River;
- A 9,804-acre tract between the Tsiu River and the Duktoth River, south of the Yakataga State Game Refuge; and
- A 5,538-acre tract at Icy Bay.

CBY land in the townsite is managed for a range of uses. Many parcels on the road network contain CBY facilities. The landfill site, sewage treatment building, water towers, power plant, City Hall, public safety building, small boat harbor, and many parks are located on CBY property. Yakutat Seafoods operates at a location that is leased from CBY. A significant amount of Borough land contains wetlands or water bodies or is otherwise not suitable for development.

In the past, CBY has made land available for sale to the private sector for residential or industrial uses. The CBY will continue to dispose of public land to meet the future residential, commercial and industrial needs, while maintaining sufficient land to provide public services.

CBY also gained title to over 20,000 acres of land as part of its municipal entitlement in three areas: west Icy Bay, a mile-wide swath of coast fronting the Yakataga State Game Refuge, and west of Seal River. During the land selection process, there was a high level of community interest in allowing sustainable use and development of parts of this new land base.

Most of Yakutat's residents live within the former City limits. Residential uses are the most prevalent land use in Yakutat, with housing found in the North Addition, Monti Bay Heights,

Thunderland Subdivision, Alaska State Housing Authority (ASHA) Subdivision, Ridge Road/Lake Street, South Addition, West Addition, and in the old townsite. The Alaska Mental Health Trust, recently sold several lots and intends to sell more in a subdivision in the Glacier Bear area. Housing is predominantly single-family, although there are some multi-family buildings and some mobile homes.

The 2008 *Yakutat Facility Plan* describes their land use capacity as:

> *"**1.7 Land Status and Management***
>
> *1.7.3 City and Borough of Yakutat*
>
> *The City and Borough of Yakutat received management authority for several thousand acres west of Icy Bay as part of its 21,500-acre municipal entitlement. The Borough will obtain full title to the land after it is surveyed. [This has not happened as of the 2019 HMP Update.] Ocean currents and shoreline drift in the area are continually moving north and west; this continual littoral drift of the shoreline and river mouths must be considered as Borough land is leased, sold, or structures are built so that easements and setbacks can be maintained. It will generally be the building owner's responsibility to ensure buildings comply with these requirements.*
>
> *The Borough also owns parcels throughout the townsite as well as a 1,757-acre parcel just south of the Ankau Lagoon area to which it recently received management authority from the State. The Borough also owns the tidelands around the townsite of Yakutat.*
>
> *The City and Borough of Yakutat prepared a Comprehensive Development Plan in 1976 and updated it in 1983, 1994, 2006 (updated but not adopted) [and in 2010]. This Plan provides the background to guide development and set land use policy and zoning within the Borough. There are specific strategies and policies to guide management and growth of Borough services and public and private development.*
>
> *The City and Borough of Yakutat was incorporated as a home rule borough in September 1992.*
>
> *According to Title 29 of Alaska Statute, "Municipal Government," a home rule borough shall provide for planning, platting, and land use regulation (AS 29.35.180). The tools in place currently include the Comprehensive Development Plan, zoning and subdivision codes, and this Yakutat Coastal Management Plan…"*
>
> ***2.5 Built Environment***
>
> *Land Use Policies:*
>
> 1. *Maintain and update, when appropriate, zoning and subdivision regulations in order to establish uniform standards and procedures for developing land within the borough.*
> 2. *The location and design of residential, commercial, industrial and recreational uses shall be compatible with overall character of the area.*
> 3. *Priority shall be given to development inside the service area.*
> 4. *Future residential development shall be encouraged to fill in vacant lots within existing areas with municipal services or within planned service areas (Sewer Service Area).*
> 5. *Utility expansion and upgrades shall reflect zoning and land use needs for service capacity.*

6. *The borough shall support commercial development that increases employment opportunities, provides services to residents, is compatible with adjacent land uses, and that promotes good community design.*
7. *Conditional uses and variances may be subject to field verification to ensure compatibility with adjacent land uses.*
8. *Encourage innovative and original development in public and private projects. Alternative development proposals may include clustering of housing and density reductions.*
9. *The borough shall support strong physical links between the waterfront and community through private and public actions such as the development of walking trails, boardwalks, and signage.*
10. *The borough shall identify coastal waters, tidelands, and uplands suitable for development.*
11. *The borough shall inventory borough-owned lands, develop a data base describing suitability of each parcel for development, and develop an ordinance that sets forth criteria for selling and leasing borough-owned land.*
12. *The borough shall carry out a fair and periodic disposal of all usable borough lots. Such a disposal should encourage the orderly development of residential areas through the encouragement of infilling. It should also promote consolidation of services to keep public costs as low as possible.*
13. *The borough shall give priority to expansion of existing commercial and industrial uses along the waterfront.*
14. *The borough shall promote development of new mixed uses along the waterfront.*
15. *Water-dependent users should have priority in shoreline areas. Furthermore, it is the borough's policy that water-dependent uses should be kept separate from other uses as much as possible in the use of shoreline areas. This is particularly important in the separation of the fish processing industry from all heavy industry.*
16. *The borough supports the insertion of protective covenants in deeds for all property that contain known grave sites.*
17. *Trees on Khantaak Island shall be protected as they provide wind protection for the small boat harbor. The removal of trees from the areas around the boat harbor, while not necessary for wind protection, are aesthetically pleasing and should also be protected from removal. Maintaining trees around Khantaak Island is considered an item of high priority.*
18. *The borough shall consider cultural and historical uses of property in making land use decisions" (Yakutat, 2006).*

The CBY's Land Use Maps are displayed on Figures 6-1 thru 6-5. These maps are from the CBY's Comprehensive Plan; Figures 6-2 thru 6-5 show land previously owned by the Bureau of Land Management. This is no longer accurate as all Bureau of Land Management land has since been transferred to Yak-Tat Native Corporation and the USFS.

