EXECUTIVE SUMMARY

The Municipality of Anchorage (MOA) is vulnerable to a wide range of natural, technological, and human/societal hazards including earthquakes, avalanches, landslides, wildfires, ground failures and hazardous material accidents. These are hazards that could cause costly disasters in neighborhoods, business districts, and rural areas. These hazards have the potential to endanger the health and safety of the population and jeopardize economic and environmental vitality. Due to the importance of avoiding or minimizing the vulnerabilities to these hazards, the public and private sector have participated in providing the Mitigation Advisory Committee necessary information for the plan update. The MOA undertook a comprehensive, multi-jurisdictional planning process that culminated in the updated publication of the "All Hazards Mitigation Plan". This plan replaces the one adopted in 2016 by the MOA.

Development and implementation of this plan has been directed by the Mitigation Advisory Committee consisting of representatives from a variety of municipal departments including the Office of Emergency Management, Project Management & Engineering, Maintenance & Operations, Anchorage School District, Anchorage Water & Wastewater Utility, the Port of Anchorage, Anchorage Health Department, Anchorage Police Department and Anchorage Fire Department.

The Mitigation Advisory Committee has identified the hazards threatening the MOA and estimated the relative risks posed to the community by those hazards. Information has been gathered from a variety of sources including various departments within the Municipality, planning offices, and state and federal programs. This information has been used by the All- Hazards Mitigation Committee to assess the vulnerabilities of the facilities and neighborhoods of the Municipality and to the impacts of future disasters potentially involving those hazards. This update reflects the growth experienced over the last five years.

The Municipality of Anchorage (MOA) represented in the updated plan had a population of 288,970 in 2020. At 1,697.2 square miles (4,395.7 km2) of land area, the borough is the fourth largest by area in the United States and larger than the smallest state, Rhode Island.

The Disaster Mitigation Act of 2000 (DMA 2000) requires that local governments have a local mitigation plan approved by the Federal Emergency Management Agency (FEMA) as a condition for receiving future FEMA mitigation funds. This hazard mitigation plan was developed to fulfill federal and state hazard mitigation planning requirements.

Upon approval by FEMA, this plan will be formally adopted by the MOA Assembly.

FEMA REQUIREMENTS

According to the FEMA regulations, a mitigation plan must identify the hazards that occur in Anchorage, contain a strategy to mitigate those hazards and a method of monitoring and updating the plan.

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CHAPTER 1 - INTRODUCTION

1.1 Background

The Municipality of Anchorage (MOA) is vulnerable to a wide range of natural, technological, and human/societal hazards including earthquakes, avalanches, landslides, ground failures and hazardous material accidents. These hazards can affect the safety of residents, damage or destroy public and private property, disrupt the local economy, and negatively impact the quality of life.

Typically, we cannot eliminate these hazards altogether, but we can lessen their impact by participating in hazard mitigation. Hazard mitigation is any action taken to reduce or eliminate the long-term risk to property and human life from hazards.

Benefits of hazard mitigation include…

- Reduced loss of life, property, essential services, critical facilities, and economic hardship
- Reduced short-term and long-term recovery and reconstruction costs
- Increased cooperation and communication within the community through the planning process
- Expedited pre-disaster and post-disaster grant funding
- Increased disaster resilience
- Improved environmental quality
- Improved economic vitality
- Improved quality of life

There is a wide variety of mitigation activities available.

They can be structural in nature, such as reinforcing a building's foundation or constructing a levee, or they can be non-structural, such as rezoning a flood- prone area or securing a water heater to a wall. Mitigation activities can focus on preventing the damage from occurring in the first place (by limiting development in hazard-prone areas), or by protecting against damage (strengthening existing or future development so that it is not damaged by a hazard event). More information about hazard mitigation activities can be found in Chapter 6.

One of the most effective tools to reduce vulnerability to hazards is a local hazard mitigation plan. A hazard mitigation plan identifies what hazards exist in the community and establishes goals and specific mitigation activities to be undertaken.

To encourage communities to develop hazard mitigation plans, the United States Congress passed the Disaster Mitigation Act of 2000 (DMA 2000). This Act requires local governments to have a Federal Emergency Management Agency (FEMA)-approved mitigation plan by November 2004 to remain eligible for FEMA Hazard Mitigation Grant Program (HMGP) funding and Building Resilient Infrastructure and Communities (BRIC) as well as Flood Mitigation Assistance (FMA) programs.

This plan for the MOA has been prepared in coordination with the State of Alaska (SOA) Division of Homeland Security and Emergency Management (DHS&EM) to ensure it meets all applicable DMA 2000 requirements. FEMA's Local Mitigation Plan Crosswalk, found in Appendix A provides a summary of federal and state minimum standards and documents where each requirement is met within the plan.

1.2 Purpose

The purpose of this plan is to:

- Identify hazards, mitigation goals and objectives, and potential mitigation projects within the MOA.
- Fulfill the DMA 2000 Local Hazard Mitigation Plan requirements.
- Serve as a qualifying document for hazard mitigation programs coordinated through the DHS&EM and the Department of Commerce, Community, and Economic Development (DCCED).

1.3 How This Plan Will be Used

A hazard mitigation plan is not intended to be developed and forgotten; it should be a living document. To be effective, the goals of the plan need to be incorporated into the everyday activities of the Municipality. As a result, this plan should be used to modify existing MOA plans and policies so that they support the Municipality's hazard mitigation goals. Issues related to emergency response are not included in this plan; these issues should be addressed in the MOA's Comprehensive Emergency Operations Plan (CEOP).

1.4 Summary of Hazards in The Municipality of Anchorage

According to the MOA's 2015 EOP, Anchorage is vulnerable to three main types of hazards: natural, technological, and human/societal hazards. Table 1.1 shows the types of potential hazards in the MOA. More information about natural and technological hazards can be found in Chapter 4.

Table 1.1 Hazards in Anchorage

Natural	Technological
Earthquake	Dam Failure
Wildfire	Energy Emergency
Extreme Weather	Urban Fire
Flooding	Hazardous Materials Release
Avalanche	Radiation Accident
Ground Failure/Landslide	Transportation Accident
Volcanic Ash Fall	Air Pollution
Severe Erosion	Communications Failure
*Communicable Diseases	*Cyber Attack

Source: 2015 MOA Comprehensive Emergency Operations Plan, and Mitigation Advisory Committee

** Added as result of COVID-19 Pandemic and increased occurrence of infrastructure related cyber-attacks, prior to the update of the MOA Comprehensive Emergency Operations Plan.*

[1] Hazard information is from various federal, state, public, and private sources and is for planning purposes only. The information should not be used for purposes it was not intended for including permit applications or for construction.

Hazards can be measured in terms of their frequency and severity. Frequency is the number of times the hazard has occurred. Severity measures how bad the situation may be and is based on several factors, including the number of deaths/injuries; how long critical facilities are shut down; extent of property damage; effect on economy; and the effect on response systems. Table 1.2 shows the frequency and severity of Anchorage's potential hazards.

Table 1.2: Hazard Probability and Priority Ranking Chart for the Municipality of Anchorage

Probability

	Has not occurred yet	Low (11-100 years)	Medium (5-10 years)	High (1-4 years)
Catastrophic (Deaths or Injuries: 50 or more)		Severe Earthquake		
Critical		Communicable Diseases	Wildfire	Communications Failure
Limited	Energy Emergency	Civil Disturbance	Ground Failure/Landslide	Avalanche Extreme Weather Urban Fire Transportation Accident Cyber Attack
Negligible		Dam Failure Severe Erosion Hazmat Release Radiation Accident Air Pollution	Volcano Ash Fall	Minor Earthquake Flooding

Catastrophic: More than 50 deaths/injuries; complete shutdown of critical facilities for 20 days or more; more than 50% property damage; severe long-term effects on economy; severely affects state/local/private sectors' capabilities to begin or sustain recovery activities; overwhelms local and state response resources.

Critical: 10-50 deaths/injuries; shutdown of critical facilities for 8-30 days; 25-50% property damage; short-term effect on economy; temporarily (24-48 hours) overwhelms response resources.

Limited: Fewer than 10 deaths/injuries; shutdown of critical facilities for 3-7 days; 10-25% property damage; temporary effect on economy; no effect on response system.

Negligible: Minor injuries; no deaths; shutdown of critical facilities for fewer than 3 days; less than 10% property damage; no effect on economy; no effect on response system.

Source: 2015 EOP

After the hazards are identified, the potential consequences of the hazard are considered. One potential consequence is property damage. Potential property damage was estimated using Geographical Information System (GIS) analysis. Table 1.3 summarizes the number of parcels and the taxable value (land and structure) that are vulnerable to each hazard. These values represent the parcels that could be vulnerable to a hazard event, the actual number and location of parcels impacted will vary depending on the size and location of the event.

Table 1.3: Vulnerability Summary

Hazard	Number of Parcels	Taxable Value
Earthquake	84,219	$39,974,839,600
Wildfire	84,219	$39,974,839,600
Extreme Weather	84,219	$39,974,839,600
Flooding	432	$376,200,000
Avalanche	206	$124,900,000
Ground Failure/Landslide	5,092	$6,300,000,000
Volcanic Ash Fall	84,219	$39,974,839,600
Severe Erosion	N/A	N/A
Dam Failure	130	$39,900,000
Energy Emergency	84,219	$39,974,839,600
Urban Fire	66,945	$132,357,638,300
Hazardous Materials Release	84,219	$39,974,839,600
Power Failure	84,219	$39,974,839,600
Communications Failure	84,219	$39,974,839,600

Source: MOA 2020 and FEMA Draft Risk Report for Anchorage 2018

Additional information about the property, infrastructure, and populations vulnerable to each hazard can be found in Chapter 4.

1.5 Scope

This plan is an update of the 2016 Anchorage All Hazard Mitigation Plan. Chapter 2 (Community Profile) and Chapter 3 (Asset Inventory) were updated to reflect the current conditions. Other changes to Chapter 4 involved updating the natural hazards information, including the vulnerability tables. In Chapter 5 significant updates to the plan's goals and objectives were conducted. The action Items were also reviewed by the Planning Team. All action items were updated to reflect their current status, and additional action items were identified. In addition, modifications to the plan were made to improve readability and ease of use whenever possible. A more detailed summary of changes can be found in Appendix A.

1.6 Organization of the Plan

The plan is organized as follows:

Chapter 1 is an introduction to the plan and includes the purpose, scope, and organization of the plan, as well as a description of the planning process.

Chapter 2 is a community profile providing an overview of the MOA's:

- Location
- Natural Setting
- History
- Demographics, and
- Economy

Chapter 3 is an asset inventory identifying what development could be vulnerable toa hazard event.

Chapter 4 provides details about the hazards that can occur in Anchorage. For each hazard, there is a description of the hazard's characteristics, the location where the hazard can occur, previous occurrences of the hazard, and what is vulnerable to the hazard. Where possible, the location of the hazard area has been mapped.

Chapter 5 contains the MOA's mitigation strategy, including mitigation goals, objectives, and action items, as well as an update to all action items since the adoption of the 2017 All Hazards Mitigation Plan. This chapter also contains information about how the mitigation measures will be implemented.

Chapter 6 is devoted to the maintenance, evaluation, and updating the plan.

Chapter 7 lists the references used in the development of the plan.

Appendices contain the plans supporting documentation.

1.7 Planning Process

The planning process was led by the MOA's Office of Emergency Management.

The planning process began with two lines of focus; multi-department input and public feedback. Two notices were sent to the community to increase public input to the MOA Hazard Mitigation Plan update.

Invitations to MOA departments to participate as part of the MOA Hazard Mitigation Planning Committee were also sent via email. As work on the plan developed, additional departments were added to the committee. As the plan update progressed, specific outreach for comment and revisions of the plan was requested from neighboring communities to include the Native Tribe of Eklutna, the Matanuska-Susitna Borough, and the Kenai Peninsula Borough via email. No formal comments or recommendations were received in the development of the updated all-hazards mitigation plan.

Table 1.4: MOA Hazard Mitigation Planning Committee and Stakeholders

Department/Jurisdiction	Representative/Position	Contact Information
MOA Office of Emergency Management	Amanda-Loach-Director	907-343-1406 Amanda.loach@anchorageak.gov
	Andrew Preis-Emergency Manager	907-343-1404 Andrew.preis@anchorageak.gov
	Drielle Welch-Planner	907-885-9061 Drielle.welch@anchorageak.gov
	Audrey Gray-Emergency Manager	907-343-1407 Audrey.gray@anchorageak.gov
MOA Real Estate	Shelley Rowton- Land Management Officer	907-343-7531 Shelly.rowton@anchorageak.gov
MOA Fire Department	Douglas Schrage- Fire Chief	907-267-4945 Douglas.schrage@anchorageak.gov
	Jodie Hettrick- Prior Fire Chief	N/A
MOA Parks and Recreation	Josh Durand- Director	907-343-4427 Joshua.durand@anchorageak.gov
MOA Health Department	Joe Gerace- Director	907-343-4650 Joseph.gerace@anchorageak.gov
	Renee Aguilar- Emergency Preparedness Planning Coordinator	907-343-6302 Renee.aguilar@anchorageak.gov
	Bill Kays- Prior Emergency Preparedness Program Manager	907-267-4993 William.j.kays@anchorageak.gov
MOA Port of Alaska	Steve Ribuffo-Port Director	907-343-6201 Steve Ribuffo@anchorheak.gov
	Sharen Walsh- Port Modernization Program Director	907-343-6203 Sharen.walsh@anchorageak.gov
MOA Development Services	Jack Frost- Acting Director	907-343-8033 Jack.frost@anchorageak.gov
	Bob Doehl- Prior Director	N/A
Anchorage School District/ MOA	George Vakalis- Consultant	vakalis_george@asdk12.org
	Ashley Lally- Director of Security & Emergency Preparedness	Lally_ashley@asdk12.org

	Deborah Engles- Senior Director of Risk Management and Safety	Engles_deb@asdk12.org
MOA Maintenance & Operations	Saxton Shearer- Director	907-343-8269 Saxton.shearer@anchorageak.gov
	Alan Czajkowski- prior employee	N/A
MOA Public Works	Lance Wilber- Director	907-343-8422 Lance.wilber@anchorageak.gov
	Maury Robinson- Manager	907-343-8191 Maury.robinson@anchorageak.gov
MOA Planning Department	Craig Lyon-Director	907-343-7996 Craig.lyon@anchorageak.gov
	Michelle McNulty- prior employee	N/A
MOA Solid Waste Services	Shaina Kilcoyne- Energy and Sustainability Manager	907-343-6270 Shaina.kilcoyne@anchorageak.gov
MOA Emergency Management Consultant	JT Maddox- contractor	jt@nationaldrsolutions.com
	Darrell Dotson- contractor	darrell@nationaldrsolutions.com
	Jason Wheeler- contractor	jason@nationaldrsolutions.com
MOA Safety Office	Anneliese Roberts- Safety Officer	907-343-2521 Anneliese.roberts@anchorageak.gov
Anchorage Wastewater Utility	Alyssa Farrar- Division Director	907-786-5589 Alyssa.farrar@awwu.biz
MOA Human Resources	Cheryl Evans- prior employee	N/A
MOA I.T. Department	Mark Merchant- Chief Information and Security Officer	907-343-6917 Mark.merchant@anchorageak.gov
	Sioux-z Marshall- prior employee	N/A
MOA Chief Financial Officer	Travis Frisk- Chief Fiscal Officer	907-343-6619 Travis.frisk@anchorageak.gov
	Alex Slivka- prior employee	N/A
MOA Geospatial Data and Information	Tina Miller- Program and Policy Director	907-343-6183 Christina.miller@anchorageak.gov
MOA Watershed Management	Steve Ellis- Flood Hazard Administrator	907-343-8078 steven.ellis@anchorageak.gov
MOA Internal Audit	Mike Chadwick- Internal Auditor	907-343-4438 Michael.chadwick@anchorageak.gov

MOA Municipal Manager	Bill Falsey- Prior Municipal Manager	N/A
Department of Commerce, Community, and Economic Development, State of Alaska	Anita Baker- Grant Administrator II	907-269-4252 Anita.baker@alaska.gov
	Pauletta Bourne- Grant Administrator III	907-451-2721 Pauletta.bourne@alaska.gov
MOA Local Emergency Planning Committee	Doug Lamkin- Facility Owner/Operator, Community Groups	dlamkin@nwalaska.org
	Ron Schwartz, Local disaster planning and service area representative	Emergencymanager@alaska.edu
	Robert Wyatt, Media representative	bobw@alaskapublic.org
	Erich Scheunemann- Vice Chair	Erich.scheunemann@anchorageak.gov
MOA Geotechnical Advisory Committee	Tom Davis- Senior Planner	Tom.davis@anchorageak.gov
The Native Tribe of Eklutna	Carrie Brophil- Land and Environment Co- Director	cbrophil@eklutna.org
Matanuska- Susitna Borough	Casey Cook- Emergency Manager	Casey.cook@matsugov.us
	Jason Bauer- EOC Specialist	Jason.bauer@matsugov.us
	Eric Mohrmann- EOC Specialist	Eric.mohrmann@matsugov.us
	Talon Boeve- EOC Specialist	Talon.boeve@matsugov.us
	David Phillips- EOC Specialist	David.phillips@matsugov.us
	Taunnie Boothby- Planner/Floodplain Manager	Taunnie.boothby@matsugov.us
Kenai Peninsula Borough	Brenda Ahlberg- Emergency Manager	bahlberg@kpb.us

The all-hazards mitigation plan update process began with a MOA planning committee meeting to introduce the process, to inform representatives about the process, and to identify what would be expected from them. This meeting was held on May 17,2021.

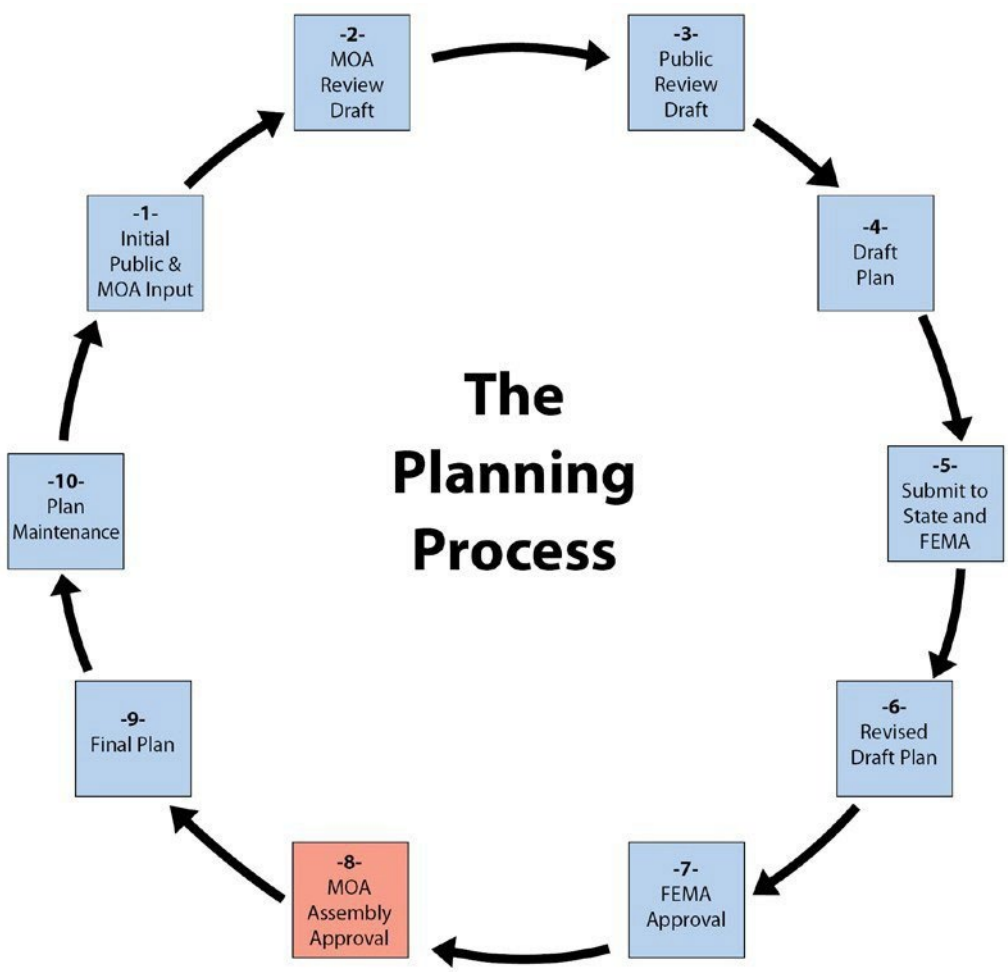
The next step was to review the asset inventory to determine if there were any changes to be made to the list of critical facilities. Each department was responsible for reviewing the list of facilities and identifying the hazards to which the facility was exposed.

Simultaneously, the hazard section was updated. The natural hazard section was updated, and the technological hazard section was drafted based on a review of existing literature, consultation with state and federal agencies and MOA departments, and interviews with MOA staff.

The next step was to review the existing goals, objectives, and action items to identify any changes that might be necessary. First, the existing goals and objectives were reviewed by the planning committee and changes were identified. Each department was also asked to review the list of action items to identify the status of each action item and to identify new action items for their department. Based on input from the planning committee, additional goals and objectives were then added and a list of action items was developed.

The next task was to develop a draft of the updated all-hazards mitigation plan, authorized by the MOA Director of Emergency Management, Amanda Loach. The draft was circulated internally within the MOA for review and to stakeholders. The plan was made available for review by the public and other interested parties. Based on the comments provided, if any, on the public review draft, the plan was revised and submitted to DHS&EM and FEMA for approval. After FEMA approves the plan, it will go to the MOA Assembly for adoption. This process is summarized in Figure 1.1.

Figure 1.1 The Planning Process



1.8 Public Involvement

The plan update announcement was placed on the emergency plans part of the MOA's website. The Municipality of Anchorage held and/or participated in two public meetings to advise and inform the public of updates to the AHMP. The meetings were announced two to three weeks prior to the meeting date on the MOA Boards and Commissions website calendar. The meeting dates were September 27th and December 6th, 2021. Both meetings resulted in attendance from the community, partially because of virtual availability allowing for greater participation. The first meeting, on September 27, 2021, was to notify the community of the AHMP update and request input. There were two community members present, one who voiced questions on the update process, however no recommendations or changes to the plan itself were given. The second meeting was to go over the status of the Draft AHMP at the public meeting for the Local Emergency Planning Committee (LEPC) Meeting and again allow for public input. No formal recommendations or changes to the plan were given. A notice that the AHMP was being updated was posted on the Municipal webpage from August 27th to September 28th, 2021. This notice provided links to the 2016 AHMP and the draft 2022 AHMP, points of contact with phone numbers and an e-mail address to provide written comments or ask questions. The 2016 version and the most recent 2022 version of the AHMP are posted on both the Project Management and Engineering, and Emergency Management website. You can go to the municipal home page (www.muni.org), search for "all hazard mitigation plan" and it will direct you to the Project Management and Engineering, or Emergency Management website for the AHMP updates. The notices and websites are provided in Appendix B, Public Involvement. The AHMP will still have one more public involvement phase. This will happen during the two week notice for adoption of the AHMP by the Municipal Assembly. The MOA will continue to monitor its e-mail for public comments and a phone option has also been given on the website.

CHAPTER 2 – COMMUNITY PROFILE

This chapter is a brief community profile for Anchorage. It contains information about Anchorage's location, history, demographics, economy, and natural setting. This information provides an overview of the MOA's physical and socioeconomic characteristics. A community profile is important because it provides an overview of the community and can be used in conjunction with the asset inventory as a reference when identifying the potential impacts of a hazard event.

2.1 Location

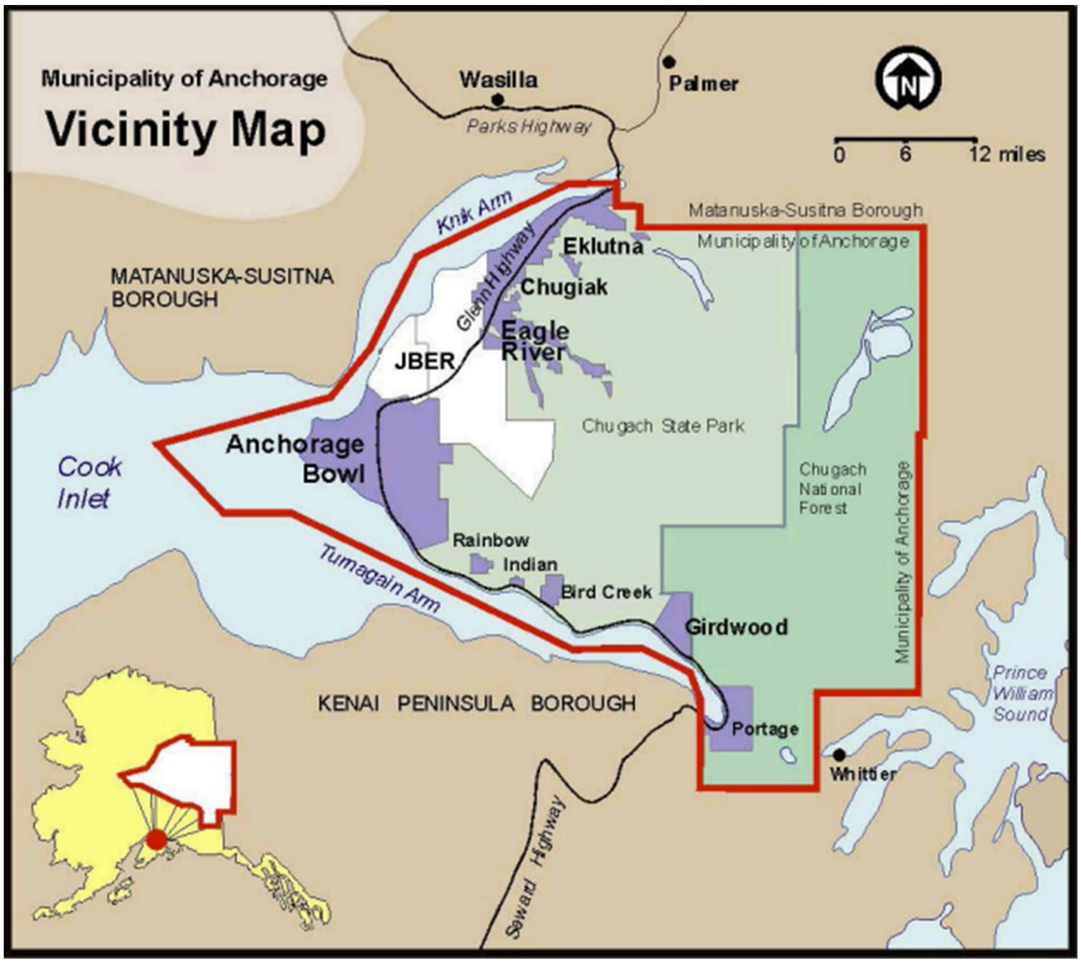
The MOA is in Southcentral Alaska at the head of Cook Inlet. It is a 1,697.2-square-mile area between northern Prince William Sound and upper Cook Inlet. The area consists of mostly rugged mountainous terrain, 84 percent of which is taken up by national forest or state parklands and tidelands. Six percent is occupied by military installation. Only the remaining 10 percent of the entire MOA is inhabited.

The Anchorage Bowl is the most urbanized area of the MOA. It occupies approximately 100 square miles, bounded by Chugach State Park, Turnagain and Knik Arms, and Joint Base Elmendorf - Richardson (JBER) (see Figure 2.1). Settlements north of Joint Base Elmendorf- Richardson include Eagle River, Chugiak, Birchwood, Peters Creek, the Native Village of Eklutna and Eklutna. Most of this lowland area is between the Chugach Mountains and Knik Arm. South of the Anchorage Bowl are the Turnagain Arm communities of Girdwood, Indian, Rainbow, Bird, and Portage.

2.2 Natural Setting

Anchorage has a unique natural setting, as it is an urban area surrounded by wilderness and water. Several thousand acres of municipal greenbelts and parklands link developed areas with surrounding natural open space and wildlife habitat in Chugach State Park (the second largest state park in the country), the Chugach National Forest, and the 50-square-mile Anchorage Coastal Wildlife Refuge. Anchorage has five salmon species and 52 mammal species, including wolf, bear, lynx, and moose.

Figure 2.1 Municipality of Anchorage



2.3 History

The Anchorage area was originally inhabited by the Dena'ina Athabascan Indians. The Native Village of Eklutna was one of eight winter settlements and is the last occupied Dena'ina village in the MOA.

2.3.1 Anchorage Bowl

Anchorage was founded in 1914 when the federal government established the field headquarters for the construction of the Alaska Railroad at Ship Creek. Soon after, in 1920, Anchorage was incorporated as a city.

Between 1940 and 1990, Anchorage grew in spurts. Military build-ups, post-1964 earthquake reconstruction, the Trans Alaska Pipeline construction in the mid-1970s, and the early 1980s petroleum boom each pumped up the economy and spurred rapid community growth.

Often, the aftermath was recession. By the 1990s, Anchorage had a much more diverse and stable economy, resulting in modest and steady community growth.[2] Information was taken with permission from *Anchorage 2020: Anchorage Bowl Comprehensive Plan*, the *Girdwood Area Plan*, and the *Chugiak-Eagle River Comprehensive Plan Update*.

2.3.2 Chugiak/Eagle River

The area north of the Anchorage Bowl saw additional development after 1900 when traders and prospectors began to arrive in the area looking for minerals and routes to the gold fields. As a result of federal involvement (home for Native Children and the Eklutna hydroelectric project), Eklutna was the dominant settlement in the area in the 1920s. However, growth occurred closer to Anchorage, with the creation of Fort Richardson Army Reservation and Elmendorf Air Force Base. Many military personnel and civilians associated with military construction jobs moved into the area. The Chugiak/Eagle River area continued to grow as people looked for a more rural lifestyle than that offered in the Anchorage Bowl. Commercial enterprises subsequently followed the population to the area.

2.3.3 Girdwood

Girdwood was founded just before the turn of the century as a supply and transport center for the area's placer and lode gold mines. The mining claims operated through the 1930s, when they stopped due either to the exhaustion of lode deposits or to lawsuits and presidential orders to stop environmentally destructive hydro-mining. In the 1920s, the construction of the Alaska Railroad benefited Girdwood, because the town was a source of timber for rail ties.

Development in the Girdwood area was revived in 1949 because of the construction of the Seward Highway. Much of the growth and development in Girdwood since the 1950s has been associated with skiing and other recreational opportunities.

2.4 Demographics

For most of its history, Anchorage grew as a community of immigrants and newcomers from outside the state, and Alaska Natives from rural areas within the state. For decades, a seasonal boom-bust economy and military personnel rotations made Anchorage a fast-growing town of transient residents without a strong stake in the community. Those who stayed as permanent residents lived in Anchorage by personal choice, not by chance of birth. They were rooted by their liking for the place and for the distinctive lifestyle it offered. At the time of the 1990 census, barely a quarter of Anchorage residents were born in Alaska.

In the 1990s, economic stability and military cutbacks dramatically slowed immigration and reduced annual population turnover by half. As a result, Anchorage's population has become much less transient and more committed to long-term community betterment.

The population of Anchorage saw a peak in growth in 2013 (see Table 2.1), although the number preferring the lifestyle offered by the smaller outlying communities is increasing. The population residing on the military bases is declining.

Table 2.1 Historic Population of the Municipality of Anchorage

Period (July-based)	2010	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-2019
End of Period Population	292,983	295,635	298,164	301,037	300,008	298,637	298,962	297,739	294,488	291,845
Population Change	1,157	2,652	2,529	2,873	-1029	-1,371	325	-1,2123	-3,251	-2,643
Growth Rate (Percentage)	1.58	0.90	0.85	0.96	-0.34	-0.46	0.11	-0.41	-1.10	-0.90
Births	1,144	4,772	4,572	4.690	4,784	4,641	4,563	4,279	4,088	3,913
Birth Rate (Percent)	1.57	1.62	1.54	1.57	1.59	1.55	1.53	1.43	1.38	1.33
Deaths	344	1,455	1,457	1,532	1,588	1,643	1,714	1,741	1,657	1,811
Death Rate (Percent)	0.47	0.49	0.49	0.51	0.53	0.55	0.57	0.58	0.56	0.62
Natural Increase	800	3,317	3,115	3,158	3,196	2,998	2,849	2,538	2,431	2,102
Net Migration	357	-665	-586	-285	-4,225	-4,369	-2,524	-3,761	-5,682	-4,745

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section

Today, Anchorage’s population is diverse, especially since Anchorage is a refugee city. Racial and ethnic minorities are the fastest-growing segment of the population and account for about 32.65 percent of the total population.

Asian/Pacific Islander make up about 7.9 percent of the total population and are the largest minority group. There are also substantial African American, and Hispanic communities, each making up about six percent of the total population. Table 2.2 is a profile of the general demographic characteristics for the MOA.

Table 2.2 Profile of General Demographic Characteristics for the Municipality of Anchorage

Age	April 2010 Census			April 2020 Estimate*			July 2021 Estimate		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total	291,826	148,209	143,617	291,247	146,249	144,998	289,697	145,501	144,196
0-4	21,961	11,349	10,612	19,349	9,929	9,420	18,332	9,381	8,951
5-9	20,618	10,542	10,076	19,998	10,159	9,839	19,629	9,961	9,668
10-14	20,443	10,407	10,036	19,993	10,391	9,602	19,945	10,299	9,646
15-19	21,187	10,990	10,197	18,268	9,388	8,880	18,062	9,320	8,742
20-24	24,379	13,059	11,320	20,682	10,955	9,727	20,496	10,949	9,547
25-29	24,820	12,820	12,000	23,484	12,062	11,422	22,121	11,329	10,792
30-34	20,620	10,458	10,162	24,378	12,217	12,161	24,288	12,160	12,128
35-39	19,569	9,843	9,726	22,308	11,164	11,144	22,880	11,536	11,344
40-44	19,493	9,892	9,601	17,899	8,947	8,952	18,645	9,328	9,317
45-49	22,394	11,157	11,237	16,817	8,195	8,622	15,994	7,880	8,114
50-54	22,175	11,084	11,091	16,881	8,428	8,453	16,860	8,370	8,490
55-59	19,088	9,755	9,333	18,694	9,246	9,448	17,573	8,640	8,933
60-64	13,940	7,186	6,754	17,405	8,537	8,868	17,517	8,651	8,866
65-69	8,347	4,169	4,178	13,936	6,921	7,015	14,584	7,229	7,355
70-74	4,962	2,328	2,634	9,479	4,670	4,809	10,189	5,008	5,181
75-79	3,482	1,533	1,949	5,645	2,614	3,031	6,144	2,826	3,318
80-84	2,386	978	1,408	3,249	1,405	1,844	3,464	1,533	1,931
85+	1,962	659	1,303	2,782	1,021	1,761	2,974	1,101	1,873
Median Age	33.0	32.4	33.7	34.9	34.2	35.6	35.4	34.7	36.2

Source: [*https://live.laborstats.alaska.gov/pop/index.cfm*](https://live.laborstats.alaska.gov/pop/index.cfm)

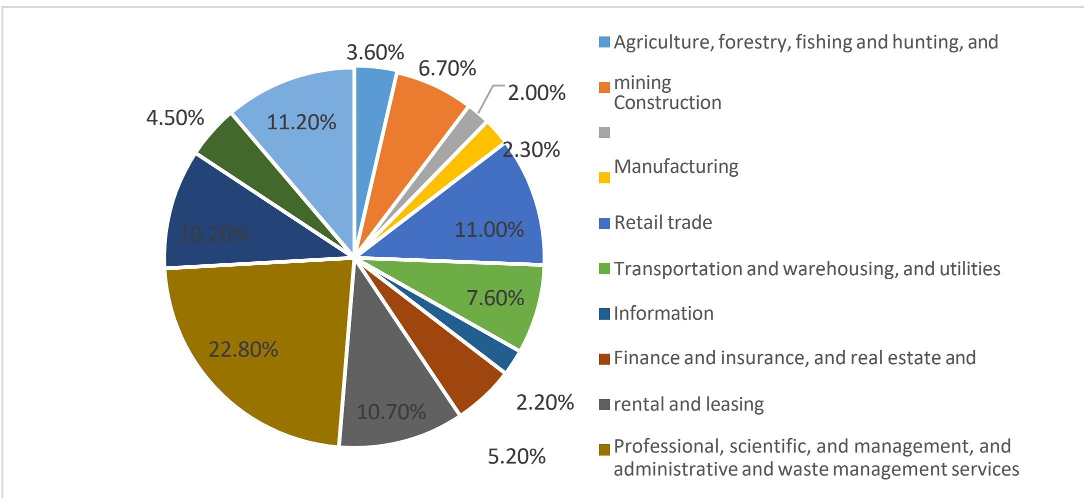
2.4.1 Future Population

Anchorage has lost over 12,000 residents since 2013. Anchorage Economic Development Corporation anticipates moderate additional population losses at least through 2025, driven by the same demographic and economic forces that have pushed the population lower over the past seven years. Where the decline in population might bottom out is unclear, but within their three-year forecast period it is expected that the outflow will ease and stabilize at around 285,000 residents.

2.5 Economy

At first glance, Anchorage appears off the beaten path, lying as far north as Helsinki, Finland, and almost as far west as Honolulu, Hawaii. However, its location, together with air, road, port, and rail transportation facilities, is the city's prime economic asset. Anchorage has capitalized on its location and versatile transportation assets to build a solid economic base. The community is firmly established as the statewide trade, finance, service, transportation, and administrative center and is the distribution gateway for central, western, and northern Alaska. Federal Express and the United Postal Service have made Anchorage a major hub and other firms have expanded their air cargo operations. With over 17 billion pounds of landed cargo, Ted Stevens Anchorage International Airport (TSAIA) is the nation's second busiest air cargo airport in the U.S. and fourth busiest in the world (AEDC). Figure 2.2 shows employment by industry in the MOA.

Figure 2.2 Employment by Industry: Municipality of Anchorage



Source: 2014 American Community Survey

The educational services, and health care services, and social assistance industry are the largest in the MOA. The growth in the health care sector is due largely to the expansion of hospitals and more local provision of services. Residents from outside Anchorage often receive treatment in Anchorage, and Anchorage residents can stay in Anchorage for more of their medical care instead of having to go to the "Lower 48."

Tourism is a growing part of the economy (Anchorage Visitor and Convention Bureau, undated). Anchorage continues to receive an increasing number of visitors due to the increase in conventions being held in Anchorage and visits associated with the cruise ship facilities in Seward and Anchorage.

In the Chugiak/Eagle River area, local retail growth in response to the increasing population has made retail trade the area's largest employment sector. Services are second, and the third-largest employment sector is government. Many government jobs are associated with education, although some are with the U.S. Postal Service and the Alaska Department of Corrections. Many residents commute to the Anchorage Bowl for employment (MOA, 2006). Approximately 85% of all workers in the Chugiak/Eagle River area work in the Anchorage Bowl (Department of Transportation and Public Facilities, 2009).

Girdwood's biggest economic sector is services, and the largest employer is the Alyeska Resort. The service industry has more than triple the amount of employment than the next closest category—construction. The third-largest employment sector is trade, mostly associated with tourism. There is seasonality to employment in Girdwood, as many of the jobs are associated with skiing in the winter or with the summer tourists. Many Girdwood residents who are not employed in the tourism sector commute into the Anchorage Bowl.

Approximately 12,000 people commute daily from the north of Anchorage. Another 16,000 commute from the Matanuska-Susitna Borough (ADOT Annual Average Daily Trips 2014).

Chapter 3 Asset Inventory

Before a community can develop its mitigation strategy, it needs to know what should be protected. The purpose of this chapter is to identify what needs to be protected, including Anchorage's critical facilities. Anchorage has many other assets that should be protected, including its infrastructure and existing development. This information will be used in Chapter 4 to describe Anchorage's vulnerability to each hazard.

3.1 Infrastructure

Infrastructure is the basic facilities and services needed for a community. Anchorage's infrastructure includes roads, water supplies, wastewater treatment plants, water and wastewater pipes, power plants, electrical lines, bridges, ports, airports, railroads, telecommunications equipment, schools, etc. The critical facilities matrix in Appendix D lists the hazards to which each facility is exposed.

3.1.1 Schools

The following is a list of public schools in Anchorage. In addition to those listed below, there are several private schools. Schools identified with an asterisk (*) after their name may be used as a shelter. School locations are shown in Figure 3.1.

Charter-

- Alaska Native Cultural
- Aquarian
- Eagle Academy
- Family Partnership
- Frontier Charter School
- Highland Tech High School
- Rilke Schule
- STrEam Academy
- Winterberry

Elementary

- Abbott Loop Elementary
- Airport Heights Elementary
- Alpenglow Elementary
- Aurora Elementary
- Baxter Elementary
- Bayshore Elementary
- Bear Valley Elementary
- Birchwood ABC
- Bowman Willard Elementary
- Campbell Elementary
- Chester Valley Elementary
- Chinook Elementary
- Chugach Optional Elementary
- Chugiak Elementary
- College Gate Elementary
- Creekside Park Elementary
- Denali Montessori Elementary
- Eagle River Elementary
- Fairview Elementary
- Fire Lake Elementary
- Girdwood Elementary*
- Gladys Wood Elementary
- Government Hill Elementary
- Homestead Elementary
- Huffman Elementary
- Inlet View Elementary
- Kasuun Elementary
- Kincaid Elementary
- Klatt Elementary
- Lake Hood Elementary
-
- Lake Otis Elementary
- Mountain View Elementary
- Muldoon Elementary
- North Star Elementary
- Northern Lights ABC
- Northwood Elementary
- Nunaka Valley Elementary
- O'Malley Elementary
- Ocean View Elementary
- Orion Elementary
- Ptarmigan Elementary
- Rabbit Creek Elementary
- Ravenwood Elementary
- Rogers Park Elementary
- Russian Jack Elementary*
- Sand Lake Elementary
- Scenic Park Elementary*
- Spring Hill Elementary
- Susitna Elementary
- Taku Elementary
- Trailside Elementary*
- Tudor Elementary
- Turnagain Elementary
- Tyson Elementary*
- Ursa Major Elementary
- Ursa Minor Elementary
- Williwaw Elementary
- Willow Crest Elementary*
- Wonder Park Elementary

Middle

- Begich Middle School*
- Central Middle School of Science
- Clark Middle School*
- Goldenview Middle School*
- Gruening Middle School*
- Hanshew Middle School*
- Mears Middle School*
- Mirror Lake Middle School
- Romig Middle School*
- Wendler Middle School*

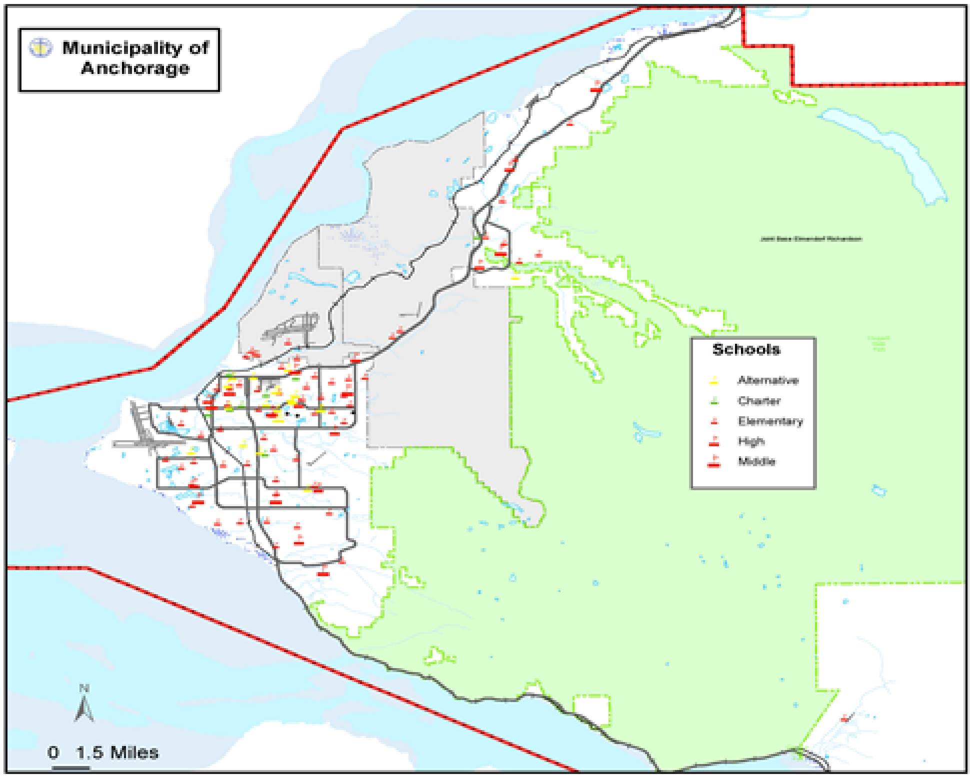
High

- Bartlett High School*
- Chugiak High School*
- Dimond High School*
- Eagle River High School*
- East High School*
- Service High School*
- South Anchorage High School*
- West High School*

Other

- ACT Program
- Alaska State School for the Deaf and Hard of Hearing
- ASD Virtual
- Benson Secondary/AVAIL/Crossroads
- Bragaw Heights
- Cordova Heights
- Debarr Heights
- Humphrey Heights
- Jesse Lee
- King Tech High School
- Maplewood
- McKinley Heights
- McLaughlin
- New Path
- PAIDEIA Cooperative
- Piper Heights
- Polaris K-12
- Providence Heights
- Puffin Heights
- SAVE High
- Stellar Secondary
- Turning Points
- Whaley School

Figure 3.1 Schools



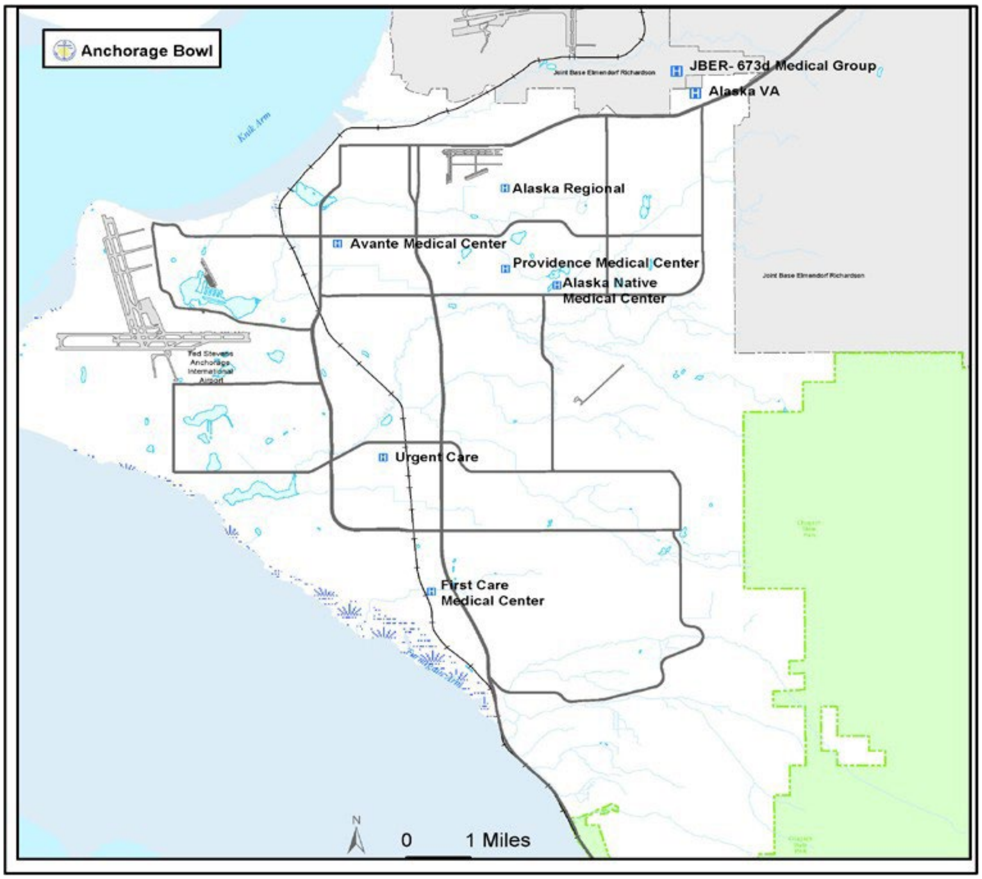
3.1.2 Hospitals and Medical Facilities

The main hospitals in Anchorage are:

- Alaska Native Medical Center
- Alaska Psychiatric Institute
- Alaska Regional Hospital
- Alaska VA Health Care System
- Anchorage Neighborhood Health Center
- Chris Kyle Patriot Hospital
- First Care Medical Center
- Joint Base Elmendorf/Richardson Hospital
- Medical Park Family Care
- North Star Behavioral Health System
- Providence Alaska Medical Center
- Providence Extended Care Facility
- St Elias Specialty Hospital

The locations of these facilities are shown in Figure 3.2.