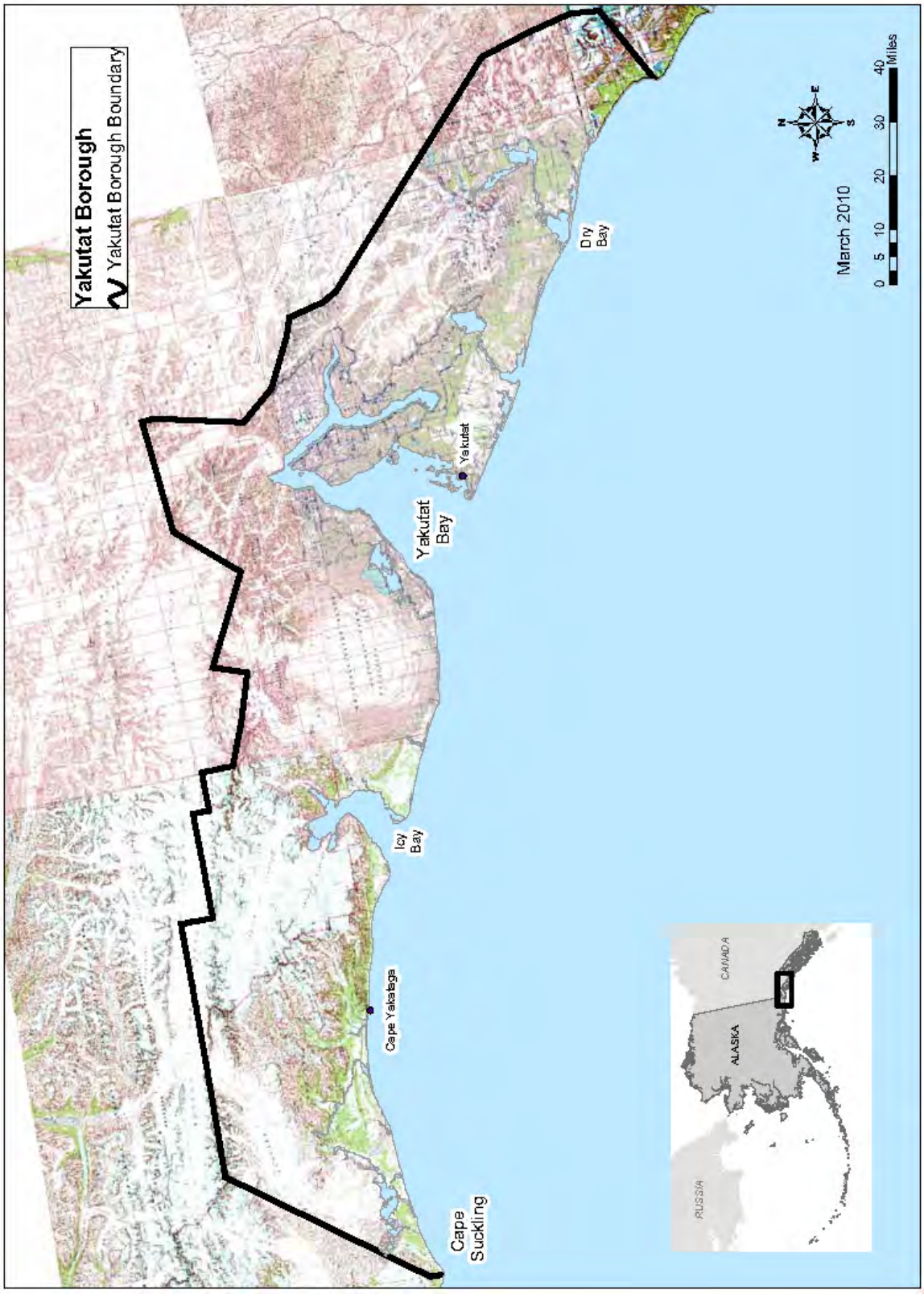


Figure 6-1 Map of Yakutat Borough

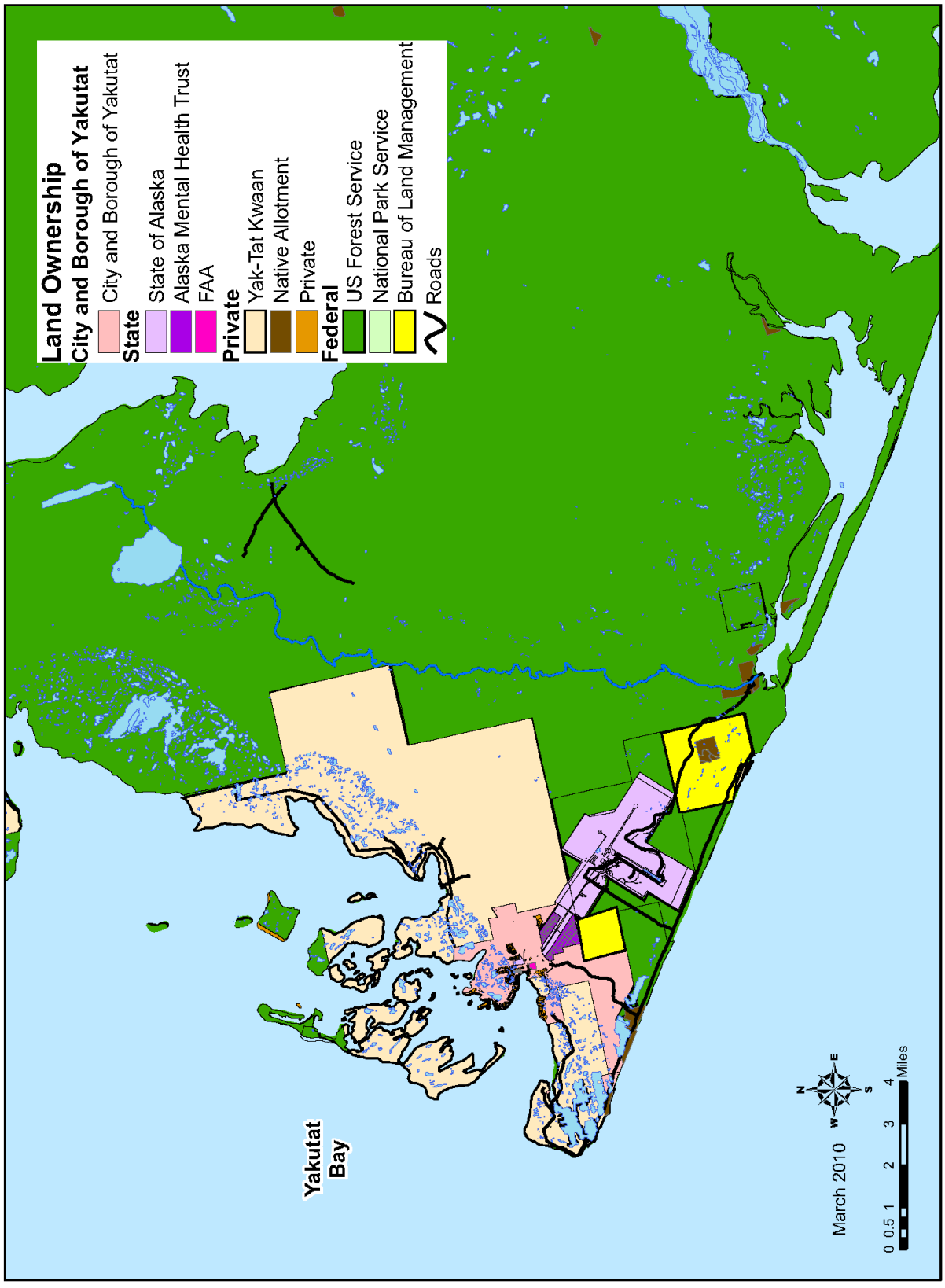


Figure 6-2 Land Ownership within Yakutat and Vicinity

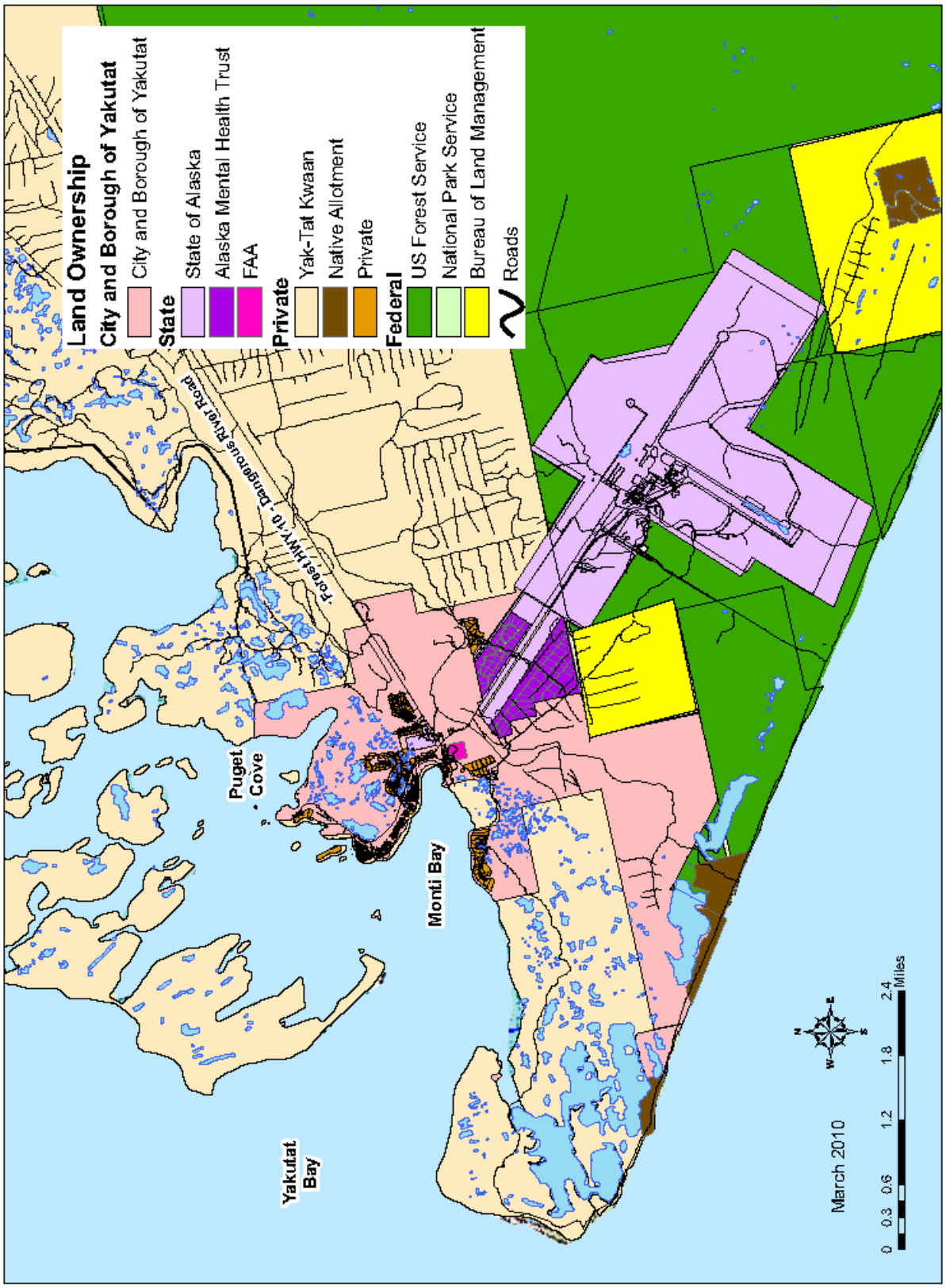


Figure 6-3 Map of Yakutat Townsite Land Ownership

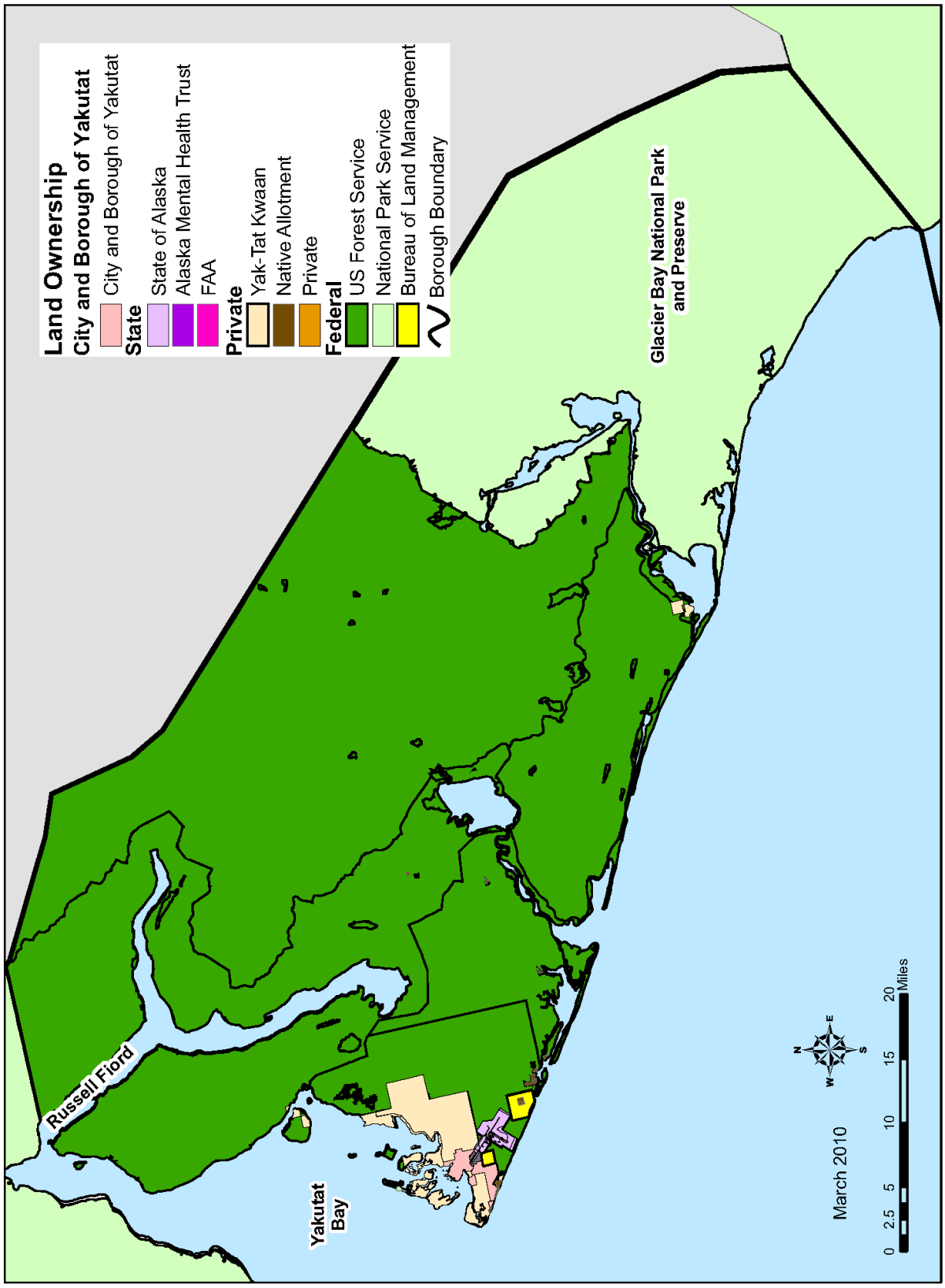


Figure 6-4 Eastern Borough Land Ownership

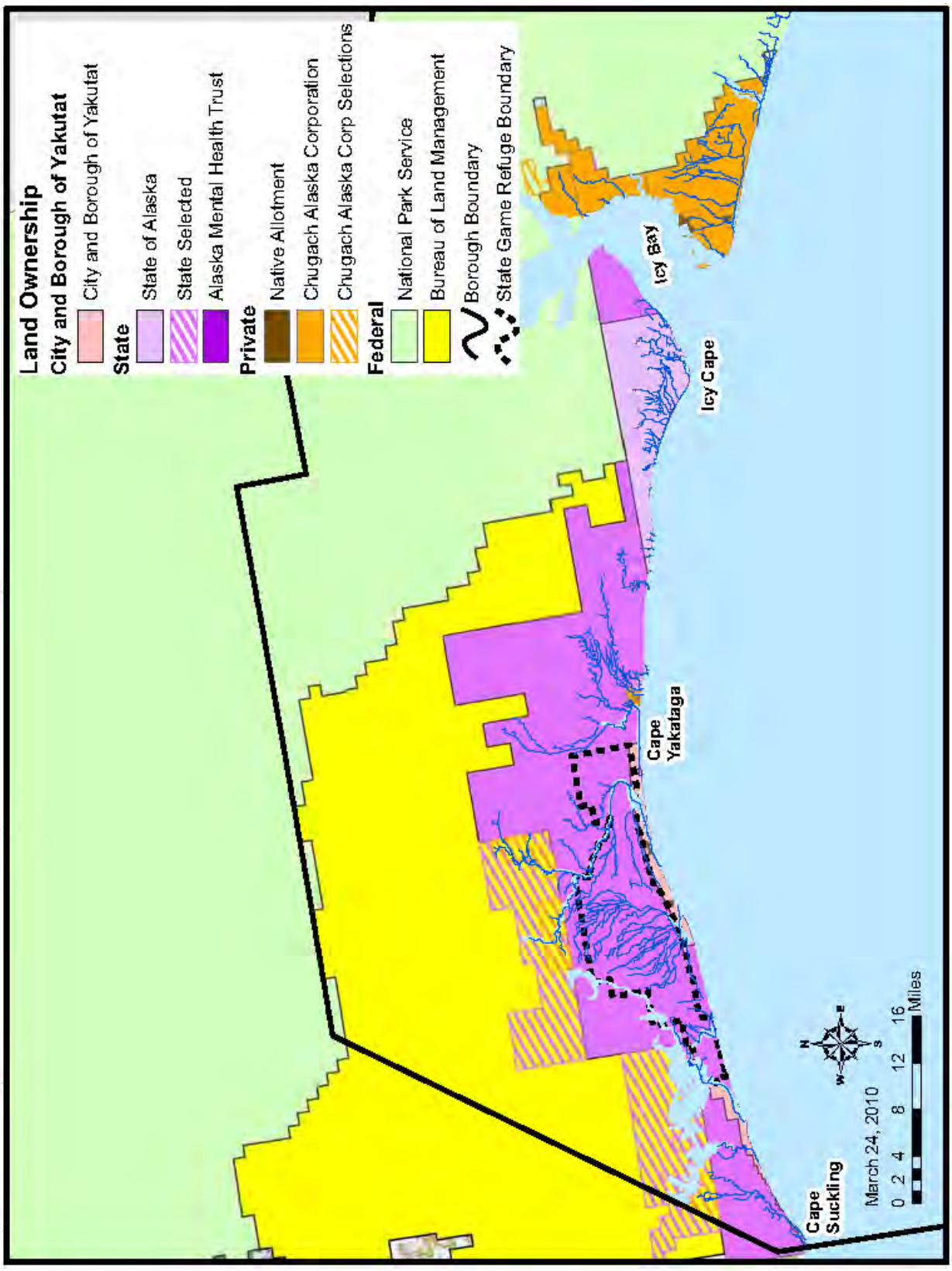


Figure 6-5 Western Borough Land Ownership

For a small community, the CBY offers a wide range of public utilities and facilities in town, including public drinking water, wastewater collection and treatment, a community landfill, power generation as a member of the AVEC cooperative, a full range of public safety services, recreational facilities, and general administration. The Yakutat School District provides public education. The Yakutat Tlingit Tribe contracts with Southeast Regional Health Consortium to provide local medical and dental services with municipal support (CBY, 2010). The community operates a local clinic that is a qualified Emergency Care Center and Yakutat is classified as a Regional Center. Currently, a range of medical services and dental services are provided at the Yakutat Community Clinic on Ocean Cape Road. A new large clinic is under construction in 2019. There are nurse practitioners and physician's assistants on staff and a doctor visits the clinic periodically. CBY provides funding to the clinic annually (Figures 6-6 and 6-7).

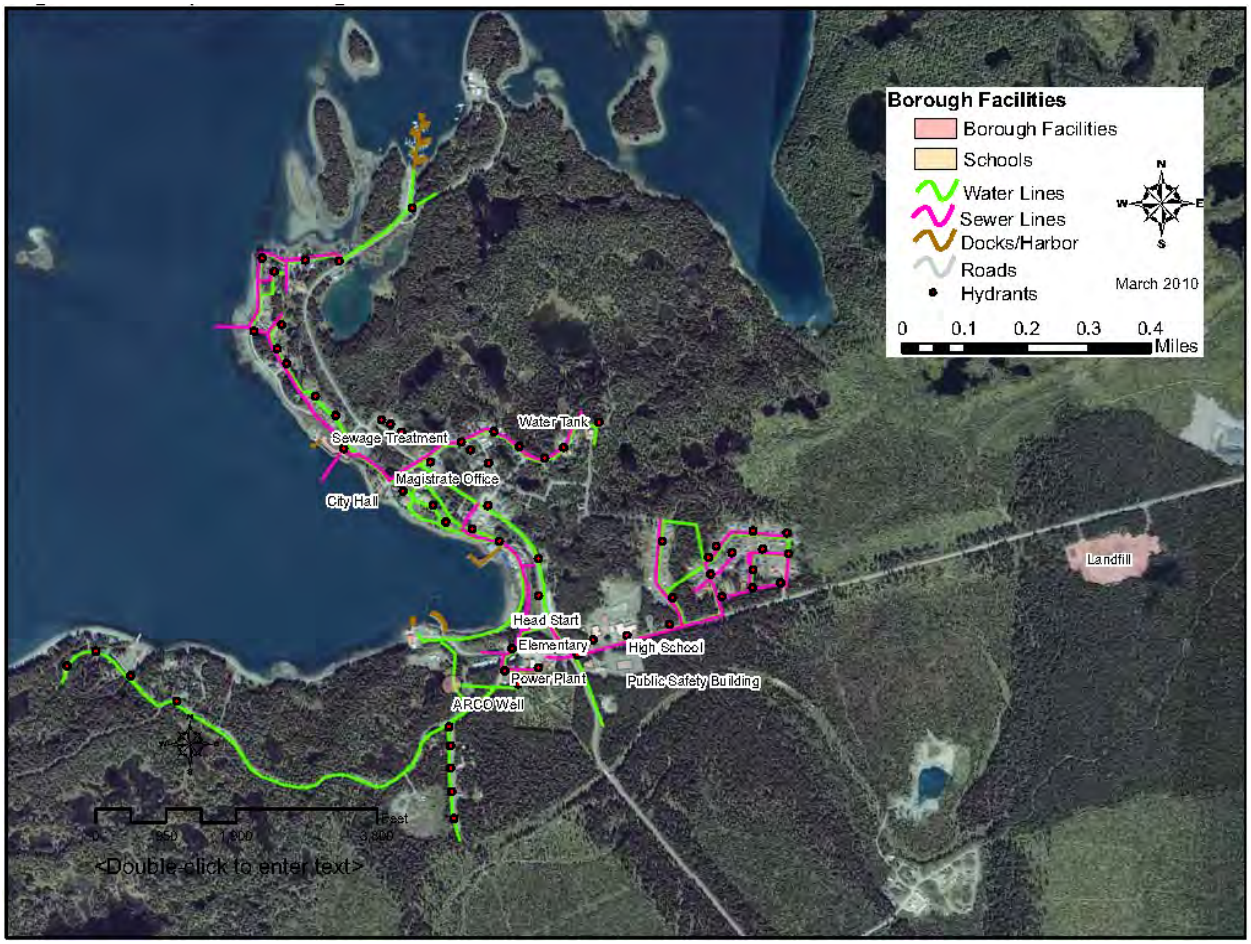


Figure 6-6 Map of Borough Facilities

Figure 6-7 Yakutat's Critical Infrastructure (2008 Legacy HMP)

6

6.3 CURRENT ASSET EXPOSURE ANALYSIS

6.3.1 Asset Inventory

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

6.3.1.1 Population and Building Stock

Population data for Yakutat were obtained from the 2013 U.S. Census's estimates and the DCCED. The U.S. Census reports CBY's total population at 662, and the 2017 DCRA-certified data showed a population of 552 residents (Table 6-3).

Table 6-3 Estimated Population and Building Inventory

Population		Residential Buildings	
2013 Census	**DCRA, 2017 Data**	**Total Building Count**	**Total Value of Buildings[1]**
662	552	302	U.S. Census $19,575,000 Yakutat: $105,700,000

[1] Sources: U.S. Census 2013, and 2017 DCRA population data. U.S. Census listed housing value at $72,500. The Project Team determined that the average structural replacement value of all single-family residential buildings is $350,000.

Estimated replacement values for those structures, as shown in Table 6-3, were obtained from the 2013 U.S. Census, and a value that the 2014 Planning Team identified as reasonable for Yakutat's isolated location.

Of the 468 residents aged 16 and over in 2013, 304 were employed. According to the U.S. Census Bureau's *2009-2013 American Community Survey 5-Year Estimates*, the Median Household Income is $72,500 with a margin of error +/- $5,472, and the per capita income is $32,640 +/-$3,967. Figure 2-2 illustrates CBY's historic population.

The Planning Team stated that residential replacement values are generally understated because replacement costs exceed 2013 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 ft by 40 ft (1,200 sq. ft) residential structure costs $350,000. A total of 302 single-family residential buildings were considered in this analysis.

The total value of property in Yakutat has been decreasing slowly over time (see Table 6-4).

Table 6-4 Taxable Real Property in Yakutat

Year	Taxable Value of Residential Property	Number of Dwellings	Average Value per Dwelling
2018	$22,162,710	222	$99,832
2017	$21,730,039	261	$83,257
2016	$21,411,623	210	$101,960
2015	$21,690,742	187	$115,993
2014	$20,779,301	187	$111,119
Source: CBY, 2019			

Housing growth is increasing in Yakutat. There are also a few undeveloped lots for sale by private owners.

6.3.1.2 Existing Infrastructure

The 2008 Yakutat Facility Plan describes their current infrastructure as:

> *"Yakutat is not reachable by road but receives frequent air and boat traffic. There are scheduled jet, air taxi, and float plane services to Yakutat using the float plane base, the State-owned runway, or one of five U.S. Forest Service (USFS) airstrips in the area. The Borough operates a boat harbor. A state ferry, the Kennicott, began summer service to Yakutat in 1998.*
>
> *Infrastructure provided in Yakutat includes water and sewer. Water is derived from wells, treated and piped to all homes in the community and the schools. Sewage is strained, sent to a settling chamber, chlorinated, de-chlorinated and released into the sea. Refuse is collected by a commercial firm or brought to the community receiving area by private individuals. Hazardous waste is identified, separated, and stored for eventual transport to appropriate treatment plants. Remaining waste is buried in accordance with a "trench and fill" operational plan. Diesel-fueled generators provide electricity for the area, run by Yakutat Power, Inc. The potential to utilize hydroelectric power is being explored in the area. The community operates a local clinic that is a qualified Emergency Care Center and Yakutat is classified as a Regional Center"* (Yakutat, 2008).

6.3.1.3 Yakutat's Critical Facilities

A critical facility is defined as a facility that provides essential products and services to the general public, such as preserving the quality of life in the CBY and fulfilling important public

safety, emergency response, and disaster recovery functions. Due to many of Alaska's remote rural locations – a long distance from their nearest neighboring community, most all facilities are deemed "critical" to their survival. The critical facilities profiled in this 2019 HMP Update include the following:

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

Table 6-5 lists the Borough's critical facilities and infrastructure.

Table 6-5 Critical Facilities and Infrastructure

Facility Type	Facility	Estimated Occupants	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Ground Failure	Flood	Tsunami	Severe Weather	Severe Weather	Cryosphere	Fire
Government	City and Borough & Borough Hall	6	Max Italio	59.551171	-139.740019	$324,065	W2	X		X	X		X		X
	Tribal Office	12	Forest Hwy	Undefined	Undefined	$1,000,000	S2	X		X	X		X		X
	Planning Department	2	Max Italio	Undefined	Undefined	$623,837	W2	X		X	X		X		X
	Public Works	4	Max Italio	Undefined	Undefined	$1,103,827	W2	X		X	X		X		X
	Airport Plaza (TSA, NPS, NOAA)?														
	FAA?														
	USFS?														
Transportation	Airport Terminal	10	Airport	59.495469	-139.635094	$2,000,000	S1	X		X	X		X		X
	Harbor Building	1	Mallott Drive	Undefined	Undefined	$50,000	W1	X		X	X		X		X
	Boat Harbor	0	Mallott Drive	Undefined	Undefined	$3,411,000	S1	X		X	X		X		X
	DOTPF 2 building	8	Airport Tarmac	Undefined	Undefined	$6,000,000	S3	X		X	X		X		X
	DOTPF Administrative	2	Air Tarmac	Undefined	Undefined	$250,000	S2	X		X	X		X		X
	Multi-Purpose Dock	0	Sandy Beach	59.548865	-139.73162	$1,000,000	S1	X		X	X		X		X

Table 6-5 Critical Facilities and Infrastructure

Facility Type	Facility	Estimated Occupants	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Ground Failure	Flood	Tsunami	Severe Weather	Severe Weather	Cryosphere	Fire
Emergency Response	Fire Station Police Station	5	Forest Highway	59.551192	-139.73901	$1,798,545	S2	X		X	X		X		X
Education	School	70	Forest Highway	67.40457	-150.12274	$10,000,000	W2	X		X	X		X		X
	Elementary School (Human Services, Cultural Heritage, and Language Education Program)	8	Forest Highway	59.546607	-139.723336	$1,000,000	S2	X		X	X		X		X
	High School	10													
	Wood Shop	10	Forest Highway	Undefined	Undefined	Included with High School	S2	X		X	X		X		X
	Headstart	15	Forest Highway	67.40457	Undefined	$533,031	W1	X		X	X		X		X
Medical	Health Clinic Administration & PA Housing	6	Ridge Road	Undefined	Undefined	$1,000,000	W1	X							
	Health Clinic	6	Ocean Cape	59.551525	-139.737808	$3,000,000	S2	X		X	X		X		X
	New Health Clinic	20	Airport Road	Undefined	Undefined	$12,000,000		X			X				
Community Facilities	Cemetery 1	0	Max Italio	Undefined	Undefined	$20,000	N/A	X		X	X		X		X
	Cemetery 2	0	Six miles outside of town	Undefined	Undefined	$20,000	N/A	X		X	X		X		X
	Alaska Native Brotherhood	150	Max Italio	Undefined	Undefined	$1,000,000	W2	X		X	X		X		X
	Post Office	2	Mallott Ave	Undefined	Undefined	$500,000	S1	X		X	X		X		X
	Senior Center & Essential Personnel Housing	15	Undefined	Undefined	Undefined	$3,200,000		X							
	Catholic Church	25	Forest Highway	59.547184	-139.719343	$500,000	W3	X		X	X		X		X
	Latter Day Saints	20	Mallott Ave	Undefined	Undefined	$300,000	W1	X		X	X		X		X

Table 6-5 Critical Facilities and Infrastructure

Facility Type	Facility	Estimated Occupants	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Ground Failure	Flood	Tsunami	Severe Weather	Severe Weather	Cryosphere	Fire
	Assembly of God	30	Mallott Ave	59.552279	-139.736158	$300,000	S2	X		X	X		X		X
	Assembly of God Parsonage	2	Ridge Road	Undefined	Undefined	$225,000		X							
	Presbyterian Church	30	Mallott Ave	59.552482	-139.737223	$300,000	W3	X		X	X		X		X
	Parsonage for Presbyterian Church	2	Mallott Ave	Undefined	Undefined	$250,000	W2	X		X	X		X		X
	Ocean Cape Dock Facility – Cannery & Bunkhouse; 60 people during the summer. 8 people year-round.	60	Sandy Beach	Undefined	Undefined	$8,127,564	S4	X		X	X		X		X
	YKI Facility – Cannery Equipment Storage, Ice House & Bunkhouse (late summer occupants/winter equipment store)	15	Sandy beach Road	Undefined	Undefined	$750,000		X							
Utility Facilities	Fuel Storage Tanks (>500gal) 1,000 gas 1,000 diesel	0	Ocean Cape Road	Undefined	Undefined	$100,000	OTF	X		X	X		X		X
	Landfill/Incinerator Class III Muni	0	Forest Highway	Undefined	Undefined	$772,453	N/A	X		X	X		X		X
	Satellite, ATT	0	Undefined	Undefined	Undefined	$50,000	N/A	X		X	X		X		X
	Satellite, GCI	0	Undefined	Undefined	Undefined	$50,000	N/A	X		X	X		X		X
	Power Generation Facility	8	Airport Road	59.54558	-139.72334	$8,000,000	S2	X		X	X		X		X
	Power Maintenance Shop	2	Undefined	Undefined	Undefined	$800,000	S2	X		X	X		X		X
	Facility Manager's House	2	Airport Road	Undefined	Undefined	$250,000	W1	X		X	X		X		X
	Power Plant Fuel Storage Tanks (>500 gal) 10,000 gallon	0	Airport Road	Undefined	Undefined	$250,000	OTF	X		X	X		X		X

Table 6-5 Critical Facilities and Infrastructure

Facility Type	Facility	Estimated Occupants	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Ground Failure	Flood	Tsunami	Severe Weather	Severe Weather	Cryosphere	Fire
	Redwood Water Tank	0	Water Tank Road	Undefined	Undefined	$250,000									
	Water Tank 1,000,000	0	Ridge Road	59.49711	-139.68643	$1,800,000	PS TC	X		X	X		X		X
	Telephone, ATT	0	Undefined	Undefined	Undefined	$50,000	N/ A	X		X	X		X		X
	Telephone, GCI	0	Undefined	Undefined	Undefined	$50,000	N/ A	X		X	X		X		X
	Telephone, ACS	0	Watershed Road	Undefined	Undefined	$250,000	S1	X		X	X		X		X
	Waste Water Treatment Plant	1	Max Italio Dr	59.552226	-139.742773	$700,000	S2	X		X	X		X		X
	Waste Water Lift Stations	0	Max Italio, Carrew St., Forest Hwy	Undefined	Undefined	$6,000,000									
	Airport Waste Water Lagoon	0	Endicott Way	Undefined	Undefined	$11,865									
	Delta Western 3 large storage tanks 10,000-20,000	0	Ocean Cape Road	Undefined	Undefined	$250,000	OT F	X		X	X		X		X
Total Estimated Occupants:		**650**			**Total Value**	**$80,494,674**									

(CBY, 2019)

6.3.1.4 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 the natural history. According to the State, cultural resources can include the 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. Sites around Yakutat include old Tlingit village sites, a Tlingit fort site, Tlingit hunting camps, the cannery railroad, old naval guns, a shaman grave, cannery sites, shipyards, the site of a fox farm, a White Alice military communications site, and a shipwreck site. The New Russia settlement archaeological site is on the National Register of Historic Places and is further designated a National Historic Landmark.

The Alaska Heritage Resource Survey of the Alaska Office of History and Archaeology lists 48 sites in the Yakutat-to-Dry Bay vicinity and none in the Yakutat to Cape Suckling vicinity. Few of these sites have been thoroughly investigated, and most are listed only for their potential significance. Five sites have been determined eligible for listing on the National Register of Historic Places, which means they are afforded special consideration and protection. Another two sites were considered for eligibility and found ineligible, although the Office of History and

Archaeology suggests that one of those could be eligible if reconsidered today. 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.

6.4 REPETITIVE LOSS PROPERTIES

DMA 2000, and its implementing regulations for estimating the number and type of structures at risk to repetitive flooding, are defined by:

DMA 2000 Requirements
Addressing Risk and Vulnerability to NFIP-Insured Structures §201.6(c)(2)(ii): The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP-insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of: §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of 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): The plan should describe vulnerability in terms of 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): The plan should describe vulnerability in terms of 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. §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.
1. REGULATION CHECKLIST
ELEMENT B. NFIP Insured Structures
B4. Does the Plan address NFIP-insured structures within the jurisdiction that have been repetitively damaged by floods?
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate?
Source: FEMA, March 2015.

6.4.1 NFIP Participation

CBY does not participate in the NFIP and has never been mapped. Neither have they kept repetitive loss property records for the Yakutat area that meets NFIP criteria as the loss thresholds are substantially below FEMA values.

6.5 VULNERABILITY ASSESSMENT METHODOLOGY

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

The Planning Team determined their facility locations within identified hazard impact zones. This data was used to develop a vulnerability assessment for those hazards.

Combined structure and contents replacement values were determined by the community for their physical assets. The community's aggregate exposure was calculated by assuming the worst-case scenario (that is, the asset would be completely destroyed and would have to be

replaced) for each physical asset located within a hazard area. A similar analysis was used to evaluate the proportion of the population at risk. However, the analysis simply represents the number of people at risk; no estimate of the number of potential injuries or deaths was prepared.

6.6 DATA LIMITATIONS

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

It is also important to note that the quantitative vulnerability assessment results are limited to the exposure of people, buildings, 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).

6.7 VULNERABILITY EXPOSURE ANALYSIS

There is limited GIS data available for CBY. The following discussion contains data obtained from the Project Team and their subsequent analysis. The results of the exposure analysis for loss estimations are summarized in Table 6-6.

Table 6-6 Potential Hazard Exposure Analyses – Critical Facilities

Government and Emergency Response		Education	
# Bldgs./# Occ	**Values ($)**	**#Bldgs./#Occ**	**Values ($)**
6/32	$6,900,000	4/145	$11,000,000
Medical		**Community**	
# Bldgs./# Occ	**Values ($)**	**#Bldgs./#Occ**	**Values ($)**
1/8	$3,000,000	13/459 (Year-Round) 13/539 (Seasonal)	$14,290,000
Utilities		**Transportation**	
# Bldgs./# Occ	**Values ($)**	**# Bldgs./# Occ**	**Values ($)**
12/13	$13,300,000	6/21	$10,300,000

6.8 FUTURE DEVELOPMENT

From the CBY's 2010 *Comprehensive Plan*,

> *"Land use patterns in Yakutat have developed in response to the physical environment and the historical orientation towards the coast for food, work, and recreation. The townsite is fairly compact with commercial and industrial development concentrated along the waterfronts of Monti Bay and Yakutat Bay and along the road to the airport.*

Residential land uses are the most prevalent, and consists predominantly of detached single-family homes with some multiple-family units and mobile homes. Commercial uses include businesses such as stores, restaurants, lodges, and private, State, and Federal offices. Industrial uses consist primarily of marine-related industries, fish processing, storage, and the CBY wastewater treatment facility, power plant, and landfill. The lands surrounding the townsite have been traditionally used by residents for subsistence activities and to a lesser but increasing extent, recreation.

The primary constraint to developing new land in CBY will be the physical attributes, including steep slopes and occasional poor drainage. These characteristics present challenges when providing public sewer and water. Developing unsuitable land may lead to increased erosion or other environmental problems. These constraints should be addressed in CBY's land development codes such as the zoning and subdivision ordinances. [There has been no change in code or ordinances since 2010.]

There is an abundance of land in CBY, although most of it is publicly-owned and managed, which can make land development a challenge. There are, however, opportunities to make CBY land available for disposal into private hands. Although controversial in the past, appropriate State lands could also be made available. In addition, the Yak-Tat Kwaan has land holdings it may choose to sell or lease in the future.

Planning for infrastructure in small communities like Yakutat requires the integration of engineering and planning so that servicing improvements do not lead development but is complementary. Problems can arise when areas located away from the main townsite are developed before more central areas. Development outside the main townsite moves residents further from the stores, schools, and other community destinations found in the center of town. It is often more expensive to provide utilities and other services to lots that are further away. For these reasons, it usually makes sense to develop new lots adjacent to existing development.

Since 2005, the population of Yakutat has not been growing, and land development has been slow. Despite this slow growth, it is still necessary to create future growth maps that identify areas appropriate for future residential, commercial and industrial development. This will allow time to plan and install the required services; amend the zoning ordinance if required; and will let property owners know what type of future development to expect on adjacent properties.

Aside from three Lake Street lots zoned commercial-waterfront- residential, CBY does not have a bank of lots that it can sell to the public for commercial, residential, or industrial development. Land uses in remote parts of CBY have traditionally been used for mining and exploration, commercial timber harvest, fishing and fish processing, subsistence activities, recreation, and tourism along with limited residential development.

The area adjacent to, and across the road from the landfill is a logical place for future industrial development because the site is large and could be subdivided into lots with enough space for a range of industrial activities. However, water and sewer and power do not extend to this area so careful consideration to the utility needs of industrial users as well as protecting air and water quality must occur. The Yak-Tat Kwaan owns land between Monti Bay and Ocean Cape Road that is also suitable for future industrial use because it has waterfront access and is large enough to be subdivided into several lots.

The economy, coastal development, subsistence, and land use are intrinsically linked in the remote parts of CBY. There has been, and will continue to be a range of economic and land use activity that includes tourism and recreational activities, including sports

lodge complexes, guided sport hunting and fishing, guided and unguided wilderness trips of various types, public recreation cabins, and cruise boat visitation; commercial fishing; subsistence fishing, hunting and gathering; residential living; a research camp and university research activities; commercial timber harvest; and onshore and offshore mining and offshore oil and gas exploration. CBY is very large, access is limited, and there are many land owners which together makes land management and planning for future development especially difficult.

There is a demand for land in remote parts of CBY that would be suitable for seasonal cabins and potentially some year-round residential development. Both CBY land and AMHT land may offer possibilities. Appropriate sites would then be surveyed and subdivided with development restrictions due to wildlife corridors, coastal fringe, and anadromous streams delineated. These lots would not be serviced with water and sewer and would likely not be accessible by road. There is the potential for a range of commercial/industrial uses outside of the Yakutat townsite. The community would like to see development that supports the economic development goals, without jeopardizing the area's rich natural resources.

The CBY is working on updating the community's Comprehensive Development Plan. The 2010 Comprehensive Plan is a vision and policy document that sets out a blueprint for desired growth patterns in the Borough over the next 25 years. As part of 2010 Comprehensive Plan, Future Growth Maps were developed to identify areas where residential, commercial, mixed-use, recreation, industrial and other types of uses are expected to occur. The Future Growth Maps will be used by the community, developers, CBY staff, the Planning Commission, and the Assembly to guide future land use and development decisions, and changes to the zoning. Through this planning process, the broad public interest is defined, and the rationale established to direct certain types of land uses to (and away from) particular areas.

The 2010 Comprehensive Plan and the Future Growth Maps do not specially prohibit or allow certain types of development; this is the role of zoning and subdivision codes and regulatory agencies. This plan and the associated maps set out desired growth direction and preferences so that zoning and capital investments can be made accordingly. The CBY also expects to see its preferences for growth and land use, as set out in this plan, will be implemented by State and Federal regulators as they review proposed projects, leases, and permits.

The 2010 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 Yakataga State Game Refuge Plan, Yakataga Area Plan, Wrangell- St. Elias National Park and Preserve Plan, the Plan for Glacier Bay National Park and Preserve, the USFS Tongass Forest Land and Resource Management Plan, and BLM Resource Management Plan. The CBY's Future Growth Maps generally follows the guidelines that the large public landowners have established. CBY also recognizes the rights of Native Allotment and other private land owners to use their land without undue restriction.

It is important to recognize that the boundaries between Future Growth Designations are soft at this scale and level of planning. Desired types of land use and growth are clear, but the location of the exact boundary between neighboring land use designations is not precise. Site-specific review of projects and zoning ideas will be needed as questions arise. The intent is not to preclude a proposed project because it falls on one side or another of a Designation boundary, rather the Planning Commission and Assembly

should consider the intent of the designation when reviewing project, lease, or zoning requests.

The purpose and expected uses of each Future Growth Designation are listed in Table 8.1. Current land use, access, proximity to CBY services, environmental conditions, and input from the public, CBY staff, the planning commission, and major land owners were considered during the development of the Future Growth Designations.

Zoning is a key tool for enforcing the 2010 Yakutat Comprehensive Plan (along with Capital Improvement Plans and spending). Shaping change into orderly, healthy growth is the role of the zoning as it seeks to separate conflicting land uses that may pose a threat to public health, safety and welfare. Current zoning is established by the Yakutat Municipal Code, at Title 8, Planning and Zoning. All territory annexed to CBY was initially zoned "R-1" Residential. This zoning district was intended to stabilize and protect the residential character and to promote and encourage a suitable environment for family life. The R-1 zone is not appropriate for the entire CBY. It is recommended that the zoning code and map be amended to more appropriate zoning districts that reflect the land use designations shown on the Future Growth Maps.

CBY is working on a mixed-use zoning ordinance in 2019. Land developments in the future will consist of housing and mixed-use construction.

Section Seven delineates CBY's updated HMP mitigation strategy.

7.1 OVERVIEW

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

1. Identifying each jurisdiction's existing authorities for implementing mitigation action initiatives;
2. NFIP Participation;
3. Developing Mitigation Goals;
4. Identifying Mitigation Actions;
5. Evaluating Mitigation Actions; and
6. Prioritizing Mitigation Actions; and Implementing the Mitigation Action Plan (MAP)

DMA 2000, and its implementing regulations for comprehensive mitigation strategy development, include:

DMA 2000 Requirements
Identification and Analysis of Mitigation Actions §201.6(c)(3): [The plan shall include the following:] A *mitigation strategy* that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools. §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards. §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. §201.6(c)(3)(iii): [The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section 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. Requirement §201.6(c)(4): [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 improvements, when appropriate.
1. REGULATION CHECKLIST
ELEMENT C. Mitigation Strategy
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources, and its ability to expand on and improve these existing policies and programs?
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate?
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure?
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit

DMA 2000 Requirements
review), implemented, and administered by each jurisdiction?
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?
Source: FEMA, March 2015.

7.2 YAKUTAT'S CAPABILITY ASSESSMENT

CBY's capability assessment reviews the technical and fiscal resources available to the community. DMA 2000, and its implementing regulations for technical and fiscal resources available to the community for HMP project implantation and management, include:

DMA 2000 Requirements
Incorporation into Existing Planning Mechanisms §201.6(c)(3): [The plan shall include the following:] A *mitigation strategy* that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing tools.
1. REGULATION CHECKLIST
ELEMENT C. Incorporate into Other Planning Mechanisms
C1. Does the plan document each jurisdiction's existing authorities, policies, programs, and resources, and its ability to expand on and improve these existing policies and programs?
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?
Source: FEMA, March 2015.

Tables 7-1, 7-2, and 7-3 delineate CBY's regulatory tools, technical specialists, financial, and training resources available for project management. Appendix A provides a detailed list of potential funding resources.

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Table 7-1 Yakutat's Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing Yes/No?	Comments (Year of most recent update; problems administering it, etc.)
Comprehensive Plan	Yes	2010 Community Development Plan (CDP), explains CBY's land use initiatives and natural hazard impacts.
Land Use Plan	Yes	2006 CDP explains CBY's land use goals and initiatives.
Emergency Response Plan	Yes	Currently being updated and will be completed in 2019.
Wildland Fire Protection Plan	No	
Building code	Yes	The 2006 CDP defines CBY's building code.
Zoning ordinances	Yes	Borough Code.
Subdivision ordinances or regulations	Yes	Borough Code.
Special purpose ordinances	Yes	Borough Code.

Local Resources

CBY 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 Hazard Mitigation Planning Team, and are summarized below.

Table 7-2 Yakutat's Technical Specialists

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	CBY 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	GIS Contractor
Scientists familiar with the hazards of the jurisdiction	No	CBY 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	CBY Mayor and Borough Manager

Table 7-3 Yakutat's Financial Resources

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	Can exercise this authority with Borough Assembly approval
Payment in Lieu of Taxes (PILT)	Provides operating support funding
Municipal Energy Assistance Program (MEAP)	Provides operating support funding
Community Development Block Grants (CDBG)	Can exercise this authority with Assembly approval
Capital Improvement Project Funding	Can exercise this authority with voter approval
Authority to levy taxes for specific purposes	Can exercise this authority with voter approval
Incur debt through general obligation bonds	Can exercise this authority with voter approval
Incur debt through special tax and revenue bonds	Can exercise this authority with voter approval
Incur debt through private activity bonds	Can exercise this authority with voter approval
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 is 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. ***CBY does not qualify for this funding source because they do not participate in the NFIP.***

Table 7-3 Yakutat's Financial Resources

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
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.

The Planning Team developed their mitigation goals and potential mitigation actions to address identified potential hazard impacts (refer to Section 5.3) for the Yakutat area.

7.3 DEVELOPING MITIGATION GOALS

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

DMA 2000 Requirements
Local Hazard Mitigation Goals §201.6(c)(3)(i): The hazard mitigation strategy shall include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.
1. REGULATION CHECKLIST
ELEMENT C. Mitigation Goals
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards?
Source: FEMA, March 2015.

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The exposure analysis results were used as a basis for developing the mitigation goals and actions (Table 7-4). Mitigation goals are defined as general guidelines that describe what a community wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing community-wide visions. As such, goals were developed to reduce or avoid identified long-term hazard vulnerabilities.

Table 7-4 Mitigation Goals

No.	Goal Description
Multi-Hazards (MH)	
MH 1	Provide **outreach** activities to educate and promote recognizing and mitigating all-natural hazards that affect CBY.
MH 2	**Cross-reference** mitigation goals and actions with other CBY planning mechanisms and projects.
MH 3	Develop **construction** activities that reduce possibility of losses from all-natural hazards that affect the Yakutat area. Update in 2019: CBY adopted state code. There are no inspectors in CBY.
Natural Hazards	
EQ 4	Reduce structural vulnerability to earthquake (EQ) damage.
FL 5	Reduce flood (FL) and erosive scour damage and loss possibility.

Table 7-4 Mitigation Goals

No.	Goal Description
GF 6	Reduce ground failure (GF) damage and loss possibility.
SW 7	Reduce structural vulnerability to severe weather (SW) damage.
TS 8	Reduce vulnerability, damage, or loss of structures from tsunami or seiche (TS).
F 9	Reduce structural vulnerability to wildland or conflagration fire (F) damage.
CC 10	Reduce changes in the cryosphere (CC) if possible. This will be combined with flood/erosion.

7.4 IDENTIFYING MITIGATION ACTIONS

DMA 2000 requirements, and implementing regulations for identifying and analyzing mitigation actions include:

DMA 2000 Requirements
Identification and Analysis of Mitigation Actions §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.
1. REGULATION CHECKLIST
ELEMENT C. Mitigation Actions
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure?
Source: FEMA, March 2015.

After developing mitigation goals, the Planning Team reviewed a comprehensive list of potential mitigation actions that were identified during this 2019 HMP Update development process for each hazard type including.

The Planning Team assessed the potential mitigation actions to carry forward into the mitigation Action Plan (MAP). Mitigation actions are activities, measures, or projects that help achieve the goals of an HMP. Mitigation actions are usually grouped into three broad categories: property protection, public education and awareness, and structural projects.

The 2008 HMP organized mitigation actions into objectives and actions as listed below. CBY staff stated that all of their objectives and actions are ongoing. During the 2015 HMP Update planning process (November 2014 through September 2015), the Planning Team reviewed the legacy HMP's mitigation actions status to determine whether to carry them forward for implementation during the five-year life cycle of the 2015 HMP. During the 2019 HMP Update planning process (December 2018 through September 2019), the Planning Team reviewed the legacy HMP's mitigation actions status to determine whether to carry them forward for implementation during the five-year life cycle of the 2019 HMP Update. The Planning Team placed particular emphasis on projects and programs that reduced the effects of hazards on both new and existing buildings and infrastructure.

Table 7-5 lists the project criteria as completed, deleted, deferred (ongoing), and new actions that were considered or selected for implementation are identified. The Planning Team considered

projects from a comprehensive list for each hazard type. They identified numerous "ongoing" mitigation actions currently in process or those that were listed in other CBY planning documents. The Planning Team did not delete any of the 2015 HMP Update actions, but reworded or clarified the actions, as deemed appropriate.

The Planning Team placed particular emphasis on projects and programs that reduce the effects of hazards on both new and existing buildings and infrastructure as well as facilities located in potential flood zones to comply with NFIP requirements should CBY join the NFIP.

Table 7-5 Potential Mitigation Actions

Supports Goal No.	Description	Status: *Complete, Deferred, Deleted, Selected, Ongoing*	Explain Status Change *Considered, Selected or Ongoing*	Action Description
MH 1	Provide outreach activities to educate and promote recognizing and mitigation all-natural hazards that affect CBY.	O	Ongoing as actions require funding.	Identify and pursue funding opportunities to implement mitigation actions.
		O	Tribe/researchers are currently implementing.	Train residents in installation of erosion monitoring devices to determine rate of eroding shorelines and riverbanks.
		C	A grant writer was hired.	Train/advise residents in grant writing and project management.
		C	This has been completed in 2019.	Develop, produce, and distribute information materials concerning mitigation, preparedness, and safety procedures for all identified natural hazards.
		C	A grant writer and additional staff were hired.	Designate liaison between CBY and community members to assist with mitigation planning; grant applications, and other funding tasks.
		O	This occurs at school and police meetings.	Encourage community to become more fire and flood ready and better prepared for fire and flood.
MH 2	Cross reference mitigation goals and actions with other CBY planning mechanisms and projects.	O	This occurs at tsunami meetings.	Regularly discuss with community residents to identify best ways to assist mitigation efforts within the community, and add mitigation actions to government documents.
		C	The code was changed to always adopt current State of Alaska code.	Encourage weather-resistant building construction materials and practices.
MH 3	Develop construction activities that reduce possibility of losses from all-natural hazards that affect the community.	C	The Public Safety Building was retrofitted.	Structure Elevation and/or Relocation.
		C	A grant writer and additional staff were hired.	Designate liaison between CBY and Tribe to assist community with mitigation planning; grant applications, and other mitigation-related tasks.
EQ 4	Reduce structural vulnerability to earthquake damage.	C	The Public Safety Building was retrofitted. The code was changed to always adopt current State of Alaska code.	Inspect, prioritize, and retrofit any critical facility or public infrastructure that does not meet current State-Adopted Building Codes.
		S	No progress was made.	Install non-structural seismic restraints for

Table 7-5 Potential Mitigation Actions

Supports Goal No.	Description	Status: *Complete, Deferred, Deleted, Selected, Ongoing*	Explain Status Change *Considered, Selected or Ongoing*	Action Description
				large furniture such as bookcases, filing cabinets, heavy televisions, and appliances to prevent toppling damage and resultant injuries to small children, elderly, and pets.
FL 5	Reduce flood and erosive scour damage and loss possibility.	**O**	The glacier is quiet at this time. Monitoring is occurring.	Hubbard Glacier - Detailed bathymetry at Gilbert Point and the gap, particularly around the recently emerged push moraine, at the earliest possible date.
		O	The station has fallen into the ocean as of June 2019 and needs to be replaced.	Hubbard Glacier - Continued laser ranger monitoring of the gap width by Cold Regions Research and Engineering Laboratory (CRREL).
		Deferred	*Ongoing: seeking agency to guide funding assistance.*	Hubbard Glacier - Use of Canadian-based MacDonald Dettwiler and Associates (MDA) Ltd. RadarSat images to monitor the status of the Hubbard Glacier terminus.
		Deferred	*Ongoing: Edited to reflect technological changes; seeking agency to guide funding expenditures.*	Hubbard Glacier - Acquisition of Advanced Land Observing Satellite-2 (ALOS) Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) high-resolution images when possible.
		Deferred	*Ongoing: Edited to reflect technological changes; seeking agency to guide funding expenditures.*	Identify drainage patterns and develop a comprehensive drainage system.
		O	The study was completed. A report is currently in progress.	Install upgraded stream flow and rainfall measuring gauges.
		Deferred	*Ongoing: Combined with other funding actions moved to MH 1.*	Apply for grants/funds to implement riverbank protection methods.
GF 6	Reduce ground failure damage and loss possibility.	**S**	The code was changed to always adopt current State of Alaska code.	Promote permafrost-sensitive construction practices in permafrost areas.
SW 7	Reduce structural vulnerability to severe weather damage.	**C**	Completed.	Research and consider instituting the National Weather Service program of "Storm Ready".
		O	NOAA does this.	Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.
		O	NOAA does this.	Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability.
TS 8	Reduce vulnerability, damage, or loss of structures from tsunami or seiche.	**O**	Will always be ongoing.	Coordinate with the Alaska Tsunami Warning Center to ensure the community receives adequate warning.
F 9	Promote education and awareness of	**O**	Will always be ongoing.	Continue to support the local fire department with adequate firefighting equipment and

Table 7-5 Potential Mitigation Actions

Supports Goal No.	Description	Status: *Complete, Deferred, Deleted, Selected, Ongoing*	Explain Status Change *Considered, Selected or Ongoing*	Action Description
	wildland and conflagration fire risks and fire-ready precautions/measures to be taken. Reduce structural vulnerability to fire damage.			training.
		C	Adopted Fire Code to stay current.	Promote Fire Wise building design, siting, and materials for construction.
		C	Update building features.	All the efficiency measures that the CBY can do or afford have been completed (i.e, LED lights, HVAC at school, waste heat repairs, new wiring, insulation, new furnaces, heaters, tanks, appliances). The power plant was sold for better management controls. Vehicles have been updated as the CBY can afford to.

7.5 EVALUATING AND PRIORITIZING MITIGATION ACTIONS

DMA 2000, and implementing regulations for evaluating and implementing mitigation actions, stipulated:

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions
Implementation of Mitigation Actions §201.6(c)(3)(iii): [The hazard mitigation strategy shall include an] action plan, describing how the action identified in paragraph (c)(3)(ii) of this section 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.
1. REGULATION CHECKLIST
ELEMENT C. MITIGATION STRATEGY
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))
Source: FEMA, March 2015.

The Planning Team evaluated and prioritized each of the mitigation actions during August 2015 to determine which actions would be included in the Mitigation Action Plan. Table 7-8 provides updates to the mitigation actions implemented from the 2015 Mitigation Action Plan that were made in Summer 2019. The Mitigation Action Plan represents mitigation projects and programs to be implemented through the cooperation of multiple entities in the Yakutat community. To complete this task, the Planning Team first prioritized the hazards that were regarded as the most significant within the community (earthquake, flood, ground failure, severe weather, tsunami, changes in the cryosphere, and wildland/conflagration fire).