Figure 3.2 Hospitals and Major Medical Facilities



3.1.3 Fire Departments

Fire protection in MOA is provided by several sources. The Anchorage Fire Department (AFD) covers most of the Anchorage Bowl. Outside the Bowl, communities rely on volunteer fire departments. The fire stations in MOA are:

- AFD Communications Center
- AFD Fire Station #1
- AFD Fire Station #3
- AFD Fire Station #4
- AFD Fire Station #5
- AFD Fire Station #6
- AFD Fire Station #7
- AFD Fire Station #8
- AFD Fire Station #9
- AFD Fire Station #10
- AFD Fire Station #11
- AFD Fire Station #12
- AFD Fire Station #14
- AFD Fire Station #15
- Ted Stevens Int'l Airport Aircraft/Rescue/Fire
- Joint Base Elmendorf/Richardson
- State of Alaska, Division of Forestry
- Bureau of Land Management Fire Services

- Chugiak Volunteer Fire Dept Station #31
- Chugiak Volunteer Fire Dept Station #32
- Chugiak Volunteer Fire Dept Station #33
- Chugiak Volunteer Fire Dept Station #34
- Chugiak Volunteer Fire Dept Station #35
- Station 41 Girdwood Volunteer Fire Dept
- Municipal Emergency Preparedness Office

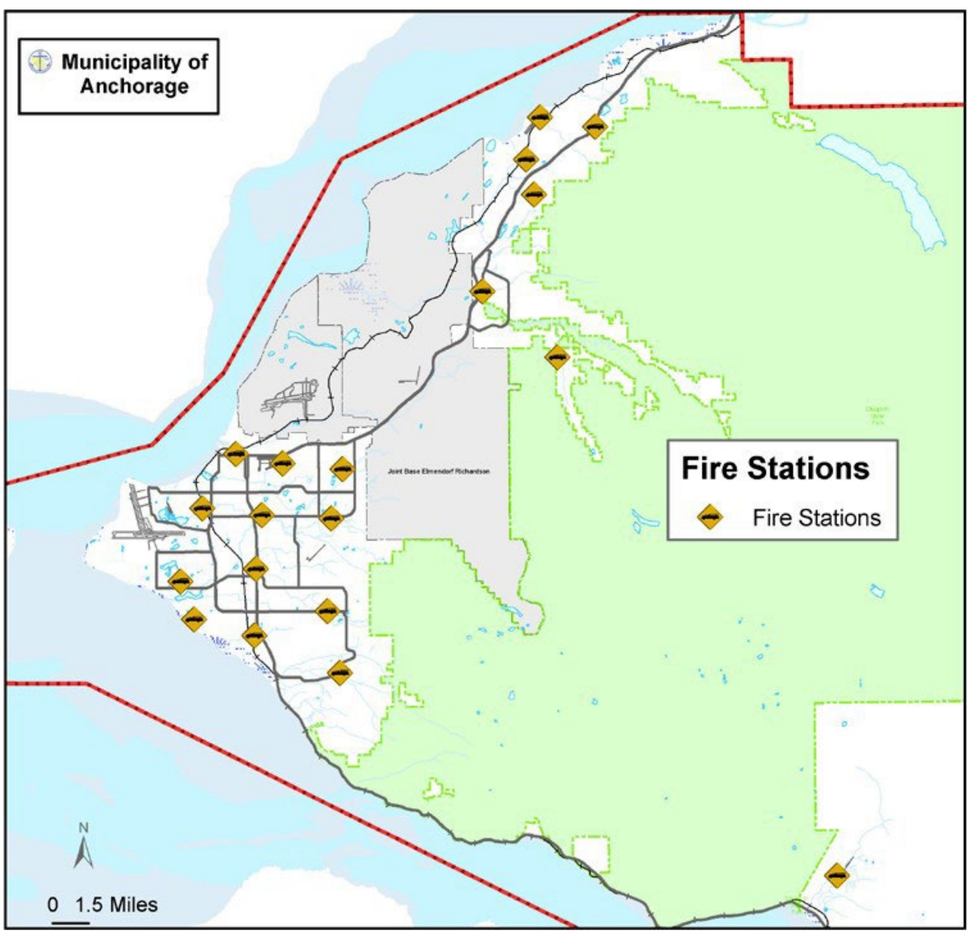
The locations of these stations are shown in Figure 3.3.

Figure 3.3 Fire Stations

3.1.4 Law Enforcement

Police protection is provided by the Anchorage Police Department (APD) and the Alaska State Troopers (AST). The Federal Bureau of Investigation (FBI) has an office in Anchorage. The law enforcement facilities in Anchorage include:

- Airport Police and Fire
- Alaska State Troopers Headquarters
- Anchorage Police Department Headquarters
- Anchorage Safety Center (Public Inebriate Title 47 Protective Custody Facility
- Eagle River Police Substation[3]
- APD Training/Miscellaneous
- Alaska State Court Building

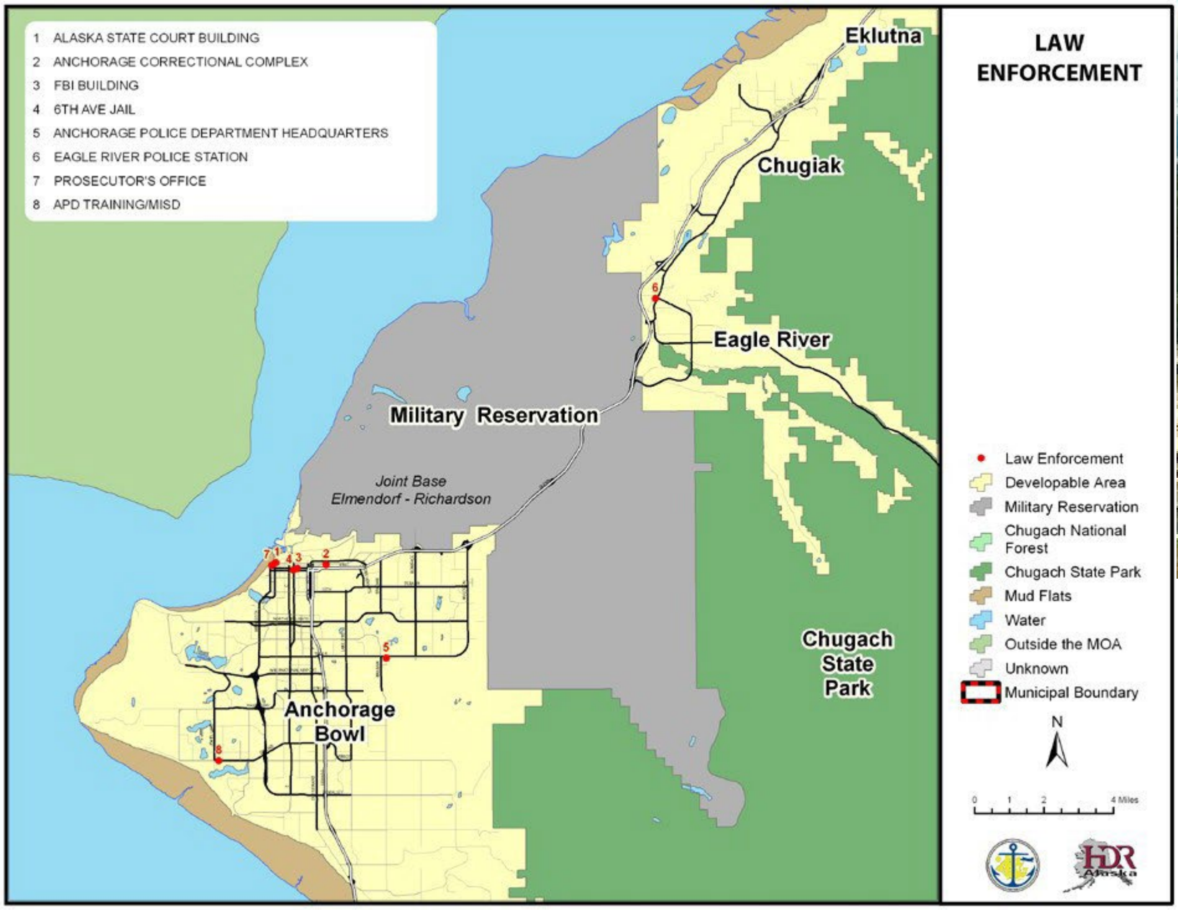


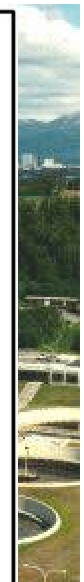
- Anchorage Correctional Complex
- Department of Homeland Security Immigration & Customs Enforcement
- Department of Justice
- Federal Emergency Management Agency
- FBI Building
- Prosecutor's Office
- U.S. Coast Guard Marine Safety
- U.S. Department of Homeland Security, U.S. Customs and Border Protection
- U.S. Drug Enforcement Administration

[3] There are other APD substations in the MOA. They are not listed here because they are not staffed facilities.

The locations of these facilities are shown in Figure 3.4.

Figure 3.4 Law Enforcement Facilities





3.1.5 Water Sources

The MOA gets its public potable water from three sources:

- Eklutna Water Treatment Plant (Eklutna Lake)
- Ship Creek Water Treatment Plant
- Wells

The Eagle River/Chugiak area relies on the Eklutna Water Treatment Plant; the Anchorage Bowl is supplied by the Eklutna Water Treatment Plant and the Ship Creek Water Treatment Plant, while Girdwood relies on wells that enter the distribution system at the Girdwood well house.

3.1.6 Wastewater Treatment Facilities

The MOA has three public wastewater treatment facilities:

- John M. Asplund Wastewater Treatment Facility
- Eagle River Wastewater Treatment Facility
- Girdwood Wastewater Treatment Facility

Some people have private on-site wastewater systems.

3.1.7 Electricity

Within MOA, electricity is provided by two utilities:

- Chugach Electric Association
- Matanuska Electric Association

These utilities operate several power plants within MOA, including:

John M. Asplund Wastewater Treatment

- George M. Sullivan Plant 2
- Generation Plant One (also known as Hank Nikkels Plant 1)
- Eklutna Hydroelectric Power Plant

In addition to the power plants, each utility operates substations and electrical (transmission and distribution) lines.

3.1.8 Airports

The largest airport in MOA is Ted Stevens Anchorage International Airport (TSAIA). It serves passenger and cargo travel. Merrill Field is one of the largest general aviation (limited to aircraft that weigh 12,500 pounds or less) airports in the United States. Lake Hood, Anchorage's only seaplane base, is considered to be the largestand most active seaplane base in the world (Alaska Department of Transportation & Public Facilities, 2016). However, many local lakes are used for floatplanes in the summer months. Other airports in the MOA are located in Birchwood, Campbell Airstrip, Joint Base Elmendorf Richardson and Girdwood.

3.1.9 Rail

The Alaska Railroad (ARRC) is headquartered in Anchorage, near Ship Creek. The main ARRC depot is near the headquarters, and the Bill Sheffield Depot is located at the Ted Stevens Anchorage International Airport. Within MOA, the ARRC has more than 100 miles of track.

3.1.10 Road

Within the MOA, there are more than 1,000 lane miles[4] of road, with numerous bridges, overpasses, etc. Most of the roads in the Anchorage Bowl are in the Anchorage Roads and Drainage Service Area

(ARDSA). Other parts of Anchorage are in Limited Road Service Areas. One of the largest is the Chugiak, Birchwood, Eagle River Rural Road Service Area (CBERRRSA), which has more than 350 lane miles of roadway. Some roadways and main arteries through the Anchorage bowl, including the Seward and Glenn Highways, are owned and maintained by the State.

3.1.11 Port of Alaska

The Port of Alaska is located at the mouth of Ship Creek. Port facilities include three general cargo terminals, two petroleum terminals, a dry barge landing, bulk cement-handling, gantry cranes and roll-on/roll-off capability. Docks are maintained at a full seaway depth of 35 ft. Most products used in Alaska are transported into our state on container ships and barges. The Port of Alaska handles three-quarters of all Southcentral Alaska/Railbelt-bound, waterborne, non-fuel freight.

Hazard materials are transported through the port as well as fuel for the entire state.

[4] Lane miles refer to a way of measuring a roadway based on its length and the number of lanes it has. A two lane street that is one mile long has two lane miles

3.1.12 Other Utilities

Natural Gas Utilities

- ENSTAR

Telephone/Communication Utilities

- GCI
- Alaska Communications Systems (ACS)
- Spark Wireless
- AT&T
- Alaska Telecom
- Matanuska Telephone Association (MTA) Wireless
- TelAlaska
- ASTAC
- Hughesnet
- Verizon
- Borealis Broadband
- ASTAC
- Alaska Fiber Star
- TelAlaska Long Distance, Inc.
- Level 3 Communications, LLC
- EarthLink Business, LLC
- France Telecom Corporate Solutions, LLC
- Comtec Business Systems, Inc.
- Starlink
- Mobilitie, LLC
- Mitel NetSolutions, Inc.
- Metropolitan Telecommunications of Alaska, Inc.
- QuantumShift Communications, Inc.
- Bowhead Communication Services, LLC
- Wide Voice, LLC

3.1.13 Historical Sites

According to the National Register Information System, the MOA has the following sites listed on the National Register of Historic Places. The State Historic Preservation Office's (SHPO) Alaska Heritage Resources Survey (AHRS) has many more sites considered historically significant within MOA. Because the AHRS has numerous entries and is not available to the general public, information about these sites is not listed here. For more information about these resources, please contact the SHPO. Several historic properties listed on the National Register of Historic Places were also adopted into the Four Original Neighborhoods Historic Preservation Plan as "Landmarks to Save". This includes the Government Hill Wireless Station, Block 13-Army Housing Association Historic District, and the Government Hill Water Tower. Contact the Anchorage Historic Preservation Program Officer for additional information.

Table 3.1 National Register of Historic Places

Resource Name	Address	City	Listed
A. E. C. Cottage No. 23	618 Christensen Dr.	Anchorage	1990-06-11
Alaska Engineering Commission Cottage No. 25	645 W. 3rd Ave.	Anchorage	1996-02-16
Alex, Mike, Cabin	Off AK 1	Eklutna	1982-09-08
Anchorage Cemetery	535 E. 9th Ave.	Anchorage	1993-04-26
Anchorage City Hall	524 W. 4th Ave.	Anchorage	1980-12-02
Anchorage Depot	411 W. 1st Ave.	Anchorage	1999-08-27
Anchorage Hotel Annex	330 E St.	Anchorage	1999-04-15
Anderson, Oscar, House	4th Ave. extended	Anchorage	1978-06-13
Atwood Campus Center	University Drive	Anchorage	1979-06-22
Beluga Point Site	Address Restricted	Anchorage	1978-03-30
Block 13-Army Housing Association Historic District	Between A and Cordova Streets and 10th and 11th Avenues	Anchorage	Pending, locally eligible
Civil Works Residential Dwellings	786 and 800 Delaney St.	Anchorage	2004-07-21
Crow Creek Consolidated Gold Mining Company	NE of Girdwood	Girdwood	1978-09-13
David, Leopold, House	605 W. 2nd Ave.	Anchorage	1986-07-24
Eklutna Power Plant	NE of Anchorage	Anchorage	1980-06-20
Federal Building-U.S. Courthouse	601 W. 4th Ave.	Anchorage	1978-06-23
Fourth Avenue Theatre (AHRS Site No. ANC-284)	630 W. 4th Ave.	Anchorage	1982-10-05
Gill, Oscar, House	1344 W. 10th Ave.	Anchorage	2001-02-02
Government Hill Federal Housing Historic District		Anchorage	2015-14-01
Government Hill Water Tower	West Harvard Avenue	Anchorage	Pending, locally eligible

Government Hill Wireless Station	123 West Manor	Anchorage	Pending, locally eligible
Historic Pioneer School House	3rd Ave. and Eagle St.	Anchorage	1980-12-03
Indian Valley Mine	Address Restricted	Indian	1989-10-25
KENI Radio Building	1777 Forest Park Dr.	Anchorage	1988-04-18
Kimball's Store	500 and 504 W. 5th Ave.	Anchorage	1986-07-24
Loussac-Sogn Building	425 D St.	Anchorage	1998-05-20
McKinley Tower Apartments	337 E. 4th Ave.	Anchorage	2008-09-12
Mt. Alyeska Roundhouse	Approx. 2 mi. W of Alyeska	Girdwood	2003-11-05
Nike Site Summit	Off Arctic Valley Rd., 12.5 mi. E of Anchorage	Anchorage	1996-07-11
Old St. Nicholas Russian Orthodox Church	Eklutna Village Rd.	Eklutna	1972-03-24
Pilgram 100B Aircraft	Anchorage Aviation Heritage Museum	Anchorage	1986-07-08
Potter Section House	Off AK 1	Anchorage	1985-12-06
Spring Creek Lodge	18939 Old Glenn Hwy.	Chugiak	2001-09-09
WendlerBuilding[5]	400 D St.	Anchorage	1988-06-24

Source: National Register of Historic Places

3.2 Existing Development in MOA

Anchorage's history has shaped its development patterns, making the Anchorage Bowl the dominant area locale in terms of developed areas in the region. Table 3.2 shows the number of parcels (by land use) in the Anchorage Bowl, the Turnagain Arm area (including Girdwood), and the Chugiak/Eagle River area. Table 3.3 shows the taxable value of the land and buildings in the MOA by land use. The number of parcels was used as a substitute for the number of structures, as it is assumed that the non-vacant parcels include existing structures (which determine the land use). Development data from 2009 and 2016 has been provided to show potential growth trends. Some of the changes are due to better available data or changes in data collection. Overall, the biggest increase is in residential development.

[5] The Wendler Building does not appear on the National Park Service's National Register of Historic Places Database. However, the weekly register listing for 1988 states this property was entered in the National Register (National Park Service, 1998).

Table 3.2 Number of Parcels by Land Use

Type of Parcels	In Turnagain Communities	In Chugiak/Eagle River	In Anchorage Bowl
Residential	1,485	12,935	60,603

Commercial	225	465	3,375
Industrial	20	86	2,491
Institutional	25	205	805
Parks, Open Space, and Recreation	2	194	40
Transportation-Related	91	110	493
Other Land Uses	0	145	213
Vacant Land	621	2,608	7,891
Unidentified	7	80	141
Total	**1,855**	**14,220**	**68,131**

Source: MOA GIS, 2016

Table 3.3 Total Parcels and Taxable Value for MOA

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	75024	8526159300	17756156200	26282315500
Commercial	4065	2568664400	4512337400	7081001800
Industrial	2597	1494944600	1907337000	3402281600
Institutional	1035	1215398400	1554183700	2769582100
Open Space	44	24995700	503000	25498700
Transportation	664	0	0	0
Other	562	377462100	36697800	414159900
Vacant	228	0	0	0
Total	84219	14207624500	25767215100	39974839600

Source: MOA-GIS 2016

3.3 Future Development

Anchorage 2020, the Chugiak Eagle River Comprehensive Plan Update, the Girdwood Area Plan, and numerous other plans all describe future development in the MOA. A few items are highlighted below because they could have a strong influence in the MOA's future vulnerability. It is important to know and track where and what will be developed in the future to plan for its protection and to mitigate hazards during development.

3.3.1 Housing

According to the March 2012 *Anchorage Housing Market Analysis*, by McDowell Group and ECO Northwest, there is not enough buildable land to accommodate future housing demand under historical development patterns, current land use policies, and development options. The study forecasts a demand for about 18,200 new dwellings in the Anchorage Bowl and 3,300 new dwellings in Chugiak- Eagle River over the next 20 years. However, the study predicts that without increasing the current level of housing density and increasing the rate of redevelopment, the Anchorage Bowl will lack land for about half of the expected demand.

While Chugiak-Eagle River has enough land to meet its own projected demand for all housing types, the study finds it cannot accommodate all the Bowl's projected demand as well.

3.3.2 Infrastructure

It is expected that MOA will experience more utility development, including:

- Electrical infrastructure improvements and a new electrical substation to serve southeast Anchorage. The location for the substation has yet to be identified. For more information on potential improvements, please contact Chugach Electric. https://www.chugachelectric.com
- New water and sewer lines (locations to be determined during the Water Master Plan and the Wastewater Master Plan updates). For more details about this process, please visit http://www.awwu.biz

3.3.3 Transportation

Population forecasts of more than 500,000 residents in the Mat-Su Borough and the Municipality of Anchorage by 2035 drive a multi-faceted approach toward meeting area transportation needs. The expectation is that there will be greater total vehicle miles traveled throughout the region as greater shares of the population move to more suburban locations, and employment grows predominantly in the Anchorage Bowl. Increased population densities in the Downtown, Midtown, and U-Med District will provide demand and opportunities for increased access by public transportation and non-motorized transportation. Specific recommendations are contained in the *2035 Metropolitan Transportation Plan* and the *Interim 2035 Metropolitan Transportation Plan* (June 26, 2015 public review draft).

3.3.4 Other Plans

Table 3.4 lists several plans that help guide where future development in the MOA will occur.

Table 3.4 MOA Publications, Studies, and Adopted Plans

Name of Plan	Year of Adoption or Publication
Anchorage 2020 – Anchorage Bowl Comprehensive Plan	2001
Anchorage Wetlands Management Plan	2014
Chugiak-Eagle River Comprehensive Plan	2006
Crow Creek Neighborhood Land Use Plan	2007
East Anchorage District Plan	2015
Eagle River Greenbelt Plan	1992
Fairview Neighborhood Plan	2014
Girdwood Commercial Area and Transportation Master Plan	2001
Girdwood Area Plan	1995
Girdwood-Iditarod Trail Route Study	1997
Glacier-Winner Creek Access Corridor Study	1997
Government Hill Neighborhood Plan	2013
Historic Preservation Plan for Anchorage’s Four Original Neighborhoods	2013
Potter Valley Land Use Analysis	1999

Section 36 Land Use Study	1992
Ship Creek/Waterfront Land Use Plan	1991
Ship Creek Framework Plan	2014
Spenard Community District Development Plan	1986
3500 Tudor Road Master Plan	2007
Tudor Road Public Lands and Institutions Plan	1986
Utility Corridor Plan	1990
Downtown Anchorage Seismic Risk Assessment and Land Use Regulations to Mitigate Seismic Risk	2010
Geotechnical Hazards Assessment Study (Harding-Lawson Associates)	1979
Snow Avalanche and Mass-wasting Hazard Analysis – Glacier/Winner Creek Areas, Alaska	1993
Anchorage Commercial Land Assessment	2012
Anchorage Housing Market Study	2012
Anchorage Police Department Strategic Plan	2009 - 2013
Anchorage Wildfire strategic Plan	2003
Spenard Corridor Plan	2020
Anchorage 2040 Land Use Plan	2017
Turnagain Arm Comprehensive Plan	2009

Chapter 4- Hazards in the Municipality of Anchorage

4.1 Risk Assessment Overview

The Municipality of Anchorage (MOA) Mitigation Program and the All-Hazard Mitigation Plan support the Office Emergency Management goals, strategies, and tactics. The Plan is a living document that is continually updated as information related to hazards in the MOA is discovered. Although this plan was approved in 2022, substantial updates to the plan were necessary in order to document the MOA's updated risk picture. For example, the State of Alaska Division of Geological & Geophysical Surveys, the Alaska Earthquake Center, and scientists from University of Alaska Fairbanks released the results of a large Tsunami study that clearly identified tsunami inundation hazard, risk, and consequences to the MOA.

This plan also serves as a companion document to the MOA's Comprehensive Emergency Management Plan (CEOP) which guides the MOA's planning, prevention, response, recovery, and mitigation against hazards that impact the residents and visitors to Anchorage.

To properly plan and prepare the residents, visitors, and stakeholders of the MOA an updated Hazard Identification and Risk Analysis (HIRA) was conducted, concluding in December 2024. The HIRA identified previously undocumented consequences on people, property, critical facilities, delivery of MOA services, and on the environment. One specific consequence that had not been documented was the OEM's continuity of operations during a flooding event, for example. Understanding these consequences are paramount to emergency responders, neighborhood planners, and community leaders who support the efforts of identifying hazards and reducing the impacts, consequences, and losses on people, property, the economy, and the environment.

4.2 Hazard Ranking

Hazard mitigation plans are required to summarize the vulnerability to and potential consequences of the hazards. The 2022 vulnerability information was calculated by identifying the parcels that intersect each of the hazard zones. Some notes about this method are:

- The taxable value is based on 2021 MOA tax assessor data
- Using the taxable value underestimates the vulnerability because:
    - Some parcels, such as schools, religious facilities, and military land, are nottaxed and therefore do not have a taxable value.
    - Some parcels are treated as economic units (separate parcels that are treated as one for tax purposes) and do not have taxable values listed.
    - Taxable value does not consider the value of the contents.
    - The taxable value is the sum of the land and building taxable values. This is different from the total taxable value listed in the tax assessor's file becausetax exemptions have been applied to those totals.
    - If a parcel was in multiple risk areas, the entire parcel was considered to bein the highest risk area (i.e., no partial parcels). However, depending on how much of the parcel is in the hazard zone and site specific factors, existing or future structures may not be at risk.
    - The number of unidentified parcels could be wrong due to data issues (i.e., extra polygons in the GIS file, not all tax records associated with aparcel, etc.).

It is important to remember that the information listed in this chapter is meant to provide an overview of each hazard. While based on the best available information, the information is forplanning purposes and should not be used for purposes which it was not intended such as securing permits, or for construction.

As part of this update, MOA departments, along with several state and federal agencies, were contacted to discover if new information was available. When available, the additional information was incorporated into the plan. The tables showing the number of parcels vulnerable to each hazard have been updated. The section on volcanoes was revised to focusmore on volcanic ash as this is the biggest threat to the MOA compared to other aspects of a volcanic event.

Plan information is continually updated and the current plan made a specific effort to make the hazard descriptions and vulnerabilities more specific to communities within the jurisdictional boundaries of the MOA

Most of the original vulnerability information describing these hazards is from the 2018 StateHazard Mitigation Plan and is used by permission from the DHS&EM.

<u>4.2.1 Updated Hazard Identification and Risk Analysis</u>

Following approval of the 2022 All Hazards Mitigation Plan additional concerns related to the possibility of a risk of Tsunami prompted Office Emergency Management to conduct a Hazard Identification and Risk Analysis (HIRA) that updated risk, threat, vulnerability, and consequence scores for the identified hazards using the following methodology:

Overall Risk

Once each element was reviewed, each hazard was given an overall risk score.

3-5 = Low • 6-7 = Medium • 8-9 = High

Threat	Vulnerability	Consequence
Measures the recurrence interval of each hazard	Measures exposure of people, property, infrastructure and operations	Evaluates the severity of impact of people, property, environment, and operations.

3 (High): Expected recurrence within 3 years **2 (Moderate):** Recurrence expected within 10 years **1 (Low):** Not expected to reoccur within 10 years	**3 (High):** Majority of planning area/infrastructure is highly vulnerable **2 (Moderate):** Significant portions are at risk **1 (Low):** Minimal portion affected	**3 (High):** Severe impact lasting over 1 week **2 (Moderate):** Moderate impacts lasting under 1 week **1 (Low):** Minimal or short-lived impacts, under 24 hours

4.3 Hazard Profiles

4.3.1 EARTHQUAKES

Local Mitigation Plan Review Tool **1. REGULATION CHECKLIST** **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)
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))	4.1.1 Earthquakes pg. 39-40

Alaska is one of the most seismically active regions in the world and is at risk of societal andeconomic losses due to damaging earthquakes. The 2002 Denali fault ruptured, causing the largest earthquake (Magnitude [M] 7.9) of its kind in North America in over 100 years. On average, Alaska has one "great" (M>8) earthquake every 13 years, one M 7-8 earthquake every year, and six M 6-7 earthquakes every year. Additionally, earthquakes that occur on tectonic plate boundary faults near the coast can generate tsunamis that impact coastal communities (see Tsunami). Earthquakes have killed more than 130 people in Alaska during the past 60 years, and as population centers near active faults and coastlines continue to grow itis imperative that Alaskans prepare for future events.

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

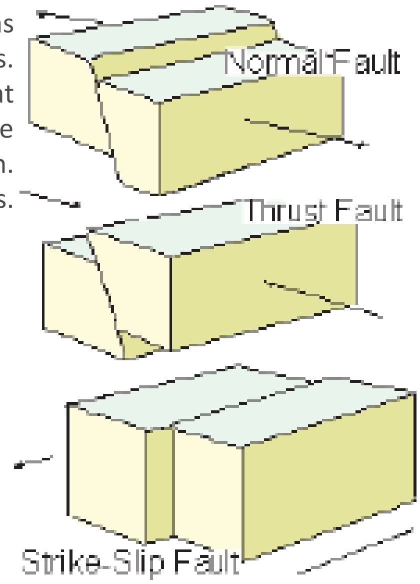
Alaska earthquake statistics

- Alaska is home to the second-largest earthquake ever recorded (1964 GreatAlaska Earthquake, moment magnitude 9.2)
- Alaska has approximately 11 percent of the world's recorded earthquakes
- Three of the eight largest earthquakes in the world were in Alaska
- Seven of the ten largest earthquakes in the U.S. were in Alaska

In addition to the previously mentioned large earthquakes, since 1900, Alaska has had an averageof

- 45 magnitude 5 – 6 earthquakes per year
- 320 magnitude 4 – 5 earthquakes per year
- 1,000 earthquakes located in Alaska each month

Source: Alaska Earthquake Center (AEC)



Earthquake shaking is caused by the release of elastic strain energy that has accumulated on faults within or atthe boundary between earth's tectonic plates. Tectonic plates are thin, brittle pieces of the crust (the outer, rigidlayer of earth) that move across the earth's surface relative to each other, like slabs of ice on a lake. The plates are constantly in motion because of forces originating from within the earth. The plates' motion causes energy buildup that is periodically released in earthquakes.

Ground shaking is responsible for most of the damage. Ground shaking is the result of the three classes of seismicwaves generated by an earthquake. Primary waves (P waves) are the first waves, often felt as a sharp jolt.

Secondary, or shear, waves (S waves) are slower and usually have a side-to-side movement. They can be very damaging because structures are more vulnerable to horizontal than vertical motion. Surface waves are the slowest waves, but they can carry thebulk of the energy in a large earthquake.

The intensity of the shaking is dependent on many factors, including the magnitude of thequake, the geology of the area, distance from the epicenter, building design, and local construction practices. The amount of damage to buildings depends on how the specific characteristics of each incoming wave interact with the buildings' height, shape, and construction materials.

Surface faulting is the differential movement of the two sides of a fault. There are three general types of faulting: strike-slip, normal, and thrust (reverse). Strike-slip faults are where each side of the fault moves horizontally. Normal faults have one side dropping down relative to the other side. Thrust (or reverse) faults have one side moving up and over the fault relativeto the other side.

Secondary Hazards

Secondary effects from an earthquake include seismically induced ground failure, snow avalanches,tsunamis, landslides, and infrastructure failure. Thesewill be discussed in greater detail in other sections ofthe plan.

Magnitude and Intensity

Earthquakes are usually measured in terms of their magnitude and intensity. Magnitude is related to theamount of energy released during an event, while intensity refers to the effects on

Richter Scale

On the Richter scale, magnitudeis expressed in whole numbersand decimals. A 5.0 earthquakeis a moderate event; a 6.0 characterizes a strong event; a 7.0 is a major earthquake; and agreat earthquake exceeds 8.0. The scale is logarithmic and open-ended.

people and structures at a particular place. Each earthquake will have only one magnitude but may have many intensities. Earthquake magnitude is usually reported according to the standard Richter scale (M_L) for small to moderate earthquakes. Large earthquakes are reported according to the moment-magnitude scale (M_W) because the standard Richter scale does not adequately represent the energy released by these large events.

Peak Ground Acceleration

Peak ground acceleration (PGA) in percent of g with 10% probability of exceedance in 50 years represents the ground motions that can be reasonably expected in a 50-year period. The acceleration values are the *peak* or maximum values expected during the earthquake. The "10% probability of exceedance in 50 years" refers to the fact that earthquakes are somewhat random in occurrence. One cannot predict exactly whether an earthquake of a given size will or will not occur in the next 50 years.

Intensity is usually reported using the Modified Mercalli Intensity Scale (MMI). This scale has 12 categories ranging from not felt to total destruction. Different MMI values can be recorded at different locations for the same event, depending on local circumstances such as distance from the epicenter or building construction practices. Soil conditions in Anchorage are a major factor in determining an earthquake's intensity, as areas with unconsolidated fill, liquefiable soils, or that are susceptible to lateral spread will sustain more damage than areas with shallow bedrock. Seismic landslide hazard is a key local issue and is discussed in more detail in see section 4.1.6 Landslide/Ground Failure.

Location

The entire MOA faces a significant threat from earthquakes. Earthquakes that result from the Pacific Plate subducting beneath the North American Plate are most likely to impact the MOA(Haeussler, 2010).

Likelihood of Occurrence

While it is impossible to know when the next earthquake will affect MOA, given the MOA's seismic history, earthquakes will continue to occur. Earthquakes are commonplace throughoutmuch of Alaska. On average there is a magnitude 7 or greater earthquake somewhere in or offshore Alaska every 1 to 2 years and a magnitude 8 or greater quake about every 13 years. However, given Anchorage's geologic situation, a dangerous damaging earthquake with a lower magnitude of 7 or 8 could occur at any time in the MOA. See Hazard Rating Matrix, Table1.2.

Peak ground acceleration with a 10% probability of exceedance in 50 years represents events that are reasonably expected to occur. Peak ground acceleration (PGA) is one method to measure the strength of ground movements. The MOA has a peak ground acceleration of 40%g (Wesson et al, 2007). This can be considered a high seismic hazard.

Historic Events

2018 Anchorage Earthquake

The November 30, 2018, Mw 7.1 earthquake near Anchorage, Alaska, occurred as the result of normal faulting at a depth of about 40 km. Focal mechanism solutions for the event indicate slip occurred on a moderately dipping fault striking north-south (dipping either to the east at about 30 degrees, or the west at about 60 degrees). At the location of this earthquake, the Pacific plate is moving towards the northwest with respect to the North America plate at about 57 mm/yr, subducting beneath Alaska at the Alaska- Aleutians Trench, approximately 150 km south-southeast of this event. The location and mechanism of this earthquake indicate rupture occurred on an intra-slab fault within the subducting Pacific slab, rather than on the shallower thrust-faulting interface between these two plates.

The Minnesota off ramp, was heavily damaged by an earthquake on November 30, 2018.

1964 Good Friday Earthquake

The best-known earthquake in Anchorage's history is the March 27, 1964 Good Friday earthquake. This 9.2 MW earthquake is the largest ever recorded in North America and the second largest in the world. The shaking lasted between four and five minutes and was felt over an area of approximately seven million square miles. This earthquake occurred at approximately 5:36 pm. The timing of the event may have saved many lives, as several structures with the most damage, such as the Government Hill School were unoccupied at this time. In 1973, the National Research Council observed that this event could have had 50 times the number of deaths and 60 times as much property damage if it had affected a more densely populated area during work/school hours. The ground shaking caused a significant amount of ground deformation as well as triggering landslides and tsunamis. The Turnagain Heights landslide was the most damaging, with more than 100 homes destroyed.

The Government Hill School after the 1964 Good Friday earthquake

Vulnerability

An earthquake could affect the entire Municipality especially as it is more densely populated now. The exact number and location of impacted structures will depend on the size, location and frequency of the earthquake. The type of building also plays a role. For example, unreinforced masonry buildings tend to be more vulnerable to earthquake damage than wood framed buildings. Many of the MOA's taller buildings are located in Downtown and Midtown. In addition, infrastructure, including roads and utilities, and other development is vulnerable to an earthquake. The disruptions to the transportation infrastructure including bridges can have an impact on emergency response activities.

Table 4.1 Earthquake Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	88,179	9,167,565,472	19,136,201,460	28,303,766,932

Commercial	9,860	5,444,977,037	9,619,693,300	15,064,670,337

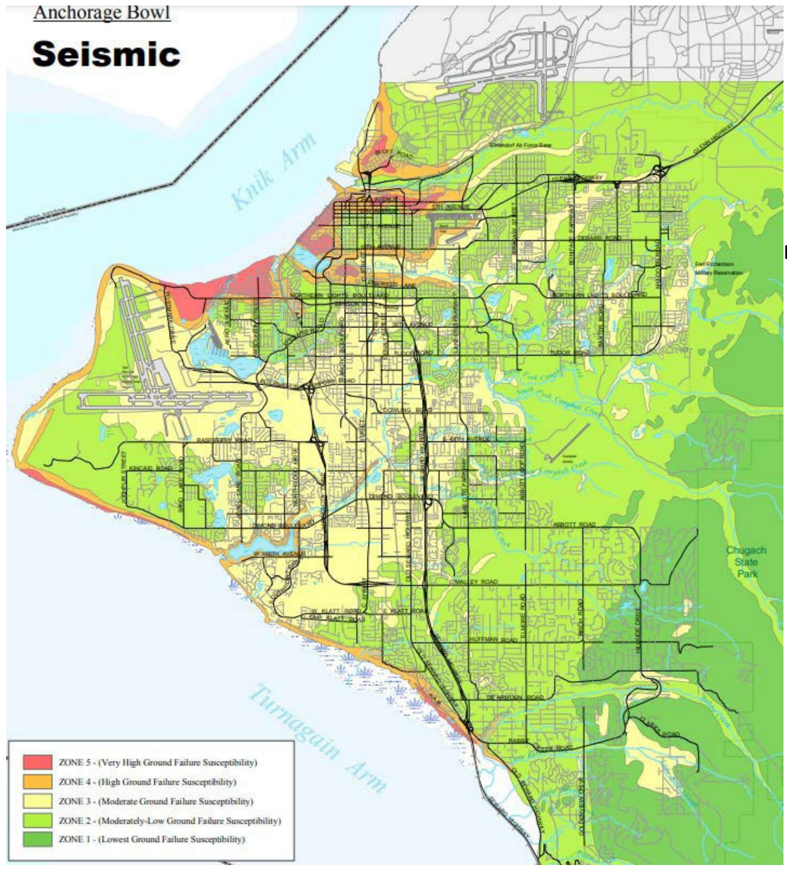
Source: MOAGIS, 2021

Earthquakes have a higher potential for injuries and fatalities than many of the other hazards in the MOA. While everyone in the MOA could be impacted by an earthquake, some populations, such as those living in poorly constructed housing may be more vulnerable than other populations. People could be impacted by the loss of utilities and business closures. The MOA is also likely to experience a decrease in tourism following an earthquake.

While the entire Municipality is at risk, communities within the jurisdiction have additional risks that impact the vulnerability to earthquakes. Factors that affect these areas are seismic zones.

Map 4.1 Anchorage Seismic Zones represents a map of the variations in hazards.

Map 4.1 Seismic Zones



4.3.1.1 Earthquake Risk Assessment Overview

In 2017 FEMA performed an earthquake risk assessment using Hazus for a Municipality of Anchorage Risk Report. The assessment used a Shake Map created for the M7.1 Border Ranges Scenario.

The team completed all three earthquake risk assessments using local parcel data from the Municipality of Anchorage and the Shake Map as shown in Maps 4.2.

For the study, the team incorporated individual parcel data from the Municipality of Anchorage into Hazus to allow losses to be reported at the parcel level. The team incorporated only properties with buildings (improvements) into the analysis; therefore, the team did not assess impacts to vacant land. The building loss from earthquake assessment is Table 4.2 and displayed in Maps 4,5, and 6.

Table 4.2 Hazus Earthquake Results for M7.1 in the Municipality of Anchorage

COMMUNITY NAME	TOTAL ESTIMATED VALUE GS AND CONTENTS IN DOLLARS)	TOTAL NUMBER OF	BORDER RANGES M7.1 SCENARIO	
			TOTAL DOLLAR	LOSS RATIO
chorage				

Anchorage	$57.5B	71,430	$616.5M	1.07%
Chugiak	$1.7B	2,896	$86.1M	4.96%
Eagle River	$4.4B	9,038	$222.4M	4.59%
Girdwood	$513.7M	1,388	$424,586	0.08%
Indian	$69.0M	130	$140,384	0.20%

Source: FEMA Municipality of Anchorage Risk Report

Building and content values in the Municipality of Anchorage total $65 billion and are highest in Anchorage ($57 billion). Eagle River ($4 billion) and Chugiak ($1 billion) have the second and third highest total building and content values.

Losses estimated from the M7.1 Border Ranges Scenario were high across all communities. The team estimated total building and content dollar loss at close to $951 million, with a municipality-wide loss ratio of 1.44 percent. The team projected that Chugiak (4.96 percent), Chugach State Park (4.67 percent), and Eagle River (4.59 percent) will have the highest loss ratios. The largest total loss values are projected for Anchorage ($616 million) and Eagle River ($222 million).

4.3.1.2 Earthquake Consequence Analysis

Impacts on the Public
An earthquake in MOA could result in casualties, injuries, and displaced residents, particularly for individuals in vulnerable or densely populated areas. Public safety could also be compromised by damaged infrastructure, collapsed buildings, and disrupted utilities.

Impacts on Responders
First responders may encounter challenges including limited access to impacted areas, hazardous building conditions, and the need for widespread search and rescue operations may delay response times and strain emergency resources. Compromised transportation routes and potential exposure to hazardous materials released by the event could also be a threat. Earthquakes can also damage buildings that house responder capabilities. Additionally, MOA's location does not allow for back up or mutual aid efforts from neighboring communities, therefore first responders are often survivors of hazards, like earthquakes, and are trying to recover while assisting in response efforts.

Impacts on Continuity of Operations
Municipal operations could be severely disrupted by an earthquake, particularly due to damage to critical infrastructure such as water treatment plants, emergency response centers, and transportation hubs. Extended utility outages could hinder governmental functions, impede emergency management and strain public services.

Impacts on Property
An earthquake could cause significant property damage, especially to older or unreinforced buildings. Earthquake shaking, liquefaction, and landslides can lead to structural collapse, foundation failure, and soil displacement. Critical infrastructure, including utilities and transportation networks, may suffer extensive damage, prolong recovery and impact response.

Impacts on the Environment
Coastal areas could experience shoreline subsidence or uplift, altering marine and estuarine ecosystems. River and stream systems may be rerouted or contaminated by sediment and debris, impacting aquatic life. Earthquake-triggered

spills from industrial facilities or wastewater systems could release pollutants, posing long-term risk to soil, water and wildlife.

Impacts on the Economy
Property damage to homes, businesses, and infrastructure would drive up repair costs and create prolonged disruptions, particularly to retail, manufacturing and tourism sectors. Utility outages and transportation route closures would hamper business operations and supply chains, while extensive repair costs could lead to a temporary housing crisis for displaced residents.