The Planning Team also reviewed the simplified social, technical, administrative, political, legal, economic, and environmental (STAPLEE) evaluation criteria (Table 7-6) and the Benefit-Cost Analysis Fact Sheet (Appendix G) 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 CBY chooses to implement.

Table 7-6 Evaluation Criteria for Mitigation Actions

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

During August 2015, the hazard mitigation Planning Team prioritized 15 legacy and 10 newly selected natural hazard mitigation actions that were selected to carry forward into the Mitigation Action Plan (MAP). During May and June 2019, the hazard mitigation Planning Team updated the status of each mitigation action in Table 7-8 and reprioritized mitigation actions accordingly to the community's current priorities.

The hazard mitigation Planning Team considered 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 within the MAP matrix (Table 7-8) was completed to provide CBY with an implementation approach.

7.6 MITIGATION ACTION PLAN

CBY has flat management structures. Like most rural-remote Alaskan communities, there is limited budget; therefore, no funding is available for developing and maintaining departmental or other infrastructure responsibilities. The City is managed by its mayoral-led City Council. This process enables the local government (CBY) to maximize governance capacity, coordinate project prioritization, and closely monitor its limited budget constraints.

Table 7-7 delineates the acronyms used in the Mitigation Action Plan (Table 7-8). See Appendix A for summarized agency funding source descriptions.

Table 7-7 Potential Funding Source Acronym List

(See complete funding resource description in Appendix A)

City and Borough of Yakutat (City Mayor's Office)

Yakutat Tlingit Tribal Council (Tribal Council Office)

US Department of Homeland Security (DHS)
Citizens Corp Program (CCP)
Emergency Operations Center (EOC)
Homeland Security Grant Program (HSGP)
Emergency Management Performance Grant (EMPG)
State Homeland Security Program (SHSP)

Federal Management Agency (FEMA)
Hazard Mitigation Assistance Grant Programs (HMA)
Emergency Management Program Grant (EMPG)
Debris Management Grant (DM)
Flood Mitigation Assistance Grants (FMA)
National Earthquake Hazards Reduction Program (NEHRP)
National Dam Safety Program (NDS)

US Department of Commerce (DOC)
Remote Community Alert Systems Program (RCASP)

National Oceanic and Atmospheric Administration (NOAA)
Economic Development Administration (EDP)
Public Works and Development Facilities Program (PWDFP)

US Environmental Protection Agency (EPA)
Indian Environmental General Assistance Program (IGAP)

US Department of Agriculture (USDA)
USDA, Farm Service Agency
Emergency Conservation Program (ECF)
Rural Development (RD)

USDA, Natural Resources Conservation Service (NRCS)
Conservation Technical Assistance Program (DCT)
Conservation Innovation Grants (CIG)
Environmental Quality Incentives Program (EQIP)

Emergency Watershed Protection Program (EWP)
Watershed Planning (WSP)

US Geological Survey (USGS)
Alaska Volcano Observatory (AVO)

Assistance to Native Americans (ANA)
Native American Housing Assistance and Self Determination Act (NAFSMA)

US Army Corp of Engineers (USACE)
Planning Assistance Program (PAP)
Capital Projects: Erosion, Flood, Ports & Harbors

Alaska Department of Military and Veterans Affairs (DMVA), Division of Homeland Security and Emergency Management (DHS&EM)
Mitigation Section (for PDM & HMGP projects and plan development)
Preparedness Section (for community planning)
State Emergency Operations Center (SEOC for emergency response)

Alaska Department of Community, Commerce, and Economic Development (DCCED)

Division of Community and Regional Affairs (DCRA)
Community Development Block Grant (CDBG)
Alaska Climate Change Impact Mitigation Program (ACCIMP)
Flood Mitigation Assistance Grants (FMA)

Alaska Department of Transportation
State road repair funding

Alaska Energy Authority (AEA)
AEA/Bulk Fuel (ABF)
AEA/Alternative Energy and Energy Efficiency (AEEE)

Alaska Department of Environmental Conservation (DEC)
Village Safe Water (VSW)
DEC/Alaska Drinking Water Fund (ADWF)
DEC/Alaska Clean Water Fund (ACWF)
DEC/Clean Water State Revolving Fund (CWSRF)

Alaska Division of Forestry (DOF)
Volunteer Fire Assistance and Rural Fire Assistance Grant (VFAG/RFAG)
Assistance to Firefighters Grant (AFG)
Fire Prevention and Safety (FP&S)
Staffing for Adequate Fire and Emergency Response Grants (SAFER)
Emergency Food and Shelter (EF&S)

Denali Commission (Denali)
Energy Program (EP)
Solid Waste Program (SWP)

Lindbergh Foundation Grant Programs (LFGP)

Rasmuson Foundation Grants (RFG)

Yakutat's Mitigation Action Plan, Table 7-8, depicts how each mitigation action will be implemented and administered by the Planning Team. The MAP delineates each selected mitigation action, its priorities, the responsible entity, the anticipated implementation timeline, and provides a brief explanation as to how the overall benefit/costs and technical feasibility were taken into consideration.

Table 7-8 City and Borough of Yakutat's Mitigation Action Plan (MAP)

(See Table 7-9 Potential Funding Agency list; Appendix A for agency programmatic details)

Goal/ Action Id	Description	Priority (High, Medium, Low)	Responsible Entity	Potential Funding Source(s)	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
MH 1.1	Identify and pursue funding opportunities to implement mitigation actions. Update in 2019: FEMA grants, Capital Improvement projects, ANTHC grants and assistance, and USDA grants have been obtained.	High	CBY Manager, Yakutat	CBY (See Appendix A)	Ongoing	B/C: Community life requires this as an ongoing activity; it is essential for rural communities as there are limited funds available to accomplish effective mitigation actions. TF: This type of activity is technically feasible within the community typically using existing labor, equipment, and materials.
MH 1.2	Train residents in installation of erosion monitoring devises to determine rate of eroding shorelines and riverbanks. Update in 2019: The Tribe is currently doing this.	High	Mayor's Office, Director of Public Works, Borough Manager's Office	City, Lindbergh, HMA, NOAA	The Tribe is currently doing this.	B/C: This project would potentially provide near-term flood damage threat warning, enabling responders to mitigate potential damages. TF: This project is feasible using existing staff skills, equipment, and materials.
MH 1.3	Train and/or advise residents in grant writing and project management. Update in 2019: CBY hired a grant writer in 2015 and provided training for project management in 2014 and 2015. The Tribe is also writing grants under new management.	High	CBY Planner's Office	City, Lindbergh, HMA, Denali Commission	Completed.	B/C: Funding agencies may be able to fulfill needed training requirements for their specific programs. Trained staff would greatly improve grant writing, and reporting quality. TF: Specialized skills may need to be contracted-out depending on the skill set required for each activity.
MH 1.4	Develop, produce, and distribute information materials concerning mitigation, preparedness, and safety procedures for all identified natural hazards. Update in 2019: The tsunami map was completed in 2018. Training is ongoing.	Medium	CBY Planner's Office	City, FEMA HMA, HMGP, DOF	Ongoing.	B/C: Sustained mitigation outreach programs have minimal cost and will help build and support area-wide capacity. This type of activity enables the public to prepare for, respond to, and recover from disasters. TF: This low-cost activity can be combined with recurring community meetings where hazard- specific information can be presented in small increments. This activity is ongoing demonstrating its feasibility.

Table 7-8 City and Borough of Yakutat's Mitigation Action Plan (MAP)

(See Table 7-9 Potential Funding Agency list; Appendix A for agency programmatic details)

Goal/ Action Id	Description	Priority (High, Medium, Low)	Responsible Entity	Potential Funding Source(s)	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
MH 1.5	Designate liaison between CBY and community members to assist with mitigation planning; grant applications, and other funding tasks. Update in 2019: CBY hired a grant writer, manager, planner, and various staff since 2015	Medium	CBY Manager's Office	City, FEMA HMA, AFG, FP&S, SAFER, EEFSP, Lindbergh, RFG, Denali Commission	Completed.	B/C: Funding agencies may be able to fulfill needed training requirements for their specific programs. Trained staff would greatly improve grant writing, and reporting quality. TF: Specialized skills may need to be contracted-out depending on the skill set required for each activity.
MH 1.6	Encourage community to become more fire and flood ready and better prepared for fire and flood. Update in 2019: Fire department training and equipment was funded in the budget. A grant is being sought.	Medium	CBY Supervisor of Public Works & Facilities Office	CBY, HMA, NRCS, USACE, USDA, Lindbergh	Ongoing	B/C: This project would ensure threatened infrastructures are available for use – their loss would exacerbate potential damages and further threaten survivability. TF: This project is feasible using existing staff skills, equipment, and materials.
MH 1.7	Conduct special hazard awareness activities, such as Winter Weather Awareness, Flood Awareness Weeks, etc. Update in 2019: NOAA does this annually.	Medium	CBY Manager's Office	CBY	Ongoing with a tsunami table at Family Fishing Day annually	B/C: Sustained mitigation outreach programs have minimal cost and will help build and support area-wide capacity. This type of activity enables the public to prepare for, respond to, and recover from disasters. TF: This low-cost activity can be combined with recurring community meetings where hazard- specific information can be presented in small increments. This activity is ongoing, demonstrating its feasibility.
MH 2.1	Regularly discuss with community residents to identify best ways to assist mitigation efforts within the community, and add mitigation actions to government documents. Update in 2019: HMP Update is nearly completed. DOG and Coast Guard conduct training.	Medium	CBY Supervisor Public Works & Facilities Office	CBY, HMA, NRCS, ANA, USACE, US USDA, Lindbergh	Ongoing	B/C: This project would ensure threatened infrastructures are available for use – their loss would exacerbate potential damages and further threaten survivability. TF: This project is feasible using existing staff skills, equipment, and materials. Specialized methods are not new to rural communities as they are used to importing required contractors.
MH 2.2	Encourage weather-resistant building construction materials	High	CBY Manager's Office	USCOE UAA DNR	Completed	B/C: Building code development, implementation, and enforcement can effectively

Table 7-8 City and Borough of Yakutat's Mitigation Action Plan (MAP)

(See Table 7-9 Potential Funding Agency list; Appendix A for agency programmatic details)

Goal/ Action Id	Description	Priority (High, Medium, Low)	Responsible Entity	Potential Funding Source(s)	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
	and practices. Update in 2019: CBY adopted codes to replace the outdated ones.					reduce future losses to hazardous events. Encouraging code compliance can actually assist bush communities through making maximum use of materials and shipping costs the first time. TF: This project is technically feasible as the community need only demonstrate cost savings by demonstrating losses from historic impacts and down time.
MH 3.1	Acquire (buy-out), demolish, elevate, or relocate* structures from hazard prone area. (* For relocated properties: Property deeds shall be restricted for open space uses in perpetuity to keep people from rebuilding in hazard areas.) Update in 2019: No progress.	High	CBY Manager's Office	CBY, HMGP, PDM, NRCS, USDA, HUD, Lindbergh Grants Program	2019-2024	B/C: Proactive; have a high/cost benefit ratio and result in less costly construction before a problem develops. TF: Specialized skills may need to be contracted out with materials and equipment barged in depending on the method selected.
MH 3.2	Designate liaison between the CBY and Tribe to assist community with mitigation planning; grant applications, and other mitigation-related tasks. Update in 2019: Ongoing	High	CBY Manager's Office	CBY	Ongoing	B/C: Funding agencies may be able to fulfill needed training requirements for their specific programs. Trained staff would greatly improve grant writing, and reporting quality. TF: Specialized skills may need to be contracted out depending on the skill set required for each activity.
EQ 4.1	Inspect, prioritize, and retrofit any critical facility or public infrastructure that does not meet current State-Adopted Building Codes. Update in 2019: CBY is working on the Public Safety Building through FEMA grants.	High	CBY Manager's Office	CBY, HMGP, PDM	Ongoing	B/C: Retrofit projects can be very cost-effective methods for rural communities as materials and shipping costs are very high. Project viability is depending on the cost and extent of the modifications. A comprehensive BCA needs to be conducted to validate this activity. TF: CBY will need phase funding to obtain engineering and design expertise to determine project viability.
EQ 4.2	Install non-structural seismic restraints for large furniture such as bookcases, filing	High	CBY Manager's Office	CBY, HMGP, PDM	Ongoing; This will always remain	B/C: Non-structural mitigation projects have minimal cost and will help the community reduce recurring earthquake impact

Table 7-8 City and Borough of Yakutat's Mitigation Action Plan (MAP)

(See Table 7-9 Potential Funding Agency list; Appendix A for agency programmatic details)

Goal/ Action Id	Description	Priority (High, Medium, Low)	Responsible Entity	Potential Funding Source(s)	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
	cabinets, heavy televisions, and appliances to prevent toppling damage and resultant injuries to small children, elderly, and pets. Update in 2019: Ongoing. Large tvs have been replaced. Shorter bookcases have replaced taller ones. Earthquake straps have been used.				ongoing.	damages from future events. TF: This project is technically feasible using existing staff.
FL 5.1	Acquire Hubbard Glacier - Detailed bathymetry at Gilbert Point and the gap, particularly around the recently emerged push moraine, at the earliest possible date. Update in 2019: Ongoing.	High	CBY Manager's Office	FEMA, NOAA, USACE, UAF/GS, CRREL	Ongoing; This will always remain ongoing.	B/C: Flood hazard mitigation is among FEMA's highest national priorities. Proactive mitigation activities have a high/cost benefit ratio and result in less costly construction before a problem develops. TF: Specialized skills and assistance from the USACE, NOAA, and universities will be needed for this action to be accomplished.
FL 5.2	Hubbard Glacier - Continued laser ranger monitoring of the gap width. Update in 2019: Ongoing.					
FL 5.3	Hubbard Glacier - Use of Canadian-based MDA, Ltd. RadarSat images to monitor the status of the Hubbard Glacier terminus. Update in 2019: Ongoing					
FL 5.4	Hubbard Glacier - Acquisition of ALOS, Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) high-resolution images when possible. Update in 2019: CBY has new aerial.					
FL 5.5	Structure Elevation and/or Relocation. Update in 2019:	Medium	CBY Supervisor in Public Works & Facilities	CBY, FEMA, HMGP, PDM	Ongoing	B/C: This project would remove threatened structures from hazard areas, eliminating future damage while keeping land clear

Table 7-8 City and Borough of Yakutat's Mitigation Action Plan (MAP)

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Goal/ Action Id	Description	Priority (High, Medium, Low)	Responsible Entity	Potential Funding Source(s)	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
	Ongoing. Road issues have been identified on Max Italio Drive. CBY has applied for CIP and State assistance.		Office			for perpetuity. TF: This project is feasible using existing staff skills, equipment, and materials. Acquiring contractor expertise may be required for large facilities.
FL 5.6	Install upgraded stream flow and rainfall measuring gauges. Update in 2019: Ongoing. There will be a report in June 2019.	Medium	CBY Supervisor in Public Works & Facilities Office	CBY	Ongoing	B/C: This project would potentially provide near-term flood threat warning, enabling responders to mitigate potential damages. TF: This project is feasible using existing staff skills, equipment, and materials.
FL 5.7	New in 2019: Weather station fell off the mountain and needs to be replaced.	High	CBY Supervisor in Public Works & Facilities Office	CRREL	2019	B/C: The information collected from this station is valuable to the community. TF: This project is feasible using CRREL resources.
GF 6.1	Promote permafrost-sensitive construction practices in permafrost areas. Update in 2019: Ongoing.	Medium	CBY Supervisor in Public Works & Facilities Office	CBY, HMA, HMGP, PDM	Ongoing	B/C: This outreach project would decrease damage to facilities if they were sited correctly and used the most appropriate construction practices. TF: Technically feasible as the community is currently working with UAF and other entities to determine most viable permafrost construction practices.
GF 6.2	New in 2019: Education to public about all out-lying beaches. People were killed while they were berry picking when the sand tip melted (whole island liquified and dropped off).	High	CBY Manager	CBY	2019	B/C: This outreach project would educate the public about a past event. Flyers relating to this concern could be given away at Family Fishing Day. TF: Event is already in place. USFS could help with understanding the terrain in the Yakutat area.
SW 7.1	Research and consider instituting the National Weather Service program of "Storm Ready". Update in 2019: Completed in 2018.	Medium	CBY Manager's Office	NOAA	Completed	B/C: Sustained emergency warning, communication, and response activity capabilities enable communities to warn and protect their hazard threatened populations. This project will help build and support community capacity enabling the public to prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing staff.
SW 7.2	Expand public awareness about NOAA	Medium	CBY Manager's	CBY, DHS&EM,	Completed	B/C: Sustained emergency warning, communication, and

Table 7-8 City and Borough of Yakutat's Mitigation Action Plan (MAP)

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Goal/ Action Id	Description	Priority (High, Medium, Low)	Responsible Entity	Potential Funding Source(s)	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
	Weather Radio for continuous weather broadcasts and warning tone alert capability. Update in 2019: Completed in 2018.		Office	NOAA		response activity capabilities enable communities to warn and protect their hazard threatened populations. This project will help build and support community capacity, enabling the public to prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing staff.
SW 7.3	Require weather-resistant building construction materials and practices. Update in 2019: Code is the same as the State of Alaska Code. However, there is no enforcement as there are no inspectors in Yakutat.	Medium	CBY Supervisor Public Works & Facilities Office	CBY	Ongoing	B/C: Sustained mitigation outreach programs combined with ordinance development, implementation, and enforcement can effectively reduce future losses to hazardous events. TF: This project is technically feasible and enforceable.
SW 7.4	New in 2019: Evaluate current heavy equipment for snow/debris and other needs created by severe weather conditions.	High	CBY Supervisor Public Works & Facilities Office	CBY	2019	B/C: Borough equipment is dilapidated and not reliable. It would not be ideal if a natural hazard event occurred, and there was no dependable CBY equipment to respond. TF: This project could be easily done. CBY would make a list of assets and tools they currently have and what is needed.
TS 8.1	Coordinate with the National Tsunami Warning Center to ensure the community receives adequate warning. Update in 2019: Ongoing.	Medium	CBY Manager's Office	CBY, DHS&EM, NOAA, NTWC	Ongoing	B/C: Sustained emergency warning, communication, and response activity capabilities enable communities to warn and protect their hazard threatened populations. This project will help build and support community capacity, enabling the public to prepare for, respond to, and recover from disasters. TF: This project is technically feasible using existing staff.
TS 8.2	New in 2019: Conduct tsunami training in the school.	High	School District Curriculum Director	School	2019	B/C: Children are a valuable source of education to their parents. TF: The Fire Department could participate in school assemblies.
TS 8.3	New in 2019: Test siren monthly. Buy batteries when needed.	High	CBY Supervisor Public Works & Facilities Office	CBY	2019	B/C: The siren is already in place. TF: The CBY Supervisor has the ability to test the siren.

Table 7-8 City and Borough of Yakutat's Mitigation Action Plan (MAP)

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Goal/ Action Id	Description	Priority (High, Medium, Low)	Responsible Entity	Potential Funding Source(s)	Timeframe	Benefit/Costs (B/C) Technical Feasibility (TF)
WF 9.1	Continue to support the local fire department with adequate firefighting equipment and training. Update in 2019: Ongoing.	Medium	CBY Supervisor in Public Works & Facilities Office	City, FEMA, AFG, VFAG, RFAG FP&S, SAFER, HSEP	Ongoing	B/C: Infrastructure protection training and equipment to reduce disaster impacts to residents and essential facilities are critical disaster management tools which enables proper response to reduce losses and damage. TF: This type of activity is technically feasible within the community typically using existing labor, equipment, and materials. Specialized methods are not new to rural communities as they are used to importing required contractors.

7.7 IMPLEMENTING MITIGATION STRATEGY INTO EXISTING PLANNING MECHANISMS

DMA 2000, and its implementing regulations for implementing the HMP into existing planning mechanisms, are:

7

DMA 2000 Requirements
Incorporation into Existing Planning Mechanisms §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.
1. REGULATION CHECKLIST
ELEMENT C. Incorporate into Other Planning Mechanisms
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate?
Source: FEMA, March 2015.

After the adoption of the 2019 HMP Update, each Planning Team member will ensure that the HMP, in particular each Mitigation Action Project, is incorporated into existing planning mechanisms. Each member of the Planning Team will achieve this incorporation by undertaking the following activities.

- Review the community-specific regulatory tools to determine where to integrate the mitigation philosophy and implementable initiatives. These regulatory tools are identified in Section 7.1 capability assessment.
- Work with pertinent community departments to increase awareness for implementing HMP philosophies and identified initiatives. Provide assistance with integrating the mitigation strategy (including the Mitigation Action Plan) into relevant planning

mechanisms (i.e. Comprehensive Plan, Capital Improvement Project List, Transportation Improvement Plan, etc.).

- Implementing this philosophy and activities may require updating or amending specific planning mechanisms.
- Family Fishing Day.

8 References

Section Eight provides a comprehensive reference list used to develop the HMP.