Impacts on Public Confidence in the Jurisdiction
Prolonged disruptions to essential services like water, power, and emergency healthcare, coupled with visible property damage and infrastructure challenges, may lead to frustration among residents. Communication gaps or delays in relief and recovery actions could amplify concerns about preparedness and resilience.

Essential Facilities

The project team extracted essential facilities identified by the Municipality of Anchorage from the building analysis as shown in Table 4.3.

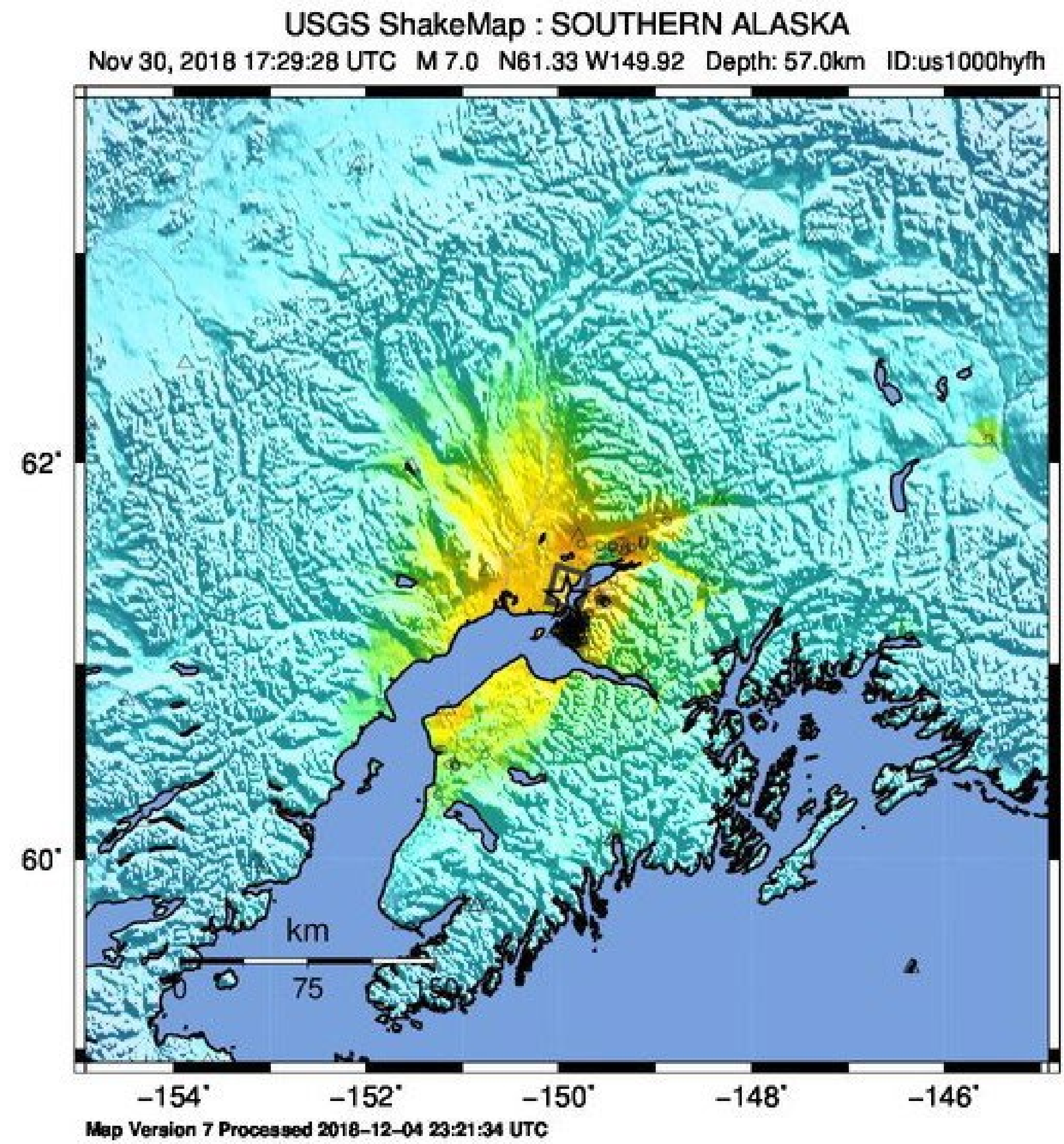
Table 4.3: Essential Facility Damage due to a M7.1 Border Ranges Scenario in the Municipality of Anchorage

ESSENTIAL FACILITY	TOTAL FACILITIES (HAZUS OUTPUT AVAILABLE)	TOTAL FACILITIES VALUE (BUILDING AND CONTENTS)	FACILITIES WITH 5% LOSS RATIO OR HIGHER	PERCENT FACILITIES WITH 5% LOSS RATIO OR HIGHER	TOTAL LOSS	LOSS RATIO
EOC	1	$68.7M	0	0.00%	$2.0M	2.85%
FIRE	19	$374.2M	4	21.05%	$6.3M	1.68%
HEALTH CARE	7	$2.2B	0	0.00%	$42.6M	1.98%
POLICE	2	$56.8M	1	50.00%	$1.6M	2.81%
SCHOOL	91	$3.9B	5	5.49%	$63.6M	1.64%
TOTAL	**120**	**$6.5B**	**10**	**8.33%**	**$116.0M**	**1.78%**

Source: FEMA Municipality of Anchorage Risk Report

Of the essential facilities with a Hazus earthquake output, the project team found that the M7.1 Border Ranges Scenario has the highest total loss at $115 million (also displayed in Map 4.4). This would account for nearly 1.78 percent of defined facilities within the Municipality of Anchorage. For this scenario, no Emergency Operation Centers would experience a loss ratio of 5 percent or higher, allowing emergency services to be maintained and monitored during an estimated earthquake scenario. It was also estimated that 10 facilities with a 5 percent or higher loss ratio. The facilities are schools (five buildings), fire (four buildings), and police (one building). The projection is that schools would have the highest total loss values of all defined facilities.

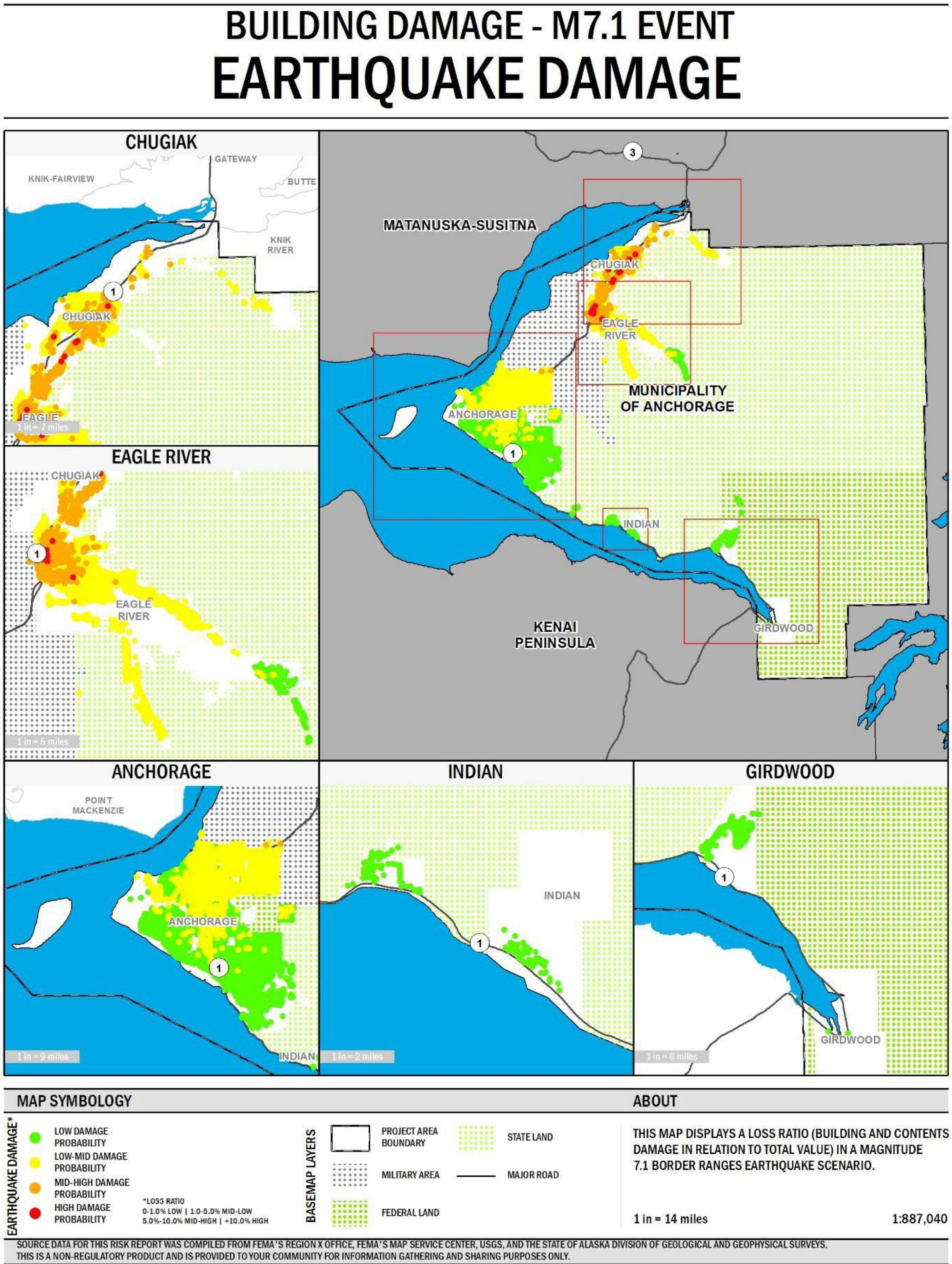
Map 4.2 Shake Map of November 30, 2018 Earthquake



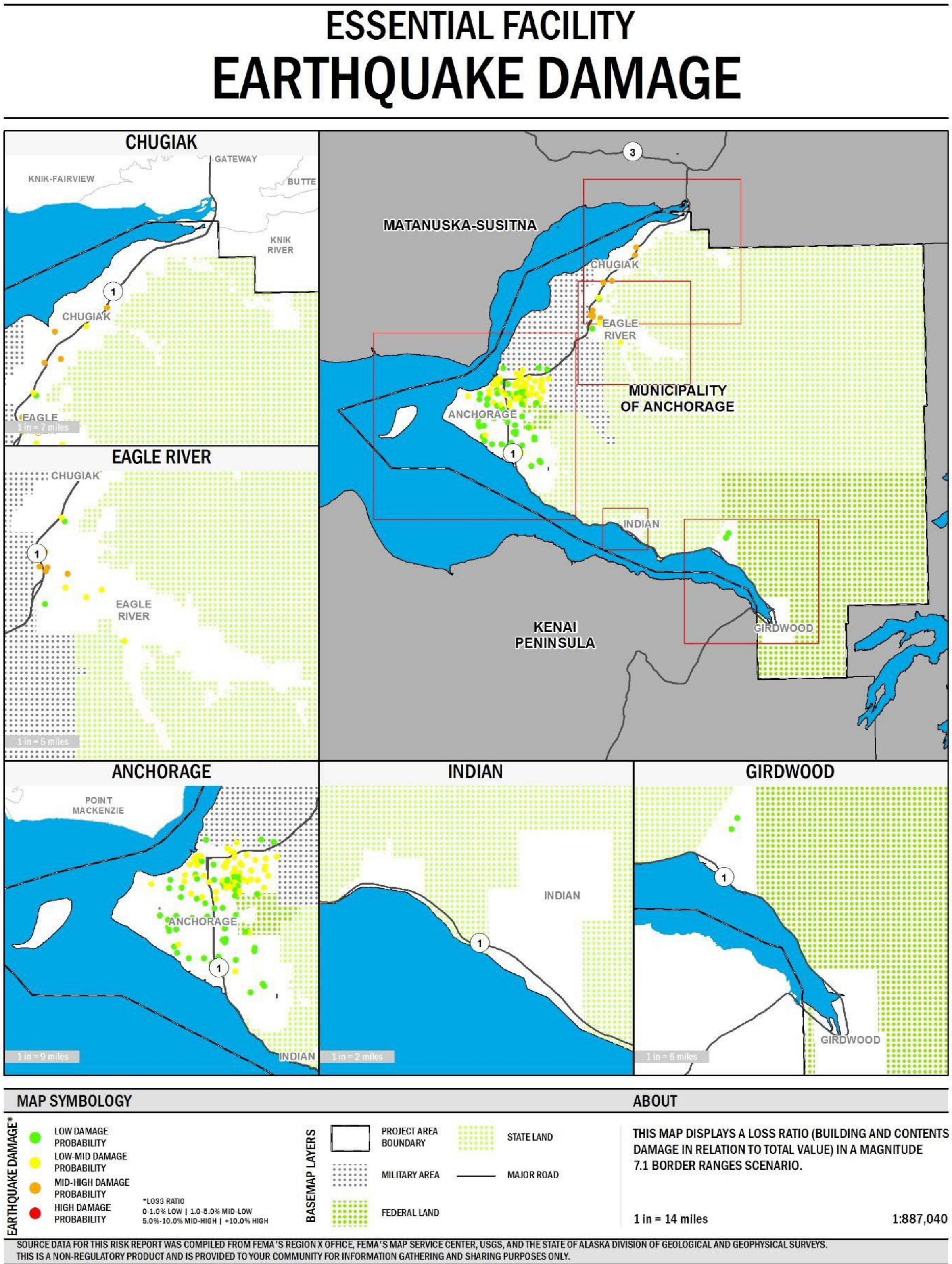
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Mod./Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<0.05	0.3	2.8	6.2	12	22	40	75	>139
PEAK VEL.(cm/s)	*<0.02*	*0.1*	*1.4*	*4.7*	*9.6*	*20*	*41*	*86*	*>178*
INSTRUMENTAL INTENSITY	I	II–III	IV	V	VI	VII	VIII	IX	X+

Scale based upon Worden et al. (2012)

Map 4.3 Border Range Scenario - Damage Reference as Loss Ratio in the Municipality of Anchorage



Map 4.4 Border Range Scenario - Damage Reference as Loss Ratio in the Municipality of Anchorage to Essential Facilities



4.3.2 Transportation and Utility Assessment

HAZUS also provided an analysis on transportation and utility systems. Transportation systems include highways, railways, light rail, buses, ports, ferries, and airports. Utility systems include potable water, wastewater, natural gas, crude and refined oil, electric power, and communication. The project team took the transportation and utility information from the original HAZUS database. *No local updates were applied, so the number of facilities could vary greatly from what actually exists.* Table 4.4 provides an overview of potential damage to transportation systems in the event of an M7.1 earthquake, summarized at the Municipality level.

Table 4.4 Transportation System Impacts for M7.1 Border Ranges Scenario in the Municipality of Anchorage

TRANSPORTATION SYSTEM	COMPONENT	LOCATIONS / SEGMENTS	MODERATE DAMAGE OR GREATER	FUNCTIONALITY After Day 1	After Day 7	INVENTORY VALUE	ECONOMIC LOSS	LOSS RATIO
Highway	Segments	23	0	23	23	$476.5M	---	---
	Bridges	99	21	86	90	$2.5B	$207.5M	8.43%
	Tunnels	2	0	2	2	$58.1M	---	---
Railway	Segments	282	0	282	282	$181.2M	---	---
	Bridges	4	0	4	4	$1.1M	---	---
	Facilities	11	0	11	11	$29.5M	$6.7M	22.68%
Light Rail	Segments	0	0	0	0	---	---	---
	Facilities	0	0	0	0	---	---	---
	Facilities	0	0	0	0	---	---	---
Bus	Facilities	1	0	1	1	$1.3M	$300,000	23.08%
Ferry	Facilities	0	0	0	0	---	---	---
Port	Facilities	8	0	8	8	$21.5M	$4.9M	22.60%
Airport	Runways	19	0	19	19	$726.3M	---	---
	Facilities	14	2	13	14	$93.8M	$19.8M	21.11%
TOTAL		**463**	**23**	**449**	**4**	**$4.1B**	**$239.1M**	**5.91%**

Source: FEMA Municipality of Anchorage Risk Report

4.3.2.1 Vulnerability Assessment

The vulnerability assessment focuses on how each element is potentially at risk from a transportation incident and the impacts within the MOA.

People

The MOA's people are particularly vulnerable to the impacts of significant transportation incidents, such as major aviation crashes, rail derailments, or marine vessel incidents. Residents living near critical transportation hubs, including Ted Stevens Anchorage International Airport, the Port of Alaska, and the Alaska Railroad, face heightened risks of injury or death during catastrophic events. Large-scale incidents involving hazardous materials or mass casualties could overwhelm local emergency medical services, leaving individuals without timely care. Vulnerable populations, such as children, the elderly, and those with disabilities, may face increased challenges during evacuation or sheltering efforts following such incidents. Psychological impacts, including trauma and anxiety, are also likely in the aftermath of significant transportation incidents, particularly those with widespread casualties or disruptions.

Property

Significant transportation incidents pose considerable risks to property. Aviation crashes could result in severe damage to residential, commercial, and industrial structures in the vicinity of flight paths. Rail derailments or marine vessel incidents involving hazardous materials could lead to contamination of nearby properties, requiring costly and time-intensive remediation efforts. Critical infrastructure, including bridges, rail lines, and port facilities, is particularly vulnerable to long-term disruption or destruction during large-scale transportation incidents. Property values in affected areas may decline due to the stigma associated with contamination or recurring hazards.

The Environment

The MOA's location near the coast makes its waters vulnerable to contamination from fuel or chemical spills, which could harm marine life and local fisheries. An incident involving flammable materials or hazardous chemicals could pollute the air, creating health risks for people and impacting the natural environment. Additionally, the MOA is surrounded by sensitive habitats, so any contamination or disruption from incidents could have long-lasting effects on local plants and wildlife, especially in areas close to water or protected green spaces.

Municipal Operations

A major transportation incident in the MOA could overwhelm emergency services, making it harder for them to respond quickly to other incidents. Road closures and increased traffic from the incident could cause delays for public transportation and people commuting, slowing movement across the city. As a central hub for goods for central Alaska, the MOA's supply of essential items like food and medical supplies could be disrupted, impacting both local businesses and consumers. Additionally, prolonged road closures, property damage, and repair efforts could lead to significant financial losses, especially in industries that rely on timely transportation, like tourism and freight.

4.3.2.2 Consequence Analysis

Impacts on the Public

A transportation incident involving hazardous materials, or a vehicle or boating vessel crash could result in significant casualties, including injuries and fatalities, as well as psychological trauma for those involved or witnessing the event. Disruption to traffic could strand commuters, delay essential travel, inhibit imports and exports, and reduce access to emergency services, potentially jeopardizing public safety further.

Impacts on Responders

First responders would face exposure to dangerous conditions, including hazardous materials, fire, or structural instability. Limited access to the incident site due to debris or secondary hazards could complicate rescue efforts, while prolonged operations might strain resources, equipment, and personnel, reducing their ability to respond to other emergencies.

Impacts on Continuity of Operations

A transportation incident could disrupt municipal services, including healthcare, emergency management, and public transportation. If key infrastructure is affected—such as major highways, the port, or transportation hubs—supply chains for food, fuel, and medical supplies could be delayed, impeding daily operations and emergency responses.

Impacts on Property

Significant damage could occur to vehicles, roadways, bridges, the port, and nearby buildings. Fires, explosions, or HazMat releases could further destroy property in the immediate area, necessitating extensive cleanup and repairs. This destruction could extend to personal property, businesses, and public infrastructure.

Impacts on the Environment
If hazardous materials are involved, the release could contaminate air, water, and soil, leading to long-term environmental degradation. Wildlife and local ecosystems, particularly in sensitive areas around the MOA, could suffer irreversible harm. Cleanup efforts would likely be expensive, time-consuming, and complex.

Impacts on the Economy
The incident could lead to economic losses from business interruptions, property damage, and costly cleanup efforts. Long-term effects might include reduced tourism, lower property values in the affected area, and disruptions to critical supply chains, impacting the local and regional economy.

Impacts on Public Confidence in the Jurisdiction
The public's confidence in the local government could erode if response efforts are perceived as inadequate or delayed. A lack of clear communication or transparency during and after the incident could further intensify public distrust, complicating recovery efforts and long-term community relations.

4.4.3 Wildfire

Wildfires are defined as fires that rage out of control in the wilderness, like a forest or countryside. Wildfires are common in wildland settings, where the initiation may often begin unnoticed, promoted by outside influences such as lightning or a human-caused disturbance. These hazard events can occur at any time throughout the year but have higher potential during periods of drought or little rainfall. High winds can also contribute to the spreading of fire. Wildfires spread quickly, igniting brush, trees, and homes.

The MOA's location in the boreal forest makes wildfires (sometimes called a wildland urban interface fire) a concern. Fuel, weather, and topography influence wildland fire behavior. The amount of fuel determines how much energy the fire releases, how quickly the fire spreads, and how much effort is needed to contain the fire. The primary fuels in wildland fires are living and dead vegetation. Weather is the most variable and uncontrollable factor in wildland fire fighting. Weather includes temperature, relative humidity, wind, and precipitation. High temperatures and low humidity encourage fire activity, while low temperatures and high humidity help retard fire behavior. Wind dramatically affects fire behavior and is a critical factor in the spread and control of the fire. Topography directs the movement of air, which can also affect fire behavior. When the terrain funnels air, as in a canyon, it can result in a faster- spreading fire.

For the purposes of this plan, a wildfire is a fire that burns within the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

The creation and maintenance of the fire requires the interaction of heat, fuel, and oxygen. This is often referred to as the fire triangle.

Fire Behavior

Fuel, weather, and topography influence wildland fire behavior. Wildland fire behavior can be erratic and extreme, causing fire whirls and firestorms that can endanger the lives of firefighters trying to suppress the blaze. The danger increases when the fire involves developed areas with structures, property and populations. The additional fuel load, high value property, life safety risk, and the need for simultaneous evacuation and suppression add significant wildfires firefighting challenges.

Figure 3.5 The Fire Triangle. Image from Northern & Intermountain Regions of the U.S.

Fuel [6]

Fuel determines how much energy the fire releases, how quickly the fire spreads, and how much effort is needed to contain the fire. The primary fuels in wildland fires are living and dead vegetation. Fuels differ in how readily they ignite and how hot or long they burn. This depends on the following characteristics:

- Moisture content
- Size and shape
- Fuel loading
- Horizontal continuity of fuels
- Vertical arrangement of fuels

Weather

Weather is the most variable and uncontrollable factor in wildland fire fighting. Weather includes temperature, relative humidity, wind, and precipitation. High temperatures and low humidity encourage fire activity, while low temperatures and high humidity help retard fire behavior. Wind dramatically effects fire behavior and is a critical factor in fire spread and control.

Topography

Topography directs the movement of air, which can also affect fire behavior. When the terrain funnels air, as in a canyon, it can lead to faster spreading. Fire can also travel up-slope quicker than it goes down.

Burning material can roll down the slope and ignite fires below. Certain areas in the MOA with glaciers, including the Eagle River and Eklutna Valleys, may experience local glacial wind effects dramatically influencing fire behavior.

Slope orientation also influences fire behavior. Forests on southern or southwestern slopes (those exposed to the sun) generally have lower humidity and higher temperatures than those on northern or northeast slopes.

Consequently, fire hazard is often higher on south- and southwest-facing hills.

[6] Adapted from Eli, 2003 and wildlandfire.com

Location

According to the AFD, the factors contributing to Anchorage's wildfire risk include:

- Mixed hardwood and conifer forests that burn readily in high fire danger conditions. White spruce trees have persistent branches that contribute to ladder fuels. Black spruce trees have a very low moisture content that allows them to burn easily when ambient weather conditions provide for low relative humidity, high temperatures, and dry duff layers in the soil.
- Residential and rural neighborhoods exist throughout forested stands that have been affected by the spruce bark beetle. In the MOA, this area extends over 85,000 acres. Dead trees resulting from beetle attacks contribute to forest fuel accumulations that create high risk for wildfire.
- Mutual aid resources to help the AFD may take an hour or more to arrive on site. Suppression resources from the SOA Division of Forestry must travel to Anchorage from Palmer and other locations outside the MOA.
- On the south Anchorage Hillside, Eagle River Valley, South Fork, and other sites around the MOA, there are limited water resources to help fight a wildland fire.
- Many neighborhoods in the MOA have limited ingress and egress routes for suppression apparatus to enter and for residents to evacuate.
- The hilly topography throughout the area contributes to increased rate of fire spread. Where the Miller's Reach Fire of 1996 spread across mostly flat terrain and still burned more than 400 structures, a wildfire in South Anchorage would spread even faster because fire spread rates increase with slope.
- The spring fire season is a dry time in Southcentral Alaska. Dry foliage on trees and dead bluejoint grass burn readily soon after snow melts.

The entire MOA has the potential for wildfires. The AFD has identified a 345,309- acre study area for wildfire exposure.

Approximately 17,088 acres of this study area are exposed to hazardous wildfire conditions (MOA, 2010b). The exact location of the wildfire hazard changes because it depends on a combination of factors, including availability of fuels, availability of ignition sources, and weather. Because of the changing conditions, the AFD has developed an Anchorage Fire Exposure Model to calculate wildfire exposure. For current information on wildfire exposure, please contact the Wildfire Mitigation Division of the AFD.

In addition, AFD has been conducting neighborhood wildfire assessments. These assessments are considered works in progress and are re-evaluated throughout the fire season. The assessments contain an evaluation of the hazard; potential hazards/complications, such as power lines; potential staging areas for equipment; water sources, potential safety zones (to wait out passing fire); and potential evacuation sites. They exist for the following areas:

The AFD Wildfire Home Assessment

The AFD provides home assessments to provide homeowners with specific recommendations for vegetation management and home maintenance activities to reduce a home's potential to ignite during a wildfire. The AFD is also able to provide financial assistance to remove dead, beetle killed spruce trees and densely growing coniferous trees.

- Tudor Road to Abbott Road, including Far North Bicentennial Park
- Eagle River
- Hiland Road, South Fork
- DeArmoun Road to Potter Creek Heights
- Chugiak

Individual neighborhood assessments are available through the AFD.

Likelihood of Occurrence - Probability - Medium

The high fire danger months are typically May through August in the MOA; however, wildfires can occur in other months. Wildfires are more likely to occur during drought or low- precipitation times and are less likely to occur during high-precipitation times and when snow is on the ground. See Hazard Rating Matrix, Table 1.2.

Wildfires in the MOA are more likely to be caused by humans than by other sources. As development increases in areas with high wildfire potential, the chances of wildfire also increase. The AFD is taking measures to reduce the risk of fires by controlling the amount of fuel available. The AFD does this through controlled burns, homeowner education, and the development of firebreaks.

Historic Events

No declared wildfire disasters have been identified to date in the MOA. However, the potential exists. Every year, the AFD puts out dozens of fires that could be disastrous if not contained early. Between 2010 and 2015, the number of wildfires per year in the MOA ranged from 58 fires in 2012 to 102 fires in 2011. Between 2007 and 2015, the MOA had 773 wildfire calls that burned approximately 152 acres (Table 4.3.3.1).

Table 4.3.3.1 Wildfires in the MOA, 2010-2015

Other Events **Wildfire**

Cause	Number	Percent	Acres
Undetermined	354	45.80%	72.11
Misuse of Fire/Unintentional	98	12.68%	15.96
Intentional/Incendiary	86	11.13%	14.31
Open/Outdoor Fire	77	9.96%	23.61
Smoking	73	9.44%	7.93
Debris/Vegetation Fire	24	3.10%	3.85
Other	21	2.72%	4.81
Act of Nature/Natural	20	2.59%	2.64
Equipment	19	2.46%	6.53
Structure/Exposure	1	0.13%	.1
Totals	**773**	**100%**	**151.85**

O'Malley/Hillside Fire, 1973

In May 1973, a small brush fire at a private home, fanned by 40 mile per hour (mph) winds, burned out of control in the foothills of the Chugach range. The fire threatened 25 homes and forced several families to evacuate. By the time firefighters contained the blaze, 300 acres of brush and timber were destroyed.

Dowling Road Fire, 2003

A wildfire near the east end of Dowling Road was ignited by a homeless person's fire. This fire burned approximately 2.5 acres.

Otter Lake Fire,2006

The Otter Lake Fire began in an approximately five-mile area near the ARRC tracks on Fort Richardson. The fire quickly expanded to approximately 50 acres before it was extinguished.

PiperFire,2008

On July 2, 2008, a wildfire burned 10 acres of Municipal parkland. This fire was ignited by a homeless person. The AFD was able to extinguish the fire before it reached nearby subdivisions.

Eklutna Lake fires 1999, 2010

There have been two wildfires over 100 acres in the MOA's Eklutna Lake Valley in the last twenty years. In 1999 a landowner ignited a fire to clear brush on a windy day and the fire escaped control and burned over 200 acres. The fire threatened homes and potentially the

MOA's Eklutna Lake water treatment facility, 2010

In May of 2010 there was a wildfire that burned over 1000 acres at the far end of the lake that threatened Eklutna State Park developments and homes near the lake.

McHugh Creek Fire, 2016

In July 2016 this fire burned approximately 800 acres of steep and remote terrain in the MOA. The fire affected travel on the Seward Highway. It was reported the fire was started by an unextinguished campfire.

Martin Luther King Jr Fire, 2019

In July 2019, the MLK fire near Campbell tract in Anchorage burned 25 acres and was said to be human caused.

4.3.3.1 Vulnerability Assessment

In 2001, Anchorage was declared a community-at-risk for wildfire by the U.S. Department of Agriculture (USDA) Forest Service (USFS). According to the AFD, a wildfire could occur anywhere in the MOA, so the entire MOA is represented in Table 4.3. Only a portion of these properties are likely to be affected by a given event. The number and location of the impacted parcels depend on the size and location of the wildfire event.

Wildfires have the potential to destroy property and vegetation. Without vegetation, these areas may experience soil erosion which can have an impact on water quality. Wildfires may reduce the amount of animal habitat. Wildfires may also cause injuries or loss of life. Fire response systems are well prepared to deal with wildfires so large numbers of injuries or fatalities are not expected. Additional research would be required to identify the number of people who could be injured or killed as the result of a wildfire.

Table 4.3.3.2 Wildfire Vulnerability

Land Use	**# of Parcels**	**Taxable Value (Land)**	**Taxable Value (Buildings)**	**Total**
Residential	75024	$8526159300	$17756156200	$26282315500
Commercial	4065	$2568664400	$4512337400	$7081001800

Source: MOAGIS, 2016

4.3.3.1.1 Vulnerability Assessment Update

Office Emergency Management updated the vulnerability assessment for wildfire in the 2024 Hazard Identification and Risk Assessment (HIRA).

People

People living in wildland-urban areas, where housing developments are near or surrounded by natural vegetation, face higher risks. Individuals living in areas with single access or egress roads may find it challenging to follow shelter-in-place or evacuation orders due to limited preparedness, lack of awareness about wildfire risks, or concerns about protecting their property.

Certain populations are at higher risk during wildfire occurrences, including elderly residents, individuals with mobility issues, people with chronic illnesses, and those living in poverty. Evacuations can be challenging for these groups due to limited access to transportation and difficulties in relocating to safer areas. Additionally, those with respiratory conditions are more susceptible to smoke-related health problems.

Even if not directly impacted by flames, residents across the MOA can be affected by wildfire smoke, leading to respiratory illnesses, aggravating asthma, and increasing hospitalizations. Prolonged smoke exposure can disproportionately affect children, the elderly, and those with pre-existing health conditions. Fire can also impact critical services that people rely on.

Individuals living in areas with single access or egress roads may find it challenging to follow shelter-in-place or evacuation orders due to limited preparedness, lack of awareness about wildfire risks, or concerns about protecting their property.

Property

Homes and buildings in the MOA that are close to wildland areas are especially vulnerable to wildfire damage. Homes lacking a "defensible space" (a buffer between the home and vegetation) are at even higher risk. Businesses near forests or grassy areas are also at risk, and those that rely on outdoor infrastructure, like power lines and communication towers, may face disruptions or destruction that could impact their operations. Additionally, critical infrastructure, such as power lines, water systems, and telecommunications, is at risk from wildfires. If power lines are damaged, it can lead to widespread outages, affecting daily life, businesses, and emergency services.

There are areas of concern within the MOA in the wildland-urban interface. Primarily those with single access or egress roads. These areas are more likely to encounter situations with shelter-in-place or evacuation recommendations from AFD. These scenarios are highly situational and are influenced by a range of fire and environmental factors, resulting in the recommendations being determined by the on-scene Incident Commander.

The Environment

Fires can demolish local ecosystems, destroying forests and meadows and displacing wildlife. In the aftermath of fires, erosion, landslides, mudslides, and flooding may become more likely, especially in areas where vegetation no longer anchors the soil. This can degrade water quality in local rivers and streams, impacting fish populations and other marine life.

The MOA frequently experiences poor air quality due to fire smoke, which can travel long distances, sometimes into the southern parts of the United States, and may settle over the municipality. Prolonged periods of poor air quality can harm human health, wildlife, and vegetation. The environmental effects of smoke, including the deposition of ash and chemicals, can also affect soil and water systems.

Fires in forested areas can result in the loss of native species and increase the risk of invasive plant species taking root in burned areas, further altering ecosystems and making them more prone to future fires.

Municipal Operations

Depending on the fire, municipal systems can be severely impacted.

- Public Safety Systems

  Firefighting Resources: The MOA's firefighting capabilities may be strained during large wildfire events, especially if multiple fires occur at once or if resources are needed in remote areas. The Anchorage Fire Department, while experienced, may require assistance from state or federal agencies for large-scale incidents.

  Evacuations: Coordinating evacuations in the wildland-urban area can be challenging, particularly for densely populated areas. Poor road access and traffic congestion could delay evacuation efforts of residents.

  First Responders' Safety: Firefighters and emergency responders face direct risks from fire exposure, including heat, smoke inhalation, and the danger of being trapped by fast-moving flames.

- Government Operations

  Disruption of Services: A major fire can disrupt municipal government operations, affecting the ability to deliver essential services, including public safety, waste management, and utilities. Critical services such as water treatment facilities, if damaged or shut down, can lead to public health crises.

  Emergency Response Coordination: The MOA may need to activate its Emergency Operations Center (EOC) to coordinate response efforts. Large-scale fires can require significant interagency cooperation.

  Public Communication: Timely communication with the public about fire risks, evacuation orders, and air quality concerns is essential. A breakdown in communication could increase confusion and risk to the public during an emergency. Information dissemination is critical, and using text messages, phone calls, and social media like X (formerly Twitter), Facebook, and Instagram will help with the dissemination of information. Utilizing these platforms will also decrease the spread of mis/disinformation.

- Healthcare Services

  Increased Demand for Medical Services: During wildfire events, healthcare facilities may experience surges in patients with respiratory issues, burns, and other fire-related injuries. The strain on hospitals and clinics can be exacerbated if healthcare workers themselves are displaced or affected by fires.

  Vulnerable Healthcare Systems: Disruptions to power supply, telecommunications, or road access could impair the functioning of hospitals and healthcare services. Rural clinics, which are often under-resourced, may face additional challenges in responding to fire-related health issues.

- Transportation Systems

  Road Closures and Accessibility: Fires may necessitate road closures, particularly in mountainous areas and major roadways like the Seward or Glenn Highways. This can impede evacuation efforts and disrupt the movement of goods and services throughout the MOA.

  Air Traffic: Fires and their associated smoke can also disrupt air travel in and out of Ted Stevens Anchorage International Airport, as reduced visibility and poor air quality can lead to delays and cancellations. The airport plays a critical role in the local economy, and any disruptions could have broader financial impacts.

4.3.3.2 Consequence Analysis

Office Emergency Management updated the consequence analysis for wildfire in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public

Fires in the MOA could have serious consequences for public health and safety. Residents in fire-prone areas may face shelter-in-place orders which the residents could find challenging to do because of limited preparedness or lack of awareness about wildfire risks. Residents could also face evacuation orders, risking displacement and temporary loss of shelter. Those with pre-existing respiratory conditions are especially vulnerable to fire smoke, which can lead to health problems like asthma attacks or hospitalizations. In extreme cases, fires could cause injuries or fatalities.

Impacts on Responders

First responders, including firefighters, police officers, and emergency medical personnel, are directly at-risk during fire events. They face hazardous conditions like extreme heat, thick smoke, and the potential for rapidly shifting fire lines. Firefighters could also face exhaustion and injury while battling fires, especially if resources are stretched thin. Additionally, the mental and emotional toll on first responders during prolonged fire events can affect their overall well-being, reducing their capability to respond efficiently to other emergencies.

Impacts on Continuity of Operations

Key public services like waste management, water treatment, and emergency services may be interrupted due to fire damage or power outages. If municipal buildings or critical infrastructure are affected, government operations could be suspended or severely limited. This could impede the municipality's ability to coordinate response efforts, issue timely public communications, and maintain essential functions such as public safety and health services.

Impacts on Property
Residential and commercial properties near wildland areas face considerable risk from fires. Homes built without defensible space may be destroyed or severely damaged. Businesses located near forested or grassy areas, as well as those reliant on outdoor infrastructure like power lines or telecommunications towers, are also vulnerable. In the event of a large fire, entire neighborhoods or business districts could be lost, leading to costly rebuilding efforts and displacement of residents and businesses.

Impacts on the Environment
Vegetation loss after a fire can lead to habitat destruction for local wildlife and long recovery periods for ecosystems. Burned areas are also more susceptible to erosion, landslides, mudslides, and flooding, especially in mountainous regions, which can degrade water quality, disrupt aquatic ecosystems, and affect fisheries. Soil health may decline due to nutrient loss and hydrophobicity, further impeding regrowth and increasing vulnerability to invasive species. Air quality will be significantly impacted by smoke, which can linger over the area for days or weeks, contributing to human and animal health hazards. The recovery of natural areas from severe fires could take years, if not decades, as ecosystems struggle to restore balance and biodiversity.

Impacts on the Economy
The costs of firefighting efforts, damage to homes and businesses, and recovery can run into the millions of dollars. Major fires may lead to prolonged business closures, loss of tourism, and a decline in property values. If infrastructure, such as roads or power lines is damaged, transportation and shipping disruptions could occur, further impacting local businesses. Recovery from a large fire would require substantial investment from stakeholders, and state and federal governments. Certain economic activities, like outdoor recreation and tourism, might also be affected.

Impacts on Public Confidence in the Jurisdiction
Delays in evacuation orders, insufficient communication, or lack of visible coordination between agencies could lead to frustration and distrust among residents. If the public perceives that the local government was unprepared or slow to respond, it could diminish trust in leadership, making it harder to gather community support for future projects. Alternatively, a well-executed response, with clear communication and effective management of resources, could strengthen public confidence and demonstrate the municipality’s ability to protect its residents in times of crisis.

4.3.4 Extreme Weather

1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)
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))	4.1.3 Extreme Weather pg. pg. 46-62

Extreme weather is a broad category that includes heavy snow, extreme cold, ice storms (freezing rain), high wind, thunder & lightning, hail, coastal storms, and storm surge. Heavy snow, heavy rain, extreme cold, extreme heat, ice storms, and high winds are the most likely types of extreme weather in the MOA.

Heavy Snow

Heavy snow is generally considered to be more than six inches of accumulation in less than 12 hours. (Albanese,2010b). Heavy snow can have a significant impact on an area.

Until the snow can be removed, airports and roadways experience delay, or are closed completely, stopping the flow of traffic, supplies and disrupting emergency and medical services. Heavy snow loads can damage light aircraft and sink small boats. It can also cause roofs to collapse and knock down trees and power lines.

Heavy snowfalls can cause secondary hazards. In the mountains, heavy snow can lead to avalanches. A quick thaw can cause flooding, especially along small streams and in urban areas. The cost of snow removal, repairing damages, and the loss of business can have severe economic impacts.

Snow Terminology

A heavy snow is considered to be 6 or more inches of snow in 12 hours. The NWS criteria for a heavy snow advisory is 6 to 11 inches in 12 hours or 12 to 23 inches in 24 hours. A heavy snow warning may be issues for 12 or more inches of snow in 12 hours or 24 or more inches of snow in 24 hours.

Snow Squalls are periods of moderate to heavy snowfall, intense, but of limited duration, accompanied by strong, gusty surface winds, and possibly lightning.

A Snow Shower is a short duration of moderate snowfall.

Snow Flurries are an intermittent light snowfall of short duration with no measurable accumulation.

Blowing Snow is wind-driven snow that reduces surface visibility. Blowing snow can be falling snow or snow that already has accumulated but is picked up and blown by strong winds.

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

Location

The entire Municipality can get heavy snow, but Girdwood tends to receive more snow than other areas.

In general, the location of heavy snowfall depends on the weather system involved. The typical storm is a low-pressure system originating in Prince William Sound that moves in from the East. This results in heavier snow on the hillside, and less as you get further from the mountains. When the storm is out of the south, the snowfall is heavier in West Anchorage (Vonderheide, 2003). Occasionally, air comes up Cook Inlet and hits the mountains. This may lead to heavy snow on the upper hillside and less in the bowl area (Vonderheide, 2003). Blizzards are rare events in the MOA but could occur along the Turnagain Arm. See Figure 4.1 for the average annual snowfall pattern in MOA.

Likelihood of Occurrence

While snow falls frequently in Anchorage during the winter, most snowfalls are not usually heavy. Anchorage tends to experience one or two heavy snowfalls each winter (Albanese, 2010). However, these tend not to result in disaster declarations. The occurrence of heavy snowfall events depends on the weather conditions.

Snowfall Records

Normal snowfall – 74.5' Top 5 Highest Winter Snowfalls

134.5……….2011-2012

132.6……….1954-1955

128.8……….1955-1956

121.5……….1994-1995

113.9……….2003-2004

Top 5 Lowest Winter Snowfall

25.1……….2014-2015

30.4……….1957-1958

32.9……….1980-1981

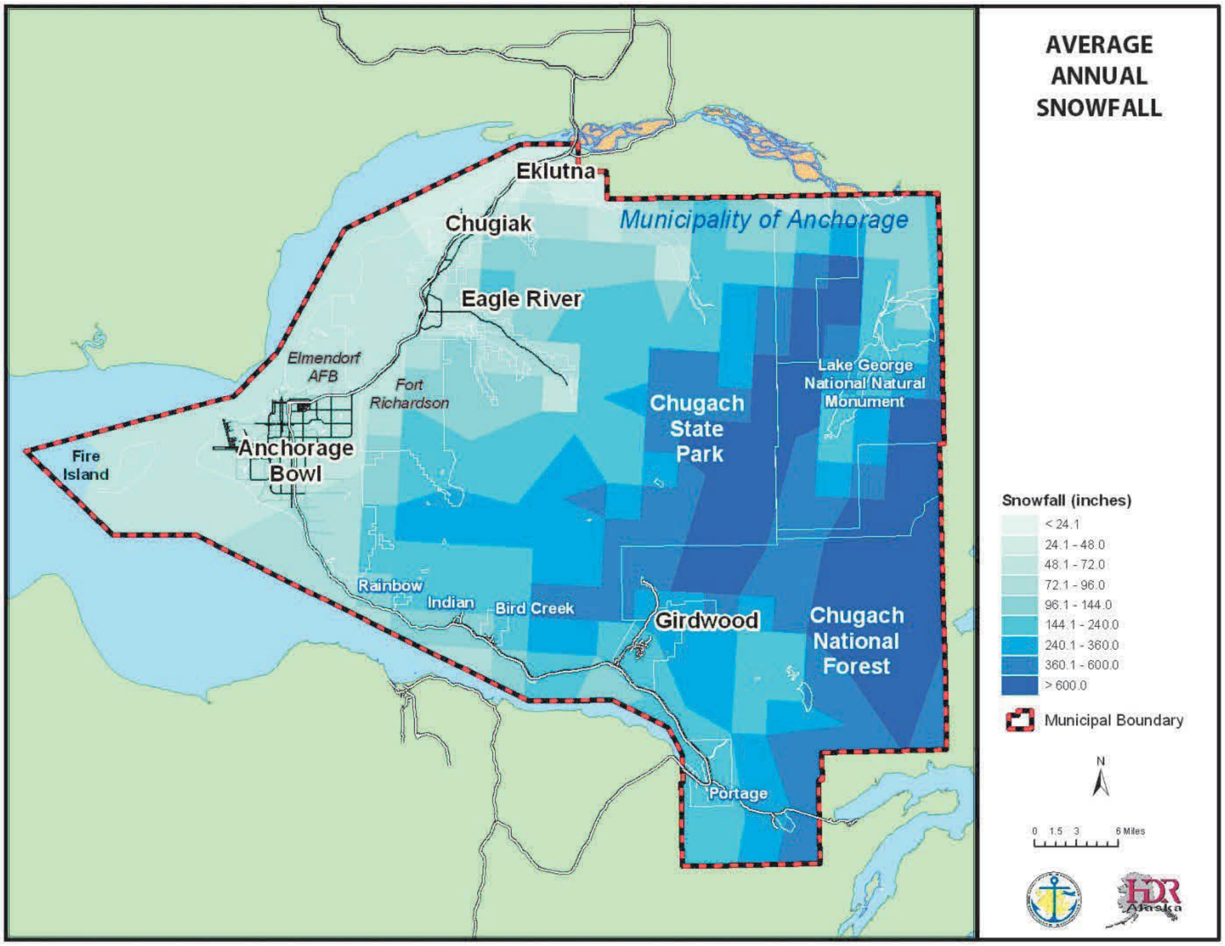
36.8……….2002-2003

38.3……….2015-2016

38.5……….1960-1961

Source: National Weather Service Anchorage Forecast Office's Climate Records List, (1917 – current) Available at https://www.weather.gov/afc/Anchoragerecords

Figure 4.1 Average Annual Snowfall



Historic Events

<u>2002 Heavy Snow Fall</u>

Record heavy snow occurred in MOA on March 17, 2002, when two to three feet of snow fell in less than 24 hours. TSAIA recorded a total of 28.7 inches while an observer near Lake Hood measured over 33 inches. The Municipality was essentially shut down because of the accumulating snow. Fortunately, the storm occurred on a Sunday morning when fewer businesses are open. The following day, both military bases, both universities, and many businesses remained closed, while Anchorage schools remained closed for two days. It took four days for snowplows to reach all areas of the city.

<u>Other Snow Events</u>

On March 20, 2001, 8-12 inches of snow fell in the Anchorage Bowl-Eagle River area.

Vulnerability

As a heavy snowfall could affect the entire Municipality, the entire MOA is represented in Table 4.4. Heavy snowfall can also damage infrastructure and critical facilities. Heavy snowfalls make transportation difficult, especially by road, and result in more money spent on snowplow services. Transportation may be distributed more in steeper areas such as the Hillside and parts of Eagle River. High numbers of injuries and fatalities are not expected with a heavy snow event. Heavy snow can have a greater impact on people who need access to medical services, emergency services, pedestrians, and people who rely on public transportation. The cost of fuel to heat homes during times of heavy snow can be a financial burden on populations with low or fixed incomes. According to the 2019 American Community Survey 5-Year Estimates, the MOA had approximately 16,073 households with a household income less than $25,000. Homeless populations are also vulnerable. According to the January 2021 single-night homeless count, there were 1,319 homeless people in Anchorage (Anchorage Coalition Data) on 1/26/21. Of those counted 1,167 were considered sheltered and 152 were outside. Heavy snows may also result in school and business closures which may result in some individuals having a loss of income. Heavy snows may also result in school and business closures, which may result in some individuals having a loss of income.

Table 4.3.4.1 Heavy Snow Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	75024	8526159300	17756156200	26282315500
Commercial	4065	2568664400	4512337400	7081001800
Industrial	2597	1494944600	1907337000	3402281600
Institutional	1035	1215398400	1554183700	2769582100
Open Space	44	24995700	503000	25498700
Transportation	664	0	0	0
Other	562	377462100	36697800	414159900
Vacant	228	0	0	0
Total	84219	14207624500	25767215100	39974839600

Source: MOAGIS, 2016

Heavy Rain

There is no universal definition of heavy rain. Generally, when rainfall is sufficient to cause localized or widespread flooding, it is considered heavy. The NWS is most concerned about potential flooding with 10% of an area’s annual rainfall occurs in one day (Albanese, 2010b).

Heavy rains are sometimes associated with a weather system called the "Pineapple Express". This weather system originates in Hawaii and usually brings heavy rain with it. This rain can lead to flooding. The "Pineapple Express" may also melt snow contributing to flooding.

Location

The Girdwood area receives the most rainfall in the MOA. See Figure 4.2 for the average annual rainfall pattern. Rainfall also varies with time of year with most precipitation occurring in late summer and fall. Table 4.5 summarizes precipitation in the MOA.

Precipitation **Records**

Normal Precipitation: 16.08 inches

Highest Annual Precipitation: 27.55 inches (1989)

Lowest Annual Precipitation: 8.08 inches (1969)

Longest Consecutive Days with Measurable Precipitation: 17 days (September 12 – 28, 1979)

Consecutive Days Without Precipitation:

47 (January 6 – February 21, 1939)

Source: National Weather Service Anchorage Forecast Office's Climate Records List, (1917 – current)

Figure 4.2 Average Annual Rainfall

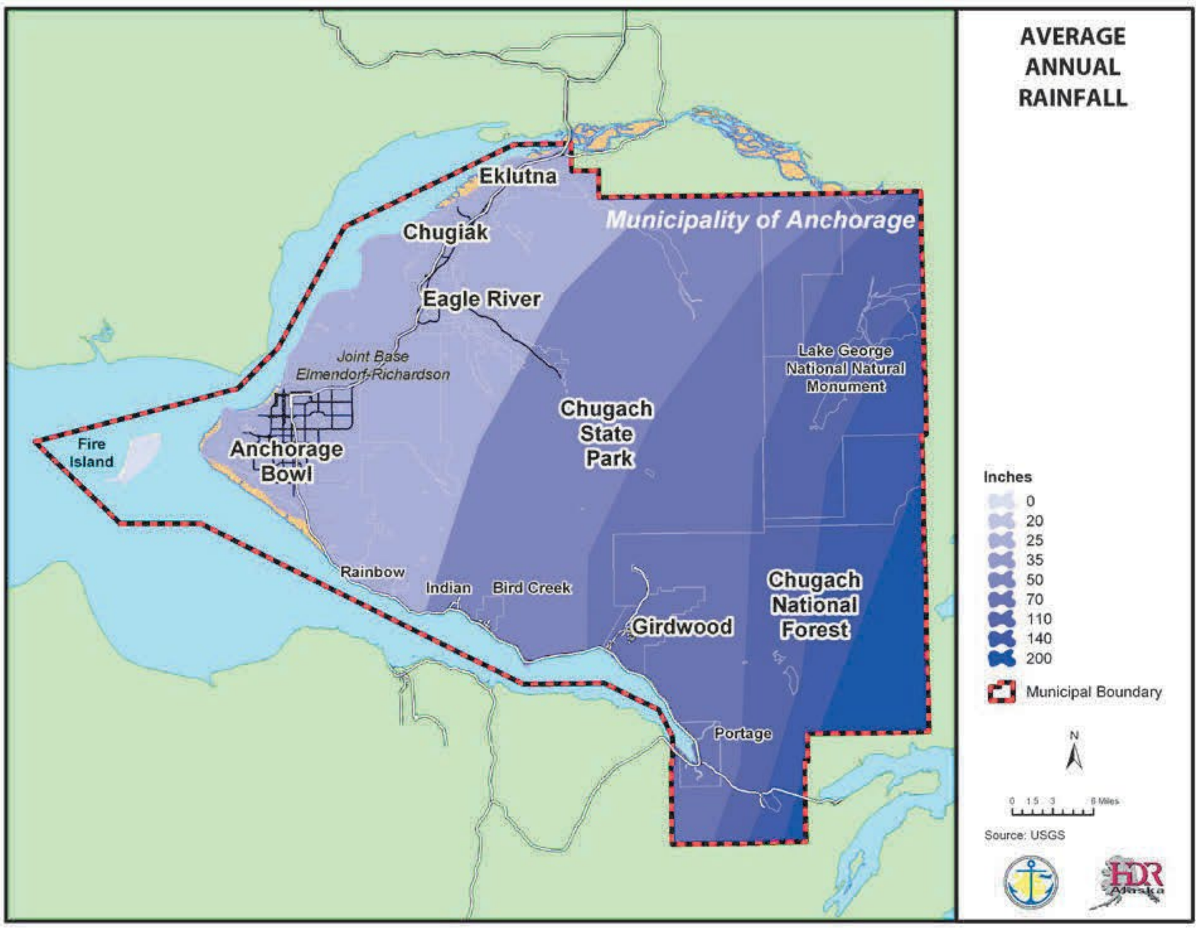


Table 4.3.4.2 Precipitation in the MOA

	(a)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
PRECIPITATION (in.)													
Water Equivalent													
-Normal		0.79	0.7	0.69	0.67	0.73	1.14	1.71	2.44	2.70	2.03	1.11	1.12
-Maximum Monthly	42	2.71	3.07	2.76	1.91	1.93	3.40	4.44	9.77	6.64	4.11	2.84	2.67
-Year		1987	1955	1979	1977	1989	1962	1958	1989	1990	1986	1976	1955
-Minimum Monthly	42	0.02	0.07	T	T	0.02	0.17	0.42	0.33	0.76	0.35	0.08	0.09
-Year		1982	1958	1983	1969	1957	1993	1.72	1969	1973	1960	1985	1995
-Maximum in 24 hrs.	42	1.19	1.16	1.25	0.78	1.18	1.84	2.06	4.12	1.92	1.60	1.66	1.62
-Year		1961	1956	1986	1989	1980	1962	1956	1989	1961	1986	1964	1955
Snow, Ice Pellets, Hail													
-Maximum Monthly	42	27.5	48.5	31.0	27.6	3.9	0.0	0.0	0.0	4.6	27.1	38.8	41.6
-Year		1990	1955	1979	1963	1963				1965	1982	1994	1955
-Maximum in 24 hrs.	42	10.5	12.4	14.5	9.1	3.9	0.0	0.0	0.0	3.5	11.2	16.4	17.7
-Year		1955	1956	1959	1955	1963				1965	1991	1964	1955

Likelihood of Occurrence - Probability - High

The occurrence of heavy rain depends on various weather conditions. Low pressure over the Bering Sea, El Niño or La Niña conditions or the direction the storm is coming from. Storms moving up Cook Inlet can cause significant precipitation in the Anchorage bowl and the Hillside area but usually have little precipitation in Girdwood. While storms coming from the Prince William Sound can cause significant precipitation from Girdwood to Portage areas but may not produce much rain in Anchorage. A warm weather rain event during the winter can cause flooding due to the snow melt, the inability of the water to infiltrate into the ground and decreased ability of the stream channels and storm drains to pass the runoff. See Hazard Rating Matrix, Table 1.2.

Historic Events

Girdwood, 2021

Between October 29 and November 1, 2021, Girdwood experienced historic rainfall. The historic rainfall event washed out Ruane Road, cutting off access to the water treatment plant in Girdwood. Loveland Road was also closed as well as Echo Ridge Drive during the flooding event. A disaster declaration was declared and approved.

Vulnerability

As a heavy rain could affect the entire Municipality, the entire MOA is represented in Table 4.6. The flooding associated with a heavy rain is typically the greatest concern. For more information, please see the flood section. High numbers of injuries and fatalities are not anticipated with a heavy rain event.

Table 4.3.4.3 Heavy Rain Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	75024	8526159300	17756156200	26282315500
Commercial	4065	2568664400	4512337400	7081001800
Industrial	2597	1494944600	1907337000	3402281600
Institutional	1035	1215398400	1554183700	2769582100
Open Space	44	24995700	503000	25498700

Transportation	664	0	0	0
Other	562	377462100	36697800	414159900
Vacant	228	0	0	0
Total	84219	14207624500	25767215100	39974839600

Source: MOAGIS, 2016

Extreme Cold

What is considered an excessively cold temperature varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In Alaska, extreme cold usually involves temperatures below –40º Fahrenheit (F). Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold can also bring transportation to a halt for days or weeks at a time. Aircraft may be grounded due to extreme cold and ice fog conditions. Long cold spells can cause rivers to freeze which increases the likelihood of ice jams and ice jam related flooding. If extreme cold conditions are combined with low or no snow cover, the ground's frost depth can increase, and disturb buried utility pipes.

The greatest danger from extreme cold is to people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening, especially for infants and the elderly. Carbon monoxide (CO) poisonings also increase as people use supplemental heating devices.

> **Frostbite** is damage to body tissue caused by that tissue being frozen. Frostbite causes a loss of feeling and a white or pale appearance in the extremities.
>
> **Hypothermia** is low body temperature. Normal body temperature is 98.6ºF. When body temperature drops to 95ºF, however, immediate medical help is needed. Hypothermia also can occur with prolonged exposure to temperatures above freezing.

Location

In MOA, the official temperature is recorded at TSAIA. Due to its close proximity to open water, the airport tends to be warmer than the rest of Anchorage. For example, east Anchorage is generally 10 to 15 degrees cooler than at the airport (Vonderheide, 2003). The Chugiak/Eagle River area tends to get the coolest temperatures in the winter. See Figure 4.3 for the extreme minimum temperatures. The coldest months in Anchorage are generally December, January, and February. The temperature tends to decrease, the further inland you are. Table 4.7 summarizes the temperature in the MOA.

Figure 4.3 Extreme Minimum Temperatures

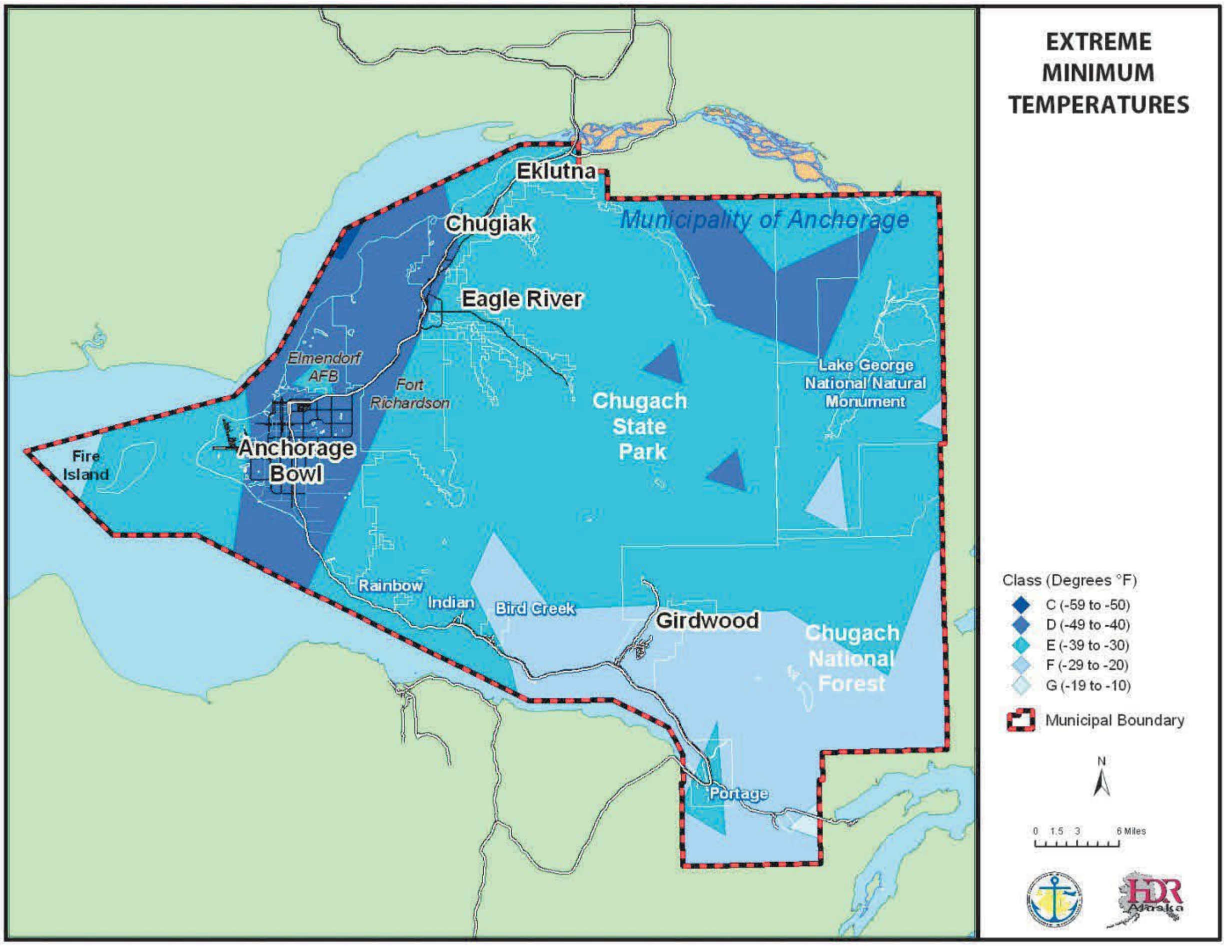


Table 4.3.4.4 Anchorage Climate Records

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE (Deg. F)													
Normals													
-Daily Maximum	23.1	26.6	33.9	44.5	56.0	62.8	65.4	63.5	55.1	40.5	27.8	24.8	43.7
-Daily Minimum	11.1	13.8	19.2	29.1	39.6	47.7	52.2	50.0	42.0	29.1	16.6	13.2	30.3
-Monthly	17.1	20.2	26.6	36.8	47.8	55.2	58.8	56.7	48.6	34.8	22.2	19.0	37.0
Extremes													
-Record Highest	50	48	5.1	69	77	85	84	82	73	64	54	48	85
-Year	1961	1991	1984	2005	1969	1969	2003	1968	1957	2006	2002	1992	JUN 1969
-Record Lowest	-34	-28	-24	-4	17	33	36	31	19	-5	-21	-30	-34
-Year	1975	1999	1971	1985	1964	1961	1964	1984	1992	1956	1956	1964	JAN 1975
NORMAL DEGREE DAYS													
Heating (base 65 Deg. F)	1485	1254	1192	846	533	293	194	256	494	936	1284	1426	10193
Cooling (base 65 Deg. F)	0	0	0	0	0	0	2	0	0	0	0	0	0
PRECIPITATION (Inches)													
Normals													
-Mean Precipitation	0.73	0.72	0.60	0.47	0.72	0.97	1.83	3.25	2.99	2.03	1.16	1.11	
-Snowfall	11.3	10.9	9.9	4.0	0.3	0.0	0.0	0.0	0.4	7.9	13.1	16.7	
Extremes													
-1 Day Maximum Total	1.1	1.16	1.25	1.32	0.97	1.62	2.00	2.76	1.41	1.68	1.16	1.39	2.76
-Year	1987	1956	1986	2008	1980	1962	1956	1997	2012	1952	1964	1955	1997
-Highest Total Precipitation	2.71	3.07	2.76	2.32	1.93	3.40	4.49	9.77	7.35	4.28	2.87	2.67	27.55
-Year	1987	1955	1979	2008	1989	1962	2001	1989	2004	2002	2010	1955	1989
-Lowest Total Precipitation	0.02	0.07	0.01	0.01	0.02	0.02	0.42	0.33	0.72	0.35	0.04	0.09	8.08
-Year	1974	1958	1997	1957	1955	1952	1972	1969	1998	1960	2006	1995	1969
-1-Day Maximum Snow	11.2	13.0	22.0	15.5	5.0	0.0	0.0	0.0	6.0	12.6	10.9	15.6	
-Year	2007	1996	2002	2008	2001	---	---	---	2004	1996	1964	1955	
-Highest Total Snow	29.3	52.1	31.0	30.8	6.10	0.00	0.0	0.0	6.3	28.1	38.8	41.6	133.6
-Year	2007	1996	1979	2008	2001	---	---	---	2004	1996	1994	1955	2011-2012
-Lowest Total Snow	0.5	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	1.4	25.1
-Year	1974	2003	1984	1993	---	---	---	---	---	2003	1995	1980	2014-2015

Source: Alaska Climate Research Center/National Weather Service, 2016

Likelihood of Occurrence - Probability - High

Extreme cold temperatures could happen every winter, depending on weather conditions. However, it is rare for temperatures in the MOA to be colder than -50°F (Albanese, 2010). See Hazard Rating Matrix, Table 1.2.

Historic Events

Extreme cold temperatures can be especially problematic if they are associated with low snow levels as happened in the winter of 1995-1996. The combination of these two factors resulted in the ground freezing to a greater depth than usual (more than 10 feet compared to the usual three of four feet). As utility pipes, including water and wastewater, are buried to a depth of 10 feet, some pipes froze and subsequently broke. Repairing the broken pipes was a massive undertaking as the ground had to be thawed before work could commence (Vonderheide, 2003).

Vulnerability

As extreme cold could affect the entire Municipality, the entire MOA is represented in Table 4.8. An extreme cold event is likely to result less property damage than other hazards such as an earthquake. In the MOA, typically buried pipes are most vulnerable to an extreme cold event. Homeless populations and people who have difficultly heating their homes (due to poor insulation, unable to afford heating costs, etc.) also tend to be more vulnerable. According to the 2019 American Community Survey 5-Year Estimates, the MOA had approximately 16,073 households with a household income less than $25,000. Homeless populations are also vulnerable. According to the January 2021 single-night homeless count, there were 1,319 homeless people in Anchorage (Anchorage Coalition Data on 1/26/21. Of those counted, 1,167 were considered sheltered and 152 were on the streets. Heavy snows may also result in school and business closures which may result in some individuals having a loss of income.

Table 4.8 Extreme Cold Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	75024	8526159300	17756156200	26282315500
Commercial	4065	2568664400	4512337400	7081001800
Industrial	2597	1494944600	1907337000	3402281600
Institutional	1035	1215398400	1554183700	2769582100
Open Space	44	24995700	503000	25498700
Transportation	664	0	0	0
Other	562	377462100	36697800	414159900
Vacant	228	0	0	0
Total	84219	14207624500	25767215100	39974839600

Source: MOAGIS, 2016

Ice Storms

Ice storm is the term used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. Ice storms result from the accumulation of freezing rain (rain that becomes super cooled and freezes upon impact with cold surfaces). Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations. Ice storms can be devastating and are often the cause of automobile accidents, power outages and personal injuries.

Glace ice, also known as black ice, which occurs when rains hits the cold ground and turns into ice, is possible in the MOA. It is responsible for multiple traffic accidents every winter.

Location

Ice storms can occur anywhere but the atmospheric conditions that can lead to ice storms occur most frequently around Cook Inlet. Freezing rains often approach from the west as storms from the Bering Sea move westward and mix with the pre-existing cold air in the MOA area.

Likelihood of Occurrence - Probability - High

The future occurrence of ice storms in the MOA depends on the weather conditions. Typically, there are a few episodes of light freezing rain each winter. The NWS will issue a freezing rain advisory which is for freezing rain up to 0.24 inches accumulation of ice. In the MOA, most

events have an accumulation less than a tenth of an inch (Albanese, 2010b).

More commonly, rain will fall on ice or snowpack covered roads which result in difficult driving conditions. This can occur when there is a storm in the Bering Sea/Bristol Bay area that has ample warm air advecting over the region and is accompanied by a strong southeast Chinook wind. See Hazard Rating Matrix, Table 4.2.

Historic Events

No significant historic ice storms have been identified. In November 2010, there were several days of freezing rain that made the roads slick and resulted in school closures. There was also an ice event in the mid-1990s (Albanese, 2010).

Vulnerability

As an ice storm could affect the entire Municipality, the entire MOA is represented in Table 4.9. An ice storm is likely to result in less building and property damage than other hazards. An ice storm has the potential to damage power lines. Infrastructure, especially above ground power lines are also vulnerable to ice. Ice storms can also increase the number of traffic accidents.

Large numbers of injuries and fatalities are not anticipated with an ice storm. Ice storm related power outages can affect people who rely on electricity for life-safety items such as respirators, monitoring equipment or medication that needs to be kept refrigerated.

Table 4.3.4.5 Ice Storm Vulnerability

Land Use	# of Parcels	Taxable Value e(Land)	Taxable Value (Buildings)	Total
Residential	75024	8526159300	17756156200	26282315500
Commercial	4065	2568664400	4512337400	7081001800
Industrial	2597	1494944600	1907337000	3402281600
Institutional	1035	1215398400	1554183700	2769582100
Open Space	44	24995700	503000	25498700
Transportation	664	0	0	0
Other	562	377462100	36697800	414159900
Vacant	228	0	0	0
Total	84219	14207624500	25767215100	39974839600

Source: MOAGIS, 2016

High Winds

High winds are generally considered to be winds in excess of 73 mph (Albanese, 2010b). A strong wind can be considered to be between 45 and 72 mph (Albenese, 2010b). They can lead to dangerous wind chill temperatures or combine with loose snow to produce blinding blizzard conditions. High winds have the potential to cause serious damage to a community's infrastructure, especially above ground utility lines. With early season high wind events, like the events in September 2010 and September 2012, high winds can cause trees to be blow over and uprooted. Later in the year, when trees are free of leaves and the ground is frozen, trees are more likely to break or have limbs broken off than being uprooted (Albanese, 2010b).

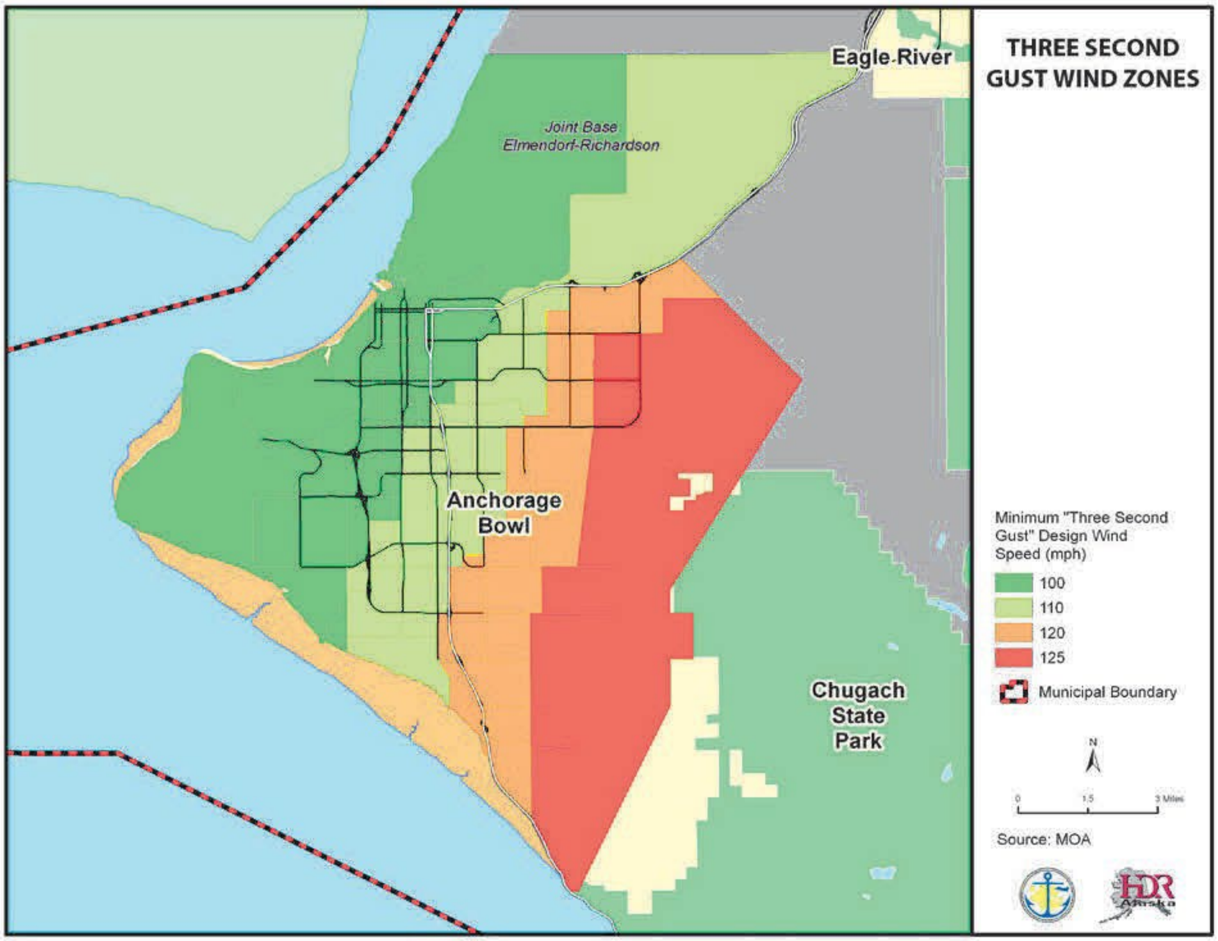
In mountainous areas, down slope windstorms created by temperature and pressure differences across the terrain can produce winds in excess of 100 mph. These windstorms can be particularly damaging as they are gusty in character and may seem to come from several directions.

Location

Typically, high wind warnings are for the Hillside and along Turnagain Arm. These areas common get high winds but the impacts are not that great until the winds are above 85 mph (Albanese, 2010b). When winds exceed 85 mph, it is not unusual for there to be damage. The damage is more widespread (especially along the Hillside and in East Anchorage), when the winds exceed 100 mph. Weaker winds (in the 50 to 60 mph range) will have more of an impact in the downtown area (Albanese, 2010b). The Port of Anchorage gantry crane operations stop at wind speeds greater than 50 miles per hour.

In the MOA, the basic wind speed, for the determination of the wind loads is determined in accordance with the Anchorage "Three Second Gust" wind zone map. This Anchorage Area- Wide Wind Speed Study noted that Anchorage gets strong winds from the southerly direction in the summer and northerly directions during the winter (RWDI, 1998).

Figure 4.4 50-Year Wind Speed



Localized high winds can also occur (see Table 4.10). The most well-known local wind is the Chugach wind which blows off the Chugach Mountains. These Chugach winds are really Chinook winds (a strong warm wind) and mostly affect the eastern side of the Anchorage Bowl. There can be winds just in the Turnagain Arm area, which affects traffic on the New Seward Highway (Vonderheide, 2003). Winds near McHugh Creek can get in the 80-90 mph range (Vonderheide, 2003). There is a Knik Valley wind, which brings warm air from Prince William Sound. The hillside area can experience a Chinook/Chugach wind. Eagle River can get winds from the Southeast. Localized winds in Bear Valley can reach 125 mph.

Table 4.3.4.6 Wind Speeds

	(a)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
WIND														
Mean Speed (mph)	42	6.4	6.9	7.0	73	8.4	8.4	7.3	6.9	6.7	6.7	6.5	6.3	7.1
Prevailing Direction		NNE	N	N	N	S	S	S	S	NNE	N	NNE	NNE	N
through 1964	38	03	04	03	15	35	17	16	02	22	03	04	05	03
Fastest Mile		61	52	51	35	33	30	29	31	35	40	41	41	61
-Direction(!!)		1971	1979	1989	1964	1964	1971	1957	1987	1993	1966	1978	1964	JAN
-Speed(mph)														1971

-Year	16	E	NE	NE	SE	S	SE	SE	N	S	S	NE	SE	
Peak Gust	16	64	61	75	43	43	46	40	44	48	55	55	55	NE
-Direction(!!)		1986	1994	1989	1987	1988	1985	1980	1987	1985	1987	1990	1992	75
-Speed(mph)														MAR
-Date														1989

Likelihood of Occurrence - Probability - High

High wind advisories, watches, and warnings are frequently issued by the National Weather Service (NWS) for different parts of Anchorage. See Hazard Rating Matrix, Table 1.2.

Historic Events

<u>September 2012</u>

A cooperative station weather observer in Glen Alps, in the Chugach Mountain foothills east of Anchorage, reported a peak gust to 131 mph on the night of September 4 to 5. Countless large trees were blown down, and there was other wind damage to structures. The damage from this storm was augmented by two factors. First, the ground was still wet and soft from rains in August. Second, the summer's growth of leaves remained on the trees as the wind increased. Combined, these factors strengthened the wind's grip on the forest canopy and weakened the ground that held the trees. At least 50,000 homes and businesses lost power as the storm hit. The Anchorage airport was closed until mid-day September 5.

<u>2003 Winter Storm – Federal Disaster 1461</u>

In March 2003, a winter storm brought high winds and freezing temperatures to Anchorage and surrounding communities for several days. This event involved a Bora wind, which is a very cold northerly wind (sometimes called the Matanuska wind). Bora winds are rare in Anchorage, and usually only occur every 10 to 15 years (Vonderheide, 2003). Prior to this event, the last one occurred in 1989.

Within the Municipality, the worst effects occurred in the west Anchorage area. Ted Stevens Anchorage International Airport had record high winds, sustained winds around 92-94 mph and a peak gust of 109 mph (Scott, Baines, and Papineau, 2004). Damage for the event in MOA alone exceeded $3.5 Million. MOA conducted a voluntary on-line survey about the damage caused by storm.

<u>2000 Central Gulf Coast Storm - Federal Disaster 1316</u>

In December 1999 and January 2000, there was series of severe winter storms (involving high winds and avalanches) that caused damage throughout Southcentral Alaska. Anchorage was one of many jurisdictions included in a Federal Disaster Declaration. In Anchorage, damage from this event included one fatality, property damage, disruption of electrical service, and interruption of rail and road access south of the Potter Weigh Station.

<u>April 1980 Windstorm</u>

On April 1, 1980, a Chinook wind with maximum gust speeds estimated at 134 mph caused approximately $25 million in damages.

<u>Other Wind Events (From RWDI 1998a and b)</u>

- December 3, 1994 - southeasterly downslope windstorm
- February 20, 1994 – northeasterly windstorm
- November 22, 1993 - southeasterly downslope windstorm
- February 3, 1993 – northeasterly windstorm
- December 1, 1992 windstorm - southeasterly downslope windstorm
- Had maximum gust speeds estimated at 112mph
- December 26, 1991 - southeasterly downslope windstorm
- March 4, 1989 – northeasterly windstorm
- November 9, 1986 – southeasterly downslope windstorm

- February 14, 1979 – northeasterly windstorm

Vulnerability

The entire MOA was not included in the Anchorage Area-Wide Wind Speed Study. The area included in the study is shown on Figure 4.4. The size of each wind speed zone is shown in Table 4.11. The vulnerability tables for each wind speed zone (Tables 4.12 – 4.15) only reflect the area included in the study.

Table 4.3.4.7 Area of Wind Speed Zones

Minimum "Three Second Gust" Design Wind Speed (mph)	Fastest Mile	Acres
100	85	31,489
110	95	21,545
120	104	12,120
125	109	22,372

Table 4.3.4.8 100 mph "Three Second Gust" Vulnerability in the Anchorage Building Service Area

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	21338	2597575600	5253931000	7851506600
Commercial	2442	1520269900	3143414100	4663684000
Industrial	1004	488792600	744528000	1233320600
Institutional	240	455801100	316954300	772755400
Open Space	34	20163000	476700	20639700
Transportation	104	2392100	227800	2619900
Other	127	117746600	13342700	131089300
Vacant	397	0	0	0
Total	25686	5202740900	9472874600	14675615500

Source: MOAGIS, 2016

Table 4.3.4.9 110 mph "Three Second Gust" Vulnerability in the Anchorage Building Service Area

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	12705	1345616400	2849712300	4195328700
Commercial	673	579464500	881644400	1461108900
Industrial	1415	906007900	1044356700	1950364600
Institutional	122	269195800	813039000	1082234800
Open Space	1	254600	0	254600
Transportation	20	0	0	0
Other	13	19226800	11192100	30418900
Vacant	15	0	0	0
Total	14964	3119766000	5599944500	8719710500

Source: MOAGIS, 2016

Table 4.3.4.10 120 mph "Three Second Gust" Vulnerability in the Anchorage Building Service Area

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	14606	1521998100	3460575500	4982573600
Commercial	220	183366800	298402000	481768800
Industrial	71	57714000	83264100	140978100
Institutional	241	259074200	187242200	446316400
Open Space	1	254600	0	254600
Transportation	4	0	0	0
Other	4	6955400	11452000	18407400
Vacant	42	0	0	0
Total	15189	2029363100	4040935800	6070298900

Source: MOAGIS, 2016

Table 4.3.4.11 125 mph "Three Second Gust" Vulnerability in the Anchorage Building Service Area

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	11242	1448168400	3085166200	4533334600
Commercial	39	34156200	39603400	73759600
Industrial	1	0	0	0
Institutional	146	169233900	117153000	286386900
Open Space	4	1503900	0	1503900
Transportation	5	0	0	0
Other	0	0	0	0
Vacant	16	0	0	0
Total	11453	1653062400	3241922600	4894985000

Source: MOAGIS, 2016

In general, a windstorm is more likely to cause property damage than injuries and fatalities. High winds can cause falling trees and branches which can bring down utility lines and cause property damage. Windstorms can lead to power failures which can affect people who rely on electricity for life-safety items such as respirators, monitoring equipment or medication that needs to be kept refrigerated. Power failures can also cause school and business closures.

Fallen trees and branches can block roads making it difficult to travel around town. Areas that are near forested areas such as the Hillside may be more vulnerable.

Fog

When the air is saturated with water vapor, a drop in temperature will cause the excess water vapor to condense into water droplets. These droplets, if thick enough, will turn into fog.

When it is foggy, ice can be deposited on the roadways, causing black ice conditions (Vonderheide, 2003).

Location

Fog is more frequent in West Anchorage. In the fall and early winter, a northerly wind comes from the north and reduces visibility. In East Anchorage, the drainage winds from the mountains mix the air to help keep the area relatively fog free.

Fog can also occur in the lower parts of Eagle River, but it is rare in the higher elevations.

Likelihood of Occurrence - Probability - High

Fog is likely to occur when the climatic conditions are right. Fog events are usually short-term with no lasting effects. See Hazard Rating Matrix, Table 1.2.

Historic Events

No significant historic fog events have been identified to date.

Vulnerability

As fog could affect the entire Municipality, the entire MOA is represented in Table 4.16. Property damage does not typically occur during a dense fog event. Dense fog can reduce visibility leading to an increase in traffic accidents. Traffic accidents have the potential to result in injuries and fatalities. Large numbers of injuries and fatalities due to dense fog is not anticipated. Dense fog may result in closures at local airports.

Table 4.3.4.12 Fog Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	75024	8526159300	17756156200	26282315500
Commercial	4065	2568664400	4512337400	7081001800

Source: MOAGIS, 2016

Other Weather Events

Other extreme weather events that are possible, but rare, in the MOA include:

- Tornadoes
- Coastal Storms
- Storm Surges
- Hail

4.3.4.1 Extreme Weather Vulnerability Assessment Update

Office Emergency Management updated the vulnerability assessment for extreme weather in the 2024 Hazard Identification and Risk Assessment (HIRA).

People

Extreme weather hazards in the MOA pose significant threats to the safety, health, and well-being of its residents.

Table 4.3.4.2.1

Hazard	Vulnerability to People
Heavy Snow	- Exposure to heavy snow can cause increased risk of hypothermia, frostbite and injuries from slips or vehicular accidents due to low visibility - Isolation of vulnerable populations (elderly, disabled) due to blocked roadways and pathways

Hazard	Vulnerability to People
	- Mental health impacts due to prolonged stress economic strain and isolation.
Heavy Rain	- Risk of injuries or fatalities from flash flooding, especially in low-lying areas - Disruption of access to critical services due to flooded roads - Increased prevalence of respiratory issues from mold growth in water-damaged homes
Extreme Cold	- Exposure to extreme cold can cause increased risk of hypothermia, frostbite, respiratory or cardiovascular complications - Greater risk of carbon monoxide poisoning from improper heating methods during power outages - Economic strain from high heating costs leading to stress and anxiety
Extreme Heat	- Exposure to extreme heat can lead to increased risk of heat exhaustion, dehydration, and heat stroke, especially for the elderly, children, and outdoor workers - Vulnerable populations, including those without air conditioning or adequate shelter, face heightened risk - Exacerbation of pre-existing health conditions, such as cardiovascular or respiratory issues, during prolonged heat events
Ice Storms	- Exposure risk to ice can increase injuries from slips and falls on icy surfaces or being struck by falling/sliding debris - Disruption to emergency services and healthcare access due to blocked or icy roads - Prolonged power outages exacerbating risks of hypothermia and carbon monoxide positioning
High Wind	- Increased injuries or fatalities from falling trees, flying debris, or vehicular accidents - Delayed emergency response and restricted access to essential services - Mental stress and anxiety from property damage, power outages and financial strain

Property

Extreme weather hazards threaten the MOA's residential, commercial and public buildings and infrastructure.

Table 4.3.4.2.2

Hazard	Vulnerability of Property
Heavy Snow	- Roof collapses and structural damage due to heavy snow load - Accelerated wear and tear on roads and bridges due to snow removal equipment and freeze-thaw cycles - Damage to trees near properties, falling branches posing a risk to buildings, fences, powerlines, and vehicles
Heavy Rain	- Flooding of basements and lower floors, damaging foundations, electrical systems and personal property - Saturated soils weakening building foundations, leading to cracks and settling - Overloaded drainage systems backing up into properties, especially in areas with inadequate stormwater management
Extreme Cold	- Frozen pipes in residential, commercial, and public buildings causing significant water damage - Strain on heating systems and increased demand on utility

Hazard	Vulnerability of Property
Extreme Heat	- Heat related degradation on materials used in the MOA that are not meant or able to withstand higher temperatures - Warping and expansion of wooden structures - Accelerated wear on paved surfaces (driveways and roads) cracking from heat expansion
Ice Storms	- Structural damage to roofs, gutters, and siding from accumulated ice - Increased stress on structural components of properties due to uneven ice loads, risking collapse or instability
High Wind	- Roof and siding damage, especially in older buildings or those with insufficient wind-resistant features - Damage to outdoor equipment, shattering of windows and doors from flying debris - Downed trees and power lines causing structural damage to buildings as well as utility service interruptions

The Environment

The MOA's natural environment is vulnerable to various extreme weather hazards.

Table 4.3.4.2.3

Hazard	Vulnerability of the Environment
Heavy Snow	- Accumulated snow can break tree branches under snow weight, damaging habitats and ecosystems - Soil compaction under heavy snow cover, reducing aeration and affecting root growth
Heavy Rain	- Increased erosion of riverbanks, hillsides and soil can lead to habitat degradation - Sedimentation in rivers and streams can affect aquatic ecosystems and water quality - Contamination of waterways can occur from urban runoff carrying pollutants
Extreme Cold	- Damage to vegetation, particularly non-native or less cold-tolerant species - And increase soil frost depth, potentially disrupting root systems of plants
Extreme Heat	- Heat stress on vegetation can lead to wilting, dieback, or reduced growth - Can increase risk of wildfires, which threaten ecosystems and natural habitats
Ice Storms	- Damage to trees and shrubs from ice accumulation
High Wind	- Uprooting of trees and vegetation potentially leading to habitat destruction and increased soil erosion - Dispersal of debris and pollutants into natural and protected areas - Potential destruction of nesting sites for birds and other wildlife

Municipal Operations

Municipal operations of the MOA are vulnerable to extreme weather hazards in various ways.

Table 4.3.4.2.4

Hazard	Vulnerability to Municipal Operations
Heavy Snow	- Increased costs and resource demands for snow removal, road salting and de-icing operations - Disruptions to public transportation due to snow-covered roads and delays in clearing bus routes, snow rates cause visibility issues and can lead to issues in clearing operations. - Strain on emergency services as snow impedes response times and challenges maintaining accessibility to critical infrastructure - Potential loss of trust in municipal operations if snow removal and road clearing are delayed
Heavy Rain	- Overwhelmed stormwater systems causing urban flooding and necessitating costly draining repairs and upgrades - Road and Bridge washouts requiring lengthy closures - Disruption to municipal services - Potential loss of trust in municipal operations if drainage systems fail or flood responses are delayed or mismanaged
Extreme Cold	- Frozen water lines affecting fire hydrants and other critical water infrastructure - Delayed response times for municipal services due to icy roads and malfunctioning equipment - Strain on shelters and warming centers to accommodate residents - Potential loss of trust in municipal operations if shelters are under-resourced or heating failures are not addressed quickly
Extreme Heat	- Increased cooling demands and demands for cooling centers, which may require increased demands on staff for MOA cooling center coordination - Potential loss of trust in municipal operations if residents perceive inadequate preparedness or poor communication about cooling resources
Ice Storms	- Strain on emergency services responding to accidents and injuries from ice covered surfaces
High Wind	- Downed trees and debris blocking roads, increasing cleanup demands and delaying public services. - Increased pressure on emergency services to address accidents, property damage, and service interruptions caused by high winds.

4.3.4.2 Extreme Weather Consequence Analysis Update

Office Emergency Management updated the consequence analysis for extreme weather in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public

Heavy snow and ice storms can make roads impassable, increase the risk of vehicle accidents, and isolate communities, particularly in remote areas. Prolonged power outages caused by ice buildup on power lines or high winds can leave residents without heat or electricity during extreme cold, posing serious health risks, especially for vulnerable populations like the elderly, children, and those with medical conditions. Flooding from heavy rain can damage homes, disrupt utilities, and displace residents. Extreme cold can lead to frostbite, hypothermia, and increased strain on heating systems. In addition to physical safety concerns, extreme weather can cause significant stress and anxiety, particularly if events are frequent or prolonged.

Impacts on Responders

Snow and ice accumulation can delay response times by making roads treacherous or impassable, while high winds and icy conditions pose hazards for operating emergency vehicles and equipment. Prolonged exposure to extreme cold increases the risk of frostbite, hypothermia, and exhaustion among responders. Heavy rain and flooding may require specialized rescue operations, adding complexity to their tasks. Power outages and communication disruptions caused by severe weather can hinder coordination, creating additional stress for responders working under hazardous conditions.

Impacts on Continuity of Operations

Heavy snow and ice can block transportation routes, delaying the movement of people and supplies and hindering access to critical facilities. Power outages caused by high winds or ice accumulation can disrupt communication systems, data networks and essential utilities, impacting operational effectiveness. Extreme cold may freeze pipes and equipment, reducing functionality in both public and private facilities. Flooding from heavy rain or thaw cycles can damage infrastructure and force the closure of key operation hubs. Staff shortages are also a threat if employees are unable to safely commute or are personally affected by the event.

Impacts on Property

Heavy snow can overload roofs, leading to structural collapses. Ice accumulation can damage gutters, roofs, and power lines. High winds can topple trees, tear off roofs, and damage siding, windows, and outbuildings. Prolonged extreme cold can freeze pipes, resulting in burst plumbing and water damage, Heavy rain can lead to localized flooding, damaging foundations, basements, and infrastructure. Ice storms may exacerbate these impacts by creating hazardous conditions that delay repair efforts. Coastal and riverfront properties are particularly vulnerable to erosion and water intrusion during heavy rain or thaw cycles. These cumulative damages can strain repair resources, drive up insurance claims, and impose significant economic burdens on property owners and the municipality.

Impacts on the Environment

Heavy rain and melting snow can lead to soil erosion, sedimentation in rivers and streams, and disruptions to aquatic ecosystems, potentially harming fish and wildlife populations. High winds can cause widespread deforestation by uprooting trees and damaging vegetation, which may lead to habitat loss and increased vulnerability to invasive species. Ice storms can damage trees and vegetation, leaving long-lasting scars on local ecosystems. Prolonged extreme cold can stress wildlife populations, limiting access to food and water while increasing mortality rates. Additionally, urban runoff from heavy precipitation or thaw cycles can carry pollutants into waterways, degrading water quality.