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Appendix A
Funding Resources

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Federal Funding Resources

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

- FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from FEMA Publication Warehouse (1-800-480-2520) and are briefly described here:
    - How-to Guides. FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides describe the four major phases of hazard mitigation planning. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements.
    - Local Mitigation Planning Handbook, March 2013. This handbook explains the basic concepts of hazard mitigation and provides guidance to local governments on developing or updating hazard mitigation plans to meet the requirements of Title 44 Code of Federal Regulations (CFR) §201.6 for FEMA approval and eligibility to apply for FEMA Hazard Mitigation Assistance grant programs.
    - 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 Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to a community's industries and businesses located in hazard prone areas.
    - The 2015 Hazard Mitigation Assistance (HMA) Guidance and Addendum, February 27 and March 3, 2015 respectively. Part I of the Hazard Mitigation Assistance (HMA) Guidance introduces the three HMA programs, identifies roles and responsibilities, and outlines the organization of the document. This guidance applies

to Hazard Mitigation Grant Program (HMGP) disasters declared on or after the date of publication unless indicated otherwise. This guidance is also applicable to the Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA) Programs; the application cycles are announced via http://www.grants.gov/. The guidance in this document is subject to change based on new laws or regulations enacted after publication.

- FEMA, http://www.fema.gov - includes links to information, resources, and grants that communities can use in planning and implementing community resilience and sustainability measures.
- FEMA also administers emergency management grants (http://www.fema.gov/help/site.shtm) and various firefighter grant programs (http://www.firegrantsupport.com/) such as
  - Emergency Management Performance Grant (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 National Incident Management System (NIMS) implementation as a condition for receiving funds. Requires 50% match.
  - National Earthquake Hazards Reduction Program (NEHRP). The National Earthquake Hazards Reduction Program (NEHRP) seeks to mitigate earthquake losses in the United States through both basic and directed research and implementation activities in the fields of earthquake science and engineering.

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

    The four goals of the NEHRP are to:
    - Develop effective practices and policies for earthquake loss-reduction and accelerate their implementation.
    - Improve techniques to reduce seismic vulnerability of facilities and systems.
    - Improve seismic hazards identification and risk-assessment methods and their use.
    - Improve the understanding of earthquakes and their effects.
  - 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 (DHS) 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 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) Guidance. This program is intended to improve emergency management and preparedness capabilities by supporting flexible, sustainable, secure, strategically located, and fully interoperable Emergency Operations Centers (EOCs) with a focus on addressing identified deficiencies and needs. Fully capable emergency operations facilities at the State and local levels are an essential element of a comprehensive national emergency management system and are necessary to ensure continuity of operations and continuity of government in major disasters or emergencies caused by any hazard. Requires 25% match.
  - Emergency Alert System (EAS). Resilient public alert and warning tools are essential to save lives and protect property during times of national, state, regional, and local emergencies. The Emergency Alert System (EAS) is used by alerting authorities to send warnings via broadcast, cable, satellite, and wireline communications pathways. Emergency Alert System participants, which consist of broadcast, cable, satellite, and wireline providers, are the stewards of this important public service in close partnership with alerting officials at all levels of government. The EAS is also used when all other means of alerting the public are unavailable, providing an added layer of resiliency to the suite of available emergency communication tools. The EAS is in a constant state of improvement to ensure seamless integration of CAP-based and emerging technologies.
- U.S. Department of Commerce's grant programs include:
  - National Oceanic and Atmospheric Administration (NOAA), provides funds to the State of Alaska due to Alaska's high threat for tsunami. The allocation supports the promotion of local, regional, and state level tsunami mitigation and preparedness; installation of warning communications systems; installation of warning communications systems; installation of tsunami signage; promotion of the Tsunami Ready Program in Alaska; development of inundation models; and delivery of inundation maps and decision-support tools to communities in Alaska.
  - 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.

- 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.

    - 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. Indian Environmental General Assistance Program (IGAP). 1992, Congress passed the Indian Environmental General Assistance Program Act (42 U.S.C. 4368b) which authorizes EPA to provide General Assistance Program (GAP) grants to federally-recognized tribes and tribal consortia for planning, developing, and establishing environmental protection programs in Indian country, as well as for developing and implementing solid and hazardous waste programs on tribal lands.

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

- Department of Agriculture (USDA). Provides diverse funding opportunities; providing a wide benefit range. Their grants and loans website provide a brief programmatic overview with links to specific programs and services.
    - Farm Service Agency: Emergency Conservation Program, Non-Insured Assistance, Emergency Forest Restoration Program, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.
    - Natural Resources Conservation Service (NRCS) has several funding sources to fulfill mitigation needs.
        - Conservation Technical Assistance Program (CTA) is voluntary program available to any group or individual interested in conserving their natural resources and sustaining agricultural production. The program assists land users with addressing opportunities, concerns, and problems related to using their

natural resources enabling them to make sound natural resource management decisions on private, tribal, and other non-federal lands.

- Conservation Innovation Grants (CIG) is a voluntary program intended to stimulate developing and adopting innovative conservation approaches and technologies while leveraging Federal investment in environmental enhancement and protection, in conjunction with agricultural production. Under CIG, Environmental Quality Incentives Program funds are used to award competitive grants to non-Federal governmental or nongovernmental organizations, Tribes, or individuals.

  CIG enables NRCS to work with other public and private entities to accelerate technology transfer and adoption of promising technologies and approaches to address some of the Nation's most pressing natural resource concerns. CIG will benefit agricultural producers by providing more options for environmental enhancement and compliance with Federal, State, and local regulations.

- The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides financial and technical assistance to agricultural producers through contracts up to a maximum term of ten years in length. These contracts provide financial assistance to help plan and implement conservation practices that address natural resource concerns and for opportunities to improve soil, water, plant, animal, air and related resources on agricultural land and non-industrial private forestland. In addition, a purpose of EQIP is to help producers meet Federal, State, Tribal and local environmental regulations.

- The Emergency Watershed Protection Program (EWP) 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.

- Watershed Surveys and Planning. NRCS watershed activities in Alaska are voluntary efforts requested through conservation districts and units of government and/or tribes. The purpose of the program is to assist Federal, State, and local agencies and tribal governments to protect watersheds from damage caused by erosion, floodwater, and sediment and to conserve and develop water and land resources. Resource concerns addressed by the program include water quality, opportunities for water conservation, wetland and water storage capacity, agricultural drought problems, rural development, municipal and industrial water needs, upstream flood damages, and water needs for fish, wildlife, and forest-based industries.

- 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.

- Department of Health and Human Services, Administration of Children & Families, Administration for Native Americans (ANA). The ANA awards funds through grants to American Indians, Native Americans, Native Alaskans, Native Hawaiians, and Pacific Islanders. These grants are awarded to individual organizations that successfully apply for discretionary funds. ANA publishes in the Federal Register an announcement of funds available, the primary areas of focus, review criteria, and application information.
- Department of Housing and Urban Development (HUD) provides a variety of disaster resources. They also partner with Federal and state agencies to help implement disaster recovery assistance. Under the *National Response Framework* the FEMA and the Small Business Administration (SBA) offer initial recovery assistance.
  - 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 (IHLGP). 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.
  - Indian Housing Block Grant / Native American Housing Assistance and Self Determination Act (IHBG/NAHASDA) administration, operating & construction funds. The act is separated into seven sections:

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

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

    An eligible recipient must submit to HUD an Indian Housing Plan (IHP) each year to receive funding. At the end of each year, recipients must submit to HUD an Annual

Performance Report (APR) reporting on their progress in meeting the goals and objectives included in their IHPs.

Eligible activities include housing development, assistance to housing developed under the Indian Housing Program, housing services to eligible families and individuals, crime prevention and safety, and model activities that provide creative approaches to solving affordable housing problems. 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.

- HUD/Indian Community Development Block Grants (ICDBG) provide grant assistance and technical assistance to aid communities or Indian tribes in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons.

- Department of Labor (DOL), Employment and Training Administration, Disaster Unemployment Assistance (DUA). Provides weekly unemployment subsistence grants for those who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible.
  - 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 (DOT), Hazardous Materials Emergency Preparedness (HMEP) Grant. The Hazardous Materials Transportation Safety and Security Reauthorization Act of 2005 authorizes the U.S. DOT to provide assistance to public sector employees through training and planning grants to States, Territories, and Native American tribes for emergency response. The purpose of this grant program is to increase State, Territorial, Tribal, and local effectiveness in safely and efficiently handling hazardous materials accidents and incidents, enhance implementation of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), and encourage a comprehensive approach to emergency training and planning by incorporating the unique challenges of responses to transportation situations.
- 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.

- U.S. Small Business Administration (SBA) Disaster Assistance Loans and Grants program provides information concerning disaster assistance, preparedness, planning, cleanup, and recovery planning.
    - May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. (https://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans). Requests for SBA loan assistance should be submitted to DHS&EM.
- United States Army Corps of Engineers (USACE) Alaska District's Civil Works Branch studies potential water resource projects in Alaska. These studies analyze and solve water resource issues of concern to the local communities. These issues may involve navigational improvements, flood control or ecosystem restoration. The agency also tracks flood hazard data for over 300 Alaskan communities on floodplains or the sea coast. These data help local communities assess the risk of floods to their communities and prepare for potential future floods. The USACE is a member and co-chair of the Alaska Climate Change Sub-Cabinet.
    - Civil Works and Planning
    - Environmental Resources Section
    - USACE Alaska District Grants
- The Grants.gov program management office was established, in 2002, as a part of the President's Management Agenda. Managed by the Department of Health and Human Services, Grants.gov is an E-Government initiative operating under the governance of the Office of Management and Budget.

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

State Funding Resources

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

      DHS&EM also provides mitigation funding resources for mitigation planning on their Web site at http://ready.alaska.gov/grants.
- Division of Health and Social Services (DHSS): On this site you will find information intended to assist all who are interested in DHSS grants and services they support.

Division of Health and Social 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.
- DCRA within the DCCED administers the HUD/CDBG, FMA Program, and the Climate Change Sub-Cabinet's Interagency Working Group's program funds and administers various flood and erosion mitigation projects, including the elevation, relocation, or acquisition of flood-prone homes and businesses throughout the State. This division also administers programs for State's" distressed" and "targeted" communities.
    - DCRA Planning and Land Management staff provide Alaska Climate Change Impact Mitigation Program (ACCIMP) funding to Alaskan communities that meet one or more of the following criteria related to flooding, erosion, melting permafrost, or other climate change-related phenomena: Life/safety risk during storm/flood events; loss of critical infrastructure; public health threats; and loss of 10% of residential dwellings.

      The Hazard Impact Assessment is the first step in the ACCIMP process. The HIA identifies and defines the climate change-related hazards in the community, establishes current and predicted impacts, and provides recommendations to the community on alternatives to mitigate the impact.
- Department of Environmental Conservation (DEC). DEC's primary roles and responsibilities concerning hazards mitigation are ensuring safe food and safe water, and pollution prevention and pollution response. DEC ensures water treatment plants, landfills, and bulk fuel storage tank farms are safely constructed and operated in communities. Agency and facility response plans include hazards identification and pollution prevention and response strategies.
    - The Division of Water's Village Safe Water (VSW) Program works with rural communities to develop sustainable sanitation facilities. Communities apply each year to VSW for grants for sanitation projects. Federal and state funding for this program is administered and managed by the VSW program. VSW provides technical and financial support to Alaska's smallest communities to design and construct water and wastewater systems. In some cases, funding is awarded by VSW through the Alaska Native Tribal Health Consortium (ANTHC), who in turn assist communities in design and construct of sanitation projects.
    - Municipal Grants and Loans (MGL) Program. The Department of Environmental Conservation / Division of Water administer the Alaska Clean Water Fund (ACWF) and the Alaska Drinking Water Fund (ADWF). The division is fiscally responsible to the Environmental Protection Agency (EPA) to administer the loan funds as the EPA provides capitalization grants to the division for each of the loan funds. In addition, it is prudent upon the division to administer the funds in a manner that ensures their continued viability.
    - 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, [and stormwater management] projects.

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 it's Planning, Design and Engineering, Maintenance and Operations, and Intelligent Transportation Systems resources to identify hazards, plan and initiate mitigation activities to meet the transportation needs of Alaskans, and make Alaska a better place to live and work. DOT/PF budgets for temporary bridge replacements and materials necessary to make the multi-modal transportation system operational following natural disaster events.
- DNR administers various projects designed to reduce stream bank erosion, reduce localized flooding, improve drainage, and improve discharge water quality through the stormwater grant program funds. Within DNR,
    - The Division of Geological and Geophysical Survey (DGGS) is responsible Alaska's mineral, land, and water resources use, development, and earthquake mitigation collaboration.

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

      The DNR's Division of Forestry (DOF) participates in a statewide wildfire control program in cooperation with the forest industry, rural fire departments and other agencies. Prescribed burning may increase the risks of fire hazards; however, prescribed burning reduces the availability of fire fuels and therefore the potential for future, more serious fires.
    - DOF also manages various wildland fire programs, activities, and grant programs such as the FireWise Program (http://forestry.alaska.gov/fire/firewise.htm), Community Forestry Program (CFP) (http://forestry.alaska.gov/community/), 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 (http://forestry.alaska.gov/fire/vfarfa.htm). Information can be found at http://forestry.alaska.gov/fire/current.htm.

- The Alaska Interagency Coordination Center (AICC) is the Geographic Area Coordination Center for Alaska. AICC serves as the focal point for initial attack resource coordination, logistics support, and predictive services for all state and federal agencies involved in wildland fire management and suppression in Alaska.

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

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

Other Funding Resources

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

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

  - Weatherization Assistance Program assists low to moderate income households in weatherization needs. The program is available to homeowners as well as renters and includes; single family homes, cabins, mobile homes, condominiums and multifamily dwellings.

- Solid Waste Management. RurAL CAP continues to host an expert solid waste liaison, Ted Jacobson, through funding provided by the Environmental Protection Agency (EPA) and Senior Services America, Inc. The liaison provides solid waste management technical assistance to rural communities through training, site visits, hands-on demonstrations, and remote contact. Resources are provided for dump management activities, collaborating with funders for funding and technical assistance on solid waste management, recycling, and backhaul.

- 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), an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. (http://www.disastersafety.org/)
- American Red Cross (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. (http://www.redcross.org/find-help)
- Catalog of Federal Domestic Assistance (DFDA) Crisis Counseling Program (CCP). 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. (http://www.denali.gov/grants)
    - The Energy Program primarily funds design and construction of replacement bulk fuel storage facilities, upgrades to community power generation and distribution systems, alternative-renewable energy projects, and some energy cost reduction projects. The Commission works with the Alaska Energy Authority (AEA), Alaska Village Electric Cooperative (AVEC), Alaska Power and Telephone and other partners to meet rural communities' fuel storage and power generation needs.
    - The goal of the solid waste program at the Denali Commission is to provide funding to address deficiencies in solid waste disposal sites which threaten to contaminate rural drinking water supplies.
- Lindbergh Foundation Grants. Each year, The Charles A. and Anne Morrow Lindbergh Foundation provides grants of up to $10,580 (a symbolic amount representing the cost of the Spirit of St. Louis) to men and women whose individual initiative and work in a wide spectrum of disciplines furthers the Lindberghs' vision of a balance between the advance of technology and the preservation of the natural/human environment. (http://www.thelindberghfoundation.org/awards)
- 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.

  Rasmuson Foundation awards grants both to organizations serving Alaskans through a base of operations in Alaska, and to individuals for projects, fellowships and sabbaticals. To be considered for a grant award, grant seekers must meet specific criteria and complete and submit the required application according to the specific guidelines of each program.

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

The Foundation trustees believe successful organizations can sustain their basic operations through other means of support and prefer to assist organizations with specific needs, focusing on requests which allow the organizations to become more efficient and effective. The trustees look favorably on organizations which demonstrate broad community support, superior fiscal management and matching project support.

Appendix B
FEMA Hazard Mitigation Plan (HMP) Review Tool

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APPENDIX A:
LOCAL MITIGATION PLAN REVIEW TOOL

The *Local Mitigation Plan Review Tool* demonstrates how the Local Mitigation Plan meets the regulation in 44 CFR §201.6 and offers States and FEMA Mitigation Planners an opportunity to provide feedback to the community.

- The Regulation Checklist provides a summary of FEMA's evaluation of whether the Plan has addressed all requirements.
- The Plan Assessment identifies the plan's strengths as well as documents areas for future improvement.
- The Multi-jurisdiction Summary Sheet is an optional worksheet that can be used to document how each jurisdiction met the requirements of each Element of the Plan (Planning Process; Hazard Identification and Risk Assessment; Mitigation Strategy; Plan Review, Evaluation, and Implementation; and Plan Adoption).

The FEMA Mitigation Planner must reference this *Local Mitigation Plan Review Guide* when completing the *Local Mitigation Plan Review Tool.*

Jurisdiction:	**Title of Plan:**	**Date of Plan:**
Yakutat, Alaska (Region 10)	The City and Borough of Yakutat Hazard Mitigation Plan Update	August 15, 2019

Local Point of Contact: Rhonda Coston	**Address:** City and Borough of Yakutat
Title: City Planner	PO Box 160
Agency: City and Borough of Yakutat	309 Max Italio Drive Yakutat, AK 99689
Phone Number: (907) 784-3323	**E-Mail:** rcoston@yakutatak.us

State Reviewer:	**Title:**	**Date:**
	DHS&EM Planner	

FEMA Reviewer:	**Title:**	**Date:**
John Schelling	Regional Mitigation Planning Manager	September 20, 2019
Date Received in FEMA Region *(insert #)*	August 19, 2019	
Plan Not Approved		
Plan Approvable Pending Adoption	October 2, 2019	
Plan Approved	November 14, 2019	

SECTION 1:
REGULATION CHECKLIST

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT A. PLANNING PROCESS			
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	PDF 25-30, 166, 185-186, 191, 210	X	
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	PDF 27-28, 165, 187-189	X	
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	PDF 28, 165-210	X	
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	PDF 30-31, 130-132	X	
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	PDF 32-33, 220-224	X	
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	PDF 31-36, 217-224	X	
ELEMENT A: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT			
B1. Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Earthquake: PDF 40-42, 44-45; Flood/Erosion: 46-50, 53-55; Ground Failure: 56-60; Severe Weather: 60-62, 65; Tsunami: 66-70; Fire: 71-74; Changes in the Cryosphere: 74-87	X	
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Earthquake: PDF 42-44, 45-46; Flood/Erosion: 50-53, 56; Ground Failure: 58, 60; Severe Weather: 63-65; Tsunami: 68-70; Fire: 72-74; Changes in the Cryosphere: 86, 88	X	
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Earthquake: PDF 45; Flood/Erosion: 55-56; Ground Failure: 58-59; Severe Weather: 65; Tsunami: 70; Fire: 74; Changes in the Cryosphere: 87-88; Overall Vulnerability: 89	X	
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	PDF 106	X	
ELEMENT B: REQUIRED REVISIONS			

ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	PDF 17, 37, 112-113	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	PDF 13, 106	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	PDF 114-115	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	PDF 116-118	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	PDF 119-128, 213-214	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	PDF 128-129	X	
ELEMENT C: REQUIRED REVISIONS			

1. REGULATION CHECKLIST Regulation (44 CFR 201.6 Local Mitigation Plans)	Location in Plan (section and/or page number)	Met	Not Met
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)			
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	PDF 90-106	X	
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	PDF 122-128	X	
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	PDF 119-128	X	
ELEMENT D: REQUIRED REVISIONS			
ELEMENT E. PLAN ADOPTION			
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	Adoption Resolution to be included in Appendix C once it is issued		X
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	N/A		
ELEMENT E: REQUIRED REVISIONS			
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)			
F1.			
F2.			
ELEMENT F: REQUIRED REVISIONS			

SECTION 2: PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

This section provides a discussion of the strengths of the plan document and identifies areas where these could be improved beyond minimum requirements.

Element A: Planning Process

Plan Strengths:

- Using a table at the Family Fishing Day on a Saturday in June each summer, operated in conjunction with partners like the USFS, to detail tsunami, earthquake, and other hazard education, provide information and detail mitigation efforts as well as collect information from a community surveys is a great way to use an existing event to increase community awareness of mitigation efforts by CBY.

- Using the city planner CBY Planning Commission as key members of the planning team and engaging them in the process can help inform their efforts for land use decisions and help ensure they evaluate CBY policies and ordinances through the lens of whether the decisions are increasing community resilience.

- The needs assessment from previous planning process and identification of resources and establishment of a 'new action commitment' can hopefully assist the planning team maintain their momentum in maintaining this plan. Consider using the items identified within this table as a source for potential mitigation actions.

Opportunities for Improvement:

- Engaging the CBY Planning and Zoning Commission in the planning process is a great best practice. As part of the plan implementation and future updates, consider how the CBY can use the Commission and other subject matter experts identified within the plan to more fully integrate the Comprehensive Plan, Land Use Plan, and regulatory tools, such as zoning code, subdivision regulations, and building codes. Integration of local regulatory authorities with the risk reduction strategies identified within the plan can lead to more effective long-term mitigation.

Element B: Hazard Identification and Risk Assessment

Plan Strengths:

- Inclusion of multiple types of flooding and erosion captures the various methods that hazards present themselves and can impact the CBY community. This more holistic look at the hazards spectrum can lead to identification of a wider variety of potential mitigation actions to reduce current and future risk.

Opportunities for Improvement:

- The impacts to the CBY community and its assets (people, structures, systems, etc.) for certain hazards, such as earthquakes and tsunamis, are generally described within the hazard profiles. Consider using the more robust information from the vulnerability assessment to provide relevant impacts from each of these hazards and the cascading effects of their potential loss. This can assist with the prioritization process within the mitigation strategy development.

Element C: Mitigation Strategy

Plan Strengths:

- The mitigation strategy includes an action item for each of the identified hazards. This demonstrates a comprehensive mitigation action plan that can reduce risks from all hazards identified within the plan.

Opportunities for Improvement:

- It is great that CBY has had success in implementing its previous mitigation actions. Consider removing completed items from the mitigation strategy into a new section on mitigation successes and including only current planning actions.

- Leveraging the mitigation plan as a source for a comprehensive action strategy to increase overall community resilience can be beneficial; however, it can sometimes lead to less emphasis on mitigation measures. The Mitigation Action Plan in Table 7-8 lists numerous projects, such as training, buying firefighting equipment, grant writing, etc. that are indirectly related to community-based mitigation but don't necessarily support the long-term reduction/elimination of risks. Of the 30 items identified within the Action Plan only 7 items are considered 'mitigation' actions. Consider how the vulnerability assessment or needs assessment can help further define more specific mitigation measures within the next plan update.

Element D: Plan Update, Evaluation, and Implementation (*Plan Updates Only*)

Plan Strengths:

- Incorporation of information from the Yakutat Facility Plan and inclusion of the CBY land ownership maps can help inform potential mitigation partners for vulnerable assets within those areas, when applicable.

Opportunities for Improvement:

- As the planning team conducts its annual survey and meetings to monitor and evaluate the progress of the plan, consider including this information as an appendix to future plans. This can help inform future planning efforts as well as document the progress over time.

B. Resources for Implementing Your Approved Plan

The **Region 10 Integrating Natural Hazard Mitigation into Comprehensive Planning** is a resource specific to Region 10 states and provides examples of how communities are integrating natural hazard mitigation strategies into comprehensive planning. You can find it in the FEMA Library at http://www.fema.gov/media-library/assets/documents/89725.

The **Integrating Hazard Mitigation Into Local Planning: Case Studies and Tools for Community Officials** resource provides practical guidance on how to incorporate risk reduction strategies into existing local plans, policies, codes, and programs that guide community development or redevelopment patterns. It includes recommended steps and tools to assist with local integration efforts, along with ideas for overcoming possible impediments, and presents a series of case studies to demonstrate successful integration in practice. You can find it in the FEMA Library at http://www.fema.gov/library/viewRecord.do?id=7130.

The **Mitigation Ideas: A Resource for Reducing Risk from Natural Hazards** resource presents ideas for how to mitigate the impacts of different natural hazards, from drought and sea level rise, to severe winter weather and wildfire. The document also includes ideas for actions that communities can take to reduce risk to multiple hazards, such as incorporating a hazard risk assessment into the local development review process. You can find it in the FEMA Library at http://www.fema.gov/library/viewRecord.do?id=6938.

The **Local Mitigation Planning Handbook** provides guidance to local governments on developing or updating hazard mitigation plans to meet and go above the requirements. You can find it in the FEMA Library at http://www.fema.gov/library/viewRecord.do?id=7209.

The **Integration Hazard Mitigation and Climate Adaptation Planning: Case Studies and Lessons Learned** resource is a 2014 ICLEI publication for San Diego with a clear methodology that could assist in next steps for integration impacts of climate change throughout mitigation actions. http://icleiusa.org/wp-content/uploads/2015/08/Integrating-Hazard-Mitigation-and-Climate-Adaptation-Planning.pdf

The **Local Mitigation Plan Review Guide and Tool** resource is available through FEMA's Library and should be referred to for the next plan update. http://www.fema.gov/library/viewRecord.do?id=4859

Volcanic Eruption Mitigation Measures: For information on Mitigation Actions for Volcanic Eruptions that would satisfy the C4 requirement, please visit: http://earthzine.org/2011/03/21/volcanic-crisis-management-and-mitigation-strategies-a-multi-risk-framework-case-study/ and http://www.gvess.org/publ.html.

The FEMA Region 10 **Risk Mapping, Analysis, and Planning program (Risk MAP)** releases a monthly newsletter that includes information about upcoming events and training opportunities, as well as hazard and risk related news from around the Region. Past newsletters can be viewed at http://www.starr-

team.com/starr/RegionalWorkspaces/RegionX/Pages/default.aspx. If you would like to receive future newsletters, email rxnewsletter@starr-team.com and ask to be included.

The mitigation strategy may include eligible projects to be funded through FEMA's hazard mitigation grant programs (Pre-Disaster Mitigation, Hazard Mitigation Grant Program, and Flood Mitigation Assistance). Contact your State Hazard Mitigation Officer, Brent Nichols at Brent.Nichols@alaska.gov, for more information.

Appendix C
Community HMP Adoption Resolution

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CITY AND BOROUGH OF YAKUTAT

RESOLUTION 19-321

City and Borough of Yakutat Hazard Mitigation Plan Update

WHEREAS the City and Borough of Yakutat Hazard is vulnerable to damages from natural hazard events which pose a threat to public health and safety and could result in property loss and economic hardship;

WHEREAS the Disaster Mitigation Act of 2000 (P.L. 106-390) (DMA 2000) and associated Federal regulations published under 44 CFR Part 201 required the City to formally adopt a Hazard Mitigation Plan subject to the approval of the Federal Emergency Management Agency (FEMA) to be eligible for federal hazard mitigation projects and activities funds;

WHEREAS the City and Borough of Yakutat adopted a Hazard Mitigation Plan (the Plan) in 2015 through the work of City and Borough of Yakutat Hazard Mitigation Plan (HMP) Planning Team, and interested parties within the Yakutat area;

WHEREAS the Plan recommends hazard mitigation actions that will protect people and property affected by natural hazards that face City residents, that will reduce future public, private, community, and personal costs of disaster response and recovery; and that will reinforce the City's leadership in emergency preparedness efforts;

WHEREAS through a grant from FEMA, an update to the Plan has now been prepared;

WHEREAS the update has been presented to the public, with an opportunity to receive public comment on the update (as may be required by DMA 2000);

WHEREAS, the update has now been approved by FEMA .

NOW THEREFORE BE IT RESOLVED by the City and Borough of Yakutat that:

1. The updated hazard mitigation Plan, dated June 2019 and attached hereto, is hereby approved, and adopted as the City and Borough of Yakutat's Hazard Mitigation Plan, and the Borough resolves to execute the actions in the Plan.

2. The Borough officials identified in the Planning Process (Section 3) and the Mitigation Action Plan (Section 7) are hereby directed to implement the recommended actions assigned to them. These officials will report yearly on their activities, accomplishments, and progress to the city Borough Assembly .

3. The City and Borough of Yakutat's Hazard Mitigation Planning Team will provide annual progress reports on the status of the implemented Mitigation Action Plan's projects to the Borough Assembly. The Planning Team will submit this report to the City and Borough of Yakutat's Assembly annually by the Plan's adoption anniversary date.

4. The City and Borough of Yakutat Hazard's Planning Team, will continue to complete periodic updates of the Plan as indicated in the Plan Maintenance Section (Section 3), but no less

frequently than every five years or when determined by the State of Alaska or the Federal Emergency Management Agency (FEMA).

ADOPTED this November 7, 2019.

NICK HOLCOMB, MAYOR PRO TEMPORE

ATTEST:

Cathy Bremner CMC, Borough Clerk

CITY AND BOROUGH OF YAKUTAT
Corporate Seal Alaska
09/22/1992

SPONSORED BY J ERICKSON, BOROUGH MANAGER

Appendix D
Public Outreach Activities

City and Borough Hazard Mitigation Plan Update for Yakutat

Newsletter #1: June 8, 2019

Photo Credit: Rootsweb, 2015.

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency Management Agency (FEMA) to update the 2015 hazard mitigation plan (HMP) for the City and Borough of Yakutat. This plan will assist the City and Borough of Yakutat as a valuable resource tool in making decisions. Additionally, communities must have a State- and FEMA-approved and community-adopted HMP to receive FEMA pre- and post- disaster grants. LeMay Engineering & Consulting, Inc. was contracted to assist the City and Borough of Yakutat with preparing a 2019 HMP Update.

Join the planning team and offer your advice: Any interested community member may join the planning team. To join, call or send Jennifer LeMay an email at jlemay@lemayengineering.com. The purpose of this newsletter is to introduce this project and encourage public involvement during this process. The goal is to receive comments, identify key issues or concerns, and improve mitigation ideas.

Attend the June 13, 2019 Community Introductory Meeting as an agenda item at the Planning and Zoning meeting starting at 7 pm at the Borough Planning Office in the Basement of the Court House: The agenda will be a summary of the hazard mitigation planning process, presentation of applicable hazards, and identification of critical infrastructure that has the potential to be impacted by a natural hazard. You're invited to provide input to the planning process.

For more information, contact:
Rhonda Coston, Yakutat Planner (907) 784-3329
Jennifer LeMay, PE, PMP, Planner, (907) 350-6061

Yakutat Public Meeting for the 2019 Hazard Mitigation Plan Update

June 13, 2019

7:00 pm at the Yakutat High School Auditorium

Name	Organization Represented or CBY Resident	Contact Information (email)
Martha Indreland	CBY	marthai@yakutatak.us
Tim Grzeskowiak	P&Z	YakTrollerTim@Gmail.com
Teresa Swanson	USFS	teresa.swanson@USDA.gov
Kathy Jacobson	P+Z	~~Yakutat~~ Hardway7@hotmail.com
MARY Porter	P&Z	lmaporter@gmail.com
RHONDA COSTON	P&Z - PLANNER	rcoston@yakutatak.us
JENNIFER LEMAY	LEMAY ENGINEERING & CONSULTING, INC.	jlemay@lemayengineering.com

Hazard Mitigation Planning Process

Update to the 2015 City and Borough of Yakutat Hazard Mitigation Plan

Plans must be updated every five years and approved by DHS&EM and FEMA and then adopted by the community via resolution for the community to remain eligible for FEMA grant funding

Public Meeting #1: June 13, 2019

The City and Borough of Yakutat Hazard Mitigation Plan was prepared for CBY in 2015 and expires next year. LeMay Engineering & Consulting, Inc. was hired in December 2018 by DHS&EM to update CBY's Hazard Mitigation Plan. The effort to update this plan is a public process, and you are invited to participate.

Today is Public Meeting #1 as part of the regularly-scheduled Planning and Zoning Commission meeting in Yakutat on June 13, 2019. Next week, CBY will post the Draft 2019 Hazard Mitigation Plan Update for review by the community and begin a 30-day public comment period. Public Meeting #2 will occur on July 11 at the regularly-scheduled Borough Assembly meeting and will serve as a public hearing and forum to provide comments on the Draft Plan Update.

Today's meeting is a forum to present a summary of the planning process and evaluate mitigation actions for the community. I welcome your input. Comments can be provided during this meeting or by email or phone. Send Jennifer LeMay, PE, PMP an email at jlemay@lemayengineering.com or call her at (907) 350-6061.

For hazards, we're interested in information related to:

- Hazard Identification,
- Profiles (characteristics),
- Previous occurrences,
- Locations,
- Extents (breadth, magnitude, and severity)
- Impacts, and
- Recurrence probability statements.

Which hazards are applicable for your community?

- Flood/Erosion Applicable to Yakutat
- Wildland/Conflagration Fires Applicable to Yakutat
- Tsunami/Seiche Applicable to Yakutat
- Earthquakes Applicable to Yakutat
- Volcano
- Ground Failure/Landslide/Avalanche Applicable to Yakutat
- Severe Weather Applicable to Yakutat
- Changes to the Cryosphere Applicable to Yakutat

Plan Process

- Introductory meeting occurred via phone on January 4, 2019.
- Gathering of data occurred during March, April, and May.
- Public Meeting #1 on June 13, 2019.
- Draft Plan available for public comment (June 17, 2019).
- Public hearing for Draft Plan (July 11, 2019).
- State/FEMA review and pre-approval of Draft Plan.
- Newsletter announcing Final Plan (the public may still comment).
- Borough Assembly adoption.
- Final Approval from State/FEMA.

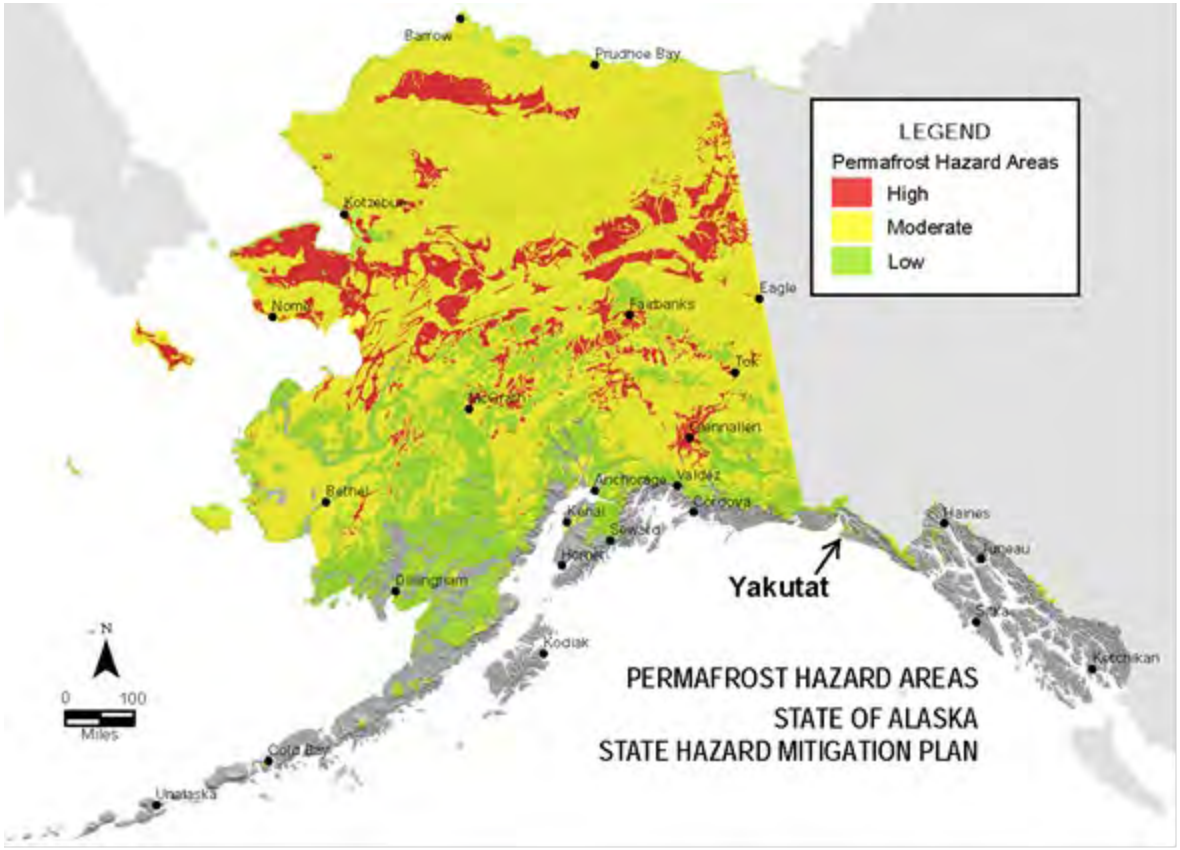
After the 2019 Hazard Mitigation Plan Update is completed, approved, and adopted, CBY will be eligible to continue to apply for mitigation project funds from DHS&EM and FEMA for five additional years until the plan requires another update in 2024.

Contacts:

Jennifer LeMay, PE, PMP, LeMay Engineering & Consulting, Inc. Planner (907) 350-6061
Brent Nichols, CFM, State of Alaska DHS&EM Hazard Mitigation Officer (907) 428-7085

Changes in the Cryosphere

- In Yakutat, glaciers, permafrost and periglacial, and snow avalanches apply to the surrounding areas outside the populated community.
- Permafrost does not underlie the populated area of CBY.



Changes in the Cryosphere Mitigation Goal: Reduce the risk from changes in the cryosphere.

Mitigation Actions for Changes in the Cryosphere are included with Flooding/Erosion/Ground Failure Hazards.

Earthquakes

- The entire geographic area of Alaska is prone to earthquake effects. As such, CBY is located within a fairly active seismic zone with the Fairweather and the Queen Charlotte Faults in close proximity to the area. USGS identified 139 earthquakes occurring within 100 miles of CBY since 1978 and the present. Eighteen of those 139 exceeded a M of 5.0. The largest one occurred on July 17, 2014, and measured M 6.0.
- The USGS earthquake probability model places the probability of an earthquake with a likelihood of experiencing strong shaking within Yakutat at 0.6 to 0.8 g PGA with a 2% probability in 50 years. A 2% probability in 50 years is a rare, large earthquake, and statistically, it happens on average every 2,500 years.

Mitigation Goals for Earthquakes:
EQ 4. Reduce structural vulnerability to earthquake (EQ) damage.

Mitigation Actions for Earthquakes

Action ID	Description	Priority	Responsible Party	Potential Funding	Timeframe
EQ 4.1	Inspect, prioritize, and retrofit any critical facility or public infrastructure that does not meet current State-Adopted Building Codes. Update in 2019: CBY is working on the Public Safety Building through FEMA grants.	High	CBY Manager	CBY, HMGP, PDM	Ongoing
EQ4.2	Install non-structural seismic restraints for large furniture such as bookcases, filing cabinets, heavy televisions, and appliances to prevent toppling damage and resultant injuries to small children, elderly, and pets. Update in 2019: No progress.		CBY Manager	CBY, HMGP, PDM	2019-2024

Flood/Erosion

The U.S. Army Corp of Engineers (USACE) Baseline Erosion Assessment included the Yakutat area, and the report listed the area as having a "Minimal" erosion threat. The Yakutat Erosion Information Paper dated September 20, 2007 reported the following erosion problems or issues:

"Erosion and flooding have recently become an important issue in the community. Erosion problems are reported in four areas. The first is at nearby Russell Fjord which is dammed periodically by the Hubbard Glacier. When the Hubbard Glacier advances enough to cross Russell Fjord, it forms an ice dam that can fill Russell Fjord until the ice dam breaks or the rising water overtops the low mountains that form the western wall of the fjord. Either conclusion to the ice damming process can cause outburst flooding and erosion. Ice damming closed Russell Fjord in 1996 and 2002.

A second area of concern is the Monti Bay coast near developed areas of Yakutat. The low-lying sand-silt beaches of the south shoreline are susceptible to erosion. Islands and navigation improvements shelter part of the community, but even the sheltered beaches can be eroded by locally-generated waves. The community survey reports the active erosion area is 5 to 15 feet wide and 6 to 30 feet high and estimates the rate of erosion is ½ to 2 feet per year. Erosion is also occurring by the Ocean Cape dock next to the fish camp buildings and in a section of washed-out road.

A third erosion area is inland from Yakutat, where unnamed streams in the Lost River basin, the Situk River basin, and Ahrnklin River basin are eroding the Forest Highway about 3 miles before its terminus at Harlequin Lake and at other locations from Mile 12 to 24. There also is a subdivision development where the sides of the roads are washing out from local runoff.
A fourth erosion area is the beaches from Dry Bay to Ocean Cape. As glaciers recede, the glaciers leave behind large lakes which are catching sediment as it is transported downriver. This is what is happening at Alsek Lake on the Alsek River. Alsek River, along with the Dangerous River, are likely the major contributors of sediments to Yakutat's beaches. If the beaches fail to accumulate, they will erode back which appears to have begun occurring three years ago. If the erosion cuts into the beach dunes, it will eventually begin the process of saltwater intrusion into several important estuaries, drastically cutting local salmon production" (USACE, 2009 and 2007).

Mitigation Goals for Flood/Erosion:
FL 5. Reduce flood (FL) and erosive scour damage and loss possibility.

Mitigation Actions for Flood/Erosion

Action ID	Description	Pri-ority	Responsible Party	Potential Funding	Time-frame
FL 5.1	Acquire Hubbard Glacier - Detailed bathymetry at Gilbert Point and the gap, particularly around the push moraine, at the earliest possible date. Update in 2019: Ongoing	High	CBY Manager	FEMA, NOAA, USACE, UAF/GS, CRREL	Ongoing
FL 5.2	Hubbard Glacier - Continued laser ranger monitoring of the gap width. Update in 2019: Ongoing				
FL 5.3	Hubbard Glacier - Use of Canadian-based MDA, Ltd. RadarSat images to monitor the status of the Hubbard Glacier terminus. Update in 2019: Ongoing				
FL 5.4	Hubbard Glacier - Acquisition of ALOS, Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) high-resolution images when possible. Update in 2019: CBY has new aerial.				
FL 5.5	Structure Elevation and/or Relocation. Update in 2019: Ongoing. Road issues have been identified on Max Italio Drive. CBY has applied for CIP and State assistance.	Medium	CBY Supervisor in Public Works & Facilities Office	CBY, FEMA, HMGP, PDM	
FL 5.6	Install upgraded stream flow and rainfall measuring gauges. Update in 2019: Ongoing. There will be a report in June 2019.			CBY	

Ground Failure

During September 1889, the Yakutat Bay region was shaken by a series of major earthquakes, the most violent of which were felt at all settlements within a radius of 249 miles. Several heavy shocks occurred on September 4 and 10, but the main earthquake that caused great topographic changes occurred at 21:41 UTC, September 10, 1889.