Impacts on the Economy

Heavy snow and ice storms can disrupt transportation networks, delaying the movement of goods and services and increasing costs for snow removal and road maintenance. High winds and extreme cold can damage infrastructure, homes, and businesses, resulting in expensive repairs and insurance claims. Prolonged power outages may interrupt business operations, leading to revenue losses for local industries, particularly those dependent on continuous energy, such as manufacturing and healthcare. Tourism, a key economic sector in MOA, can also be negatively affected by severe weather, deterring visitors and impacting related businesses like hotels, restaurants, and tour operators. Additionally, extreme weather events may strain municipal budgets, requiring substantial expenditures for emergency response, infrastructure repairs, and recovery efforts.

Impacts on Public Confidence in the Jurisdiction

Delays in clearing snow and ice, restoring power, or addressing flooding and infrastructure damage may lead residents to question the jurisdiction's preparedness and ability to ensure public safety. Ineffective communication about risks, shelter availability, or recovery timelines can exacerbate frustration and mistrust, particularly if vulnerable populations feel neglected. Repeated disruptions without visible improvements to mitigation efforts, such as enhancing infrastructure resilience or emergency response capabilities, may further diminish trust.

4.3.5 Flooding

Local Mitigation Plan Review Tool	
1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)
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))	4.1.4 Flooding pg. pg. 63-71

Flooding occurs when weather, geology, and hydrology combine to create conditions where river and stream waters flow outside of their usual course and "spill" beyond their banks. In the MOA, these natural factors can be exacerbated by development and result in an increase in the frequency of flood events. The MOA spans a wide range of climatic and geologic regions, resulting in considerable variation in precipitation. Primary factors in the amount of precipitation and area will receive are elevation and slope aspect, or direction. Within the MOA, annual precipitation varies from less than 15 inches at TSAIA to over 70 inches in Girdwood and along Turnagain Arm. Snowmelt from the Chugach Mountains provides a continuous water source throughout the year and can contribute significantly to the development of flooding.

Types of Flooding

Riverine, icing, and urban flooding are the three types[7] of flooding that primarily affect the MOA. Riverine flooding is the overbank flooding of rivers and streams. The natural processes

of flooding add sediment and nutrients to fertile floodplain areas. Riverine flooding can be the result of rainfall runoff or snowmelt and can occur on any of the rivers and streams within the MOA. Riverine flooding occurred on many rivers and creeks during the falls of 1995, 1997, 2002, and 2005.

Icing, also called aufeis, occurs when the growth of large bodies of ice on the streambed during freeze-up or breakup creates an obstruction to normal streamflow, causing river and streams to leave their banks. This can occur on many streams within the MOA. During the winters of 2003 and 2006, aufeis lead to overbank flooding on many creeks including Peters Creekand Rabbit Creek.

Urban flooding results from the conversion of land from wetlands or woodlands to parking lots and roads, through which the land loses its ability to absorb rainfall, causing runoff to overwhelm natural and manmade drainages.

Within the MOA, other types of flooding that may occur infrequently include:

Ice Jam Floods – the MOA tends not to have the typical ice jam flood like other parts of Alaska. In the MOA, when an ice jam flood occurs, it tends to be the result of ice collecting in a channel constriction such as a culvert. During a rain event or a sudden thaw, runoff enters a stream before the stream ice can melt, resulting in a flood. This type of flooding is more likely on larger creeks such as Campbell Creek.

[7] Flooding types are not exclusive categories and a flood event could have elements of multiple types of floods.

Flash Floods - These floods are characterized by a rapid rise in water level and are often caused by heavy rain on small stream basins, ice jam formation, or by dam failure. Flash floods are usually swift moving and debris filled, which cause them to be very powerful and destructive. Steep coastal areas in general are subject to flash floods. A flash flood could occur downstream of a Lake o' the Hills Dam. For more information, please see section 4.2.1, Dam Failure.

Fluctuating Lake Level Floods - Generally, lakes buffer downstream flooding due to the storage capacity of the lake. But when lake inflow is excessive, flooding of the lake shore area can occur.

Alluvial Fan Floods - Alluvial fans are areas of eroded rock and soil deposited by rivers. When various forms of debris fill the existing river channels on the alluvial fan, the water overflows and is forced to cut a new channel. Fast, debris-filled water causes erosion and flooding problems over large areas. The Girdwood area is prone to this type of flooding.

Glacial Outburst Floods - A glacial outburst flood, also known as a jökulhlaup, is a sudden release of water from a glacier or a glacier-dammed lake. They can fail by overtopping, earthquake activity, melting from volcanic activity, or draining through conduits in the glacier dam.

Subglacial releases occur when enough hydrostatic pressure occurs from accumulated water to “float” the glacial ice. Water then drains rapidly from the bottom of the lake.

Other problems related to flooding are deposition and stream bank 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. Stream bank erosion involves the removal of material from the stream bank. When bank erosion is excessive, it becomes a concern because it results in loss of streamside vegetation, fish habitat, and land and property.

A flood can injure or kill people as well as damage property. A flood may disrupt public utilities including water supplies and water treatment facilities. It can impact the transportation system by washing out roads or damaging bridges and culverts. This can make it difficult for emergency responders to get where they are needed.

Overflowing wastewater treatment systems can expose people to raw sewage which may make them ill. If a flooded building has not been treated properly, mold and mildew may develop which can become a health hazard especially for people with respiratory issues. The contents of a building such as household furnishing can be lost if they are washed away.

Important papers, photographs, and similar items may be damaged. Standing pools of water may become breeding grounds for mosquitoes.

Location

The MOA has many small streams and larger rivers that are susceptible to annual flooding events. Large rivers include the Glacier Creek, Twenty-mile River, Portage Creek, Placer River, Ship Creek, and Eagle River. Smaller streams include California Creek, Virgin Creek, Alyeska Creek, Fire Creek, Chester Creek, Campbell Creek, Little Campbell Creek, Fish Creek, Furrow Creek, Rabbit Creek, Meadow Creek, Hood Creek, and Peters Creek. Additionally, the shorelines of many of the small lakes in Anchorage are subject to periodic flooding. Coastal areas may experience flooding associated with extreme high tides.

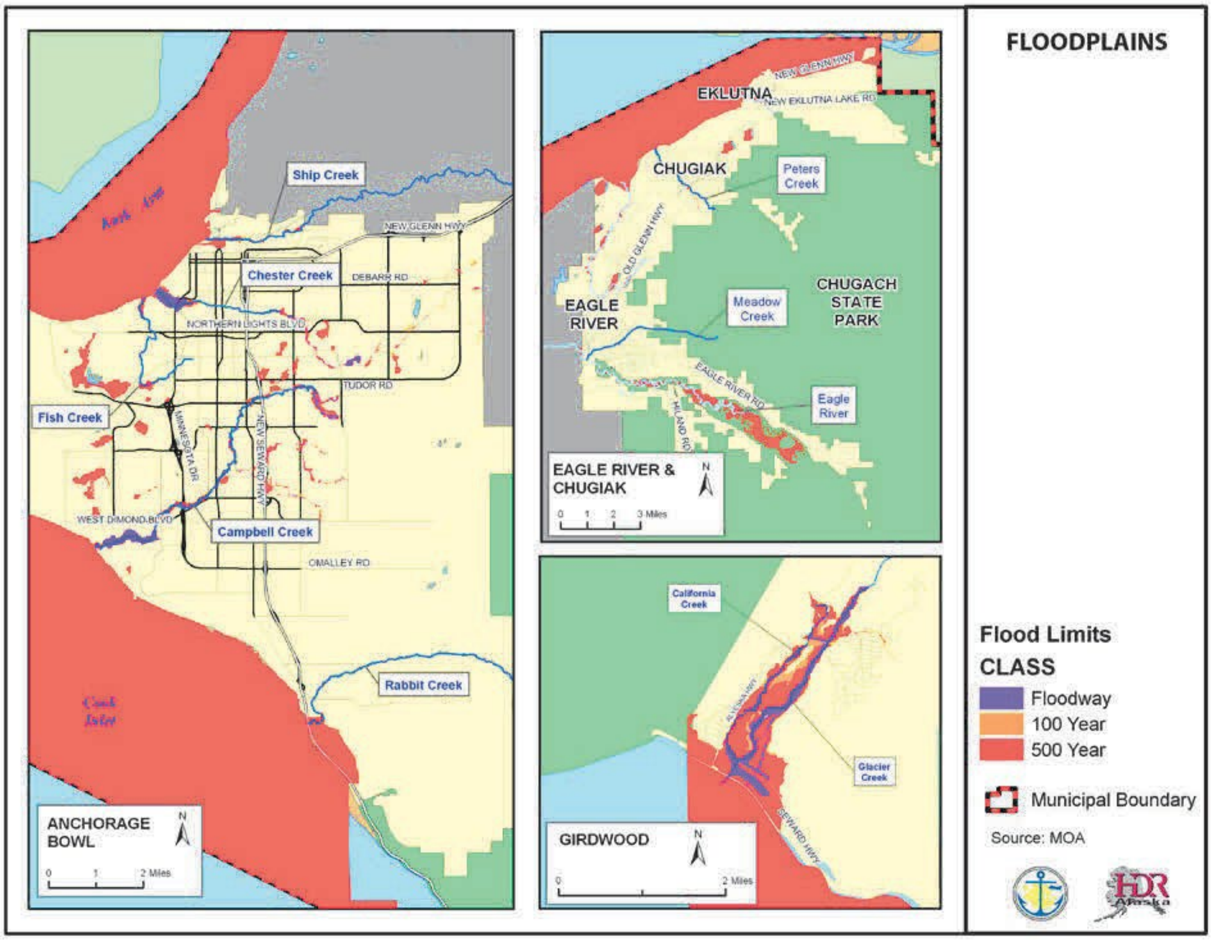
The flood hazard varies by location and type of flooding. The FEMA Flood Insurance Study from 2009 identifies potential areas of flooding. The study excluded Fire Island, Joint Base Elmendorf- Richardson, and Kincaid Park (referred to in the study as the Point Campbell Military Reservation. According to this report, most of the development land in MOA is “low, swampy, and subject to inundate from flooding” (FEMA, 2009. There are no flood studies being updated at this time.

FEMA would like the MOA to change vertical datum prior to initiating or adopting any new flood studies.

Figure 4.5 shows flood-prone areas in the MOA. This map is for illustrative purposes, as not all the floodplains identified on MOA's Flood Insurance Rate Maps (FIRM are on this map. The main flood-prone areas are near Glacier and California Creeks in Girdwood, Potter's Marsh, and along Campbell and Chester Creeks in Anchorage.

Please see the appropriate FIRM in Appendix D for more detailed flood information.

Figure 4.5 Flood-Prone Areas in the MOA



Much of Girdwood is subject to flooding because Girdwood valley occupies a fluvial valley drained by Glacier and California Creeks. The mouth of the valley is at sea level and gains elevation inland of the Seward Highway (MOA, 1995). The entire mouth of the Girdwood valley and the area adjacent to Glacier Creek to the airport is essentially within the 100-year floodplain. Other areas susceptible to flooding are California, Alyeska, and Virgin Creeks. The primary cause of flooding is runoff during heavy rainfall or rapid snowmelt during the spring (MOA, 1995).

Property Owner Outreach

On an annual basis, the MOA sends an informational letter to people who own property located in a floodplain. The letter provides an overview of flooding sources within the MOA, the causes of flooding, recent flooding events, flood insurance, floodplain regulation, flood safety tips and a list of contacts where home owners can obtain additional information.

Likelihood of Occurrence - Probability - High

Coastal areas are more likely to flood when there is a storm that causes storm surge, high waves, or intense rainfall. Riverine flooding is more likely to occur in the spring when the snowpack is melting. There is also more chance of flooding in heavy snow seasons.

Riverine flooding can also occur in response to heavy rainfall in upstream areas. Glacier outburst floods are not very predictable. See Hazard Rating Matrix, Table 1.2.

Historic Events

Girdwood, 2021

Between October 29 and November 1, 2021, Girdwood experienced historic rainfall. The historic rainfall event washed out Ruane Road, cutting off access to the water treatment plant in Girdwood. Loveland Road was also closed as well as Echo Ridge Drive during the flooding event. A disaster declaration was declared and approved.

July 2015

A 50-year rainfall event, 2 inches of rain in less than 12 hours, recorded by the National Weather Service. Approximately 30 people were evacuated from an apartment building at 12th and Cordova that partly flooded. A storm drain had failed and caused localized flooding.

Peters Creek Flooding

In 2006, Peters Creek has some of the worst flooding local residents have seen in 50 years. The Anchorage Soil and Water Conservation District

(ASWCD) had to blast a series of ice dams on Peters Creek to reopen the creek channel and stop the flooding. Since then, the ASWCD has been working on the Peters Creek Flooding and Erosion Control Project address the flooding issue.

Summer 2008

During the summer of 2008, an intense localized “cloudburst” caused flooding on the east side of the Anchorage Bowl. Stormwater runoff exceeded the capacity of the constructed and natural drainage system. Floodwaters flowed into the crawlspaces and lower floors of some local residences.

Winter of 2003 and 2006

During the winters of 2003 and 2006, colder than normal temperatures, combined with later than normal snowfall, caused the formation of aufeis in local streams, leading to overbank flooding, particularly on Peters Creek.

Fall of 1995, 1997, 2002, and 2005

The “Pineapple Express” brought warm weather to Anchorage in the fall of 1995, 1997, 2002, and 2005. The warmer than average temperatures, combined with prolonged precipitation, resulted in flooding throughout Southcentral Alaska, including the MOA. The 1995 event resulted in a federal disaster and is discussed below.

In September 1995, there was a federal disaster declaration (AK-1072-DR) due to flooding caused by heavy rainfall. Most of the damages were outside the MOA, but Girdwood was negatively impacted. Officials in Girdwood had to shut down the wastewater treatment plant when it was overwhelmed by large volumes of mud and water. This resulted in raw sewage being washed into local creeks.

Other Flood Events

August 30, 1989

In August 1989, more than 5 inches of rain fell in the Anchorage area, causing heavy flooding along drainage systems in the MOA. The flooding was concentrated at homes and businesses along Campbell, Chester, and Ship creeks. The flooding resulted in a State Disaster Declaration.

February 10, 1978

During February 1978, the south fork of Campbell Creek experienced flooding and glaciation. Glaciation is when a stream freezes to the bottom or a culvert freezes full. The water flowing on top of the ice also freezes, so more ice develops and spreads into the overbank areas.

The flooding affected an area bounded by East 80th Avenue, Spruce Avenue, Lake Otis Parkway, and Abbott Loop Road. Many residential structures were threatened with water, ice, and contamination of surface and subsurface water. The flooding resulted in a State Disaster Declaration.

Other flooding events are listed in Table 4.3.5.1.

Table 4.3.5.1 Historic Flooding

Flooding Source and Location	Maximum Discharge (cfs)	Date	Estimated Recurrence Interval (Years)
Ship Creek Near Anchorage	1,860	June 1949	50.0
South Fork Campbell Creek at mouth	891	June 1949	100.0
Chester Creek	N/A	April 1963	5.0
Rabbit Creek	N/A	June 1964	100.0
Eagle River	6,240	September 1967	N/A
Glacier Creek at Girdwood	7,710	September 1967	20.0
Ship Creek	1,600	August 1971	20.0

Below Power Plant at Elmendorf Air Force Base			
Campbell Creek Near Dimond Boulevard	421	August 1971	1.7
Chester Creek At Arctic Boulevard At Anchorage	95	August 1971	1.1
Peters Creek	N/A	August 1971	50.0
Meadow Creek	N/A	August 1971	5.0

From: Flood Insurance Study, 2002

Vulnerability

The MOA has almost 10,000 acres of floodplain and more than 3,500 parcels that are partially or wholly located within the regulatory floodplain. Ongoing development increases the developed area that is vulnerable to flooding as natural areas that have historically functioned as flood storage are displaced.

Parcels adjacent to waterbodies are the most vulnerable to flooding. The vulnerability shown in Tables 4.18 and 4.19 are based on the Municipality's flood limit GIS file shown in Figure 4.6. The number and location of parcels impacted may be different during different events. Flood waters may cause road closures leading to a disruption of the transportation infrastructure.

While the exact number of people living in the 2,827 residential parcels in a known floodplain, based on the MOA average household size of 2.65, the number of people who could be affected by a flood event is approximately 7,492. Large numbers of injuries and fatalities are not anticipated with a flood event however people could be impacted by the need to evacuate their home, water damaged belongings, and the cost of clean-up activities. Proper clean-up after a flood event is important to prevent mold from developing.

Table 4.3.5.2 100-Year Floodplain Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	2233	442489300	496510900	939000200
Commercial	283	96818500	84792200	181610700
Industrial	211	9717250	73592500	83309750
Institutional	258	288382700	839591000	1127973700
Open Space	315	146199700	58629200	204828900
Transportation	29	0	0	0
Other	241	250204600	12481500	262686100
Vacant	17	71214500	0	71214500
Watershed	6	612200	0	612200
Total	3593	1305638750	1565597300	2871236050

Source: MOAGIS, 2016

Table 4.3.5.3 500-Year Floodplain Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	802	98676700	190217500	288894200
Commercial	60	11823300	5437300	17260600
Industrial	71	13311600	15087700	28399300
Institutional	35	10904000	111697800	122601800
Open Space	66	22899500	4033400	26932900
Transportation	2	0	0	0
Other	22	0	0	0
Vacant	1	0	0	0
Watershed	0	0	0	0
Total	1059	157615100	326473700	484088800

Source: MOAGIS, 2016

For more information about potential vulnerabilities, please see the 2009 Flood Insurance Study.

Figure 4.6 Flood Insurance Zones

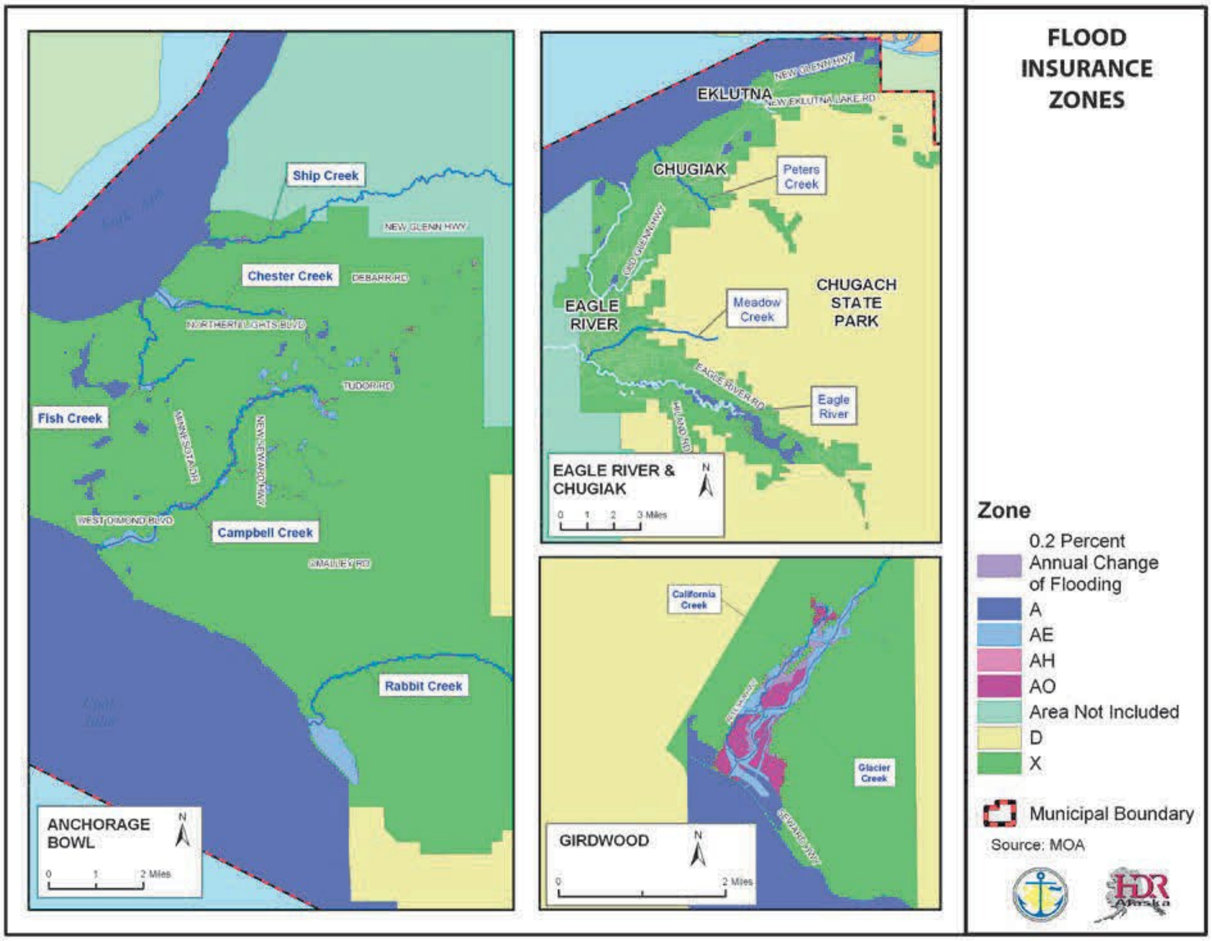
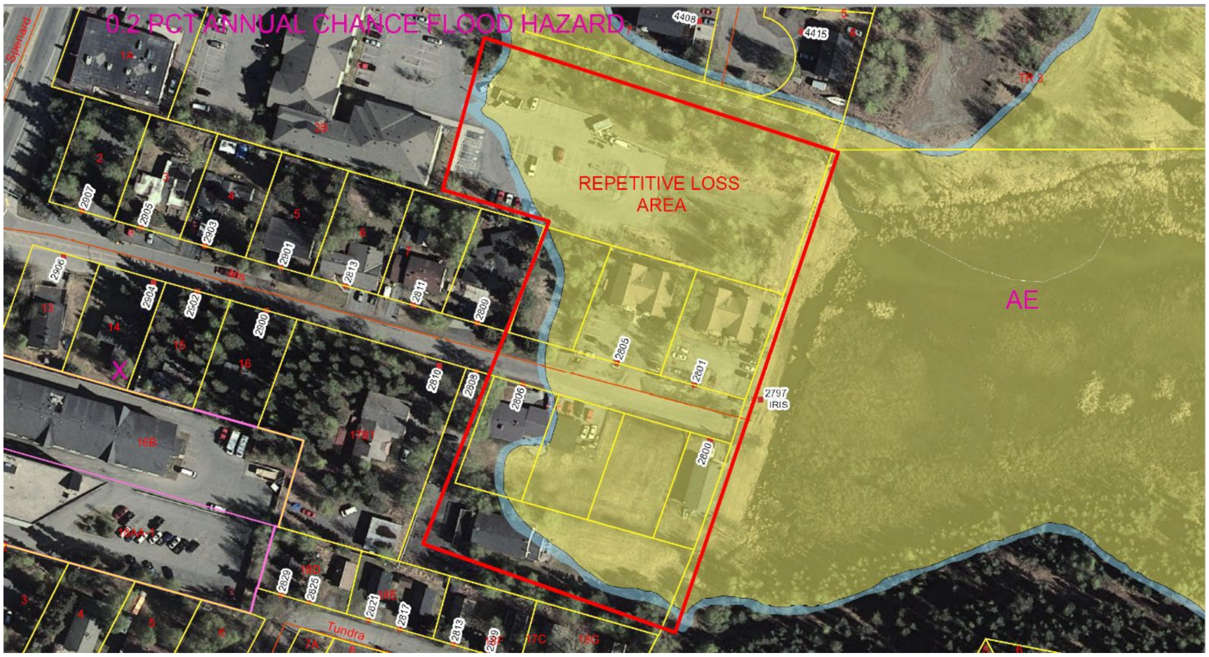


Figure 4.7 Repetitive Loss Area



One property has been identified as a repetitive loss property. This structure is a residential duplex that is located in FEMA mapped Special Flood Hazard Zone AE (Figure 4.7). This zone has been determined to potentially have a 1 percent annual chance of flooding and Base Flood Elevations have been determined. Annually the MOA Watershed Management Services department provides flood information to the property owners inside the boundary of the repetitive loss area map. A repetitive loss property is defined in the Flood Insurance Manual as a National Flood Insurance Program (NFIP) "insured structure that has had at least two paid flood losses of more than $1,000 each in any 10-year period since 1978."

Flood Insurance

The Municipality of Anchorage participates in the NFIP, which makes federally backed flood insurance available for all structures, whether or not they are located within the floodplain. Membership within NFIP —and the availability of flood insurance to municipal residents — requires the MOA to manage its floodplain in ways that meet or exceed standards set by FEMA. Federal financial assistance requires the purchase of flood insurance for buildings located within the Special Flood Hazard Area, a requirement that affects nearly all mortgages financed through commercial lending institutions. While the mandatory flood insurance purchase requirement has been in effect in the MOA since 1970, this requirement was often overlooked by lending institutions. Today, however, all institutions are complying with the applicable flood insurance purchase requirements and are reviewing all mortgage loans to determine whether flood insurance is required and should have been required in the past.

The MOA requires permits for activity within the FEMA mapped Special Flood Hazard Areas (SFHA) (see appendix D for a copy of the permit application). The MOA complies with the NFIP and FEMA regulations for work in the floodplain. Copies of the FIRMs, elevation certificates, Letters of Map Changes and other documents are maintained by the MOA. All building permits are reviewed for FEMA/NFIP requirements. The floodplain manager also reviews MOA and ADOT projects that will work in the mapped FEMA SFHA. As a participant in the NFIP, the MOA has adopted code to comply with 44 CFR, Part 60.3(d).

The MOA has participated in the NFIP since 1979. The first FIRM became effective in 1979 and the current effective map date is September 25, 2009. The MOA makes PDF versions of the FIRM maps available through their Web site (http://anchoragestormwater.com). The web site also has interactive flood maps that can be searched by address. Digital FIRMs are available through FEMA's Map Service Center. The MOA's floodplain ordinance exceeds the FEMA and state minimum requirements by having a 1-foot freeboard requirement, prohibiting critical facilities from being located in a floodplain, and prohibiting most types of floodway development. The floodplain permitting process is described in Appendix D.

The MOA has a dedicated floodplain manager, whose primary duty is floodplain management. The MOA also currently provides the following administrative services: map and records depository, permit review, cooperative technical partners mapping, assistance with letters of map changes preparation, technical and design assistance, and agency coordination. The only change that would improve the effectiveness of the NFIP program would be the addition of more support from the development community and some sectors of the MOA.

The MOA is in good standing with the NFIP and there are no outstanding compliance issues. The most recent Community Assistance Visit or Community Assistance Contact was in 2019 and there are none scheduled or needed at this time. In 2009 FEMA and the MOA updated all of the FIRMs to digital FIRMs or DFIRMS. There are no new mapping projects pending. Only one Letter of Map Revision (LOMR) is pending for Chester Creek at Muldoon Rd.

Community Rating System

The MOA participated in the Community Rating System (CRS); the current CRS class ranking is 7. Flood hazard policy holders within the Municipality receive a 15 percent discount on their premiums, due to MOA's Flood Hazard Program rating.

4.3.5.1 Flooding Vulnerability Assessment Update

Office Emergency Management updated the vulnerability assessment for flooding in the 2024 Hazard Identification and Risk Assessment (HIRA).

People

Residents of the MOA are vulnerable to flooding due to geographical, environmental and socio-economic factors. Low-lying residential neighborhoods, especially those near rivers and creeks, are threatened by the risk of high-water levels causing damage to homes and drainage systems becoming overwhelmed. Seasonal and flash floods can disrupt essential services like water and power. Health concerns are also significant as exposure to contaminated floodwaters and the potential for mold growth in water-damaged buildings can exacerbate respiratory conditions for residents with preexisting health issues. Analysis determines that 5,971 people, or 2% of the MOA's population, live in the 100-year floodplain and 6,990 people or 2% of the population live in the 500-year floodplain.

Property

Property in the MOA is vulnerable to flooding due to a combination of environmental and urban factors. Low-lying areas near creeks such as Chester, Ship, and Campbell are particularly susceptible to flood damage, with water intrusion, erosion, and hydrostatic pressure compromising building foundations and infrastructure. The municipality's floodplain, covering around 10,000 acres, exposes thousands of properties to periodic flooding risks. Rapid urban development exacerbates this vulnerability by replacing natural, permeable flood buffers with impermeable surfaces, which accelerates runoff and increases flood severity in densely developed areas. Floodwaters can damage roads, bridges, and utilities, causing erosion, washouts, and service disruptions. Properties built before modern floodplain standards, often without elevated foundations or barriers, face heightened risk and financial impacts from recurring flood damage.

Table 4.3.5.4: *Buildings in Special Flood Hazard Zones*

Flood Zone	Buildings in Flood Zone
A	415
AE	340
AH	5
AO	112
X	266
Total	**1138**

Table 4.3.5.5: Buildings in 100-year and 500-year Flood Risk Areas

Category	Total in 100-Year Flood Risk Area	Total in 500 Year Flood Risk Area
Airport	36	36
Commercial	114	135
Community Center	0	0
Cultural	0	0
Education	1	3
General	871	1188
Government	12	17
Hotel	1	1
Industrial	88	88
Medical	8	10
Pedestrian Bridge	2	2
Recreation	0	0
Religious	3	3
Transportation	2	2
Total	**1138**	**1485**

The Environment

Flooding can be very detrimental to the environment and can disrupt ecosystems, degrade water quality, and threaten wildlife habitats. Floodwaters often carry sediments, pollutants, and debris into rivers and creeks; this particularly impacts Chester and Ship Creeks, where sedimentation can reduce water channel capacity and decrease oxygen levels, harming fish and aquatic life. Urban runoff from impermeable surfaces exacerbates this, altering the natural water cycle by reducing groundwater recharge and causing more severe floods. These floods accelerate soil erosion along riverbanks and coastal areas, damaging riparian zones and wetlands that serve as natural flood buffers and wildlife corridors. Additionally, repeated flooding can promote the spread of invasive species, as disturbed soils create favorable conditions for non-native plants that outcompete local species, disrupting ecological balance.

Municipal Operations
Flooding poses challenges to MOA's municipal operations by disrupting infrastructure, emergency response, and public services. Floodwaters can damage roads, bridges, and utilities, slowing emergency response and affecting transportation routes, while also threatening water supply and wastewater systems, which may require costly repairs and contamination control. Increased urban runoff can overwhelm stormwater systems, leading to localized flooding that affects municipal property and daily operations. These impacts emphasize the need for resilient infrastructure and flood response strategies to ensure continuity of essential services during flood events. Analysis was completed on critical facilities located in the 100-year and 500-year floodplains.

Table4.3.5.6: Critical Facilities in 100-year and 500-year Floodplains

Critical Facility Type	Total	Total in 100-Year Floodplain	Total in 500-Year Floodplain
AFD (Anchorage Fire Department)	20	1	2
Airport	7	0	0
ASD (Anchorage School District)	97	0	0
ASD-Special Schools	11	0	0
AWWU (Anchorage Waste and Wastewater Utility)	45	3	3
Dam	10	3	3
Electricity	4	0	0
Federal	7	1	1
Historical Sites	32	0	0
Hospitals/Medical Facilities	13	0	0
JBER FD (Joint Base Elmendorf-Richardson)	8	0	0
MOA	2	0	0
Other Utilities	2	0	0
Police	13	0	0
Railroad	2	1	1
SOA (State of Alaska)	8	0	0
Total	**281**	**9**	**10**

<u>4.3.5.2 Flooding Consequence Analysis Update</u>
Office Emergency Management updated the consequence analysis for flooding in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public
Floodwaters can inundate homes, displacing residents and forcing many into temporary shelters, particularly in low-lying areas. Access to essential services, including healthcare, utilities, and transportation, may be disrupted, leaving communities vulnerable and isolated. Flooding can also lead to contamination of water supplies, increasing the risk of waterborne diseases and health complications. Vulnerable populations, such as the elderly, children and individuals with

disabilities, are at greater risk of harm due to limited mobility and access to resources. The psychological toll of flooding can also induce stress and anxiety, further straining community wellbeing.

Impacts on Responders

Responders may face risk such as drowning, injury form debris, or exposure to contaminated floodwaters while conducting rescues or assessing damage. Flooded roads and infrastructure can delay emergency response times, hinder the transport of personnel and resources, and isolate affected areas, complicating rescue and relief efforts. The physical and mental toll on responders may increase during prolonged operations, particularly in cold and wet conditions typical of the MOA's climate. Coordination among agencies may be strained by communication disruptions caused by damages infrastructure.

Impacts on Continuity of Operations

Flooded facilities, damaged infrastructure, and transportation route closures can prevent staff from accessing critical work sites, delaying service delivery and decision-making. Utility outages, including power, water and communication systems, may compromise the functionality of emergency response centers, data systems, and essential public services. Prolonged disruptions to operations can impede recovery efforts and reduce public confidence in the jurisdiction's ability to manage crises. Flood-related damage to records, equipment, and supply chains can further delay the restoration of operations.

Impacts on Property

Floodwaters can inundate homes and businesses, damaging foundations, walls and interiors, and rendering properties uninhabitable or unstable without costly repairs. Essential infrastructure such as roads, bridges, utilities, and stormwater systems may be compromised, further exacerbating property damage and hindering recovery efforts. Coastal and low-lying areas are particularly vulnerable, with the potential for erosion and loss of land, while heavy debris carried by floodwaters can cause additional destruction to buildings and infrastructure. The financial burden of repairing or rebuilding damages properties can strain individual homeowners, businesses and municipal budgets.

Impacts on the Environment

Floodwaters can erode soil, destabilize riverbanks, and alter natural watercourses, leading to habitat loss for fish and wildlife. Sedimentation from erosion can degrade water quality, impacting aquatic ecosystems, particularly species like salmon that rely on clear streams for spawning. Flooding can also introduce pollutants, such as oil, chemicals, and untreated sewage, into waterways, further harming the environment and posing long-term risks to both ecosystems and human health. Vegetation in flood-prone areas may be uprooted or smothered by sediment, reducing biodiversity and increasing vulnerability to invasive species. Wetlands and coastal zones may be permanently altered, affecting their ability to act as natural buffers against future flooding.

Impacts on the Economy

Flooding can force a temporary or permanent closures of businesses, particularly those in affected commercial districts, leading to lost revenue and job losses. Infrastructure damage to roads, bridges, and utilities can disrupt supply chains and delay economic activity, increasing costs for transportation and logistics. Residential and commercial property damage can drive up insurance claims and out-of-pocket expenses for repairs, placing financial stress on households and businesses. Municipal resources may be diverted to emergency response and recovery efforts, limiting investment in other critical areas. Industries reliant on natural resources or tourism may suffer from damaged ecosystems of diminished visitors.

Impacts on Public Confidence in the Jurisdiction

Delays in addressing flood impacts, such as restoring utilities, reopening roads, or providing assistance to displaced residents, may lead to frustration and mistrust among the community. Ineffective communication about evacuation plans, safety measures, or recovery timelines can exacerbate public concerns, especially for vulnerable populations who may feel overlooked. Repeated flooding events without visible improvements to mitigation infrastructure, such as drainage systems or floodplain management, can further erode confidence in the jurisdiction's ability to protect its residents.

4.3.6 Avalanche

Local Mitigation Plan Review Tool **1. REGULATION CHECKLIST** **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)
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))	4.1.5 Avalanche pg. 72-80

A snow avalanche is a swift, downhill-moving snow mass. The amount of damage is related to the type of avalanche, the composition and consistency of the avalanche material, the force and velocity of the flow, and the avalanche path.

Avalanche Types

There are two main types of snow avalanches: loose snow and slab. Other types of avalanches include cornice collapse, ice, and slush.

Loose Snow Avalanches

Loose snow avalanches, sometimes called point releases, generally occur when a small amount of un-cohesive snow slips and causes additional un-cohesive snow to travel downhill. They occur frequently as small, local cold dry "sluffs" that remove excess snow (involving just the upper layers of snow) and keep the slopes relatively safe. Loose avalanches are often small. Most dry loose snow avalanche do not have enough size to cause damage (American Avalanche Association, 2002). Wet loose snow avalanches, most commonly occurring in the spring, also tend to be small but are more likely to cause damage (American Avalanche Association, 2002). Loose snow avalanches can also trigger slab avalanches.

Loose snow avalanches typically occur on slopes above 35 degrees and leave behind an inverted V-shaped scar. They are often caused by snow overloading (common during or just after a snowstorm), vibration, or warming (triggered by rain, rising temperatures or solar radiation).

Slab Avalanches

Slab avalanches are the most dangerous types of avalanches. They happen when a mass of cohesive snow breaks away and travels down the mountainside. As it moves, the slab breaks up into smaller cohesive blocks.

Slab avalanches usually require the presence of structural weaknesses within interfacing layers of the snowpack. The weakness exists when a relatively strong, cohesive snow layer overlies weaker snow or is not well bonded to the underlying layer. Weaknesses are caused by changes in the thickness and type of snow cover due to changes in temperature or multiple snowfalls. The interface fails for several reasons. It can fail naturally due to earthquakes, blizzards, temperature changes, or other seismic and climatic causes, or artificially by human activity. When a slab is released, it accelerates, gaining speed and mass as it travels downhill.

The slab is defined by fractures. The uppermost fracture delineating the top line of the slab is termed the "crown surface;" the area above that is called the crown. The slab sides are called the flanks. The lower fracture indicating the base of the slab is called the "stauch wall." The surface over which the slab slides is called the "bed surface." Slabs can range in thickness from less than an inch to 35 feet or greater.

Cornice Collapse

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

Ice Fall Avalanche

Ice fall avalanches result from the sudden fall of broken glacier ice down a steep slope. They can be unpredictable. They are unrelated to temperature, time of day, or other typical avalanche factors.

Slush Avalanches

Slush avalanches occur mostly in high latitudes. One reason they are more common in high latitudes is because of the rapid onset of snow melt in the spring. Slush avalanches can start on slopes from 5 to 40 degrees, but usually not above 25 to 30 degrees. The snowpack is totally or partially water-saturated. The release is associated with a bed surface that is nearly impermeable to water. It is also commonly associated with heavy rainfall or sudden intense snow melt. Additionally, depth hoar is usually present at the base of the snow cover.

Slush avalanches can travel slowly or reach speeds up to more than 40 mph. Their depth is variable as well, ranging from 1 foot to more than 50 feet.

Avalanche Terrain Factors

There are several factors that influence avalanche conditions. The main factors are slope angle, slope aspect, and terrain roughness. Other factors include slope shape, vegetation cover, elevation, and path history. Avalanches usually occur on slopes above 25 degrees. Below 25 degrees, there usually is not enough stress on the snowpack to cause it to slide. Above 60 degrees, the snow tends to "sluff" off and does not accumulate. It is uncommon for avalanches to occur outside this slope angle range.

Slope aspect, also called orientation, describes the direction a slope faces with respect to the wind and sun. Leeward slopes loaded by wind-transported snow are problematic because the wind-deposited snow increases the stress and enhances slab formation. Intense direct sunlight, primarily during the spring months, can weaken and lubricate bonds between snow grains, weakening snowpack. Shaded slopes are potentially more unstable because weak layers are held for a longer time in an unstable state.

Terrain influences snow avalanches because trees, rocks, and general roughness act as anchors, holding snow in place. However, once an anchor is buried by snow, it loses its effectiveness. Anchors make avalanches less likely but do not prevent them unless the anchors are so close together that a person could not travel between them.

Avalanche Path

The local terrain features determine an avalanche's path. The path has three parts: the starting zone, the track, and the run-out zone.

The starting zone is where the snow breaks loose and starts sliding. It is generally near the top of a canyon, bowl, ridge, etc., with steep slopes between 25 and 50 degrees. Snowfall is usually significant in this area.

The track is the actual path followed by an avalanche. The track has milder slopes, between 15 and 30 degrees. This is where the avalanche will reach maximum velocity and mass. Tracks can branch, creating successive runs that increase the threat, especially when multiple releases share a run-out zone.

Avalanche Impact Pressures Related to Damage

Impact Pressures		**Potential Damage**
Kilopascals (kPa)	Pounds per square foot (Lbs/ft^2)	
2-4	40-80	Break windows
3-6	60-100	Push in doors, damage walls, roofs
10	200	Severely damage wood frame structures
20-30	400-600	Destroy wood frame structures, break trees
50-100	1000-2000	Destroy mature forests
>300	>6000	Move large boulders

Source Mears 1992

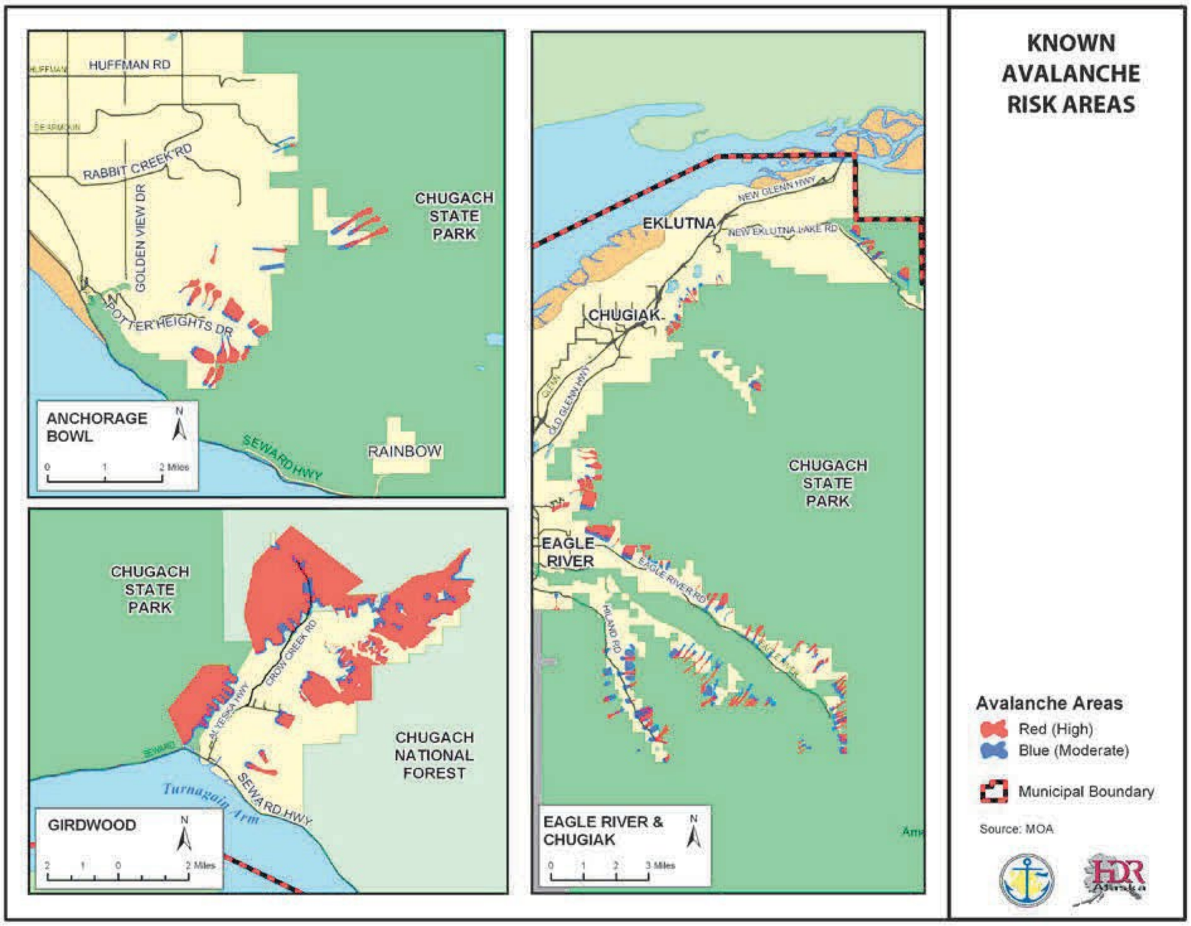
The run-out zone is a flatter area—around 5 to 15 degrees. It is located at the path base where the avalanche slows down, resulting in snow and debris deposition.

The impact pressure determines the amount of damage caused by an avalanche. The impact pressure is related to the density, volume (mass), and velocity of the avalanche.

Location

Avalanches can occur anywhere, but gullies, steep snow-covered slopes, and areas below steep ridges are particularly susceptible. To identify avalanche-prone areas in Anchorage, the Anchorage Snow Avalanche Zoning Analysis was conducted in 1982 by Arthur Mears. This report identified moderate (blue) and high (red) hazard areas, as shown in Figure 4.7.

Figure 4. Known Avalanche Risk Areas



The report describes the red zone as subject to avalanches with a 10-year average return period and the blue zone as prone to avalanches with a 100-year average return period. This means that a 10-year avalanche has a 10% annual probability, while a 100-year event has a 1% probability. Because an average return period is used, a 10-year avalanche has a return period of 3 to 30 years, while a 100-year avalanche has a return period of approximately 30 to 300 years. Events greater than a 100-year avalanche will affect parcels outside the blue zone.

The area with the potential for the largest avalanches is the Girdwood/Crow Creek area. Evidence of snow avalanches is prominent along the mountainsides above the Girdwood valley. The western mountainside has high and moderate avalanche danger from Turnagain Arm to California Creek. Avalanche hazard is moderate to high on the eastern mountainside at the head of the valley, near the day lodge and resort area, and southeast of Virgin Creek. Alyeska's day lodge and day parking are located partially in both the moderate and high avalanche hazard areas. Part of the original base area hotel and condos are in a moderate hazard area.