A USGS team did not study the region until six years after the shocks, but the topographic changes were obvious. The ground failure impacts included a maximum uplift of 47.6 ft that occurred on the west coast of Disenchantment Bay, and changes of 16.4 ft or more affected a large area. Subsidence of as much as 6.6 ft was observed in a few areas.

Phenomena observed included surface faulting, avalanches, and fissures spouting from sand craterlets, and slight damage to buildings.

CBY's 2010 Comprehensive Plan described the area's threat from natural events as,

*"**4.1 Natural Environmental Analysis.***

*A large portion of the borough is subject to physical conditions that limit and guide how development in the coastal zone can occur. The landscape of the borough experiences glaciation and modification by erosion, deposition, wave and wind action, and some minimal tectonic uplift. In addition, the borough is potentially subject to natural hazards that include earthquake**, ground instability,** tsunamis, seafloor instability, and faulting. Glacial advancement and retreat, outburst flooding, waves from calving ice, heavy snows, poor soils, and avalanches are also concerns…"* (Yakutat, 2010).

Mitigation Goal for Ground Failure
GF 6: Reduce ground failure (GF) damage and loss possibility.

Mitigation Actions for Ground Failure

Action ID	Description	Pri-ority	Respon-sible Party	Potential Funding	Time-frame
GF 6.1	Promote permafrost- sensitive construction practices in permafrost areas. Update in 2019: Ongoing.	Medium	CBY Supervisor in Public Works & Facilities Office	CBY, HMA, HMGP, PDM	Ongoing

Severe Weather

In CBY, severe weather consists of heavy snowfall, high winds, and storms.

Mitigation Goal for Severe Weather

SW 7: Reduce structural vulnerability to severe weather (SW) damage.

Mitigation Actions for Severe Weather

Action ID	Description	Pri-ority	Respon-sible Party	Potential Funding	Time-frame
SW 7.1	Research and consider instituting the National Weather Service program of "Storm Ready". Update in 2019: Completed in 2018.	Medium	CBY Manager's Office	NOAA	Completed
SW 7.2	Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability. Update in 2019: Completed in 2018.	Medium	CBY Manager's Office	CBY, DHS&EM, NOAA	Completed
SW 7.3	Encourage weather-resistant building construction materials and practices. Update in 2019: Ongoing.	Medium	CBY Supervisor Public Works & Facilities Office	CBY	Ongoing

Tsunami and Seiche

Yakutat has not been struck by a damaging tsunami in recent history; however, CBY, 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.

Mitigation Goal for Tsunami: TS 8. Reduce vulnerability, damage, or loss of structures from tsunami or seiche (TS).

Mitigation Actions for Tsunami

Action ID	Description	Pri-ority	Respon-sible Party	Potential Funding	Time-frame
TS 8.1	Coordinate with the National Tsunami Warning Center to ensure the community receives adequate warning. Update in 2019: Ongoing.	Medium	CBY Manager	CBY, DHS&EM, NOAA, NTWC	Ongoing

Wildland/Conflagration Fire

Wildland fires have not been documented within the boundaries of CBY. Since 1939, 4 wildland fire events have occurred within 50 miles of CBY. No conflagration fires have occurred in CBY.

Mitigation Goal for Fire

F 9: Reduce structural vulnerability to wildland or conflagration fire (F) damage.

Mitigation Actions for Fire

Action ID	Description	Pri-ority	Respon-sible Party	Potential Funding	Time-frame
WF 9.1	Continue to support the local fire department with adequate firefighting equipment and training. Update in 2019: Ongoing.	Medium	CBY Supervisor in Public Works & Facilities Office	City, FEMA, AFG, VFAG, RFAG FP&S, SAFER, HSEP	Ongoing

Vulnerability of the community of Yakutat

Population

- 2013 U.S. Census was 662.
- 2017 DCCED was 552.

Houses and Critical Infrastructure

- 270 single-family residential structures ($94,500,000).
- Critical facilities and infrastructure have been identified ($80,494,674).

Planning and Zoning Hearing and Meeting
June 13th, 2019
7:02 p.m. – 7:47 p.m.

CALL TO ORDER: Chair Kathy Jacobson called the meeting to order at 7:00 p.m.
ROLL CALL/QUORUM PRESENT: Commissioners T.A. Swanson, M.A. Porter, K. Jacobson, Tim Grzeskoviak, (Sam Demmert – excused)
STAFF PRESENT: Planner Rhonda R. Coston
OTHERS PRESENT: Jennifer LeMay, Martha Indreland, Nick Brilli
AGENDA: Agenda approved, with a change to conduct New Business first. M/S TA Swanson, MA Porter, Question - Voice Vote, ALL AYES, **Motion Carried.**
MINUTES OF PREVIOUS MEETINGS: N/A
COMMUNICATIONS, APPEARANCES & REQUESTS: None
HEARINGS, ORDINANCES & RESOLUTIONS:
OLD BUSINESS:
7.1 2019 Update to Hazard Management Plan
Schedule for update includes meeting, comment period, Assembly meeting, FEMA approval, Assembly Approval. Discussion at this meeting went over questions contractor Jennifer LeMay had regarding choices in changes to plan. After discussion, M/S to approve as updated, and move to Assembly for approval and public comment. M/S TA Swanson, MA Porter, Question - Voice Vote, ALL AYES, **Motion Carried.**
7.2 Proposed Ordinance to send to Assembly for Mixed Use Zoning in appropriate new subdivisions as called for by 2010 Comprehensive Plan. No discussion M/S TA Swanson, T. Grzeskoviak, Question - Voice Vote, ALL AYES, **Motion Carried.**
NEW BUSINESS:
8.1 Introduction Sketch Plat for Subdivision of Parcel 31124, USS 84-89, Bock 12, Lot 5, Vince Jacobson request for subdivison of 2.48 acre lot into aproximately two equal parcels. Survey to follow if approved. Discussion minimal. Sketch Plat approved, survey and plat submission to follow. M/S TA Swanson/MA Porter, Question - Voice Vote, ALL AYES, **Motion Carried.**
8.2 1 Introduction Sketch Plat for Subdivision of Parcel 30932, South Addition, Bock E, Lot 3, Herb Holcomb request for subdivison of 1.65 acre lot into aproximately three equal parcels. Survey to follow if approved. Discussion minimal. Sketch Plat approved, survey and plat submission to follow. M/S TA Swanson/MA Porter, Question - Voice Vote, ALL AYES, **Motion Carried.**
8.3 Introduction CUP 2019-2, Parcel 31927, Lot 18, Block 2, USS 4853, Jodi Kappedahl request for CUP for mobile home on private lot in "Water Street" Subdivision. M/S TA Swanson/MA Porter, move to introduce CUP 2019-2. Question - Voice Vote, ALL AYES, **Motion Carried.**
Discussion involved questions regarding distance from water, setbacks, and the question as to whether there would be a foundation built. Hearing to be scheduled as schedules allow.
COMMMISSIONER REPORT/COMMENTS:
PLANNER REPORT AND NEXT MEETING DATE:
10.1 Next scheduled meeting to be held July 11th, 2019, 7:00 PM in Planning Office. Hearing to be scheduled as schedules allow.
ADJOURNMENT:
12.1 Motion to Adjourn at 7:47 PM, M/S TA Swanson/MA Porter, Question - Voice Vote, ALL AYES, **Motion Carried.**

Kathy Jacobson — Rhonda R Coston

Attest: Kathy Jacobson, P&Z Chair: **RhondaR.Coston, CBYPlanner:**

Jennifer L. LeMay, PE, PMP
Vice President
4272 Chelsea Way
Anchorage, AK 99504
(907) 350-6061
jlemay@lemayengineering.com

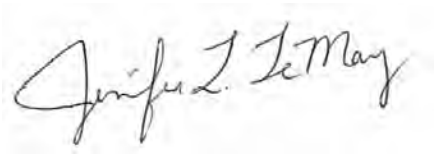
June 15, 2019

Brent A. Nichols, EMSII, CFM
State Hazard Mitigation Officer
Department of Military and Veterans Affairs (DMVA)
Division of Homeland Security and Emergency Management (DHS&EM)
P.O. Box 5750
JBER, AK 99505-5750

Subject: Hazard Mitigation Planning Process Trip Report

On June 13, 2019, I traveled to Yakutat, Alaska. The purpose of this trip was to conduct an introductory meeting, gather hazard data, review with community leaders the applicable hazards for the area, review potential mitigation strategies, and identify the critical facilities within the community. I attended the Planning and Zoning Meeting and gave an overview of the hazard mitigation planning process. The group discussion was beneficial to update the plan.

If you have any questions, please do not hesitate to call me at (907) 350-6061.



6/15/19
Jennifer L. LeMay, PE, PMP/Date
LeMay Engineering & Consulting, Inc.

Hazard Mitigation Plan Update for Yakutat

Newsletter #2: June 24, 2019

Photo Credit: Rootsweb, 2015.

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency Management Agency (FEMA) to update the 2015 hazard mitigation plan (HMP) for the City and Borough of Yakutat. This plan will assist the City and Borough of Yakutat as a valuable resource tool in making decisions. Additionally, communities must have a State- and FEMA-approved and community-adopted HMP to receive FEMA pre- and post- disaster grants. LeMay Engineering & Consulting, Inc. was contracted to assist the City and Borough of Yakutat with preparing a 2019 HMP Update.

You're Invited to Comment on the Plan:

The goal of Newsletter #2 is to announce the availability of the Draft HMP and invite you to provide comments, identify key issues or concerns, and improve mitigation ideas. This plan has been posted at the CBY Planning Office and on the Borough's website for your review. Comments can be provided verbally to Jennifer LeMay at (907) 350-6061 or emailed to jlemay@lemayengineering.com.

Attend the July 18, 2019 Borough Assembly meeting starting at 7 pm at the Yakutat High School Auditorium:

The agenda will be a summary of the hazard mitigation planning process, presentation of applicable hazards, and mitigation actions.

For more information, contact:
Rhonda Coston, Yakutat Planner (907) 784-3329
Jennifer LeMay, PE, PMP, LeMay Engineering & Consulting, Inc., Planner, (907) 350-6061

jlemay@lemayengineering.com

From: jlemay@lemayengineering.com
Sent: Monday, June 24, 2019 3:36 PM
To: 'nmoulton@ytttribe.org'; 'shariajnsn@gmail.com'; 'yvonneb@yakutatschools.org'; 'taswanson@fs.fed.us'
Cc: 'Rhonda Coston'; 'marthai@yakutatak.us'
Subject: Hazard Mitigation Plan Update for Yakutat
Attachments: Yakutat Newsletter Number 2.pdf; 2019 Draft Yakutat HMP Update.pdf

Good afternoon,

The City and Borough of Yakutat is updating its hazard mitigation plan. The 30-day public comment period began today and will end July 24. If you're interested, please review the attached plan and provide comment before the public comment period ends.

Also, if you know local email addresses for the NWS, FAA, ADF&G, ADOT&PF, and NPS, feel free to forward this email.

Thank you.

Jennifer LeMay, PE, PMP
Vice President
(907) 350-6061

LeMay Engineering & Consulting, Inc.

jlemay@lemayengineering.com

From: yakclerk@yakutatak.us
Sent: Monday, June 24, 2019 3:27 PM
To: jlemay@lemayengineering.com
Subject: RE: Hazard Mitigation Plan Update

Ok will do. And it should be on the July 18th Agenda. On July 12th I will have the final notice and agenda completed after the approval of the Manager and Mayor.

Cathy Bremner, CMC Borough Clerk
City & Borough Of Yakutat
PO Box 160
Yakutat, AK 99689
907 784 3323 ext 104
www.yakutatak.us

Any reply should be directed to the sender only. Do not Reply All.

From: jlemay@lemayengineering.com [mailto:jlemay@lemayengineering.com]
Sent: Monday, June 24, 2019 3:23 PM
To: yakclerk@yakutatak.us
Cc: 'Rhonda Coston'; marthai@yakutatak.us
Subject: Hazard Mitigation Plan Update

Good afternoon, Kathy,

I spoke with you last week about including me as an agenda item for the July 18th Borough Assembly Meeting. Please post the attached plan and flyer on the Borough's website so that interested members of the community may review the plan prior to the meeting.

Thank you.

Jennifer LeMay, PE, PMP
Vice President
(907) 350-6061

LeMay Engineering & Consulting, Inc.

Must Be Recognized By Mayor/Mayor Pro Tempore before Speaking
Stand Up State Your Name & Whom You Represent
Address **Only** Mayor, Mayor Pro Tempore & Assembly
3 Minute Statement/Questions
PLEASE SILENT CELL PHONE, NO CONVERSATION IN THE AUDIENCE

Your Cooperation is appreciated.

CITY AND BOROUGH OF YAKUTAT
BOROUGH ASSEMBLY MEETING
July 18, 2019

1. CALL TO ORDER:
2. ROLL CALL:
3. ADOPTION OF AGENDA:
4. MINUTES OF PREVIOUS MEETING:
   - 4.1 May 2, 2019
   - 4.2 June 6, 2019

5.A MANAGER' S REPORT:

5.B EXECUTIVE SESSION: Matters, the immediate knowledge of which would clearly have an adverse effect upon the finances of the Borough: To receive advice and counsel from the Borough Attorney regarding the West Addition Special Assessment lawsuit (1JU-18-00485Civ)

6. COMMUNICATIONS AND APPEARANCE REQUESTS:
   - 6.1 Jennifer LeMay, PE, PMP, Draft CBY Hazard Mitigation Plan Update

7. AUDIENCE PARTICIPATION:
8. HEARINGS, ORDINANCES AND RESOLUTIONS: INTRODUCTION:

INTRODUCTION:

8.1 ORD 19-659: A NONCODE ORDINANCE AUTHORIZING THE BOROUGH MANAGER TO ENTER INTO DIRECT NEGOTIATIONS WITH SEALASKA AND YAK TIMBER, INC. FOR THE SALE OF CERTAIN BOROUGH TIMBER RESOURCES.

8.2 **ORD19-958:** A CODE ORDINANCE AMENDING VARIOUS SECTIONS OF CHAPTER 12.04 OF THE CODE OF THE CITY AND BOROUGH OF YAKUTAT, TO REMOVE CANINE LICENSING AND RABIES IMMUNIZATION REQUIREMENTS.

8.3 ORD 19-657: A CODE ORDINANCE ADDING A NEW SECTION 8.12.110 TO THE CODE OF THE CITY AND BOROUGH OF YAKUTAT TO ADOPT A MIXED-USE ZONING DISTRICT.

PUBLIC HEARING:

8.4 ORD 19-656: A NON-CODE ORDINANCE OF THE BOROUGH ASSEMBLY OF THE CITY AND BOROUGH OF YAKUTAT APPROPRIATION FOR OPERATING SCHOOL DISTRICT OPERATIONS FUNDING FOR FISCAL YEAR 2020

RESOLUTION: None

9. OLD BUSINESS: None
10. **NEW BUSINESS:**

10.1 WEST ADDITION SPECIAL ASSESSMENT LAWSUIT (1JU-18-00485CIV)
10.2 FINANCIAL REPORT FOR PERIOD ENDING MAY 31, 2019
10.3 ESTABLISH A DATE AND TIME FOR THE BOARD OF ADJUSTMENT HEARING ON THE CJ JOSEPH APPEAL- *Recommendation 6:30 pm August 1 2019.*
10.4 HARBOR PARKING

11. AUDIENCE PARTICIPATION
12. MAYOR'S REPORT, ASSEMBLY MEMBERS COMMENTS:
13. ADJOURNMENT:

Yakutat Public Meeting for the 2019 Hazard Mitigation Plan Update

July 18, 2019

7:00 pm at the Yakutat High School Auditorium

Name	Organization Represented or CBY Resident	Contact Information (email)
William Sprott	Yakutat School Superintendent	williams@yakutatschools.org
Cathy Bremner	CBY Borough Clerk	yakclerk@yakutatak.us
Steve + Jenn Kaufman	Residents	Jennrmayor@gmail.com
Tammie McCutcheon	Residents	bntmccutcheon@yahoo.com
Verna Hennigeic	Resident	—
Daryl James	CBY Ass	darpen@hotmail.com
Sheri Rulson	CBY Assembly	Elijk.Raven@gmail.com
Cindy L Bremner	CBY Mayor	cindybremner@yahoo.com
Samson Demmert	CBY Assembly	Samson demmert@Gmail.com
Jon Erickson	CBY Manager	manager@yakutatak.us
Mary	CBY Assembly	via phone
Lee	Radio Station Manager	live broadcasting of meeting to public
Jennifer LeMay	LeMay Engineering & Consulting, Inc.	jlemay@lemayengineering.com

Hazard Mitigation Planning Process

Update to the 2015 City and Borough of Yakutat Hazard Mitigation Plan

Plans must be updated every five years and approved by DHS&EM and FEMA and then adopted by the community via resolution for the community to remain eligible for FEMA grant funding.

Public Meeting #2: July 18, 2019

The City and Borough of Yakutat Hazard Mitigation Plan was prepared for CBY in 2015 and expires next year. LeMay Engineering & Consulting, Inc. was hired by DHS&EM to update CBY's Hazard Mitigation Plan. The effort to update this Plan is a public process, and you are invited to participate.

Public Meeting #1 occurred as part of the regularly-scheduled Planning and Zoning Commission meeting in Yakutat on June 13, 2019. The Planning and Zoning Commission approved the Plan and recommended that Public Meeting #2 occur at the next regularly-scheduled Borough Assembly meeting on July 18. CBY posted the Draft 2019 Hazard Mitigation Plan Update for review by the community on their web page and through email on June 24. The 30-day public comment period ends July 24.

Tonight's meeting (Public Meeting #2) serves as a public hearing and forum to provide comments on the Draft Hazard Mitigation Plan Update. I welcome your input. Comments can be provided during this meeting or by email or phone. Send Jennifer LeMay, PE, PMP an email at jlemay@lemayengineering.com or call her at (907) 350-6061.

For hazards, we're interested in information related to:

- Hazard Identification,
- Profiles (characteristics),
- Previous occurrences,
- Locations,
- Extents (breadth, magnitude, and severity)
- Impacts, and
- Recurrence probability statements.

Which hazards are applicable for your community?

- Flood/Erosion Applicable to Yakutat
- Wildland/Conflagration Fires Applicable to Yakutat
- Tsunami/Seiche Applicable to Yakutat
- Earthquakes Applicable to Yakutat
- Volcano
- Ground Failure/Landslide/Avalanche Applicable to Yakutat
- Severe Weather Applicable to Yakutat
- Changes to the Cryosphere Applicable to Yakutat

Plan Process

- Introductory meeting occurred via phone on January 4, 2019.
- Gathering of data occurred during March, April, and May.
- Public Meeting #1 on June 13, 2019.
- Draft Plan available for public comment (June 24, 2019).
- Public hearing for Draft Plan (July 18, 2019).
- State/FEMA review and pre-approval of Draft Plan (Late July – August).
- Newsletter announcing Final Plan (the public may still comment).
- Borough Assembly adoption.
- Final Approval from State/FEMA.

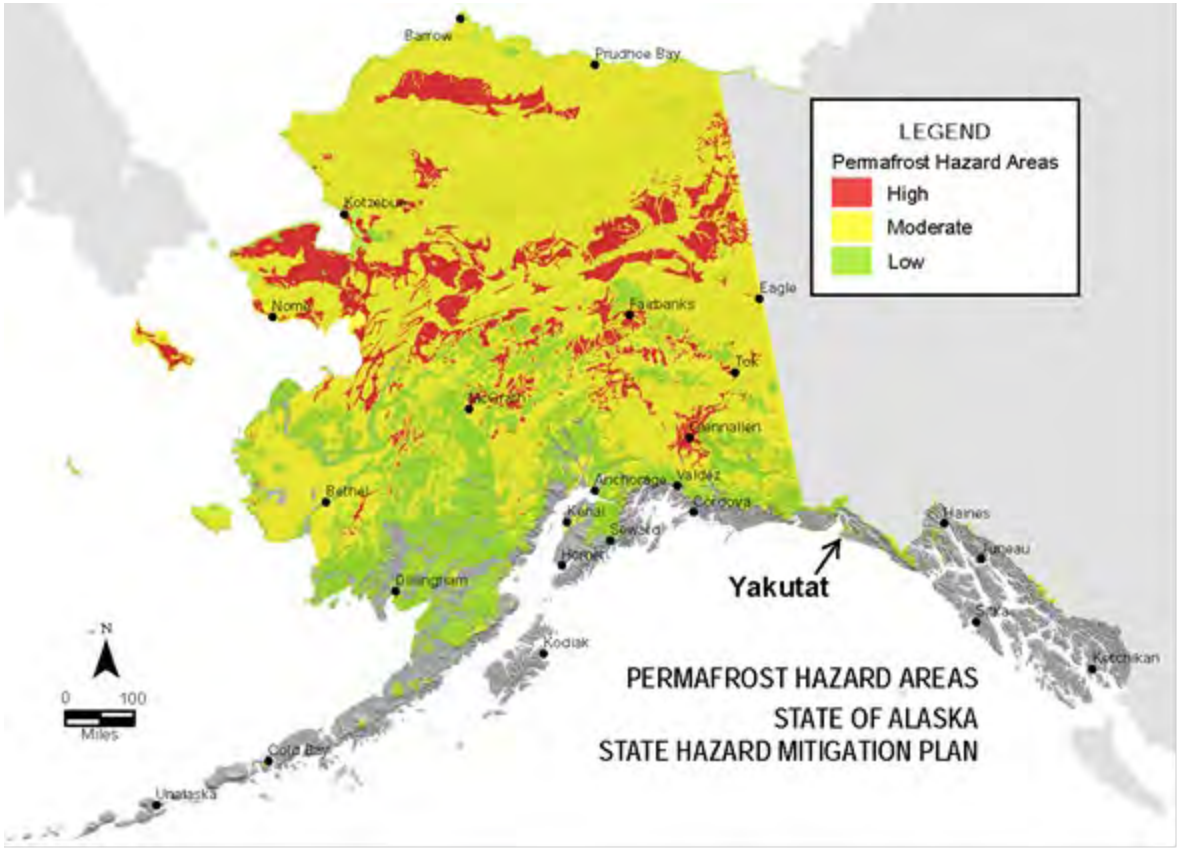
After the 2019 Hazard Mitigation Plan Update is completed, approved, and adopted, CBY will be eligible to continue to apply for mitigation project funds from DHS&EM and FEMA for five additional years until the plan requires another update in 2024.

Contacts:

Jennifer LeMay, PE, PMP, LeMay Engineering & Consulting, Inc. Planner (907) 350-6061
Brent Nichols, CFM, State of Alaska DHS&EM Hazard Mitigation Officer (907) 428-7085

Changes in the Cryosphere

- In Yakutat, glaciers, permafrost and periglacial, and snow avalanches apply to the surrounding areas outside the populated community.
- Permafrost does not underlie the populated area of CBY.



Changes in the Cryosphere Mitigation Goal: Reduce the risk from changes in the cryosphere.

Mitigation Actions for Changes in the Cryosphere are included with Flooding/Erosion/Ground Failure Hazards.

Earthquakes

- The entire geographic area of Alaska is prone to earthquake effects. As such, CBY is located within a fairly active seismic zone with the Fairweather and the Queen Charlotte Faults in close proximity to the area. USGS identified 139 earthquakes occurring within 100 miles of CBY since 1978 and the present. Eighteen of those 139 exceeded a M of 5.0. The largest one occurred on July 17, 2014, and measured M 6.0.
- The USGS earthquake probability model places the probability of an earthquake with a likelihood of experiencing strong shaking within Yakutat at 0.6 to 0.8 g PGA with a 2% probability in 50 years. A 2% probability in 50 years is a rare, large earthquake, and statistically, it happens on average every 2,500 years.

Mitigation Goals for Earthquakes:
EQ 4. Reduce structural vulnerability to earthquake (EQ) damage.

Mitigation Actions for Earthquakes

Action ID	Description	Priority	Responsible Party	Potential Funding	Timeframe
EQ 4.1	Inspect, prioritize, and retrofit any critical facility or public infrastructure that does not meet current State-Adopted Building Codes. Update in 2019: CBY is retrofitting the Public Safety Building through FEMA grants.	High	CBY Manager	CBY, HMGP, PDM	Ongoing
EQ4.2	Install non-structural seismic restraints for large furniture such as bookcases, filing cabinets, heavy televisions, and appliances to prevent toppling damage and resultant injuries to small children, elderly, and pets. Update in 2019: Ongoing. Large tvs have been replaced. Shorter bookcases have replaced taller ones. Earthquake straps have been used.		CBY Manager	CBY, HMGP, PDM	2019-2024

Flood/Erosion

The U.S. Army Corp of Engineers (USACE) Baseline Erosion Assessment included the Yakutat area, and the report listed the area as having a "Minimal" erosion threat. The Yakutat Erosion Information Paper dated September 20, 2007 reported the following erosion problems or issues:
"Erosion and flooding have recently become an important issue in the community. Erosion problems are reported in four areas. The first is at nearby Russell Fjord which is dammed periodically by the Hubbard Glacier. When the Hubbard Glacier advances enough to cross Russell Fjord, it forms an ice dam that can fill Russell Fjord until the ice dam breaks or the rising water overtops the low mountains that form the western wall of the fjord. Either conclusion to the ice damming process can cause outburst flooding and erosion. Ice damming closed Russell Fjord in 1996 and 2002.

A second area of concern is the Monti Bay coast near developed areas of Yakutat. The low-lying sand-silt beaches of the south shoreline are susceptible to erosion. Islands and navigation improvements shelter part of the community, but even the sheltered beaches can be eroded by locally-generated waves. The community survey reports the active erosion area is 5 to 15 feet wide and 6 to 30 feet high and estimates the rate of erosion is ½ to 2 feet per year. Erosion is also occurring by the Ocean Cape dock next to the fish camp buildings and in a section of washed-out road.

A third erosion area is inland from Yakutat, where unnamed streams in the Lost River basin, the Situk River basin, and Ahrnklin River basin are eroding the Forest Highway about 3 miles before its terminus at Harlequin Lake and at other locations from Mile 12 to 24. There also is a subdivision development where the sides of the roads are washing out from local runoff.
A fourth erosion area is the beaches from Dry Bay to Ocean Cape. As glaciers recede, the glaciers leave behind large lakes which are catching sediment as it is transported downriver. This is what is happening at Alsek Lake on the Alsek River. Alsek River, along with the Dangerous River, are likely the major contributors of sediments to Yakutat's beaches. If the beaches fail to accumulate, they will erode back which appears to have begun occurring three years ago. If the erosion cuts into the beach dunes, it will eventually begin the process of saltwater intrusion into several important estuaries, drastically cutting local salmon production" (USACE, 2009 and 2007).

Mitigation Goals for Flood/Erosion:
FL 5. Reduce flood (FL) and erosive scour damage and loss possibility.

Mitigation Actions for Flood/Erosion

Action ID	Description	Pri-ority	Responsible Party	Potential Funding	Time-frame
FL 5.1	Acquire Hubbard Glacier - Detailed bathymetry at Gilbert Point and the gap, particularly around the push moraine, at the earliest possible date. **Update in 2019:** Ongoing	High	CBY Manager	FEMA, NOAA, USACE, UAF/GS, CRREL	Ongoing
FL 5.2	Hubbard Glacier - Continued laser ranger monitoring of the gap width. **Update in 2019:** Ongoing				
FL 5.3	Hubbard Glacier - Use of Canadian-based MDA, Ltd. RadarSat images to monitor the status of the Hubbard Glacier terminus. **Update in 2019:** Ongoing				
FL 5.4	Hubbard Glacier - Acquisition of ALOS, Panchromatic Remote-sensing Instrument for Stereo Mapping (PRISM) high-resolution images when possible. **Update in 2019:** CBY has new aerial.				
FL 5.5	Structure Elevation and/or Relocation. **Update in 2019: Ongoing.** Road issues have been identified on Max Italio Drive. CBY has applied for CIP and State assistance.	Medium	CBY Supervisor in Public Works & Facilities Office	CBY, FEMA, HMGP, PDM	
FL 5.6	Install upgraded stream flow and rainfall measuring gauges. **Update in 2019:** Ongoing.			CBY	
FL 5.7	New in 2019: Weather station fell off the mountain and needs to be replaced.	High	CBY Supervisor in Public Works & Facilities Office	CRREL	2019

Ground Failure

During September 1889, the Yakutat Bay region was shaken by a series of major earthquakes, the most violent of which were felt at all settlements within a radius of 249 miles. Several heavy shocks occurred on September 4 and 10, but the main earthquake that caused great topographic changes occurred at 21:41 UTC, September 10, 1889. A USGS team did not study the region until six years after the shocks, but the topographic changes were obvious. The ground failure impacts included a maximum uplift of 47.6 ft that occurred on the west coast of Disenchantment Bay, and changes of 16.4 ft or more affected a large area. Subsidence of as much as 6.6 ft was observed in a few areas. Phenomena observed included surface faulting, avalanches, and fissures spouting from sand craterlets, and slight damage to buildings.

CBY's 2010 Comprehensive Plan described the area's threat from natural events as,
*"**4.1 Natural Environmental Analysis.***
*A large portion of the Borough is subject to physical conditions that limit and guide how development in the coastal zone can occur. The landscape of the Borough experiences glaciation and modification by erosion, deposition, wave and wind action, and some minimal tectonic uplift. In addition, the Borough is potentially subject to natural hazards that include earthquake**, ground instability,** tsunamis, seafloor instability, and faulting. Glacial advancement and retreat, outburst flooding, waves from calving ice, heavy snows, poor soils, and avalanches are also concerns…"* (Yakutat, 2010).

Mitigation Goal for Ground Failure
GF 6: Reduce ground failure (GF) damage and loss possibility.

Mitigation Actions for Ground Failure

Action ID	Description	Pri-ority	Respon-sible Party	Potential Funding	Time-frame
GF 6.1	Promote permafrost- sensitive construction practices in permafrost areas. Update in 2019: Ongoing.	Medium	CBY Supervisor in Public Works & Facilities Office	CBY, HMA, HMGP, PDM	Ongoing
GF 6.2	New in 2019: Education to public about all out-lying beaches. People were killed while they were berry picking when the sand tip melted (whole island liquified and dropped off).	High	CBY Manager	CBY	Ongoing

Severe Weather

In CBY, severe weather consists of heavy snowfall, high winds, and storms.

Mitigation Goal for Severe Weather

SW 7: Reduce structural vulnerability to severe weather (SW) damage.

Mitigation Actions for Severe Weather

Action ID	Description	Pri-ority	Respon-sible Party	Potential Funding	Time-frame
SW 7.1	Research and consider instituting the National Weather Service program of "Storm Ready". **Update in 2019:** Completed in 2018.	Medium	CBY Manager's Office	NOAA	Completed
SW 7.2	Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability. **Update in 2019:** Completed in 2018.	Medium	CBY Manager's Office	CBY, DHS&EM, NOAA	Completed
SW 7.3	Require weather-resistant building construction materials and practices. **Update in 2019:** The Borough adopted the State of Alaska Code. However, there is no enforcement as there are no inspectors in Yakutat.	Medium	CBY Supervisor Public Works & Facilities Office	CBY	Ongoing
SW 7.4	Require weather-resistant building construction materials and practices. **New in 2019:** Evaluate current heavy equipment for snow/debris and other needs created by severe weather conditions.	High	CBY Supervisor Public Works & Facilities Office	CBY	2019

Tsunami and Seiche

Yakutat has not been struck by a damaging tsunami in recent history; however, CBY, 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.

Mitigation Goal for Tsunami: TS 8. Reduce vulnerability, damage, or loss of structures from tsunami or seiche (TS).

Mitigation Actions for Tsunami

Action ID	Description	Pri-ority	Respon-sible Party	Potential Funding	Time-frame
TS 8.1	Coordinate with the National Tsunami Warning Center to ensure the community receives adequate warning. Update in 2019: Ongoing.	Medium	CBY Manager	CBY, DHS&EM, NOAA, NTWC	Ongoing
TS 8.2	New in 2019: Conduct tsunami training in the school.	High	School District Curriculum Director	School	2019
TS 8.3	New in 2019: Test siren monthly. Buy batteries when needed.	High	CBY Supervisor Public Works & Facilities Office	CBY	2019

Wildland/Conflagration Fire

Wildland fires have not been documented within the boundaries of CBY. Since 1939, 4 wildland fire events have occurred within 50 miles of CBY. No conflagration fires have occurred in CBY.

Mitigation Goal for Fire

F 9: Reduce structural vulnerability to wildland or conflagration fire (F) damage.

Mitigation Actions for Fire

Action ID	Description	Pri-ority	Respon-sible Party	Potential Funding	Time-frame
WF 9.1	Continue to support the local fire department with adequate firefighting equipment and training. Update in 2019: Ongoing.	Medium	CBY Supervisor in Public Works & Facilities Office	City, FEMA, AFG, VFAG, RFAG FP&S, SAFER, HSEP	Ongoing

Vulnerability of the community of Yakutat

Population

- 2013 U.S. Census was 662.
- 2017 DCCED was 552.

Houses and Critical Infrastructure

- 302 single-family residential structures ($105,700,000).
- Critical facilities and infrastructure have been identified ($80,494,674).

Jennifer L. LeMay, PE, PMP
Vice President
4272 Chelsea Way
Anchorage, AK 99504
(907) 350-6061
jlemay@lemayengineering.com

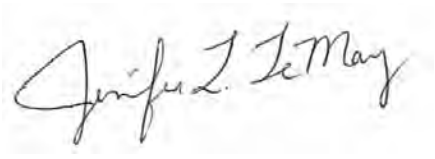
July 19, 2019

Brent A. Nichols, EMSII, CFM
State Hazard Mitigation Officer
Department of Military and Veterans Affairs (DMVA)
Division of Homeland Security and Emergency Management (DHS&EM)
P.O. Box 5750
JBER, AK 99505-5750

Subject: Hazard Mitigation Trip Report

On July 18, 2019, I traveled to Yakutat, Alaska. The purpose of this trip was to collect public comments on the Draft Hazard Mitigation Plan Update and provide an overview of the hazards and mitigation actions to the Borough Assembly. One public comment was received. BLM no longer owns the land identified in yellow on Figures 6-2 thru 6-5. The lands have since been transferred to Sealaska as part of their native allotments.

If you have any questions, please do not hesitate to call me at (907) 350-6061.



7/19/19
Jennifer L. LeMay, PE, PMP/Date
LeMay Engineering & Consulting, Inc.

Appendix E
Benefit–Cost Analysis Fact Sheet

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Benefit-Cost Analysis Fact Sheet

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

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

All Benefit-Costs must be:

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

General Data Requirements:

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

Damage and Benefit Data

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

- The Level of Protection MUST be documented and readily apparent.
- When using the Limited Data (LD) BCA module, users cannot extrapolate data for higher frequency events for unknown lower frequency events.

Building Data

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

Use Correct Occupancy Data

- Design occupancy for Hurricane shelter portion of Tornado module.
- Average occupancy per hour for the Tornado shelter portion of the Tornado module.
- Average occupancy for Seismic modules.

Questions to Be Answered

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

Common Shortcomings

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

Appendix F

Plan Maintenance Documents

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Annual Review Questionnaire

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

MITIGATION ACTION PROGRESS REPORT

Progress Report Period: _____ **To** _____
(Date) **(Date)**

Project Title: _____ **Project ID#:** _____

Responsible Agency: _____

Address: _____

: _____

Contact Person: **Title:**

Phone #(s): _____ **eMail Address(s):** _____

_____ _____

List Supporting Agencies and Contacts:

Total Project Cost: _____

Anticipated Cost Overrun/Underrun: _____

Project Approval Date: _____ **Project Start Date:** _____

Anticipated Completion Date: _____

Description of Project (describe each phase, if applicable, and the time frame for completing each phase:

Milestones	Complete	Projected Completion Date

MITIGATION ACTION PROGRESS REPORT

Plan Goal(s) Addressed:

Goal:

Success Indicators:

Project Status

- ☐ **On Schedule**
- ☐ **Completed**
- ☐ **Delayed***

*** Explain:**

- ☐ **Canceled**

Project Cost Status

- ☐ **Cost Unchanged**
- ☐ **Cost Overrun****

**** Explain:**

- ☐ **Cost Underrun*****

***** Explain:**

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

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

C. How was each problem resolved?

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

Other Comments:

Community Local Hazard Mitigation Plan Survey

This survey is an opportunity for you to share your opinions and participate in the mitigation planning process. The information that you provide will help us better understand your concerns for hazards and risks, which could lead to mitigation activities that will help reduce those risks and the impacts of future hazard events.

The hazard mitigation process is not complete without your feedback. All individual responses are strictly confidential and will be used for mitigation planning purposes only.

Please help us by taking a few minutes to complete this survey and return it to:

CBY Planner, Yakutat

Vulnerability Assessment

The following questions focus on how vulnerable the community or its facilities are to damage from a particular hazard type using the following vulnerability scale:

0= Don't Know 1 =Minimally Vulnerable 2=Moderately Vulnerable 3=Severely Vulnerable

1. How vulnerable to damage are the *structures* in the community from:

a. Flooding?	0 1 2 3
b. Wildfire?	0 1 2 3
C. Earthquakes?	0 1 2 3
d. Volcanoes?	0 1 2 3
e. Snow Avalanche?	0 1 2 3
f. Tsunami/Seiches?	0 1 2 3
g. Severe weather storms?	0 1 2 3
h. Ground failure (landslide)?	0 1 2 3
i. Coastal erosion?	0 1 2 3
j. Changes to the cryosphere (permafrost, sea ice)?	0 1 2 3
k. Other hazards?	0 1 2 3
Please Specify:	

2. How vulnerable to damage are the *critical facilities* within our community from:

[Critical facilities include airport, community shelter, bulk fuel storage tanks, generators, health clinic, law enforcement office (VPO, VPSO, police department), school, public works, e.g. washeteria/water treatment, reservoir/water supply, satellite dish, communications tower, landfills, sewage lagoons, and stores.]

a. Flooding?	0 1 2 3
b. Wildfire?	0 1 2 3
C. Earthquakes?	0 1 2 3
d. Volcanoes?	0 1 2 3
e. Snow Avalanche?	0 1 2 3
f. Tsunami/Seiches?	0 1 2 3
g. Severe weather storms?	0 1 2 3
h. Ground failure (landslide)?	0 1 2 3
i. Coastal erosion?	0 1 2 3
j. Changes to the cryosphere (permafrost, sea ice?)	0 1 2 3
k. Other hazards?	0 1 2 3

Please Specify:

3. How vulnerable to displacement, evacuation or life-safety is the community from:

a. Flooding?	0 1 2 3
b. Wildfire?	0 1 2 3
C. Earthquakes?	0 1 2 3
d. Volcanoes?	0 1 2 3
e. Snow Avalanche?	0 1 2 3
f. Tsunami/Seiches?	0 1 2 3
g. Severe weather storms?	0 1 2 3
h. Ground failure (landslide?	0 1 2 3
i. Coastal erosion?	0 1 2 3
j. Changes to the cryosphere (permafrost, sea ice?)	0 1 2 3
k. Other hazards?	0 1 2 3

Please Specify:

4. Do you have a record of damages incurred during past flood events? Yes No

If yes, please describe:_____

_____

_____

Preparedness

Preparedness activities are often the first line of defense for protection of your family and the community. In the following list, please check those activities that you have done, plan to do in the near future, have not done, or are unable to do. *Please check one answer for each preparedness activity*.

Have you or someone in your household:	Have Done	Plan to do	Not Done	Unable to do
Attended meetings or received written information on natural disasters or emergency preparedness?	☐	☐	☐	☐
Talked with family members about what to do in case of a disaster or emergency?	☐	☐	☐	☐
Made a "Household/Family Emergency Plan" in order to decide what everyone would do in the event of a disaster?	☐	☐	☐	☐
Prepared a "Disaster Supply Kit" extra food, water, medications, batteries, first aid items, and other emergency supplies)?	☐	☐	☐	☐
In the last year, has anyone in your household been trained in First Aid or CPR?	☐	☐	☐	☐

5. Would you be willing to make your home more resistant to natural disasters? ☐ Yes ☐ No

6. Would you be willing to spend more money on your home to make it more disaster resistant? ☐ Yes ☐ No ☐ Don't know

7. How much are you willing to spend to better protect your home from natural disasters? *(Check only one)*

☐	Less than $100	☐	Desire to relocate for protection
☐	$100-$499	☐	Other, please explain
☐	$500 and above		
☐	Nothing / Don't know		
☐	Whatever it takes		

Mitigation Activities

A component of the Local Hazard Mitigation Plan activities is developing and documenting additional mitigation strategies that will aid the community in protecting life and property from the impacts of future natural disasters.

Mitigation activities are those types of actions you can take to protect your home and property from natural hazard events such as floods, severe weather, and wildfire. Please check the box for the following statements to best describe their importance to you. Your responses will help us determine your community's priorities for planning for these mitigation activities.

Statement	Very Important	Somewhat Important	Neutral	Not Very Important	Not Important
Protecting private property	☐	☐	☐	☐	☐
Protecting critical facilities (clinic, school, washeteria, police/fire department, water/sewer, landfill)	☐	☐	☐	☐	☐
Preventing development in hazard areas	☐	☐	☐	☐	☐
Protecting natural environment	☐	☐	☐	☐	☐
Protecting historical and cultural landmarks	☐	☐	☐	☐	☐
Promoting cooperation within the community	☐	☐	☐	☐	☐
Protecting and reducing damage to utilities, roads, or water tank	☐	☐	☐	☐	☐
Strengthening emergency services (clinic workers, police/fire)	☐	☐	☐	☐	☐

8. Do you have other suggestions for possible mitigation actions/strategies?

_____

_____

_____

_____

_____

General Household Information

9. Please indicate your age: _____

and Gender: ☐ Male ☐ Female

10. Please indicate your level of education:

☐	Grade school/no schooling	☐	College degree
☐	Some high school	☐	Postgraduate degree
☐	High school graduate/GED	☐	Other, please specify
☐	Some college/trade school		

11. How long have you lived in Yakutat?

☐ Less than 5 years ☐ 5 to 10 years ☐ 11 to 20 years ☐ 21 or more years

12. Do you have internet access? ☐ Yes ☐ No

13. Do you own or rent your home? ☐ Own ☐ Rent

If you have any questions regarding this survey or would like to learn about other ways that you can participate in the development of the Local Hazard Mitigation Plan, please contact the CBY Planner.

Thank You for Your Participation!

This survey may be submitted anonymously; however, if you provide us with your name and contact information below, we will have the ability to follow up with you to learn more about your ideas or concerns (optional):

Name: _____

Address: _____

_____

Phone: _____