Other areas south of the Anchorage Bowl that may experience avalanches are Bird Creek, Indian, and Rainbow. North of the Anchorage Bowl, the areas near the South Fork of Eagle River, Eagle River, Peters Creek (especially near what is locally known as 4-mile), and Mirror Lake/N.W. Spur of Mt. Eklutna have avalanche potential. For more details, please refer to the Anchorage Snow Avalanche Zoning Analysis.

Another avalanche-prone area is the Seward Highway between the flats near Bird Point and the entrance to the Girdwood Valley (CSAC, 2004). This may be one of the most dangerous stretches of highway for avalanches due to traffic volume. In this area, avalanches have caused numerous accidents, killed at least five people, and caused other deaths from drowning by sweeping people into Turnagain Arm (CSAC, 2004).

Likelihood of Occurrence - Probability - High

Multiple avalanches occur every year, but they usually occur in more remote areas. The number and location depend on the conditions —the formation of weak layers in the snow, wind loading, terrain, etc. On a large scale, avalanches are hard to predict because winter conditions change and can vary from hour to hour. See Hazard Rating Matrix, Table 1.2.

Historic Events

The most remembered avalanches in recent history are those associated with the 2002 winter storms. Those avalanches resulted in road and rail access to Girdwood being blocked, disruption of electrical service, property damage, and the death of a heavy equipment operator who was clearing debris from an earlier avalanche off the Seward Highway.

<u>2000 Central Gulf Coast Storm - Federal Disaster 1316</u>

In December 1999 and January 2000, a series of severe winter storms triggered avalanches and flooding throughout Southcentral Alaska. Anchorage was one of many jurisdictions included in a Federal Disaster Declaration. In Anchorage, damage from this event included one fatality, property damage, disruption of electrical service, and interruption of rail and road access south of the Potter Weigh Station.

The section of New Seward Highway from Bird Point to Girdwood is very avalanche prone. Between 1951 (when the Seward Highway opened, and 1998) avalanches have blocked the road at least 485 times and have been a factor in more than 60 accidents (CSAC, 2004). In 1998, a six-mile stretch of highway was relocated (from mountainside to a new sea-level route) and was expected to reduce avalanche danger by approximately 70 percent. See Table 4.20 for additional historic avalanche events.

Table 4.3.6.1 Known Historic Avalanche Events

Date	Description
February 13, 2010	An avalanche near Mile 7.3 of Hiland Road in Eagle River resulted in a cross-country skier being fatally injured.
March 25, 2009	An avalanche hit an ARRC freight train approximately 5-20 miles south of Portage. Several of the rail cars were buried by the avalanche but there were no fatalities.
January 3, 2006	An avalanche on Ragged Top Mountain near Girdwood, Resulted in fatal injuries to a skier.
February 9, 2006	A snowshoer was fatally injured on Flat Top Mountain.
February 28, 2004	A cornice gave way on Bryon Glacier Peak, near Portage, and triggered an avalanche resulting in the death of a mountain climber.
January 22, 2004	A block of ice slide off the roof of a Forest Service warehouse near Portage

	and killed a Forest Service employee.
November 11, 2003	A self-triggered slab avalanche occurred in the Chugach State Park on Triangle Peak near the head of the South Fork of the Eagle River Valley. One man was partially buried but his two companions were able to dig him out.
April 1, 2002	An avalanche occurred on the south side of Mount Magnificent, killing two snowshoers. A third man was caught in the avalanche but was able to free himself. The avalanche triggered other slides in the area.
March 28, 2002	Two backcountry skiers and two dogs triggered an avalanche in the south bowl of Three Bowl Path near Mile 6.6 of Hiland Road in Eagle River. One skier was buried under 4 feet of debris and was rescued by the other skier. The following day, while searching for the dogs, a rescuer triggered another slide that hit a house. The slide damaged the fence but not the house; however, there were several feet of debris against the back wall.
November 11, 2000	On the North Gully of Flat Top Mountain, in Chugach State Park, one person was severely injured when he was caught by a small slab avalanche.
February 1, 2000	Avalanche near Bird Flats on the Seward Highway. An Alaska Railroad employee who was helping clear previous slides from the highway was killed when the avalanche struck the bulldozer he was operating. Three avalanches occurred that day. This specific avalanche occurred at the Five Fingers chute and was estimated to have crossed the highway at between 100 and 125 miles per hour. Slides also occurred at Mile 5.7 on the Eklutna Lake Road, Mile 7.5 of the Old Glenn Highway, and the Glenn Highway at Mile 95.
	Late 1999 and early 2000 saw avalanches in Cordova, Valdez, Anchorage, Whittier, Cooper Landing, Moose Pass, Summit, Matanuska-Susitna Valley, and Eklutna from the Central Gulf Coast Storm.
January 25, 2000	An avalanche occurred in the High Traverse area of Alyeska Resort. All skiers in the area were accounted for.
March 1999	An avalanche at Alyeska Resort partially buried two skiers. This was the first time in 25 years that an avalanche hit skiers at the resort.
December 7,1997	One woman was killed in a self-triggered soft slab avalanche while hiking on the Crow Pass Trail. Her companion was not caught by the avalanche but was unable to locate her.
April 1997	There was a series of avalanches between April 5th and 11th that involved skiers, climbers, and snow machiners. A snow machiner was killed in one of those accidents.
1987-88	Several (34) avalanches reached the Seward Highway. Some of the avalanches resulted in temporary highway closures and downed power poles. One avalanche, near Super Scooper (MP 94), struck a vehicle on the highway.
January 1980	Near MP 94, in a chute called Super Scooper, an avalanche hit a vehicle and derailed 4 locomotives and 13 cars of a freight train. Later that winter, avalanches blocked the road again, closing it for 4 days.
March 1979	A series of storms near Bird Hill caused 24 avalanches over several weeks. One slide, with 33 separate tongues, buried 2 miles of highway, closing it for 3 days.
1978	Seward Highway was blocked at least 17 times. One series of slides trapped 20 cars on Bird Hill. Another slide, near MP 99, hit one car and took high voltage lines off 13 poles.
1959-60	The Seward Highway was blocked by avalanches at least 81 times because of frequent blizzards in the Bird Hill area.
1952	On the Girdwood Flats near MP 91.8, an avalanche hit several cars on the highway. One person got out of their vehicle and was hit by a second slide and subsequently died.
1920	Near MP 91, an avalanche buried an Alaska Railroad train. As the train's occupants started to dig themselves out, the train was struck by a second slide. This slide buried 25 people and 4 killed others. It has been reported that several people were swept into Turnagain Arm and drowned.

1918	An avalanche near the present Seward Highway MP 92 killed several draft horses and knocked a telegraph pole over.

Additional avalanche events are listed in Mears, 1993 and Mears, 1982.

Vulnerability

Avalanche vulnerability is calculated using the areas in the MOA's avalanche GIS file (shown in Figure 4.10). The number of parcels in a high-risk avalanche area is shown in Table 4.21, while those in a moderate-risk area are shown in Table 4.22. Only a portion of these parcels are likely to be impacted by a given avalanche event. Other development including above ground utility lines can also be vulnerable to avalanches.

Avalanches have the ability to cause injury and death to people in the impacted area. With the average household size in the MOA being 2.65, the 24 residential parcels there is approximately 64 people living in an area with a known avalanche risk. Most avalanche related fatalities involve outdoor recreationalists such as back country skiers, snowboarders and snowmachiners but not exclusively. Many times, the victim triggers the avalanche. Other people such as passing motorists can also be at risk. Avalanches have the ability to destroy buildings, cover buildings and roads with snow and debris. They can also take down utility lines.

Historically, avalanches have caused the closure of the Seward Highway isolating Girdwood from the rest of the MOA. The avalanche hazard may increase road maintenance costs.

Depending on the conditions, more avalanche mitigation measures may be needed.

Table 4.3.6.1.1 High Avalanche Hazard Area Vulnerability

Land Use: Anchorage	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	1	48600	285600	334200
Commercial	0	0	0	0
Industrial	0	0	0	0
Institutional	0	0	0	0
Parks	0	0	0	0
Transportation	0	0	0	0
Other	0	0	0	0
Vacant	25	4641600		4641600
Watershed	10	0	0	0
Total	36	4690200	285600	4975800
Land Use: Chugiak/Eagle River	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	97	11521400	25484800	37006200
Commercial	0	0	0	0
Industrial	0	0	0	0
Institutional	4	0	0	0

Parks	0	0	0	0
Transportation	0	0	0	0
Other	10	0	0	0
Vacant	74	8475900		8475900
Watershed	67	0	0	0
Total	252	19997300	25484800	45482100
Total	252			
Land Use: Girdwood	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	31	1339400	3202500	4541900
Commercial	12	5402700	1133400	6536100
Industrial	1	459900	185000	644900
Institutional	0	0	0	0
Parks	0	0	0	0
Transportation	0	0	0	0
Other	11	0	0	0
Vacant	15	861800	0	861800
Watershed	2	0	0	0
Total	72	8063800	4520900	12584700

Source:MOAGIS, 2016

Table 4.3.6.1.2 Moderate Avalanche Hazard Area Vulnerability

Land Use: Anchorage	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	9	712,400	3,001,900	3,714,300
Commercial	0	0	0	0
Industrial	0	0	0	0
Institutional	2	1981900	0	1981900
Parks	0	0	0	0
Transportation	0	0	0	0
Other	0	0	0	0
Vacant (residential)	34	5,500,500	0	5,500,500
Watershed	8	3415700	0	3415700
Total		11610500	3001900	14,612,400
Land Use: Chugiak/Eagle River	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	270	30,820,800	73,422,300	104,243,100
Commercial	0	0	0	
Industrial	0	0	0	0
Institutional	4	2901100		2901100
Parks	3	7108500	0	7108500
Transportation	0	0	0	0
Other	19	38477300		38477300
Vacant	137	20,188,100		20,188,100

Watershed	74	26480200	2938500	29418700
Total	507	125,976,000	76,360,800	202,336,800
Land Use: Girdwood	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	15	4461700	6363400	10825100
Commercial	12	5781400	1458000	7239400
Industrial	0	0	0	0
Institutional	0	0	0	0
Parks	0	0	0	0
Transportation	0	0	0	0
Other	3	0	0	0
Vacant	18	1745000		1745000
Watershed	1	0	0	0
Total	49	11988100	7821400	19809500

Source: MOAGIS, 2016

4.3.6.1 Avalanche Vulnerability Assessment Update

Office Emergency Management updated the vulnerability assessment for avalanche in the 2024 Hazard Identification and Risk Assessment (HIRA).

People

People are highly vulnerable in areas with frequent avalanche activity, particularly in the Girdwood/Crow Creek area and along the Seward Highway. Analysis identified 7,119 residents in an avalanche hazard area; this number does not take into account visitors to these areas at any given time.

Residential areas, backcountry recreationists (skiers, snowboarders), and travelers on avalanche-prone roads are most at risk. Avalanches cause an average of one fatality per year in the region, with incidents including backcountry users and highway accidents.

Property

Property within avalanche zones, particularly in the high-hazard regions of Girdwood and the surrounding mountain slopes, is vulnerable to damage. Analysis identified 420 structures located in identified avalanche hazard areas in the MOA.

Table 4.3.6.1: Identified Buildings in Avalanche Hazard Area

Category	Total in Avalanche Risk Area
Airport	0
Commercial	2
Community Center	0
Cultural	0
Education	2
General	415
Government	0
Hotel	1

Category	Total in Avalanche Risk Area
Industrial	0
Medical	0
Pedestrian Bridge	0
Recreation	0
Religious	0
Transportation	0
Total	**420**

Avalanches can destroy homes, vehicles, and critical infrastructure such as power lines and roads. For example, the Alyeska day lodge and parking area, as well as some residential areas, are located within moderate-to-high hazard zones. Avalanches can damage wood-frame structures and result in costly repairs, especially for those located in known high-risk zones.

The Environment

Avalanches have a significant impact on the environment, often causing deforestation, altering landscapes, and impacting wildlife and wildlife habitats. Vegetation that stabilizes snow can be stripped, increasing the risk of future avalanches. The debris from an avalanche can block streams, disrupt ecosystems, and impact water quality due to sediment and debris flows.

Municipal Operations

Analysis was conducted to identify critical infrastructure in identified avalanche risk areas, though the resulting data showed now critical infrastructure in a risk zone that may affect municipal operations.

Avalanches disrupt municipal operations by closing highways (e.g., the Seward Highway), train tracks, and other critical transportation routes, which can isolate communities like Girdwood. The additional resources needed for highway clearance, emergency response, and search and rescue operations increase municipal costs. In severe winters, increased avalanche mitigation measures (such as controlled detonations) may be required, putting a strain on local resources.

4.3.6.2 Avalanche Consequence Analysis Update

Office Emergency Management updated the consequence analysis for avalanche in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public

Avalanches can lead to injuries, fatalities, and psychological trauma, particularly for those living in high-risk areas or engaging in recreational activities. Public fear of avalanches can also lead to a reduction in tourism in affected areas. In addition, avalanches can isolate communities by cutting off transportation routes, leaving residents without access to essential services.

Impacts on Responders

Avalanche rescue efforts are complex and hazardous, requiring specialized equipment and training. Search and rescue teams are often put at risk due to unstable snow conditions, while severe weather can delay or complicate recovery operations. Responders may also face challenges from secondary slides triggered by the initial avalanche or rescue efforts.

Impacts on Continuity of Operations
Avalanches can disrupt municipal operations, particularly when key transportation routes are blocked or critical infrastructure is damaged. Local governments may need to redirect resources toward recovery and mitigation, resulting in delays to other municipal projects. In areas prone to avalanches, mitigation strategies such as snow fences or controlled explosions must be employed regularly to minimize disruptions.

Impacts on Property
Avalanches can cause severe damage to buildings, roads, and infrastructure. Homes in avalanche-prone areas are often damaged or destroyed, especially those with weaker structures. Commercial buildings and infrastructure (e.g., power lines, transportation routes) are also at risk. Historical data shows that avalanches have frequently blocked the Seward Highway, disrupting travel and damaging property.

Impacts on the Environment
Avalanches strip vegetation, destabilize soil, and disrupt natural habitats. The debris from avalanches can block streams, altering watercourses and negatively affecting water quality. Deforestation caused by avalanches also leads to further environmental vulnerability, as fewer trees remain to stabilize snow on slopes, which may increase the frequency of future avalanches.

Impacts on the Economy
Avalanche-related disruptions, particularly in tourism-heavy areas like Girdwood, have a direct economic impact. Business closures, reduced tourism, and the cost of clearing avalanches from highways contribute to economic losses. Property damage in avalanche zones can lead to high repair costs for residents and municipalities alike, and in some cases, homes may be deemed uninsurable, further impacting the local economy.

Impacts on Public Confidence in the Jurisdiction
Frequent avalanches and the municipality's response to these events can affect public confidence. If residents feel that the government is not adequately managing the risk or that response times are insufficient, it can lead to decreased trust. Regular and effective mitigation measures, timely response, and clear communication are crucial to maintaining public confidence.

4.3.7 Landslide/Ground Failure

Local Mitigation Plan Review Tool **1. REGULATION CHECKLIST** **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** **(section and/or page number)**
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))	4.1.6 Landslide/Ground Failure pg. 80-85

Ground failure is a general term used to describe hazards that affect the stability of the ground. It can occur in many different ways, including landslides, land subsidence, and failures related to seasonally frozen ground and permafrost. Frequently, ground failure occurs as the result of another hazard such as an earthquake or volcanic eruption.

Seismically- induced ground failure is a major concern in the MOA.

Ground failure tends to cause more property damage than injuries or fatalities. Property damage can occur to buildings and infrastructure such as buried pipes. Ground failure can cause damage to the transportation system including roads, bridges, and railroads. Areas threatened by ground failure may have lower real estate values which can result in lower property tax revenue.

Landslides

Landslide is a generic term for a variety of downslope movements of earth material under the influence of gravity. Some landslides occur rapidly, in mere seconds, while others might take weeks or longer to develop.

It is hard to identify high and moderate zones of hazard intensity for different types of landslides. For example, hazard zones for rock falls can't be identified because the risk depends on the size of the rocks involved. It is known that the bluff near Points Campbell and Woronzof is a "narrow zone of very unstable material with a strong risk of landslide" (Mason, 1997: 198-199). The area near Campbell Lake has a high risk of landslides (Mason, 1997). "Debris flows occur in small, steep drainage basins throughout the" Glacier/Winner Creek area (Mears, 1993:13).

Landslides can occur naturally or be triggered by human activities. They occur naturally when inherent weaknesses in the rock or soil combine with one or more triggering events such as heavy rain, snowmelt, changes in groundwater level, and seismic or volcanic activity. Landslides can be caused by long-term climate change that results in increased precipitation, ground saturation, and a rise in groundwater level, which reduces shear strength and increases the weight of the soil. Erosion that removes material from the base of a slope can also trigger landslides.

Human activities that trigger landslides are usually associated with construction, such as grading that removes material from the base, loads material at the top, or otherwise alters a slope. Changing drainage patterns, groundwater level, slope, and surface water (for example, the addition of water to a slope from agricultural or landscape irrigation, roof downspouts, septic-tank effluent, or broken water or sewer lines) can also cause landslides.

Three main factors that influence landslides are topography, geology, and precipitation. Topography and geology are associated with each other; the steeper the slope, the greater the gravitational influence. Rock strength is important, as certain bedrock formations or rock types appear to be more prone than others to landsliding. Precipitation may erode and undermine slope surfaces. When precipitation is absorbed into the ground, it increases the pore water pressure and lubricates weak zones of rock or soil.

Secondary Effects

Landslides are often associated with other hazards. For example, a landslide may occur during floods because both involve precipitation, runoff, and ground saturation. Landslides are often associated with seismic and volcanic events. It has been estimated that ground failure, not shaking, caused most of the damage in the Good Friday Earthquake in Alaska.

The secondary effects of landslides can extend the damage past the limits of the actual landslide. For example, a landslide that dams a river or creek can cause damage upstream due to flooding and downstream due to flooding that may result from a sudden break in the dammed river. Landslides can also trigger tsunamis and seiches.

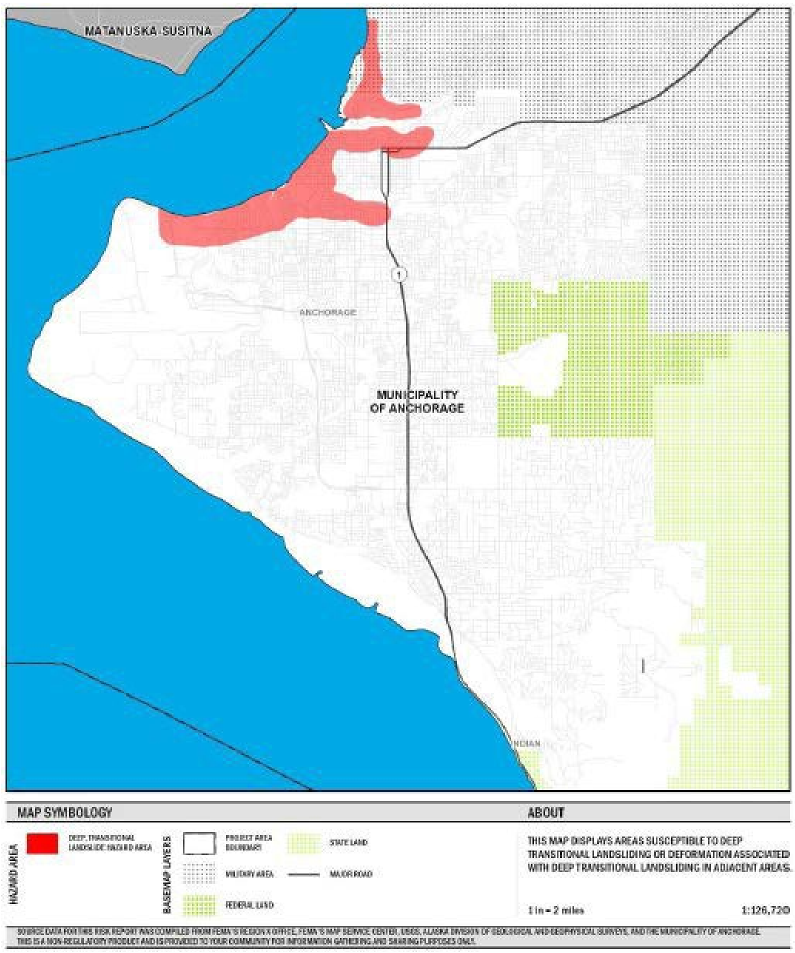
Seismically Induced Ground Failure

In 1979, a Geotechnical Hazards Assessment Study was developed to "inventory all significant geotechnical data with respect to geologic hazards, to analyze the data to provide an indication of the degree of hazard, and to designate those areas of potential hazards upon a series of maps" (Harding-Lawson, 1979:3).

Most landslides caused by the 1964 earthquake fall into two categories: "(1) deep, translational block-type landslides on sub-horizontal shear surfaces, and (2) shallower, more disrupted slides and slumps, on more steeply dipping shear surfaces, along coastal and stream bluffs and other steep slopes" (USGS, 2009). The translational block slides occurred mostly in the downtown and Turnagain Heights areas. These areas tend to have thick (over 30 feet) layers of Bootlegger Cove Formation clay. The shallower slides generally occurred in coastal areas and stream bluffs. The following figures show the seismic landslide hazard for deep translational landslides associated with great subduction zone earthquakes with return periods between approximately 300 and 900 years, shallow landslides with a 2 percent probability of exceedance in 50 years, and shallow landslides with a 10 percent probability of exceedance in 50 years.

The United States Geologic Survey (USGS) recently completed a report on seismic landslide hazards in the Anchorage Bowl (Jobson and Michael, 2009). According to this report, a large portion of the Anchorage Bowl has a low hazard but areas with moderate, high, and very high potential exist.

Figure 4.8 Seismic Landslide Hazards



As Figure 4.8 shows, the areas most likely for a deep translational landslide are Turnagain Heights, Downtown, Government Hill, and along the western portion of Chester Creek and Ship Creek. The areas most likely for shallow landslides are "steeper slopes, principally along coastal and stream bluffs and steep slopes bounding some glacial hills" (Wesson and others, 2007). Areas that have high and very high shallow landslide hazard include the Government Hill, along Chester Creek, along the Turnagain and Knik Arms, and Campbell Lake.

The Chugiak/Eagle River and Turnagain Arm areas were not included in this report. While landslides are possible in these areas, additional research is needed.

Land Subsidence

Land subsidence is any sinking or downward settling of the Earth's surface. Common causes of land subsidence in Alaska are sediment compaction and seismic or volcanic activity.

Based on previous experience, the Portage and Girdwood areas are susceptible to subsidence.

Seasonally Frozen Ground

Frost action is the seasonal freezing and thawing of water in the ground and its effect on the ground and development. Frost heave is when ice formation causes an upward displacement of the ground. When the ground ice thaws, the ground loses bearing strength and its ability to support structures is weakened. This is a widespread problem in Alaska.

Likelihood of Occurrence - Probability - Medium

Ground failure events are difficult to predict, as many of them are triggered by other events such as earthquakes. See Hazard Rating Matrix, Table 1.2.

Historic Events

The 1964 Good Friday earthquake triggered a wide variety of falls, slides, and flows through Southcentral Alaska. The Anchorage area was heavily impacted because of Bootlegger Cove clay failures. Some of the more significant events occurred at 4th Avenue, L Street, Government Hill, and Turnagain Heights. Several less-devastating slides occurred throughout town, including slides at Point Woronzof and Potter Hill.

The Government Hill slide was a complex movement. Government Hill Elementary School was severely damaged by the translational slide. The south wing of the school dropped about 30 feet, while the east wing split lengthwise and collapsed. Part of this slide became an earth flow that spread 150 feet across the flats into the Alaska Railroad yards. Anchorage All-Hazards Mitigation Plan Update

The Turnagain Heights landslide is also considered a complex movement. In fact, it was probably the most complex of all the Anchorage landslides associated with the Good Friday earthquake. The landslide likely began as a block slide, but evolved to include lateral spreading, slumping, and possibly other types of movement. This landslide caused serious damage to a housing development, in which three people died.

The earthquake caused at least one rock avalanche as a slab of rock became detached from the mountain peak overlooking Sherman Glacier. The rock slab disintegrated as it moved downhill, enabling it to reach high velocity and extend a great distance over the glacier.

Rockslides were also triggered, including “one relatively significant event in the Winner Creek drainage”(Mears, 1993:12).

Extensive subsidence also occurred as a result of the 1964 Good Friday earthquake. The zone of subsidence covered about 110,039 square miles, including the north and west parts of Prince William Sound, the west part of the Chugach Mountains, most of Kenai Peninsula, and almost all the Kodiak Island group. Some areas experienced subsidence that exceeded seven feet, but most areas subsided less. For example, part of the Seward area is about 3.5 feet lower than before the earthquake and portions of Whittier subsided more than five feet. The village of Portage, at the head of Turnagain Arm of Cook Inlet, experienced six feet of tectonic subsidence during the earthquake.

4.3.7.1 Vulnerability Assessment

An earthquake could cause seismically induced landslide. For information about earthquakes, please see Section 4.1. The susceptibility for seismically induced ground failure has been determined only for the part of the Municipality shown in Figure 4.9. Table 4.23 shows the parcels that are susceptible to a deep, translational landslide while Table 4.24 shows the parcels that are susceptible to deformation associated with deep, translational landslides in adjacent areas. A similar calculation could not be conducted to identify the vulnerability to the shallow landslide hazard as the file format did not permit this analysis. Based on an average MOA household size of 2.65, there is approximately 5,955 people living areas that are vulnerability to deep, translational landslides and an additional 3,729 living in the adjacent areas. Infrastructure, including buried pipes, are vulnerable to ground failure.

Table 4.3.7.1.1 Deep, Translational Landslide Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	2339	433511900	637984400	1071496300
Commercial	419	223303600	451056700	674360300
Industrial	48	49107700	44055800	93163500
Institutional	43	74470000	77213700	151683700
Open Space	12	3164300	271500	3435800
Transportation	0	0	0	0
Other	3	0	0	0
Vacant	22	0	0	0
Total	2886	783557500	1210582100	1994139600

Source: MOA GIS, 2016

Table 4.3.7.1.2 Deformation in Adjacent Areas Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	1350	189932800	320803700	510736500
Commercial	700	362166700	879711300	1241878000
Industrial	80	72405800	123638800	196044600
Institutional	59	39055100	32231200	71286300
Open Space	9	2814000	0	2814000
Transportation	0	0	0	0
Other	4	0	0	0
Vacant	32	0	0	0
Total	2234	666374400	1356385000	2022759400

Source: MOAGIS, 2016

4.3.7.2 Consequence Analysis

Office Emergency Management updated the consequence analysis for ground failure/landslide/severe erosion in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public
Direct impacts can include injuries or fatalities from collapsing structures, road closures, and disrupted evacuation routes. Residents in affected areas may face displacement due to property damage or unsafe conditions, resulting in temporary housing needs and emotional distress. Access to essential services such as water, electricity, and emergency healthcare may be hindered if critical infrastructure is damaged. Additionally, landslides can isolate communities, disrupt daily activities, and cause economic hardships.

Impacts on Responders
Injury or fatalities while operating in unstable terrain or amidst secondary slides. Blocked roads and damaged infrastructure can delay response times, restrict access to affected areas, and limit the movement of personnel and equipment. Responders may also face challenges in locating and rescuing individuals trapped under debris, requiring specialized training and tools. The psychological strain of working in high-stress environments, especially in prolonged search and recovery operations, can affect mental health and performance. Resource demands may overwhelm local response capabilities, necessitating mutual aid or state and federal assistance, potentially complicating coordination efforts.

Impacts on Continuity of Operations
Physical damage to facilities, such as administrative buildings or operational hubs, and interruptions to essential services like water, electricity, and communications if infrastructure is compromised. Blocked transportation routes can delay personnel, supplies, and equipment, hinder the delivery of emergency services and disrupt supply chains. Extended disruptions can affect public trust in organizational effectiveness, especially if recovery is slow or poorly managed.

Impacts on Property
Homes, buildings, and infrastructure located in vulnerable zones may suffer partial or total collapse, rendering them unsafe or uninhabitable. Foundations can shift, roads and bridges may be destroyed, and utilities such as water, gas, and power lines are at high risk of rupture, leading to further cascading impacts. In addition to direct structural losses, landslides can bury or erode large areas of land, making rebuilding costly and challenging.

Impacts on the Environment
Landslides can strip vegetation, destabilize soil, and deposit debris in rivers, streams, and coastal waters, degrading water quality and harming aquatic habitats. Coastal erosion can lead to the loss of shoreline habitats, impacting species that rely on these areas, while increasing sedimentation can smother marine ecosystems such as coral reefs and seagrass beds. Landslides may also release pollutants from disturbed soils or damaged infrastructure, further threatening ecosystems. These events can cause long-term changes to natural drainage patterns, accelerate habitat loss, and undermine the stability of ecosystems.

Impacts on the Economy
Transportation disruptions caused by blocked roads, damaged bridges, and railways can halt commerce and delay critical supply chains, impacting local businesses and industries. Landslides and erosion in agricultural areas may reduce productivity by burying or destabilizing arable land, while coastal erosion can harm tourism-dependent economies by damaging beaches, resorts, and recreational areas. Cleanup and repair costs for affected infrastructure, coupled with prolonged disruptions to utility services, often place a heavy financial burden on communities and governments.

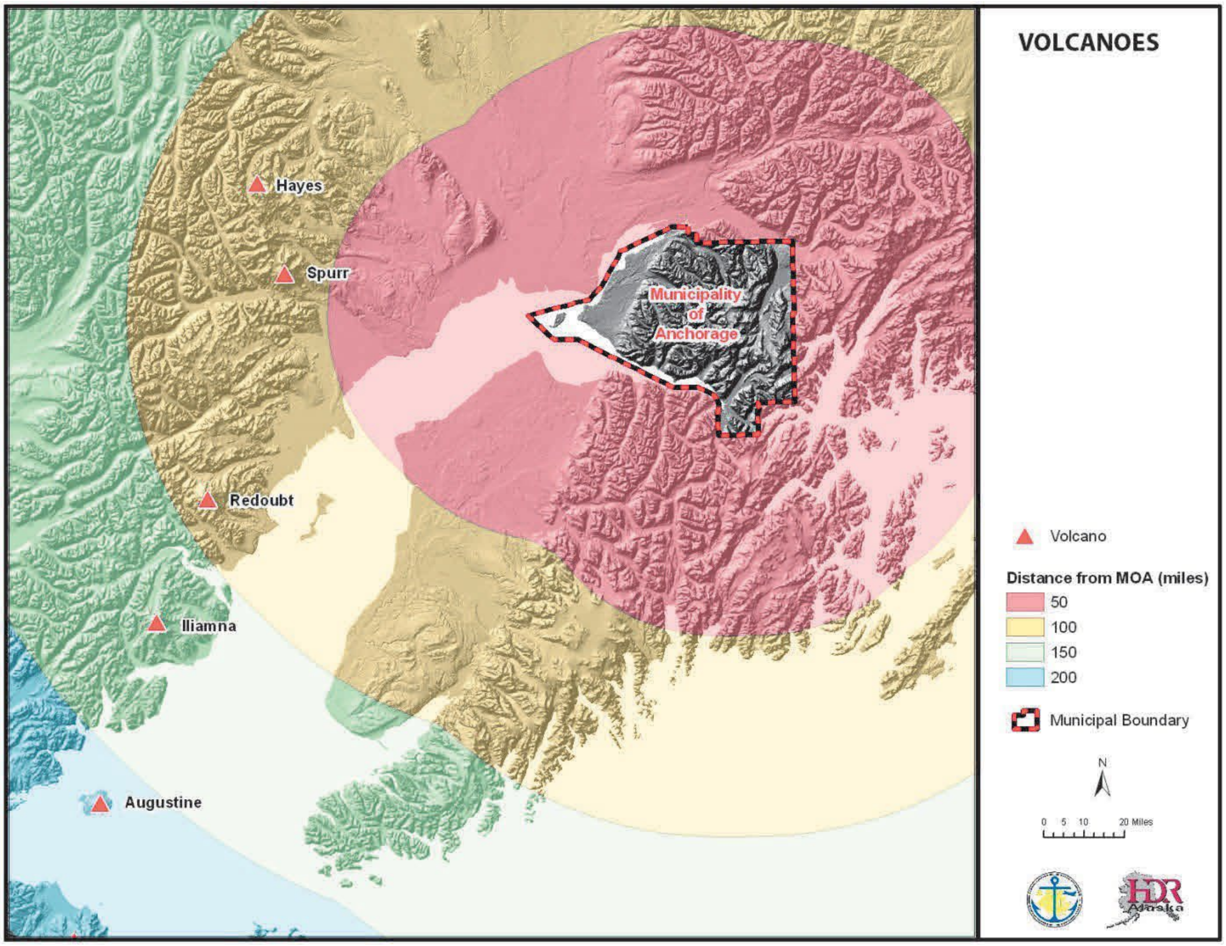
Impacts on Public Confidence in the Jurisdiction
Visible destruction of homes, infrastructure, and public spaces, coupled with delays in restoring essential services or stabilizing affected areas, can lead to frustration and distrust among residents. Insufficient communication about risks, evacuation plans, and long-term mitigation efforts may further erode confidence, especially if the public feels unprepared or unsupported.

4.1.7 Volcanic Ashfall

Local Mitigation Plan Review Tool	
1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** **(section and/or page number)**
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))	4.1.7 Volcanic Ashfall pg. 86 90

According to the Alaska Volcano Observatory (AVO), a volcano is "a vent in the surface of the Earth through which magma and associated gases and ash erupt; also, the form or structure (usually conical) that is produced by the ejected material" (AVO www.avo.alaska.edu, undated). Alaska is home to over 130 volcanoes with 90 of them being active in the last 10,000 years and over 50 have been active since approximately 1760. None of these volcanoes are located within the MOA (see Figure 4.9). Because of the distance between any volcano and the MOA, the MOA will not be likely be directly affected by most elements of a volcanic eruption that occurs in Alaska; with the exception of ash fall.

Figure 4.9 Volcanoes

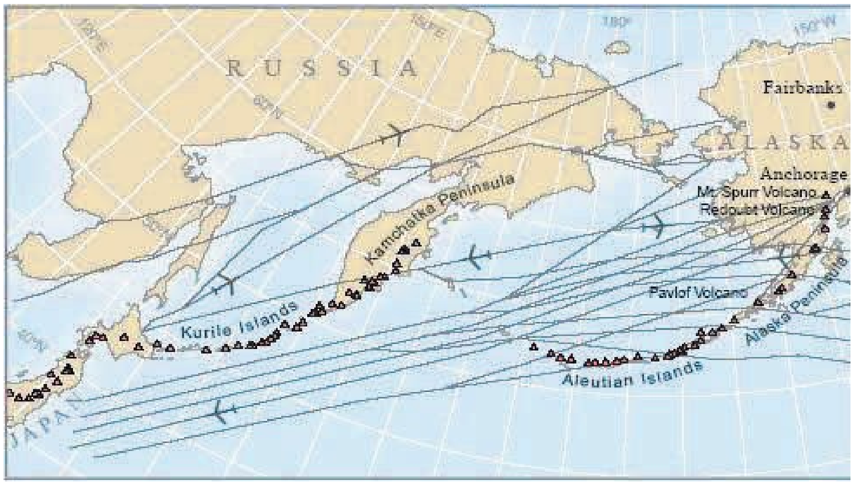


There are a variety of hazards associated with a volcanic eruption, but the primary hazard to the MOA is volcanic ash fall. Volcanic ash consists of small jagged pieces (less than 1/12 inch in diameter) of rocks, minerals, and volcanic glass sent into the air by a volcano (Kenedi and others, 2000). Volcanic ash is created during an explosive volcanic eruption. Alaska's volcanic activity is dominated by explosive volcanism.

Volcanic ash can accumulate on roof tops, power lines or other structures causing them to collapse. Wet ash can conduct electricity and may cause short circuits or the failure of electrical components. Ash fall may interfere with telephone and radio communications. Ash can also interfere with the operation of mechanical equipment, including aircraft. In Alaska, this is a major problem, as many major flight routes are near historically active volcanoes; the main airport for the MOA and all of Alaska, the TSAIA along with Merrill Field, and JBER Elmendorf AFB air facilities, are all at risk from volcanic ash fall. Ash falling or resuspended can also reduce visibility and make roads and runways slippery making transportation difficult. Ash may be a health risk especially to people with cardiac or respiratory conditions, children and the elderly. Ash is abrasive and can injure eyes (Kenedi and others, 2000).

Based on proximity, the volcanoes that are most likely to result in ash fall in the MOA are the five Cook Inlet Volcanoes, Hayes, Spurr, Redoubt, Iliamna and Augustine (figure 4.10). Of these, Augustine is considered the most historically active volcano in the Cook Inlet region (Wallace and others, 2010). For more information about these volcanoes, please see the respective volcano hazard report available on the AVO website at http://www.avo.alaska.edu/downloads/classresults.php?pregen=haz

Figure 4.10 Flight Routes



Alaska's volcanoes and a schematic depiction of selected major North Pacific and Russian Far East air routes. SOURCE: AVO

Location

The entire MOA could be impacted by a volcanic ash event. Different areas of the MOA may be impacted by any given event depending on which volcano erupts, wind direction, and duration of the eruption. Due to the prevailing winds, the MOA could receive ash fall from any Cook Inlet volcano depending on wind conditions at the time of the eruption (Waythomas and others, 1997; Waythomas and Waitt, 1998). Recent lake-core studies in the Anchorage area indicate that Mount Spurr volcano is the most prolific source of ash fall in the MOA over the last 12,000 years (Wallace and others, 2010). It is also possible that ash could reach the MOA from a large eruption outside of the Cook Inlet region.

Likelihood of Occurrence - Probability - Medium

Volcanic activity that poses a risk to aircraft or local populations in Alaska is infrequent. The AVO actively monitors Alaska's volcanoes for signs of unrest. AVO is also responsible for issuing warnings of eruptions or activity that may lead to an eruption. See Hazard Rating Matrix, Table 1.2.

The MOA is more likely to experience ash fall from Spurr, Redoubt, and Augustine volcanoes because of the proximity of the MOA to these sources upwind. Based on geologic studies of the Cook Inlet volcanoes, Spurr, Redoubt, and Augustine are considered more frequently active than Hayes or Iliamna volcanoes, According to the USGS, "large-volume, explosive, ash-forming eruptions of Iliamna are probably unlikely in the future but significant disruptive small eruptions could occur (Waythomas and Miller, 1999). Hayes Volcano appears to be largely inactive in the past few thousand years and historical eruptions are unknown (USGS, 2002). However, the largest ash fall event in the MOA in the late Holocene occurred from Hayes Volcano (3,700–4,200 years ago).

Historic Events

In its nearly 100 years of existence, Anchorage has dealt with ash from historical eruptions of Spurr, Redoubt, and Augustine volcanoes. Additional information about these eruptions can be found in the respective Volcano-Hazard Assessments.

Spurr Volcano

In 1992, a series of three ash-producing eruptions occurred from Crater Peak, the active vent on Spurr Volcano. Ash fall from one of the three events occurred in the MOA (August 18) and triggered a disaster declaration. Approximately 0.12 inches (3 mm) of sand-sized ash fell in the MOA. The eruption caused health problems and property damage. Economic losses resulted from businesses, schools, and industrial facility closures. Cars, computers, and other electronic devices were damaged. TSAIA was closed for 20 hours. Two people had heart attacks while shoveling ash (Waythomas and Nye, 2002). Numerous air-quality alerts were issued for days following the ash-fall event due to resuspension of the ash deposit and air- quality was a concern until the first snow in the fall (Waythomas and Nye, 2002).

The only other historical eruption of Mount Spurr, was in July 1953. Ash from this eruption reached the MOA and deposited about twice as much ash as in 1992 (Waythomas and Nye, 2002).

Redoubt Volcano

The most recent eruption of Redoubt occurred in 2009 and produced at least 19 ash- producing explosions between March 22 and April 4 (Wallace and Schaefer, 2009). Only one such explosion on March 28 resulted in trace (< 0.8 mm or 0.031 in) ash fall in the MOA. Ash- fall impacts to the MOA were relatively minor due to the short duration (<1 hour) of ash fall and occurrence during winter months where the ash quickly mixed with snow on the ground preventing significant resuspension. Economic losses due to disruptions to airline travel were, however, significant and the TSAIA was closed for 22 hours (March 28) and numerous flights were cancelled or rerouted throughout the eruption (Wallace and Schaefer, 2009).

Redoubt Volcano also erupted in 1989–1990 during which some 20 ash-producing explosions occurred (Scott and McGimsey, 1994). Ash fall in the MOA occurred on 3 occasions depositing trace amounts of ash (<0.8 mm or 0.031 in). The most serious impacts were economic losses due to disruptions to airline travel and the KLM Boeing 747-400 jet aircraft that temporarily lost power when it encountered a diffuse volcanic ash plume causing millions of dollars in damage. The volcanic ash cloud affected flights from TSAIA, Merrill Field, and Joint Base Elmendorf Richardson. As a result of eruption, the lost revenue to TSAIA is estimated at $2.6 million (Waythomas and others, 1997). The volcanic ash resulted in some school and business closures. Some people experienced respiratory problems from inhaling fine ash particles.

Augustine Volcano

The most recent eruption of Augustine occurred in 2006 when 13 major ash-producing explosions occurred between January 11 and mid-March. This was the fifth major eruption in 75 years (Power and others, 2010). Impacts from this event were considered minor with the biggest economic losses associated with cancelled, diverted, and rescheduled flights to avoid possible exposure to ash (Neal and others, 2010). The level of respirable particulate matter in the air within the MOA was reportedly elevated on several days during the eruption but did not exceed Environmental Protection Agency (EPA) standards (Wallace and others, 2010).

There is no known significant property damage or adverse health effects associated with this eruption (Neal and others, 2010).

The 1986 eruption of Augustine (March-April) deposited trace (<0.8 mm or 0.031 in) amounts of ash in the MOA and caused significant disruptions to air traffic. A dome formed in the crater and caused some to fear it would subsequently collapse and trigger a tsunami along the east shore of Cook Inlet, as occurred in 1883. This eruption caused flights to and from TSAIA to be cancelled and military aircraft were evacuated from Elmendorf Air Force Base. The level of respirable particulate matter in the air within the MOA was elevated for several days in late March but remained just below the health emergency threshold (EPA national standard), although some sensitive people experienced respiratory problems. Many schools and businesses were temporarily closed (Swanson and Kinele, 1988).

A significant eruption also occurred in 1976 and produced ash plumes during January, February, and April. Minor ash fall (0.6 in or 1.5 mm) occurred in the MOA on January 24–25 (Shackelford, 1978). Advisories to remain indoors were issued and many schools and businesses were closed in the MOA. Some people experienced respiratory problems and visibility in some locations was reduced to about 300 feet (100 meters or less) (Waythomas and Waitt, 1998). Ash was ingested by the equipment at the Beluga power plant, the primary power supply for Anchorage (Swanson and Kinele, 1988).

4.3.8.1 Vulnerability Assessment

Because the ash from a volcanic eruption could affect the entire Municipality, the entire MOA is represented in Table 4.32. In general, weather patterns and wind direction during an eruption will influence where ash fall occurs. Air transportation is particularly vulnerable to volcanic ash clouds as these clouds can travel great distances and cover broad areas. Ash may lead to increased traffic accidents as it reduces visibility and can make roadways slippery (IVHHN, unknown). Disruptions to the transportation system may cause delayed shipments of goods into the area.

Ashfall can disrupt power service. Power generation facilities may close to prevent equipment damage. As wet ash is conductive, equipment may need to be shut down to be properly cleaned or serviced (USGS, 2009a). Ash can contaminate water supplies making them unsafe to drink (IVHHN, unknown). Volcanic ash can cause changes in water quality (turbidity, acidity, and chemistry), increased wear on water delivery and treatment systems and high demand for water during cleanup activities (USGS 2009). Building roofs may collapse under the weight of the ash (IVHHN, unknown). In addition, volcanic ash also poses a health risk to people especially those cardiac or respiratory conditions such as asthma and emphysema (IVHHN, unknown). Volcanic ash can also cause eye irritation and skin irritation (IVHHN, unknown).

Table 4.3.8.1.1 Volcanic Ash Vulnerability

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	75024	8526159300	17756156200	26282315500
Commercial	4065	2568664400	4512337400	7081001800
Industrial	2597	1494944600	1907337000	3402281600
Institutional	1035	1215398400	1554183700	2769582100
Open Space	44	24995700	503000	25498700
Transportation	664	0	0	0
Other	562	377462100	36697800	414159900
Vacant	228	0	0	0
Total	84219	14207624500	25767215100	39974839600

Source: MOAGIS, 2016

4.3.8.2 Consequence Analysis

Office Emergency Management updated the consequence analysis for volcanic ashfall in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public

Volcanic ashfall could significantly disrupt MOA residents' health, safety, and quality of life. Fine ash particles pose respiratory risks, particularly for vulnerable individuals, potentially leading to increased hospital visits and strain on healthcare resources. Ashfall could also restrict outdoor activities and reduce visibility on roads, heightening the risk of accidents and complicating daily routines. Public facilities such as schools and recreational centers may need to close temporarily, disrupting work, education, and childcare arrangements. Additionally, prolonged exposure to poor air quality may create psychological stress, especially if residents lack adequate protective resources like masks or access to clean indoor spaces.

Impacts on Responders

Responder safety and operational capacity may be affected. Ash in the air and on roads can hinder visibility, slowing response times and increasing the risk of vehicle accidents as responders navigate through affected areas. Inhalation of fine ash particles poses respiratory risks, necessitating additional protective gear and potentially limiting the duration responders can work safely in ash-filled environments. Equipment and vehicles may also be vulnerable to the abrasive effects of ash, causing mechanical failures or requiring more frequent maintenance, which can strain resources and delay response activities. Moreover, the need to address public health concerns, ensure safe transportation routes, and manage infrastructure impacts may stretch responder capacity, requiring careful prioritization of resources.

Impacts on Continuity of Operations

Ash accumulation on roads and infrastructure may necessitate widespread closures and intensive cleanup efforts, temporarily halting or reducing access to key facilities. Public utilities, including water treatment plants and power stations, are vulnerable to ash infiltration, which could damage equipment and lead to service interruptions, affecting residents' access to clean water and electricity. Additionally, municipal offices and service centers may face indoor air quality challenges if ventilation systems become clogged, limiting the government's ability to conduct in-person operations and requiring alternative work arrangements for staff. Emergency and health services would likely experience heightened demand, diverting resources from routine functions and further stressing continuity efforts.

Impacts on Property

The abrasive and dense nature of ash can lead to structural issues, especially if it accumulates on roofs, where the added weight increases the risk of collapse, particularly on flat or lightly built structures. Ash particles can damage exterior surfaces, windows, and paint, while infiltrating buildings through ventilation systems, potentially harming electronics and machinery. For properties that rely on rainwater collection, ash contamination poses additional cleanup and repair challenges.

Impacts on the Environment

Ash particles suspended in the air would reduce air quality, posing respiratory risks for wildlife and harming vegetation as the fine particles settle on leaves, potentially hindering photosynthesis. When ash accumulates on the ground, it can alter soil chemistry, making the soil more acidic and affecting plant health, which could impact local agriculture and natural flora. Ash runoff into water bodies, such as Ship Creek and Cook Inlet, could lead to contamination, affecting water quality and potentially harming fish and aquatic ecosystems. Aquatic organisms are particularly vulnerable to the abrasive nature of ash, which can damage gills and digestive tracts. These environmental disruptions may take time to remediate, and the effects on local biodiversity could have cascading impacts on the broader ecosystem.

Impacts on the Economy

Volcanic ashfall could disrupt the local economy by affecting multiple sectors, including transportation, tourism, business operations, and public services. Ash accumulation on roads, runways, and railways could temporarily halt transportation, impacting the movement of goods and slowing commerce, especially at critical hubs like Ted Stevens Anchorage International Airport and the Port of Alaska. Businesses may experience closures or reduced hours due to air quality concerns, cleanup requirements, and potential damage to property, leading to lost revenue and increased operational costs. Tourism, a vital contributor to the local economy, could suffer as visitors avoid areas affected by ash, particularly if travel infrastructure remains compromised. Additionally, cleanup and repair costs would strain public resources and private finances, with impacts cascading to insurance claims and increased premiums.

Impacts on Public Confidence in the Jurisdiction

Residents may become frustrated if air quality issues, infrastructure disruptions, or access to essential services are not quickly addressed, leading to concerns about the city's preparedness and resilience. Prolonged closures of public facilities, transportation hubs, or businesses could exacerbate these feelings, particularly if communication about recovery timelines is unclear. Additionally, if health impacts from poor air quality are widespread, the public may question the adequacy of health and safety resources, such as mask distribution or shelter options.

4.3.9 Erosion

Local Mitigation Plan Review Tool **1. REGULATION CHECKLIST** **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)
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))	4.1.8 Erosion pg. 90-94

Erosion is a process that involves the wearing away, transportation, and movement of land. Erosion rates can vary significantly because erosion can occur quite quickly as the result of a flash flood, coastal storm, or other event. It can also occur slowly, as the result of long-term environmental changes. Erosion is a natural process, but its effects can be exacerbated by human activity.

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.

> **Bluff erosion** occurs when water runs off the land, forming gullies. It is also caused by wave action at the toe of the bluff or when a bluff collapses under the weight of a heavy snow or rainfall.

Classifying erosion can be difficult, as there are multiple terms used to refer to the same type of erosion. For example, riverine erosion may be called stream erosion, stream bank erosion, or riverbank erosion, among other terms. Coastal erosion is sometimes referred to as tidal erosion. Sometimes bluff erosion is included in coastal erosion; other times they are considered two separate processes. The same goes for beach erosion. For this plan, coastal erosion encompasses bluff and beach erosion, while riverine erosion will be considered synonymous with stream erosion, stream bank erosion, and riverbank erosion.

Coastal Erosion

Coastal erosion is the wearing away of land, through natural activity or human influences, that results in loss of beach, shoreline, or dune material. Coastal erosion occurs over the area roughly from the top of the bluff out into the near-shore region, to about the 30-foot water depth. It is measured as the rate of change in position or the horizontal displacement of a shoreline over a period of time. Bluff recession is the most visible aspect of coastal erosion because it causes dramatic in the landscape. As a result, this aspect of coastal erosion usually receives the most attention.

On the coast, the forces of erosion are embodied in waves, currents, and wind. 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 also may be from 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 the construction of shore protection structures and dams or aquifer depletion. Studies are underway to determine the effects generated from global warming.

Ironically, attempts to control erosion through shoreline protective measures such as groins, jetties, seawalls, or revetments can actually lead to increased erosion activity. 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.

Definitions

Groin - A narrow, elongated coastal-engineering structure built on the beach perpendicular to the trend of the beach. Its purpose is to trap longshore drift to build up a section of beach.

Jetty - A narrow, elongated coastal-engineering structure built perpendicular to the shoreline at inlets to stabilize the position of a navigation channel, to shield vessels from wave forces, and to control the movement of sand along adjacent beaches to minimize the movement of sand into a channel.

Seawall - A vertical, wall-like coastal-engineering structure built parallel to the beach or duneline and usually located at the back of the beach or the seaward edge of the dune. It is designed to halt shoreline erosion by absorbing the impact of waves.

Revetment - An apron-like, sloped, coastal-engineering structure built on a dune face or fronting a seawall. It is designed to dissipate the force of storm waves and prevent undermining of a seawall, dune or placed fill.

Factors Influencing the Erosion Process

There are a variety of natural and human-induced factors that influence the erosion process. For example, shoreline orientation and exposure to prevailing winds, open ocean swells, and waves influence erosion rates. Beach composition influences erosion rates as well. For example, a beach composed of sand and silt, such as those near Shishmaref, is easily eroded, whereas beaches consisting primarily of boulders or large rocks are more resistant to erosion. Other factors may include:

- Shoreline type
- Geomorphology of the coast
- Structure types along the shoreline
- Density of development
- Amount of encroachment into the high hazard zone

- Proximity to erosion inducing coastal structures
- Nature of the coastal topography
- Elevation of coastal dunes and bluffs
- Shoreline exposure to wind and waves.

Location

Coastal erosion is occurring west of TSAIA, as:

…several hundred yards of bluff have eroded in this century, much of it since 1949. The bluffs erode when high-energy storms enter Cook Inlet and generate large waves at their bases. Storms arriving in the fall are the most dangerous because the bluffs are not yet frozen and their sediment can be easily eroded (Mason, 1997: 193).

Coastal erosion is also occurring near the Tony Knowles Coastal Trail because "piles of construction or earthquake rubble plus a rock revetment built by the state to protect the bike path are increasing local rates of shoreline erosion by blocking lateral beach sand transport" (Mason, 1997:198).

Likelihood of Occurrence

Coastal erosion is a natural process that continually occurs. Unlike other parts of Alaska, it would be rare to have a single event in the MOA associated with a significant amount of coastal erosion.

Historic Events

No significant coastal erosion events have been identified.

4.3.9.1 Vulnerability Assessment

Only coastal areas are vulnerable to coastal erosion. Property is considered more vulnerable to coastal erosion than people.

Riverine Erosion

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 long period of time.

Riverine erosion is often initiated by failure of a riverbank, causing high sediment loads, or by heavy rainfall. This generates high volume and velocity run-off that will concentrate in the lower drainages within the river's catchment area. When the stress applied by these river flows exceeds the resistance of the riverbank material, erosion will occur.

As the sediment load increases, fast-flowing rivers will erode their banks downstream. Eventually, the river becomes overloaded, or velocity is reduced, leading to the deposition of sediment further downstream or in dams and reservoirs. The deposition may eventually lead to the river developing a new channel.

While all rivers change in the long-term, short-term rates of change vary significantly. In less- stable braided channel reaches, erosion and deposition of material are a constant issue. In more stable meandering channels, episodes of erosion may only occur occasionally. The erosion rate depends on the sediment supply and amount of run-off reaching the river. These variables are affected by many things including earthquakes, floods, climatic changes, loss of bank vegetation, urbanization, and the construction of civil works in the waterway.

Riverine erosion has many consequences, including the loss of land and development on that land. It can cause increased sedimentation of harbors and river deltas, hinder channel navigation, and affect marine transportation.

Other problems include reduction in water quality due to high sediment loads, loss of native aquatic habitats, damage to public utilities (roads, bridges and dams) and maintenance costs from trying to prevent erosion sites.

Location

Most of the MOA is not impacted by riverine erosion, although it may occur in some localized areas. For example, "Peters, Meadow, and Rabbit Creeks experience high-velocity flows that can lead to extensive erosion of banks and washouts at inadequate stream crossings" (FEMA, 2002:11).

Likelihood of Occurrence - Probability - Low

Riverine erosion will always occur in Anchorage and Eagle River because rivers and other flowing waterbodies are constantly altering their course. See Hazard Rating Matrix, Table 1.2.

Historic Events

No significant riverine erosion events have been identified.

Vulnerability

A recent GIS file showing the location of riverine erosion is not available. Only property adjacent to a river may be affected by riverine erosion. Property is considered more vulnerable to riverine erosion that people.

Wind Erosion

Wind erosion is when wind is responsible for the removal, movement, and redeposition of land. It occurs when soils are exposed to high-velocity wind, which picks up the soil and carries it away. The wind moves soil particles 0.0039 -0.0197 inch in size in a hopping or bouncing fashion (known as saltation) and those larger than 0.0197 inch by rolling (known as soil creep). The finest particles (less than 0.0039 inches) are carried in suspension. Wind erosion can increase during periods of drought.

Wind erosion can cause a loss of topsoil, which can hinder agricultural production. The dust can reduce visibility, which can cause automobile accidents, hinder machinery, and have a negative effect on air and water quality, creating animal and human health concerns. Wind erosion can also cause damage to public utilities and infrastructure.

Location

Every parcel in MOA could be affected by wind erosion. Those in higher wind areas are more likely to experience wind erosion.

Likelihood of Occurrence - Probability - Low

In Anchorage, wind erosion is not a significant problem, but it can occur during a weather event with strong winds. See Hazard Rating Matrix, Table 1.2.

Historic Events

No significant wind erosion events have been identified.

Vulnerability

Every parcel in MOA could be vulnerable to wind erosion, but this is not a significant threat. Property is considered more vulnerable to wind erosion than people. Point Woronzof has a lack of vegetation, lack of a talus pile at the base, and lack of a protective mudflat, which indicate erosion about two feet per year (Mason, 1997). Point Campbell is also eroding but at a slightly slower rate (Mason, 1997).

Technological Hazards

Technological hazards are hazards originating from technological or industrial accidents, dangerous procedures, infrastructure failures, or human error or omission.

4.3.10 Dam Failure

Local Mitigation Plan Review Tool 1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)
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))	4.2.1 Dam Failure pg. 95-84

Alaska Statute 46.17.900(3) defines a dam as an "artificial barrier and its appurtenant works, which may impound or divert water." Dam safety is regulated by Alaska Statute 46.17 and 11 Alaska Administrative Code 93 Article 3, Dam Safety, which became effective in May 1987.

In Alaska, dams exist for many purposes, some of which include:

- Hydroelectric
- Water supply
- Flood control and storm water management
- Recreation
- Fish and wildlife habitat
- Fire protection
- Mine tailings

Dam failures involve the unintended release of impounded water. A dam failure can destroy property and cause injury and death downstream. A dam failure does not always involve a total collapse of the dam. Dams may fail due to structural deficiencies, poor initial design or construction, lack of maintenance or repair, weakening of the dam through aging, debris blocking the spillway, other disasters such as earthquakes, improper operation, or vandalism.

The failure of a dam can be result in a major catastrophe with substantial economic impacts and loss of life. There are varying degrees of failure that can contribute to the uncontrolled release of water from the reservoir, ranging from improper gated spillway operation to the partial or full breach of the main structural component of the dam. Lesser degrees of failure often occur in advance of a catastrophic failure and are generally amenable to mitigation if detected and properly addressed. According to the State Hazard Mitigation Plan, there are several general causes of dam failure, including:

- Inadequate spillway capacity, which results in dam overtopping during extreme rainfall events.
- Internal erosion or piping caused by seepage through the embankment or foundation or along conduits.
- Improper or insufficient maintenance, leading to decay and deterioration.
- Inadequate design, improper construction materials, and poor workmanship.
- Operation issues.
- Failure of upstream dams on the same river system.
- Landslides into a dam's reservoir, creating a wave that overtops the dam.
- Seismic instability.

Source: State Hazard Mitigation Plan, 2018

Location

According to DNR, there are 10 dams in the MOA (Table 4.26 and Figure 4.11).

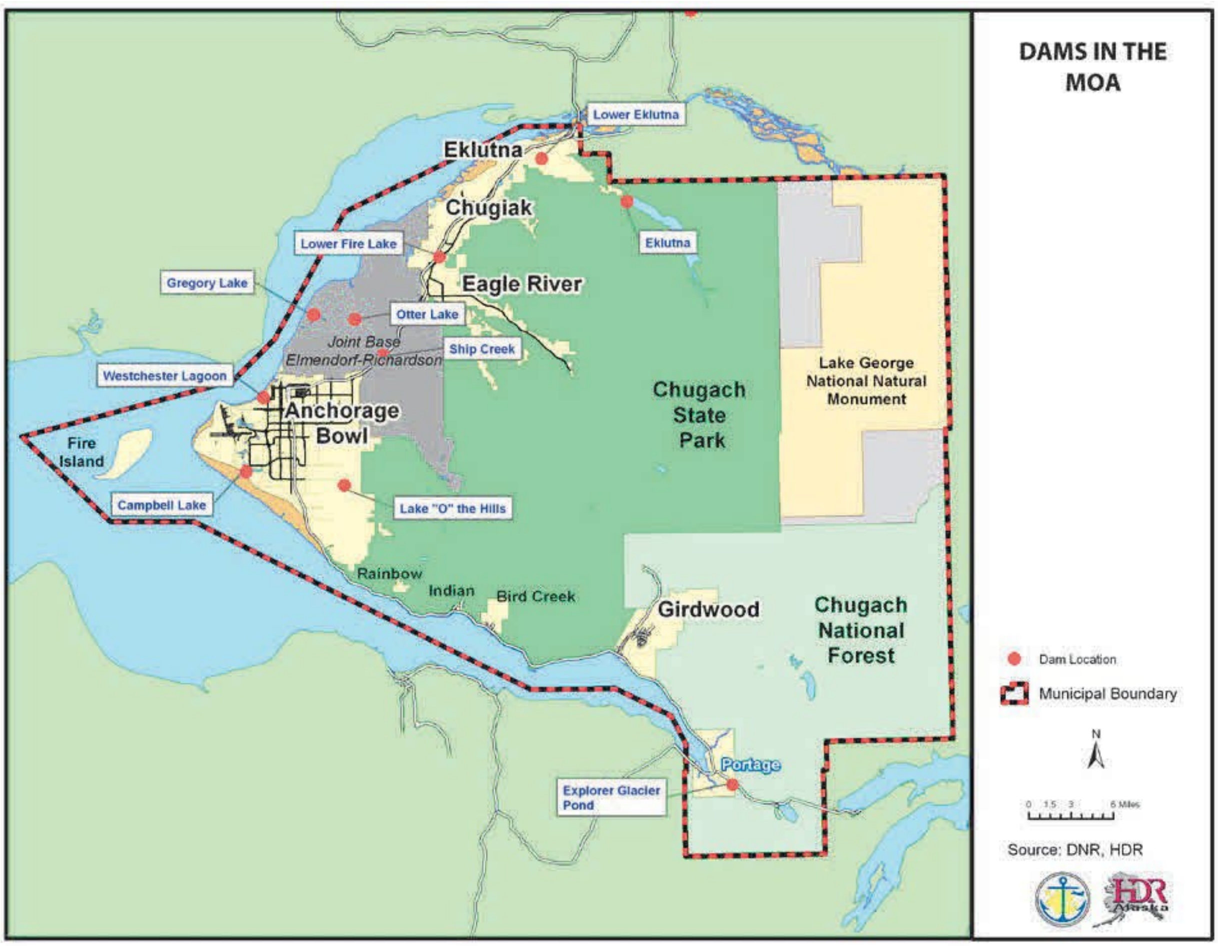
Table 4.26 Dams Located Within the MOA

DAM ID	Name	Nearby Development	Hazard Potential Classification	Emergency Action Plan	Regulatory Jurisdiction
AK00033	Eklutna	Eklutna Village	High	Yes	State
AK00034	Lake "O" The Hills	Anchorage	High	Yes	State
AK00189	Lower Fire Lake Dam	Eagle River	High	Yes	State
AK00028	Campbell Lake Dam	Anchorage	Low	Not Required	State
AK00029	Westchester Lagoon Dam	Anchorage	Significant	No	State
AK00093	Lower Eklutna	Eklutna Village	Significant	No	State
AK00035	Ship Creek Dam	Anchorage	Low	Not Required	Federal
AK00036	Gregory Lake Dam	Elmendorf Air Force Base	Low	Not Required	Federal
AK00076	Otter Lake Dam	Ft. Richardson Army Base	Low	Not Required	Federal
AK82401	Explorer Glacier Pond Dam	Portage	Low	No	Federal

Likelihood of Occurrence - Probability - Low

Dam failures can occur wherever there is a dam. The risk increases as dams age and deteriorate from deferred maintenance and decay. Eighty percent of older dams designed and constructed before Alaska adopted dam safety regulations (1989) may have a higher risk due to design inadequacy. The State is especially concerned about those dams with known or suspected deficiencies because they pose a greater failure risk than properly designed and structurally sound dams. See Hazard Rating Matrix, Table 1.2.

Figure 4.11 Map of Dams in the MOA



Historic Events

Only one dam failure in Alaska has resulted in a fatality. Anchorage's Lake O' the Hills dam failed in 1972, resulting in the downstream death of a child swept into a culvert by the floodwaters. The inundation map for this dam includes the grounds adjacent to O'Malley Elementary School, homes, and O'Malley Road. Table 4.27 lists the known dam failures in Anchorage since 1962.

Table 4.3.10.1 Dam Failures in Anchorage Since 1962

Source: State Hazard Mitigation Plan,2018

Name	NID No.	Description	Class	Height	Date of Failure	Type of Failure	Consequences	Suspected Cause
Campbell Lake Dam	AK00028	Earth embankment	Low	11	1964	Full breach	Repair costs	Foundation liquefaction, slope stability
Lake O' the Hills	AK00034	Earth embankment	High	13	1964	Unknown	Unknown	Seismic
Old Eklutna Dam	None	Earth and sheet pile	Low	NA	1964	Structural damage	Replacement costs	Seismic racking
Lake O' the Hills	AK00034	Earth embankment	High	13	1972	Full breach	One life lost	Inadequate low level outlet design, and construction, classic piping
Campbell Lake Dam	AK00028	Earth embankment	Low	11	1989	Full breach	Repair costs	Insufficient spillway capacity

4.3.10.1 Vulnerability Assessment

Office Emergency Management updated the vulnerability assessment for dam failure in the 2024 Hazard Identification and Risk Assessment (HIRA).

People

In a dam failure, thousands of residents in downstream areas, including communities along the Eklutna River, northern Anchorage (such as Eagle River and Chugiak), and residential areas downstream of Lake O' The Hills dam, would face severe flooding. Vulnerable populations, including low-income households, people with disabilities, and those lacking evacuation resources, would be hit hardest. Contaminated water could lead to outbreaks of diseases like cholera or E. coli if water supplies are compromised. Evacuations would be necessary, and limited shelter and support could result in long-term displacement, resulting in declined mental health, job security, and children's education. There is a call down tree for the Eklutna dam because it is in a remote area and it is extremely difficult to communicate with those individuals. The Eklutna dam has a contractor to complete an EAP update every year and they do a tabletop exercise every three years.

Property

Homes and apartments in low-lying areas would quickly flood, causing significant damage and displacing residents. The strong water flow could also erode building foundations, leaving structures unsafe even after the water recedes.

The Environment

A dam failure could lead to severe environmental damage, including erosion, destruction of natural habitats, and contamination of rivers and lakes, potentially harming fish populations, wildlife, and plant life. Salmon runs in the Eklutna River, vital to the local ecosystem, could be severely impacted.

Municipal Operations
In the event of a dam failure in the MOA, public safety systems would face severe strain. Emergency responders would be overwhelmed with flood rescues and evacuations, leading to delays in other emergencies. Flooding could also damage the communication infrastructure like radio towers, making it harder to coordinate relief efforts. Government offices in flood-prone areas could close, stopping essential services like permitting and social services. Healthcare services would be disrupted, especially if hospitals lose access to power or water. Transportation systems, including key roads like the Glenn Highway, could be washed out, isolating parts of the MOA and delaying evacuations. Impacts on railways and ports, crucial for supply chains, could affect the local economy.

Areas located within the inundation area of a dam are vulnerable to dam failure. However, most dams within the MOA have not had their inundation areas mapped. The exceptions are the Lake O' the Hills dam and the Eklutna dam. The inundation mapping for these areas is several years old. The actual dam inundations areas may be different due to increased development in the area, changes in the amount of water being impounded, or other reasons. Maps are in Appendix F.

4.3.10.2 Consequence Analysis
Office Emergency Management updated the consequence analysis for dam failure in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public
A sudden dam failure in the MOA could lead to devastating consequences, including significant loss of life and injuries, particularly in low-lying areas like Eklutna River Valley and Eagle River, where flash flooding might trap unprepared residents. Thousands could be displaced, resulting in housing shortages, especially for vulnerable populations such as the elderly and low-income households. Additionally, the flooding could contaminate the water supply, raising public health concerns and increasing the risk of waterborne diseases like cholera and E. coli. The emotional toll on the community would also be considerable, as many individuals would face trauma from displacement and the loss of loved ones or property.

Impacts on Responders
First responders, including the Fire Department, Police Department, and emergency medical services—would face overwhelming challenges as they simultaneously manage rescues, evacuations, and medical emergencies. Response times could be delayed due to damaged transportation routes, and emergency personnel would quickly run out of essential resources like rescue equipment and medical supplies. This strain could lead to fatigue among responders, increasing the risk of mistakes or accidents. Additionally, first responders would be at risk, navigating dangerous floodwaters and unstable infrastructure, which could result in additional injuries or fatalities. Responders may also have homes in the inundation area themselves, potentially impacting their ability or willingness to respond.

Impacts on Continuity of Operations
If a dam fails, the MOA will face major disruptions to essential services. Water treatment plants, power grids, and transportation networks could be severely damaged, affecting water, sanitation, and electricity for residents. Government offices might also be inaccessible, making it hard to provide necessary support. Emergency management teams would struggle to coordinate a response, especially if communication systems are down. Additionally, floodwaters could overwhelm water and sewage systems, leading to widespread contamination and public health concerns. Restoring power and utilities could take days or weeks.

Impacts on Property
Floodwaters from a dam failure could cause widespread damage to residential and commercial properties, destroying homes, businesses, and public buildings and leading to costly repairs and reconstruction. Critical infrastructure like roads, bridges, and utility systems could be severely impacted, making response and recovery efforts more difficult. Lastly, culturally and historically significant sites could suffer irreparable damage, potentially causing the loss of irreplaceable landmarks.

Impacts on the Environment
Flooding from a dam failure would cause significant erosion along riverbanks and low-lying areas, permanently changing the landscape and complicating recovery efforts. Essential habitats, like salmon spawning areas in the Eklutna River, would be destroyed, leading to declines in fish populations and other wildlife, further affecting the Native Alaskans who use the river for salmon runs. Additionally, floodwaters could carry hazardous materials, such as oil and sewage, into the environment, contaminating water supplies and harming local ecosystems. Cleanup would be costly and lengthy, with lasting effects on water quality and soil health. Wildlife would also be displaced, which could upset the local ecosystem and increase conflicts between animals and humans as they search for shelter in populated areas.

Impacts on the Economy
In the event of a dam failure, it could cause damage to Glenn Highway, a vital transportation route that could cut off access to the city, affecting trades and logistics. Many local businesses may have to close temporarily or permanently, resulting in job losses and financial instability, particularly in tourism, agriculture, and fishing industries. The overall recovery cost would be massive, requiring significant investments to rebuild infrastructure and provide disaster relief. Federal assistance will be essential, but local governments and businesses may face financial challenges, potentially lowering property values in affected areas and impacting the local tax base.

Impacts on Public Confidence in the Jurisdiction
Public trust in local government during a dam failure centers on the effectiveness and speed of its response. If authorities are seen as unprepared or slow, frustration and loss of confidence could occur. Mismanagement of evacuations, rebuilding delays, or poor communication can lead to public outrage and demands for accountability. Clear and timely communications are vital to maintaining trust, as mis/disinformation or slow warnings can further increase frustration. Social media plays a large role in shaping public perceptions, making officials manage expectations and provide regular updates. A poorly handled response may result in political consequences for local leaders, while a well-coordinated effort can strengthen public support and confidence in their ability to handle crises effectively

4.3.11 Energy Management

Local Mitigation Plan Review Tool **1. REGULATION CHECKLIST** **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)
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))	4.2.2 Energy Management pg. 98-99

An energy emergency refers to the inability to produce and transmit sufficient quantities of energy to the public, businesses and industry. It can involve one or more energy resources such as heating oil, natural gas, gasoline, coal, or electricity.

An energy emergency can develop quickly. For example, a storm could cause a power line to break. It could also develop over days or weeks. For example, during the 1973 OPEC (Oil Producing and Exporting Countries) embargo, gasoline, fuel oil, and other petroleum derivatives were in short supply. An energy emergency could even develop over years or decades. For example, increased development puts pressure on the amount of energy needed; if a utility company expands to meet that need but the revenue is not sufficient, the utility company could potentially close.

The 2011 plan identified potential winter natural gas shortages due to the Cook Inlet Gas Fields and infrastructure to supply peak demands. The Cook Inlet Natural Gas Storage Alaska facility was constructed. This is a ground injection facility able to store natural gas for peak demands. The facility was ready for operation November 2013. The MOA and some utilities still maintain the energy watch campaign on their websites but it appears there has not been any practice of the system for the past few years. Long duration energy disruption, 24 hours or greater, during extreme cold weather can cause significant damage to buildings in Anchorage if the structures remain unheated.

"Energy Watch" Campaign. The MOA and regional utility organizations have worked together to create a public awareness campaign designed to ask residents to conserve energy use in the event of an energy emergency.

Location

All areas of the MOA are susceptible to energy emergencies.

Likelihood of Occurrence - Probability – Has not occurred yet

Typically, several small, localized power outages occur every year. However, a large- scale, extended-duration power outage is not considered likely. See Hazard Rating Matrix, Table 1.2.

Historic Events

While power outages are not rare, they typically occur for a short duration and are limited to a small geographic area. There have been no known prolonged citywide power outages or other type of energy emergency recorded in Anchorage.

4.3.11.1 Vulnerability Assessment

Office Emergency Management updated the vulnerability assessment for utility emergencies in the 2024 Hazard Identification and Risk Assessment (HIRA).

People

People in the MOA are vulnerable to utility emergencies due to the city's reliance on stable energy, water, and communication systems, especially during harsh winter months. Economically disadvantaged residents may struggle during prolonged energy or water outages, as they may lack resources for alternative heating, water storage, or emergency supplies. Vulnerable groups—including the elderly, young children, and individuals with electricity-dependent or water-dependent medical needs—face elevated risks if energy or water disruptions affect access to essential healthcare, clean drinking water, sanitation, or heating. Additionally, remote or underserved areas may experience longer restoration times due to limited infrastructure redundancy and challenging access routes. The MOA's dependence on digital and cellular networks for emergency information, healthcare, and public safety further heightens vulnerability during communication failures. Populations without alternative communication options, such as low-income households, remote residents, and non-English-speaking individuals, may face increased risks and delays in accessing critical services and emergency information during extended outages.

Property

Property in the MOA is highly vulnerable to utility emergencies, especially critical facilities such as hospitals, the Anchorage Emergency Operations Center (EOC), and water infrastructure management by the Anchorage Water and Wastewater Utility, which rely on stable energy and communication networks. The Port of Alaska is also of concern as it has enough generator power to protect infrastructure, but not enough to maintain operations. During outages, these facilities risk severe damage, such as frozen pipes in winter or equipment failure, which could impair essential functions in healthcare, emergency response, and public utilities. Residential areas, particularly older neighborhoods like Mountain View, are also at increased risk of structural damage if heating fails, leading to frozen and burst pipes and costly repairs. Water disruptions can further result in plumbing system failures, compounding property damage in both residential and commercial buildings. Local businesses, especially in sectors dependent on refrigeration and heating, or water availability, face property and inventory losses if energy outages disrupt operations, with high-risk areas including Midtown Mall and downtown Anchorage. Additionally, communication failures pose security risks for properties with automated systems, like fire alarms and surveillance, leaving them more susceptible to damage or loss due to delayed response times. Any damage at the Port of Alaska, a critical fuel and resource hub, is a significant vulnerability, as damage here could disrupt the regional supply chain including water-related resources essential for emergency recovery efforts.

The Environment

The environment in the MOA is vulnerable to utility emergencies, particularly from disruptions at critical infrastructure near sensitive ecosystems. Energy infrastructure at the Port of Alaska and nearby fuel storage facilities poses a risk to Cook Inlet; a spill or leak during an outage could severely impact marine life and water quality. Water infrastructure failures could lead to untreated sewage or contaminated water being released into local waterways, degrading habitats and harming aquatic wildlife. Power outages may also disrupt operations at the Anchorage Water and Wastewater Utility, increasing the risk of untreated sewage entering local waterways, degrading habitats, and harming wildlife. Additionally, reliance on backup generators during energy outages contributes to air pollution, affecting both local air quality and public health. Communication failures further elevate environmental risks, as facilities handling hazardous materials, like the Port of Alaska, rely on coordinated networks to manage safe storage and transport. Without timely communication, the response to spills or leaks may be delayed, heightening contamination risks to Cook Inlet and surrounding ecosystems.

Municipal Operations

Municipal operations are highly vulnerable to utility emergencies, as many essential services rely on continuous energy, water, and communication supplies to function effectively. Critical facilities such as the Anchorage EOC, Police Department, and Fire Department depend on stable power for communication, dispatch, and emergency response coordination; prolonged outages could delay responses and reduce support for residents in crisis. Energy and water disruptions also impact services like water treatment and distribution at the Anchorage Water and Wastewater Utility, raising public health concerns if untreated water reaches residents. Additionally, public transportation systems, administrative offices, and public schools could experience delays or closures, disrupting access to essential services across the community. Communication failures further exacerbate these vulnerabilities, as they impair coordination among emergency services and hinder situational awareness, particularly at the EOC and Police Department. The reliance on digital networks for daily operations means that municipal facilities, such as City Hall and the Municipal Clerk's Office, may be unable to maintain public services and records, emphasizing the need for resilient systems to support municipal functions during utility emergencies.

The MOA is vulnerable to localized short-term energy emergencies. Because an energy emergency could affect the entire Municipality, the entire MOA is represented in Table 4.28. Power failures are more likely to affect people than the built environment though. As the MOA continues to grow, the amount of energy demanded will increase. This has the potential of increasing the city's vulnerability unless the energy supply also increases. Facilities that rely on electricity for life safety needs such as hospitals and nursing homes tend to be more vulnerable to an energy emergency. While these facilities tend to have back-up generators, they may not be able to meet the needs of the facility for an extended period of time.

Extended power outages will also have negative impact on the local economy as many businesses will be unable to functions. Businesses with perishable inventories, such as grocery stores and restaurants may suffer permanent losses.

Table 4.3.11.1.1 Parcels Vulnerable to Energy Emergencies

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	**75024**	**8526159300**	**17756156200**	**26282315500**
Commercial	**4065**	**2568664400**	**4512337400**	**7081001800**

Source: MOAGIS, 2016

4.3.11.2 Consequence Analysis

Office Emergency Management updated the consequence analysis for utility emergencies in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public

A prolonged utility emergency could have severe impacts on the public, particularly during winter months when a power outage would leave residents without adequate heating, heightening risks of hypothermia for vulnerable populations like the elderly and young children. Water utility disruptions would compound these risks by limiting access to clean drinking water and sanitation, increasing the likelihood of dehydration and waterborne illnesses, especially for vulnerable groups. Disruptions to electricity and fuel supplies would limit access to essential public services, including hospitals, schools, and public safety facilities, restricting critical care and support. Transportation and fuel shortages could hinder residents' ability to commute, leading to economic hardship and reduced work and school attendance. Extended outages may also lead to food spoilage and water supply failures, further straining local resources and increasing public health risks. Additionally, communication failures would prevent timely hazard warnings, leaving residents unprepared for threats such as severe weather or evacuation orders. Vulnerable groups, including those with disabilities or limited English proficiency, would be disproportionately affected, as they may struggle to access alternative communication channels and essential information.

Impacts on Responders

First responders would face significant challenges during utility emergencies, as power outages and communication failures can severely impair their ability to coordinate and respond effectively. Without reliable energy, or access to water utilities, emergency services may struggle to operate critical equipment, maintain hydration for personnel, and support firefighting efforts, reducing operational readiness and slowing response times. Disrupted communication systems hinder real-time information sharing, leading to delays, miscommunication, or duplication of efforts, which can put both responders and the public at greater risk. In the MOA 's diverse and often challenging terrain, ineffective communication could isolate units in the field, making it difficult to relay updates or request backup. Energy emergencies may also elevate the incidence of accidents, fires, and other emergencies as residents resort to alternative heating sources, increasing the demand on first responders during a time of constrained resources. Additionally, hospitals and emergency shelters might experience surges in demand if residents seek refuge from the cold, or if water outages force closures of sanitation facilities, placing further strain on emergency personnel. Overall, utility emergencies compromise the safety and effectiveness of responders precisely when their capabilities are most critically needed.

Impacts on Continuity of Operations
The continuity of operations across essential city functions could be severely impacted, including water treatment, waste management, and public transportation, all of which rely on stable energy, water, and fuel supplies. Extended outages could interrupt these services, affecting public health and sanitation, while government offices may face shutdowns or reduced capacity, limiting residents' access to critical services and slowing crisis decision-making. Schools, healthcare facilities, and public safety departments would struggle to maintain operations without reliable energy and water utilities, compromising public welfare and safety. Additionally, communication failures would disrupt interagency coordination, impeding decision-making and response actions, particularly during emergencies. Prolonged communication breakdowns could also hinder the MOA's ability to engage with external support agencies, leading to service delays that weaken the city's resilience and recovery capabilities. Overall, prolonged utility disruptions could destabilize the MOA's economy and essential services, emphasizing the need for robust continuity planning.

Impacts on Property
Significant property damage could occur, especially during extended energy outages. Without reliable heating, buildings are at risk of frozen and burst pipes, causing flooding and structural damage. Water utility failures can exacerbate these risks by disrupting plumbing systems, leading to water leaks or contamination within properties. The use of temporary heating solutions, such as space heaters or fireplaces, increases the risk of fires, which could cause further damage to residential and commercial properties. Prolonged outages may also affect critical systems like HVAC and fire suppression, leaving structures more vulnerable to hazards and complicating emergency response efforts. Businesses dependent on refrigeration, water, or temperature-sensitive storage could face inventory losses, resulting in financial strain and potential closures. Communication failures further amplify property risks by delaying hazard warnings and response coordination for threats like fires or severe weather, leaving properties more exposed. Additionally, communication breakdowns could disrupt security systems, raising the risk of theft or vandalism and complicating damage assessment and insurance claims processes, which would extend recovery times for property owners. Finally, any concern that requires homeowners or businesses to turn off gas for safety will take significant time to come back online, as the process to reestablish flow takes a significant amount of time.

Impacts on the Environment
Utility emergencies in the MOA could have significant environmental consequences, particularly during prolonged energy outages. Extended reliance on generators may increase air pollution, affecting local air quality and potentially harming wildlife and human health. Water outages could lead to untreated wastewater or contaminated water being released into local waterways, such as Cook Inlet and Ship Creek, harming aquatic ecosystems and local fisheries. Fuel shortages could disrupt waste treatment facilities, leading to untreated wastewater discharges into nearby water bodies like Cook Inlet or Ship Creek, which would damage aquatic ecosystems and local fisheries. Power outages may also hinder environmental monitoring systems, reducing the MOA's capacity to detect and respond to pollution events or environmental hazards in real time. Communication failures further amplify these risks by delaying coordinated responses to hazardous spills, wildfires, or other environmental emergencies, allowing harmful incidents to escalate. The MOA's proximity to sensitive natural areas emphasizes the need for rapid response and monitoring to prevent contamination and protect wildlife habitats from compounding environmental impacts.

Impacts on the Economy
Utility emergencies in the MOA could have significant economic impacts, with extended power outages or fuel shortages disrupting key sectors, including retail, healthcare, logistics, and tourism. Small businesses, especially those with limited contingency resources, may face revenue losses and job impacts, as the MOA's reliance on energy for heating and transportation drives up operational costs and living expenses. Critical facilities like the port and airport, essential for Alaska's supply chain, could experience operational slowdowns or shutdowns, affecting the movement of goods across the state and beyond. Additionally, communication failures may impair business operations and essential services, as internet and phone networks are vital for transactions, customer communication, and supply chain coordination. Financial institutions might struggle to process transactions, leading to public frustration and a drop in consumer

confidence, while tourism could decline as visitors avoid areas with unreliable services. Together, these disruptions could reduce economic confidence, potentially triggering a long-term economic downturn for the MOA.

Impacts on Public Confidence in the Jurisdiction
Extended utility emergencies, particularly during winter, could leave MOA residents feeling vulnerable and frustrated, especially if communication about response efforts is unclear or delayed. Prolonged power outages, water disruptions, and communication failures may lead the public to question the jurisdiction's preparedness and resilience, especially if these issues recur or seem inadequately managed. Trust in local leadership could erode further if critical services, such as heating, clean water access, emergency shelters, and fuel distribution, are not prioritized or effectively coordinated. Without timely updates, residents may feel disconnected and anxious, as reliable information is crucial for safety during crises. Over time, perceptions of unreliable energy, water, and communication systems could diminish public confidence in the MOA's ability to protect its community, potentially impacting engagement in future preparedness initiatives and reducing public support for resilience efforts.

4.3.12 Urban Fire (Conflagration)

Local Mitigation Plan Review Tool **1. REGULATION CHECKLIST** **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)
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))	4.2.3 Urban Fire pg. 100-101

An urban fire is one involving a structure or property within an urban or developed area. For the purposes of this plan, urban fires are defined as major fires affecting (or with the potential to affect) multiple properties. These types of fires are rare in modern, developed cities but could happen if associated with another disaster such as an earthquake, secondary to an aircraft crash, during civil unrest, where multiple ignitions could occur simultaneously, overwhelming the fire department's ability to respond.

Location

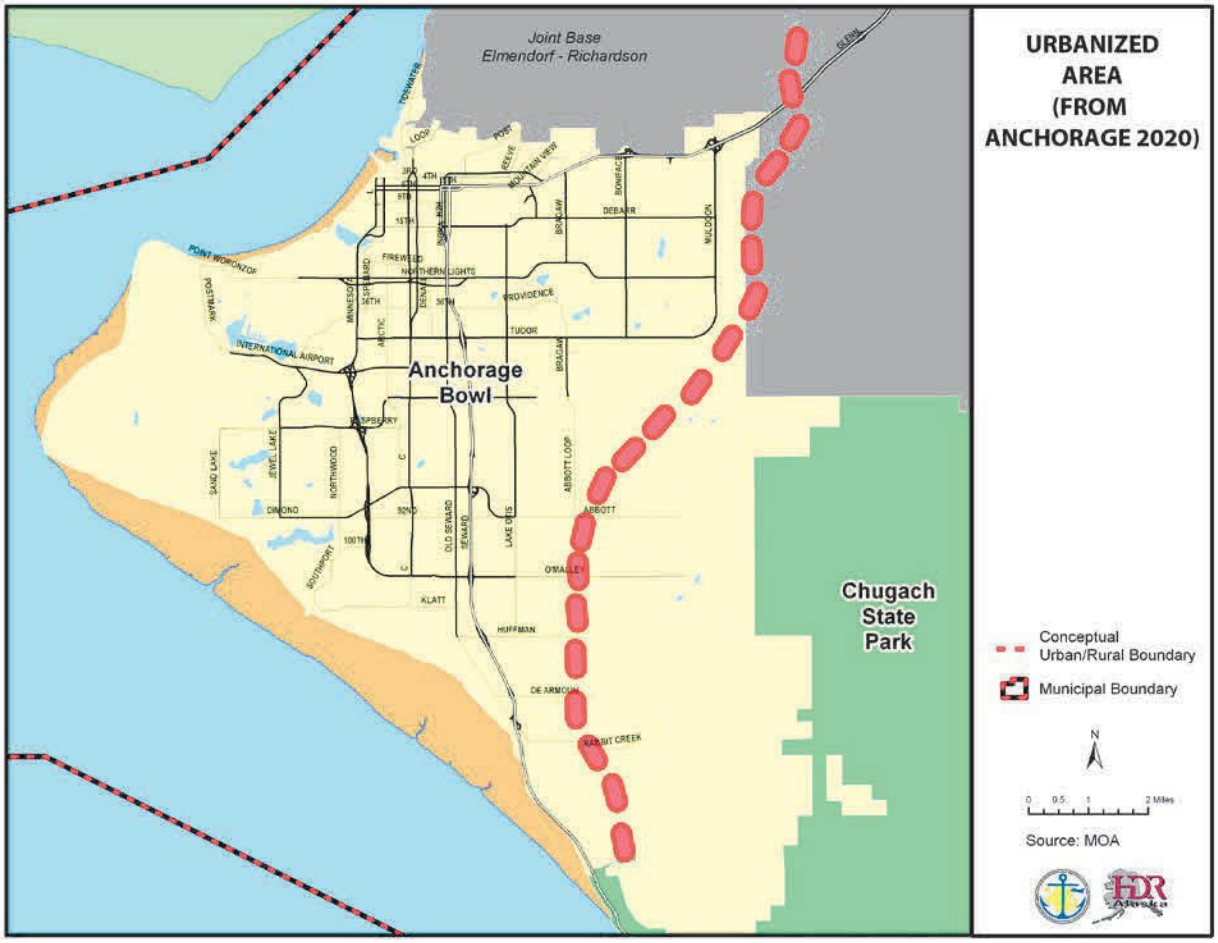
Every parcel in the urbanized portion of the MOA, as identified in Anchorage 2020 (see Figure 4.13) has the potential for a major urban fire. In general, the potential for a conflagration is higher in high-density areas that have structures located close to each other.

Parts of the Chugiak/Eagle River area also have the potential for a conflagration but a specific geographic area has not been identified. The downtown area, which tends to have higher densities, is more likely than areas with lower densities.

Likelihood of Occurrence - Probability - High

In the MOA, there is not a significant likelihood of a major urban fire but the potential exists. Modern building codes, construction techniques, building materials have been developed to reduce the possibility of a major urban fire. A major urban fire is more likely to occur as the secondary effect of another hazard such as an earthquake as fire department resources may have to respond to multiple incidences simultaneously, water for firefighting purposes may be unavailable, etc. See Hazard Rating Matrix, Table 4.2.

Figure 4.13 Map of Urbanized Area from Anchorage 2020



Historic Events

There have been no major urban fires in the MOA in recent years that have resulted in a disaster declaration. Fires within the urbanized portion of the MOA are usually quickly contained and are typically limited to one or two buildings.

One of the most significant urban fires in recent history occurred on June 5, 2007 at the Park Place Condominiums. This fire was accidentally started during plumbing maintenance.

Damages from the fire were estimated at $19 million: $14 million in property loss and $5 million in personal content loss.

4.3.12.1 Vulnerability Assessment

Every parcel in the urbanized portion of the Anchorage Bowl could be vulnerable to a major urban fire and is represented in Table 4.29. This is not considered a significant threat. Hotels, nursing homes, theaters, daycares, assisted living facilities, nightclubs and other places where large groups of people tend to gather tend to have a higher potential for injuries and fatalities.

Table 4.3.12.1.1 Parcels Vulnerable to Urban Fire in the Anchorage Bowl

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	55,130	6,165,655,300	13,159,778,900	19,325,434,200
Commercial	3,375	2383528500	4349166300	6732694800
Industrial	2491	1452514500	1872148800	3324663300
Institutional	368	650247000	1348498700	1998745700
Parks	259	287975300	9803500	297778800
Transportation	129	89869000	49512800	139381800
Other	0	0	0	0
Vacant (residential)	5,193	538,939,700	0	538,939,700
Watershed	0	0	0	0
Total	66945	11487847200	19575309000	31063156200

Source: MOAGIS, 2016

A geographic boundary has not been established for the Eagle River area so the number of parcels and their value that could be impacted has not been calculated as part of this update.

4.3.13 Hazardous Materials (HAZMAT) Release

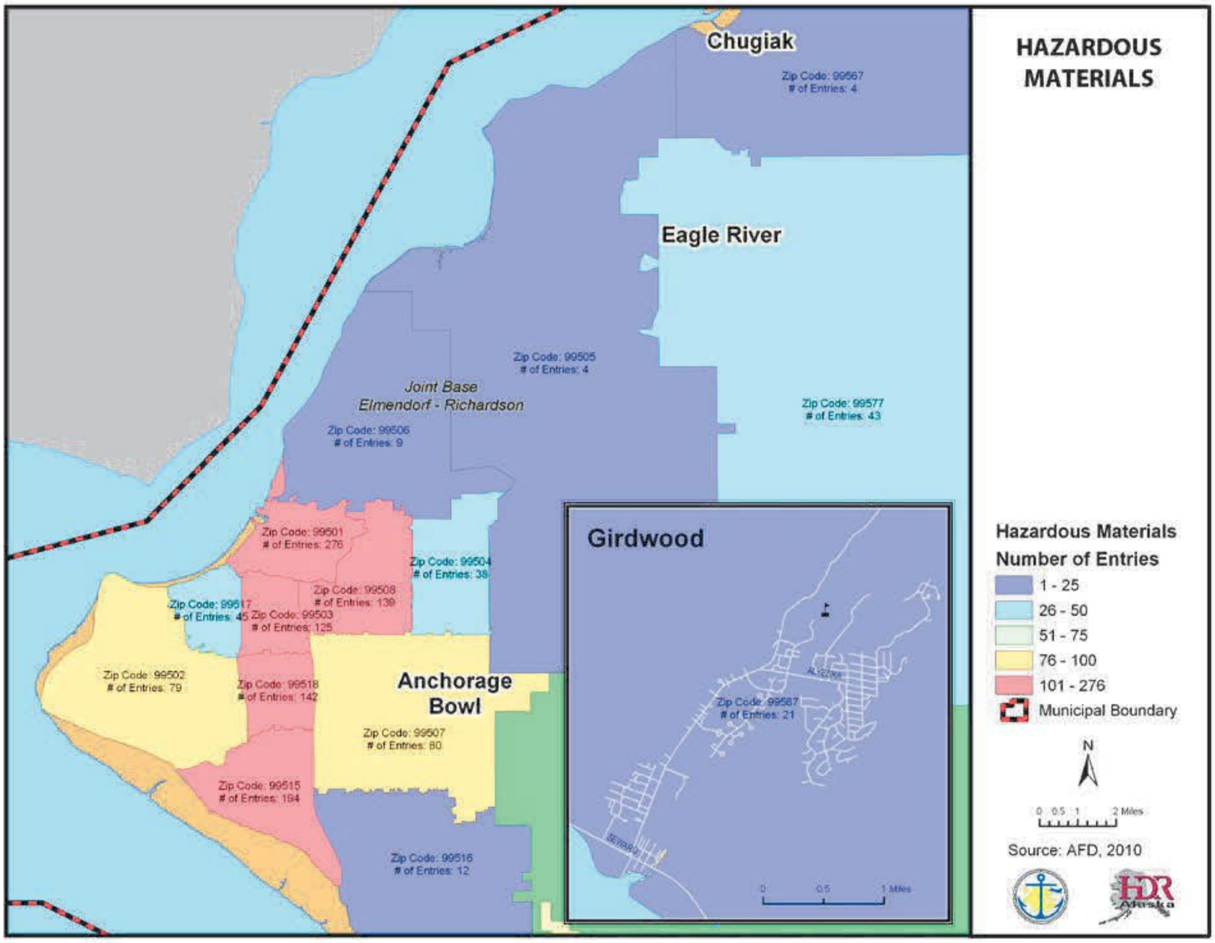
Local Mitigation Plan Review Tool	
1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan** (section and/or page number)
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT	
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	4.2.4 Hazardous Materials pg. 102-104

In general, a hazardous material is any substance or a material that has the potential to harm humans, animals, or the environment. A hazardous materials incident is the intentional or accidental release of toxic, combustible, illegal, or dangerous nuclear, biological, or chemical agents into the environment. The types of material that can cause a hazardous materials incident are wide ranging. Examples include materials such as chlorine, sulfuric acid, gasoline, medical/biological waste, etc. Many accidents happen at fixed sites (where hazardous materials are stored or handled), but incidents may also occur during transportation (by road, rail, pipeline or waterway). Terrorist incidents are not covered in this chapter.

Location

Hazardous materials incidents are more likely to occur where hazardous materials are located. Facilities that meet certain requirements are required to report information regarding the type and volume of hazardous materials to the State of Alaska and the AFD. According to the AFD records (as of July, 2016), zip code 99506 has the highest number of reportable hazardous materials. This zip code includes the Ship Creek area which has a higher percentage of industrial land uses (see Figure 4.14).

Figure 4.14 Map of the Distribution of Hazardous Materials



The MOA Solid Waste Services Division has two sites to collect hazardous wastes. The first Hazardous Waste Collector Center is located at the Anchorage Regional Landfill (near the intersection of the Glenn Highway and Hiland Road). The second Household Hazardous Waste Collection Facility is located at the Central Transfer Station near E. 54th and Juneau (east of the Old Seward Highway). These sites are for household use only.

Transportation related incidents are more likely on the main transportation routes such as the Seward and Glenn Highways and the Alaska Railroad. Materials enter the Port of Anchorage and are dispersed around the State. However, they can also occur on local roads or by air or marine vessel traffic.

Pipelines, such as the pipeline used to transport fuel from the Port of Anchorage to TSAIA, are another potential source of a hazardous materials incident.

Likelihood of Occurrence - Probability - Low

Small-scale hazardous materials incidents occur every year although the exact number is unavailable. As the MOA continues to grow, it is likely that the number of facilities using hazardous materials will increase and so will the likelihood of a hazardous materials incident. Additionally, as the State of Alaska itself grows, so too will the demand for Hazardous Materials needed statewide, more of which are brought through the Port of Anchorage. In the year 2015 there were a total of 417 HazMat calls requiring AFD response. 289 of these were fuel/chemicals. 137 were a release of CO and 144 pertained to a gas leak in nature. See Hazard Rating Matrix, Table 1.2.

Historic Events

There have been no events that resulted in a declared disaster. However, small scale hazardous materials incidents have occurred. For example, on June 9, 2009, there was a chemical spill at TSAIA that resulted in a cargo hanger being evacuated for an hour.

4.3.13.1 Vulnerability Assessment

Office Emergency Management updated the vulnerability assessment for hazardous materials release in the 2024 Hazard Identification and Risk Assessment (HIRA).
As a hazardous material incident could occur at a facility or during transportation, the entire MOA is considered vulnerable to a hazardous materials incident (see Table 4.30).

Table 4.3.13.1.1 Parcels Vulnerable to a Hazardous Material Incident

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	75024	8526159300	17756156200	26282315500
Commercial	4065	2568664400	4512337400	7081001800

Source: MOA GIS, 2016

Areas with higher concentrations of hazardous material usage, such as industrial areas, are more vulnerable. Zip code 99501 has the highest number of hazardous materials. People living in close proximity to a hazardous material incident are more vulnerable. The number of people vulnerable to a hazardous material incident will depend on the location of the event.

Areas with higher concentrations of hazardous material usage, such as industrial areas, are more vulnerable. Zip code 99501 has the highest number of hazardous materials. People living in close proximity to a hazardous material incident are more vulnerable. The number of people vulnerable to a hazardous material incident will depend on the location of the event, the amount of material involved and the specific material involved.

Discharges/Releases, nuclear facilities (such as power plants, waste storage sites, and processing plants) in eastern Russia and Japan could impact Alaska because weather patterns have the potential to bring radioactive fallout to the state. Most Russian facilities are considered to have substandard construction and have had a history of reported and unreported releases (Alaska Department of Environmental Conservation, 2010).

People
The populations most at risk from hazardous materials releases in the MOA include facility workers, first responders, and residents near industrial sites, transportation corridors, and facilities where hazardous substances are stored or handled.

Exposure to toxic chemicals can lead to acute health effects such as respiratory distress, chemical burns, and poisoning, as well as chronic conditions like cancer or organ damage. Vulnerable groups, including children, pregnant women, the elderly, and individuals with pre-existing health conditions, are particularly susceptible to the impacts of hazardous materials exposure. Evacuations necessitated by hazardous materials incidents may also lead to displacement, psychological stress, and long-term disruptions to daily life for affected communities.

Property

Properties exposed to hazardous materials may require extensive decontamination before being deemed safe for occupancy or use. Critical infrastructure such as transportation hubs, hospitals, schools, and industrial facilities are especially vulnerable, with the potential for prolonged closures and loss of functionality. Contaminated areas could result in significant economic losses for businesses and property owners due to cleanup costs, operational disruptions, and potential legal liabilities. The stigma associated with contamination may also lead to declining property values and challenges in real estate transactions, further compounding economic impacts in the affected region.

The Environment

The natural environment in and around the MOA is highly vulnerable to the effects of hazardous materials releases. Local waterways, including Ship Creek, Knik Arm, and the surrounding Cook Inlet, are critical habitats for fish and wildlife. A release of toxic chemicals into these water bodies could have substantial ecological impacts, threatening species such as salmon, which is culturally important to Alaskan natives and economically important to the region. Contaminants can persist in water, soil, and sediment, leading to long-term ecological damage and posing risks to drinking water supplies. Sensitive ecosystems near the MOA may be particularly slow to recover from contamination due to Alaska's short growing seasons and characteristic environmental conditions.

Municipal Operations

Municipal and community operations, including emergency response, public health, transportation, and utilities, would be directly affected by a hazardous materials release. Emergency response agencies, such as the Anchorage Fire Department and local hospitals, may become overwhelmed, especially if the release impacts a large area or involves particularly hazardous chemicals. Transportation routes, including the port, rail, and Glenn Highway, could be temporarily closed, disrupting logistics and supply chains. Hazardous materials contamination could affect the MOA's water treatment and distribution systems, compromising drinking water quality and requiring costly remediation efforts. School closures, business disruptions, and temporary evacuations could strain community resources.

4.3.13.2 Consequence Analysis

Office Emergency Management updated the consequence analysis for hazardous materials release in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public

A hazardous materials release poses significant risks to public health, particularly through exposure to toxic chemicals, which may result in respiratory issues, chemical burns, or long-term effects such as cancer or organ damage. Vulnerable populations, including children, the elderly, and those with pre-existing health conditions, face heightened risks. The psychological impact of such incidents, compounded by evacuations, shelter-in-place orders, or prolonged displacement, could cause widespread anxiety and disrupt daily life. Housing instability and long-term health monitoring for exposed individuals may add additional stress on affected communities.

Impacts on Responders

Responders face significant risks during a hazmat release, including potential exposure to toxic substances even when using protective gear. The situation can place a heavy strain on local emergency services, as specialized HazMat teams are needed, leaving fewer resources for other emergencies. Prolonged response efforts can lead to fatigue, stress, and long-term health effects (physical and mental) for responders working in hazardous conditions.

Impacts on Continuity of Operations
A hazardous materials incident could disrupt critical municipal services, such as emergency response, healthcare, transportation, and utilities. If contamination affects key infrastructure, such as the Port of Alaska, water treatment facilities, or major transportation routes like the Glenn Highway, recovery efforts may be significantly delayed. The MOA's reliance on specific transportation corridors and its isolation from external support could exacerbate these disruptions. Prolonged closures of essential services, combined with the high cost of decontamination and repairs, could hinder the city's ability to restore normal operations promptly.

Impacts on Property
Properties in the vicinity of a hazardous materials release, including homes, businesses, and industrial facilities, may suffer significant contamination, rendering them unsafe for occupancy until decontamination is completed. Cleanup efforts could be expensive and time-consuming. Contamination stigma may also result in decreased property values, particularly in areas directly impacted by the incident.

Impacts on the Environment
A HazMat release could contaminate the air and local water systems, posing serious risks to human health, harming wildlife, and damaging ecosystems. Persistent substances, like flame retardants, anesthetic gasses, expired pharmaceuticals, and latex, might seep into the soil, leading to long-term environmental damage and requiring costly cleanup efforts to ensure safety and restore the affected areas.

Impacts on the Economy
A hazardous materials incident could disrupt the MOA's economy through impacts on industries such as transportation, fishing, and tourism. Contamination at key transportation hubs, including Ted Stevens Anchorage International Airport and the Port of Alaska, could halt the movement of goods and disrupt supply chains. The fishing industry could face significant losses if waterway contamination affects marine life, leading to closures and decreased revenue. Tourism could decline if safety concerns, or access restrictions deter visitors. The financial burden of cleanup and decontamination efforts, reduced property values, and long-term recovery needs could strain public and private sector resources.

Impacts on Public Confidence in the Jurisdiction
An inadequate or delayed response to a hazardous materials release could erode public trust in local authorities, particularly regarding their ability to protect public health and safety. Poor communication during evacuations or shelter-in-place orders may heighten anxiety and skepticism. Prolonged contamination or economic disruption could diminish confidence in the jurisdiction's preparedness and recovery capabilities. Addressing these challenges transparently and efficiently will restore public trust and maintain community resilience.

4.3.14 Transportation Accident

The transportation system in the MOA consists of air, road, rail, and marine systems. All of these modes have the potential for accidents that could lead to a disaster. For this plan, a transportation accident is any large-scale aircraft, vehicular, railroad, or marine accident, i.e., one that is not handled on a day-to-day basis by emergency responders.

Anchorage is home to many public airports, the largest of which is TSAIA. TSAIA is the major passenger and cargo facility and is located on the western edge of the city. Merrill Field, one of the busiest general aviation[8] airports in the country, is located just east of downtown.

Several of the flight paths of both airports pass over developed parts of the Municipality. Other airports located within the MOA include Birchwood Airport and Girdwood Airport. There are also two military airfields on JBER. In addition, the MOA has one seaplane base (Lake Hood), although several lakes are used by seaplanes, including Sand Lake, Campbell Lake, and Lower Fire Lake.

The MOA is vulnerable to two major types of air transportation accidents; a crash involving a large passenger aircraft or a crash causing casualties on the ground. Mid-air collisions between two aircrafts are also possible.

As a coastal community, the MOA has the potential for marine accidents. The type of accident of greatest concern involves barges transporting materials, fuels, or other hazardous materials. Most goods designated for Alaska come through the Port of Alaska. The Port also provides all of the jet fuel to JBER and between 66 to 80 percent of the fuel to TSAIA

(MOA, 2016). The Port also exports petroleum products.

There are several major transportation routes in the MOA, including the Seward and Glenn Highways, which connect the MOA to adjacent boroughs (see Figure 4.19). There are approximately 1,800 miles of roadway in the MOA.

There are approximately 140 miles of railroad track in the MOA. The ARRC operates passenger and freight trains on this track.

Location

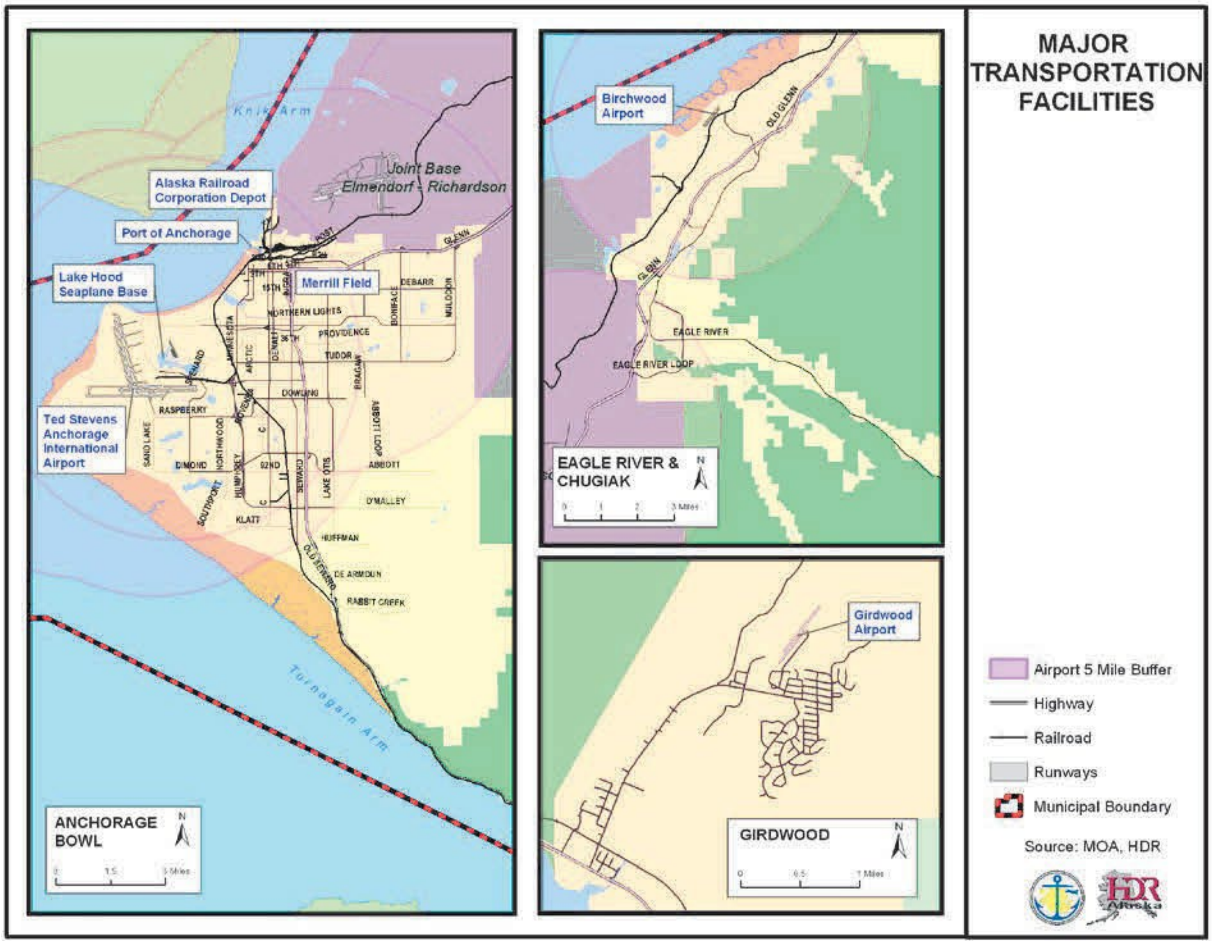
The majority of airplane crashes occur immediately before landing or after takeoff. The areas most likely to be impacted by a plane crash are under or close to the flight path, especially if they are within 5 miles of an airport (see Figure 4.15).

A marine accident is more likely in the Port of Alaska area and in shipping lanes but with the high tides in Anchorage and strong currents could rapidly affect the entire coastline.

A motor vehicle accident could occur on any roadway in the MOA but is more likely on roads with higher traffic volumes.

A rail accident would occur along the railroad tracks.

Figure 4.15 Map of Major Transportation Facilities



[8] General aviation refers to non-military flying except scheduled passenger airlines (Department of Transportation & Public Facilities, 2006).

Historic Events

From January 1, 2004 to December 14, 2009, there were 70 reported aircraft accidents/incidents within the MOA (National Transportation Safety Board, 2010). Most of the accidents/incidents were minor; only 3 of the 70 accidents involved fatalities.

On May 27, 2011, a small plane crashed shortly after takeoff from the Birchwood airport. The crash killed the five people on board. The crashed caused the closure of the ARRC tracks for several hours.

On June 29, 2010, a cargo plane crashed shortly after takeoff on Elmendorf Air Force Base. The crash killed all four crew members on board. The crash also damaged the ARRC's main rail line and a parallel siding, forcing train traffic to be suspended until repairs could be made.

On June 2, 2010, a plane crashed just after taking off from Merrill Field resulting in one fatality and four people seriously injured. The plane crash occurred during rush hour near a busy intersection (7th Avenue and Ingra Street). Traffic in the downtown area was disrupted for several hours due to road closures.

On September 22, 1995, an E-3B Airborne Warning and Control Systems (AWACS) jet carrying a crew of 24 crashed just after takeoff from Elmendorf Air Force Base. The cause of the crash was due to bird strikes.

On August 24, 2013, an airplane was coming in to land at Merrill Field and was told to wait due to another plane on the runway. The plane continued over the runway at approximately 100 feet when it suddenly pitched to the left and crashed. It was determined that the plane had been starved for fuel due to the nose-high altitude during the go-around and the engines failed. Two people were killed in this accident.

On May 28, 2014, a Robinson R44 II helicopter collided with the ground and caught fire while conducting practice flights for an external load project that was coming up at the Birchwood Airport. The pilot was killed in the crash.

On July 2, 2014, a plane crashed at Merrill Field killing the pilot after undergoing maintenance and modifications over the course of several years. The elevator controls had been misrigged and were in the opposite locations resulting in the reversal of control inputs. Witnesses stated that the airplane climbed steeply in an extreme nose-high attitude until it pivoted and descended straight to the ground.

On August 6, 2015, two people were missing after a Piper PA-18-150 plane crashed into the Knik Arm off the Birchwood Airport. The airplane was located and recovered, with extensive damage. The two occupants were never recovered and are presumed deceased.

On December 21, 2015, a small airplane lost engine power after taking off from Girdwood and landed on a highway bridge. No one was injured or killed.

On December 29, 2015, a Cessna 172 was destroyed and the pilot lost his life when the plane collided with an office building in downtown Anchorage.

The worst crash in Anchorage occurred on November 27, 1970. A DC-8-63F plane went off the end of the runway at TSAIA and was destroyed in a post-crash fire. The National Transportation Safety Board determined that the probable cause was that the plane was not traveling fast enough during takeoff. Of the 229 people on board, there were 47 fatalities (Embry-Riddle Aeronautical University, 1972).

Other aircraft accidents include:

- An in-flight engine separation on March 31, 1993
- A collision between two aircrafts at TSAIA on December 23, 1983
- A crash during landing on December 4, 1978; five of the seven people on board were fatally injured.

According to the Minerals Management Service's Alaskan Shipwreck online database, there have been approximately 19 marine accidents since 1900. The actual number of accidents is likely to be different because not all accidents are reported and because the location description may not be detailed enough to determine if the accident with within the MOA limits. Reported accidents include:

- A ship ran into the dock at the Port of Anchorage and damaged a 30-ton section of dock on February 10, 1972
- A ship ran into the Port of Anchorage dock on July 22, 1974 and damaged the pier
- A strong wind pushed a ship onto the mudflats on April 19, 1982
- A ship ran into the dock on March 17, 1985 and damaged part of the dock

Motor vehicles accidents are typically small-magnitude events, some with fatalities, but of no impact to the entire community. According to the 2013 MOA Annual Traffic Report, in 2013 there were 4,283 accidents, including 13 that involved fatalities. In the past, there have numerous accidents that resulted in roadway closures for several hours, but there have been no accidents that resulted in a disaster declaration.

According to the Federal Rail Administration database, there were 4 train accidents in the MOA from 2000 to 2009, with no fatalities.

Likelihood of Occurrence - Probability - High

Most airplane accidents are likely to involve general aviation aircraft. However, it is unlikely that a general aviation aircraft could cause a citywide emergency. However, the presence of large planes over the developed portion of the city makes a large crash a possibility.

Marine, road, and rail accidents that result in a citywide emergency are also possible; however, the likelihood is considered low.

4.3.14.1 Vulnerability Assessment

Office Emergency Management updated the vulnerability assessment for transportation accident in the 2024 Hazard Identification and Risk Assessment (HIRA).

The entire MOA is vulnerable to a transportation accident and is shown in Table 4.32. In general, the areas closer to a transportation route are more vulnerable than areas further away. A major transportation accident could have an impact on the local economic if it results in a long-term shut down of that transportation mode.

Table 4.3.14.1.1 Parcels Vulnerable to Transportation Accidents

Land Use	# of Parcels	Taxable Value (Land)	Taxable Value (Buildings)	Total
Residential	75024	8526159300	17756156200	26282315500
Commercial	4065	2568664400	4512337400	7081001800
Industrial	2597	1494944600	1907337000	3402281600
Institutional	1035	1215398400	1554183700	2769582100
Open Space	44	24995700	503000	25498700
Transportation	664	0	0	0
Other	562	377462100	36697800	414159900
Vacant	228	0	0	0
Total	84219	14207624500	25767215100	39974839600

Source: MOAGIS, 2016

In subsequent updates of the plan, additional research should be conducted to identify the areas vulnerable to each mode of transportation. For example, areas underneath the flight In subsequent updates of the plan, additional research should be conducted to identify the areas vulnerable to each mode of transportation. For example, areas underneath the flight path for one of the airports would be more vulnerable to an airplane crash than other parts of the MOA.

People

The MOA's people are particularly vulnerable to the impacts of significant transportation incidents, such as major aviation crashes, rail derailments, or marine vessel incidents. Residents living near critical transportation hubs, including Ted Stevens Anchorage International Airport, the Port of Alaska, and the Alaska Railroad, face heightened risks of injury or death during catastrophic events. Large-scale incidents involving hazardous materials or mass casualties could overwhelm local emergency medical services, leaving individuals without timely care. Vulnerable populations, such as children, the elderly, and those with disabilities, may face increased challenges during evacuation or sheltering efforts following such incidents. Psychological impacts, including trauma and anxiety, are also likely in the aftermath of significant transportation incidents, particularly those with widespread casualties or disruptions.

Property

Significant transportation incidents pose considerable risks to property. Aviation crashes could result in severe damage to residential, commercial, and industrial structures in the vicinity of flight paths. Rail derailments or marine vessel incidents involving hazardous materials could lead to contamination of nearby properties, requiring costly and time-intensive remediation efforts. Critical infrastructure, including bridges, rail lines, and port facilities, is particularly vulnerable to long-term disruption or destruction during large-scale transportation incidents. Property values in affected areas may decline due to the stigma associated with contamination or recurring hazards.

The Environment

The MOA's location near the coast makes its waters vulnerable to contamination from fuel or chemical spills, which could harm marine life and local fisheries. An incident involving flammable materials or hazardous chemicals could pollute the air, creating health risks for people and impacting the natural environment. Additionally, the MOA is surrounded by sensitive habitats, so any contamination or disruption from incidents could have long-lasting effects on local plants and wildlife, especially in areas close to water or protected green spaces.

Municipal Operations

A major transportation incident in the MOA could overwhelm emergency services, making it harder for them to respond quickly to other incidents. Road closures and increased traffic from the incident could cause delays for public transportation and people commuting, slowing movement across the city. As a central hub for goods for central Alaska, the MOA's supply of essential items like food and medical supplies could be disrupted, impacting both local businesses and consumers. Additionally, prolonged road closures, property damage, and repair efforts could lead to significant financial losses, especially in industries that rely on timely transportation, like tourism and freight.

4.3.14.2 Consequence Analysis

Office Emergency Management updated the consequence analysis for a transportation accident in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public

A transportation incident involving hazardous materials, or a vehicle or boating vessel crash could result in significant casualties, including injuries and fatalities, as well as psychological trauma for those involved or witnessing the event. Disruption to traffic could strand commuters, delay essential travel, inhibit imports and exports, and reduce access to emergency services, potentially jeopardizing public safety further.

Impacts on Responders

First responders would face exposure to dangerous conditions, including hazardous materials, fire, or structural instability. Limited access to the incident site due to debris or secondary hazards could complicate rescue efforts, while prolonged operations might strain resources, equipment, and personnel, reducing their ability to respond to other emergencies.

Impacts on Continuity of Operations

A transportation incident could disrupt municipal services, including healthcare, emergency management, and public transportation. If key infrastructure is affected—such as major highways, the port, or transportation hubs—supply chains for food, fuel, and medical supplies could be delayed, impeding daily operations and emergency responses.

Impacts on Property

Significant damage could occur to vehicles, roadways, bridges, the port, and nearby buildings. Fires, explosions, or HazMat releases could further destroy property in the immediate area, necessitating extensive cleanup and repairs. This destruction could extend to personal property, businesses, and public infrastructure.

Impacts on the Environment

If hazardous materials are involved, the release could contaminate air, water, and soil, leading to long-term environmental degradation. Wildlife and local ecosystems, particularly in sensitive areas around the MOA, could suffer irreversible harm. Cleanup efforts would likely be expensive, time-consuming, and complex.

Impacts on the Economy

The incident could lead to economic losses from business interruptions, property damage, and costly cleanup efforts. Long-term effects might include reduced tourism, lower property values in the affected area, and disruptions to critical supply chains, impacting the local and regional economy.

Impacts on Public Confidence in the Jurisdiction

The public's confidence in the local government could erode if response efforts are perceived as inadequate or delayed. A lack of clear communication or transparency during and after the incident could further intensify public distrust, complicating recovery efforts and long-term community relations.

4.3.15 Communications Failure

COMMUNICATIONS FAILURELocal Mitigation Plan Review Tool	
1. REGULATION CHECKLIST **Regulation** (44 CFR 201.6 Local Mitigation Plans)	**Location in Plan (section and/or page number)**
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))	4.2.7 Communication Failure pg. 109-110

A communications failure is the interruption or loss of communications systems including transmission lines, communications satellites, and associated hardware and software necessary for the communications system to function. A communications failure may be the result of an equipment failure, human acts (deliberate or accidental) or the result of another hazard event.

When a communications failure occurs, it can have a wide range of affects. A failure that results in a small delay in response times by emergency service providers might have a minimal impact on the community in general even though it may be problematic to individuals who require those services. A failure of the 911 system or an emergency warning system has the potential to impact the entire community.

Location

All parts of the MOA have the potential to be impacted by a communications failure.

Likelihood of Occurrence - Probability - High

The likelihood of a large-scale extended communications failure is high. It is assumed that there will be widespread communication failures during an earthquake.

Historic Events

Communication failures in the MOA have been limited to small scale outages associated with equipment failures or natural events such as severe weather storms and mainly affecting landline and cellular telecommunication capabilities.

There have been no failures of the 911 system in the MOA since the late 1990s. Backup systems are in place so when the APD dispatch is unable to answer 911 calls, the calls are directed to the AFD. In the past 5 years, there have been 3 instances where the back-up system has been activated. Two of these events were caused by human error which the third event was caused by a computer failure (Kurtz, 2010).

On May 19, 2002, the APD dispatch and the 911 center was evacuated due to a fire/air conditioning overheating which resulted in Halon being discharged (Roberts, 2010).

4.3.15.1 Vulnerability Assessment

Office Emergency Management updated the vulnerability assessment for utility emergencies, including communication failure in the 2024 Hazard Identification and Risk Assessment (HIRA

Anyone who relies on technology such as telephones, are somewhat vulnerable to experiencing some type of communications failure. Interruptions in day to day communications would create problems for businesses, public agencies, citizens, and emergency services. The most common problems would range from minor inconveniences of our citizens to loss of production and revenues for businesses.

Emergency services could face more serious consequences, as nonexistent communications failure could escalate what would have been a minor emergency into a disaster situation.

People

People in the MOA are vulnerable to utility emergencies due to the city's reliance on stable energy, water, and communication systems, especially during harsh winter months. Economically disadvantaged residents may struggle during prolonged energy or water outages, as they may lack resources for alternative heating, water storage, or emergency supplies. Vulnerable groups—including the elderly, young children, and individuals with electricity-dependent or water-dependent medical needs—face elevated risks if energy or water disruptions affect access to essential healthcare, clean drinking water, sanitation, or heating. Additionally, remote or underserved areas may experience longer restoration times due to limited infrastructure redundancy and challenging access routes. The MOA's dependence on digital and cellular networks for emergency information, healthcare, and public safety further heightens vulnerability during communication failures. Populations without alternative communication options, such as low-income households, remote residents, and non-English-speaking individuals, may face increased risks and delays in accessing critical services and emergency information during extended outages.

Property

Property in the MOA is highly vulnerable to utility emergencies, especially critical facilities such as hospitals, the Anchorage Emergency Operations Center (EOC), and water infrastructure management by the Anchorage Water and Wastewater Utility, which rely on stable energy and communication networks. The Port of Alaska is also of concern as it has enough generator power to protect infrastructure, but not enough to maintain operations. During outages, these facilities risk severe damage, such as frozen pipes in winter or equipment failure, which could impair essential functions in healthcare, emergency response, and public utilities. Residential areas, particularly older neighborhoods like Mountain View, are also at increased risk of structural damage if heating fails, leading to frozen and burst pipes and costly repairs. Water disruptions can further result in plumbing system failures, compounding property damage in both residential and commercial buildings. Local businesses, especially in sectors dependent on refrigeration and heating, or water availability, face property and inventory losses if energy outages disrupt operations, with high-risk areas including Midtown Mall and downtown Anchorage. Additionally, communication failures pose security risks for properties with automated systems, like fire alarms and surveillance, leaving them more susceptible to damage or loss due to delayed response times. Any damage at the Port of Alaska, a critical fuel and resource hub, is a significant vulnerability, as damage here could disrupt the regional supply chain including water-related resources essential for emergency recovery efforts.

The Environment

The environment in the MOA is vulnerable to utility emergencies, particularly from disruptions at critical infrastructure near sensitive ecosystems. Energy infrastructure at the Port of Alaska and nearby fuel storage facilities poses a risk to Cook Inlet; a spill or leak during an outage could severely impact marine life and water quality. Water infrastructure failures could lead to untreated sewage or contaminated water being released into local waterways, degrading habitats and harming aquatic wildlife. Power outages may also disrupt operations at the Anchorage Water and Wastewater Utility, increasing the risk of untreated sewage entering local waterways, degrading habitats, and harming wildlife. Additionally, reliance on backup generators during energy outages contributes to air pollution, affecting both local air quality and public health. Communication failures further elevate environmental risks, as facilities handling hazardous materials, like the Port of Alaska, rely on coordinated networks to manage safe storage and transport. Without timely communication, the response to spills or leaks may be delayed, heightening contamination risks to Cook Inlet and surrounding ecosystems.

Municipal Operations

Municipal operations are highly vulnerable to utility emergencies, as many essential services rely on continuous energy, water, and communication supplies to function effectively. Critical facilities such as the Anchorage EOC, Police Department, and Fire Department depend on stable power for communication, dispatch, and emergency response coordination; prolonged outages could delay responses and reduce support for residents in crisis. Energy and water disruptions also impact services like water treatment and distribution at the Anchorage Water and Wastewater Utility, raising public health concerns if untreated water reaches residents. Additionally, public transportation systems, administrative offices, and public schools could experience delays or closures, disrupting access to essential services across the community. Communication failures further exacerbate these vulnerabilities, as they impair coordination among emergency services and hinder situational awareness, particularly at the EOC and Police Department. The reliance on digital networks for daily operations means that municipal facilities, such as City Hall and the Municipal Clerk's Office, may be unable to maintain public services and records, emphasizing the need for resilient systems to support municipal functions during utility emergencies.

4.3.15.2 Consequence Analysis

Office Emergency Management updated the consequence analysis for utility emergencies, including communication failures in the 2024 Hazard Identification and Risk Assessment (HIRA).

Impacts on the Public

A prolonged utility emergency could have severe impacts on the public, particularly during winter months when a power outage would leave residents without adequate heating, heightening risks of hypothermia for vulnerable populations like the elderly and young children. Water utility disruptions would compound these risks by limiting access to clean drinking water and sanitation, increasing the likelihood of dehydration and waterborne illnesses, especially for vulnerable groups. Disruptions to electricity and fuel supplies would limit access to essential public services, including hospitals, schools, and public safety facilities, restricting critical care and support. Transportation and fuel shortages could hinder residents' ability to commute, leading to economic hardship and reduced work and school attendance. Extended outages may also lead to food spoilage and water supply failures, further straining local resources and increasing public health risks. Additionally, communication failures would prevent timely hazard warnings, leaving residents unprepared for threats such as severe weather or evacuation orders. Vulnerable groups, including those with disabilities or limited English proficiency, would be disproportionately affected, as they may struggle to access alternative communication channels and essential information.

Impacts on Responders

First responders would face significant challenges during utility emergencies, as power outages and communication failures can severely impair their ability to coordinate and respond effectively. Without reliable energy, or access to water utilities, emergency services may struggle to operate critical equipment, maintain hydration for personnel, and support firefighting efforts, reducing operational readiness and slowing response times. Disrupted communication systems hinder real-time information sharing, leading to delays, miscommunication, or duplication of efforts, which can put both responders and the public at greater risk. In the MOA 's diverse and often challenging terrain, ineffective communication could isolate units in the field, making it difficult to relay updates or request backup. Energy emergencies may also elevate the incidence of accidents, fires, and other emergencies as residents resort to alternative heating sources, increasing the demand on first responders during a time of constrained resources. Additionally, hospitals and emergency shelters might experience surges in demand if residents seek refuge from the cold, or if water outages force closures of sanitation facilities, placing further strain on emergency personnel. Overall, utility emergencies compromise the safety and effectiveness of responders precisely when their capabilities are most critically needed.

Impacts on Continuity of Operations

The continuity of operations across essential city functions could be severely impacted, including water treatment, waste management, and public transportation, all of which rely on stable energy, water, and fuel supplies. Extended outages could interrupt these services, affecting public health and sanitation, while government offices may face shutdowns or reduced capacity, limiting residents' access to critical services and slowing crisis decision-making. Schools, healthcare facilities, and public safety departments would struggle to maintain operations without reliable energy and water utilities, compromising public welfare and safety. Additionally, communication failures would disrupt interagency coordination, impeding decision-making and response actions, particularly during emergencies. Prolonged communication breakdowns could also hinder the MOA's ability to engage with external support agencies, leading to service delays that weaken the city's resilience and recovery capabilities. Overall, prolonged utility disruptions could destabilize the MOA's economy and essential services, emphasizing the need for robust continuity planning.

Impacts on Property

Significant property damage could occur, especially during extended energy outages. Without reliable heating, buildings are at risk of frozen and burst pipes, causing flooding and structural damage. Water utility failures can exacerbate these risks by disrupting plumbing systems, leading to water leaks or contamination within properties. The use of temporary heating solutions, such as space heaters or fireplaces, increases the risk of fires, which could cause further damage to residential and commercial properties. Prolonged outages may also affect critical systems like HVAC and fire suppression, leaving structures more vulnerable to hazards and complicating emergency response efforts. Businesses dependent on refrigeration, water, or temperature-sensitive storage could face inventory losses, resulting in financial strain and potential closures. Communication failures further amplify property risks by delaying hazard warnings and response coordination for threats like fires or severe weather, leaving properties more exposed. Additionally, communication breakdowns could disrupt security systems, raising the risk of theft or vandalism and complicating damage assessment and insurance claims processes, which would extend recovery times for property owners. Finally, any concern that requires homeowners or businesses to turn off gas for safety will take significant time to come back online, as the process to reestablish flow takes a significant amount of time.

Impacts on the Environment

Utility emergencies in the MOA could have significant environmental consequences, particularly during prolonged energy outages. Extended reliance on generators may increase air pollution, affecting local air quality and potentially harming wildlife and human health. Water outages could lead to untreated wastewater or contaminated water being released into local waterways, such as Cook Inlet and Ship Creek, harming aquatic ecosystems and local fisheries. Fuel shortages could disrupt waste treatment facilities, leading to untreated wastewater discharges into nearby water bodies like Cook Inlet or Ship Creek, which would damage aquatic ecosystems and local fisheries. Power outages may also hinder environmental monitoring systems, reducing the MOA's capacity to detect and respond to pollution events or environmental hazards in real time. Communication failures further amplify these risks by delaying coordinated responses to hazardous spills, wildfires, or other environmental emergencies, allowing harmful incidents to escalate. The MOA's proximity to sensitive natural areas emphasizes the need for rapid response and monitoring to prevent contamination and protect wildlife habitats from compounding environmental impacts.

Impacts on the Economy

Utility emergencies in the MOA could have significant economic impacts, with extended power outages or fuel shortages disrupting key sectors, including retail, healthcare, logistics, and tourism. Small businesses, especially those with limited contingency resources, may face revenue losses and job impacts, as the MOA's reliance on energy for heating and transportation drives up operational costs and living expenses. Critical facilities like the port and airport, essential for Alaska's supply chain, could experience operational slowdowns or shutdowns, affecting the movement of goods across the state and beyond. Additionally, communication failures may impair business operations and essential services, as internet and phone networks are vital for transactions, customer communication, and supply chain coordination. Financial institutions might struggle to process transactions, leading to public frustration and a drop in consumer confidence, while tourism could decline as visitors avoid areas with unreliable services. Together, these disruptions could reduce economic confidence, potentially triggering a long-term economic downturn for the MOA.

Impacts on Public Confidence in the Jurisdiction

Extended utility emergencies, particularly during winter, could leave MOA residents feeling vulnerable and frustrated, especially if communication about response efforts is unclear or delayed. Prolonged power outages, water disruptions, and communication failures may lead the public to question the jurisdiction's preparedness and resilience, especially if these issues recur or seem inadequately managed. Trust in local leadership could erode further if critical services, such as heating, clean water access, emergency shelters, and fuel distribution, are not prioritized or effectively coordinated. Without timely updates, residents may feel disconnected and anxious, as reliable information is crucial for safety during crises. Over time, perceptions of unreliable energy, water, and communication systems could diminish public confidence in the MOA's ability to protect its community, potentially impacting engagement in future preparedness initiatives and reducing public support for resilience efforts.

CHAPTER 5 MITIGATION STRATEGY

The purpose of this chapter is to document the MOA's mitigation strategy, which is based on the findings presented in the preceding chapters. This chapter is divided into the following sections:

- Hazard Mitigation Goals and Objectives
- Hazard Mitigation Strategies
- Action Plan
- Table 5.1 All Hazards Mitigation Plan Tracking

The goals, objectives, and action items in this chapter are intended to guide everyday activities and provide a long-term hazard mitigation approach for the MOA to follow. The intent is that these goals, objectives, and action items will be incorporated into future MOA plans, policies, and projects and reduce the overall risk within the MOA. The goals are broad statements about what the MOA wants to achieve in terms of hazard mitigation and the reduction of risk. Objectives identify how the MOA will achieve those goals. The Action Plan items are specific actions that will be taken or projects that will be built to implement this mitigation plan.

A review of the goals, objectives and action items was conducted as part of this plan update. The planning group was asked to review the goals, objectives and action items identified in the 2016 plan and has provided written and verbal input. This has resulted in changes in the goal and objectives with corresponding updates to our action items. These updates are reflected in **Table 5.1: All Hazards Mitigation Plan.** Each year upon plan review, stakeholders will provide input on the current status of their projects and project monitoring occurs throughout the year. Activity progress will be tracked on the All Hazards Mitigation Plan Action List that is maintained outside the plan.

5.1 Goals and Objectives

Goal 1: Implement and maintain the MOA All Hazards Mitigation Plan.

Objective 1.1 Ensure municipal involvement by appointed personnel in this plan.

Objective 1.2 Require periodic meetings with municipal personnel and the public.

Objective 1.3 Ensure funding for plan maintenance and 5-year updates.

Objective 1.4 Ensure this plan is updated and enhanced to include other recent local plan updates, hazard data and studies. Integrate this plan into future plans and local comprehensive plans.

Goal 2: Inform the community on the local hazards and ways to be prepared if a hazard event occurs.

Objective 2.1 Educate individuals and businesses about hazards, disaster preparedness, and mitigation.

Objective 2.2 Increase coordination between hazard mitigation goals and existing and future plans, including the incorporation of effective hazard mitigation strategies into the Capital Improvement Program and Anchorage Comprehensive Plan.

Objective 2.3 Educate public officials, developers, realtors, contractors, building owners, and the general public about hazard risks and building requirements.

Objective 2.4 Partner with Municipal Departments and other agencies serving vulnerable populations to minimize harm in the event of an emergency.

Objective 2.5 Ensure hazard information/maps are easy to access and up to date in the municipal GIS database.

Objective 2.6 Partner with private sector to promote employee education about disaster preparedness while on the job and at home.

Goal 3: Increase the survivability and resiliency of municipal structures and functions for local hazards.

Objective 3.1 Conduct surveys of essential municipal buildings and infrastructure to determine if seismic and life safety retrofits are required.

Objective 3.2 As surveys are completed prioritize the municipal facilities to receive upgrades.

Objective 3.3 Implement the facility upgrades as funding becomes available. Objective 3.4 Incorporate non-structural mitigation into existing buildings.

Objective 3.5 Create redundancies for critical networks such as water, sewer, digital data, power, and communications.

Goal 4: Improve the resiliency of essential private sector functions.

Objective 4.1 Create a planning document to determine which private sector facilities should be prioritized for MOA assistance in disaster recovery

Objective 4.2 Develop a recovery plan for essential private sector functions such as health care or food distribution facilities

Objective 4.3 Determine if essential private sector functions should be required to implement seismic upgrades.

Objective 4.4 Minimize economic loss.

Goal 5: Land Use Planning: Develop land use regulations to reduce the hazard risk to the general population and property.

Objective 5.1 Conduct studies to determine hazard areas within the MOA

Objective 5.2 Adopt and enforce public policies to minimize impacts of development and enhance safe construction in high hazard areas.

Objective 5.3 Integrate the All-Hazards Mitigation Plan into local comprehensive and land use plans.

Goal 6: Reduce the flood risk to the community.

Objective 6.1 Continue to participate in the National Flood Insurance Program.

Objective 6.2 Revise and update flood hazard information whenever possible.

Objective 6.3 Implement flood reductions measures and improve local drainage.

Goal 7: Emergency Management: Create and maintain a community where people and property are safe.

(From Anchorage 2020, LRTP, Housing & Community Development Consolidated Plan, Work Force & Economic Development Plan)

Objective 7.1 Develop mechanisms in advance of a major emergency to cope with subsequent rebuilding and recovery phases.

Objective 7.2 Plan for and respond to the secondary effects of disasters, such as hazardous waste and hazardous materials spills, when planning and developing mitigation projects.

Objective 7.3 Promote disaster contingency planning and facility safety among institutions that

Provide essential services such as food, clothing, shelter, and health care.

Objective 7.4 Improve disaster warning systems.

Goal 8: Reduce the Urban and rural Wildfire Risk.

Objective8.1 Support the AFD Wildfire Strategic Plan.

Objective 8.2 Promote Firewise homes through the concepts in Firewise Alaska: landscaping and vegetation management; structure protection through preparedness; building design, siting, and construction material; and homeowner awareness.

Objective 8.3 Promote vegetation management in greenbelts and parks to limit fire spread.

Objective 8.4 Maintain the wildfire risk model.

Objective 8.5 Maintain and develop additional water resources.

Objective 8.6 Improve road connectivity for evacuation purposes.

5.2 Implementation

5.2.1 Strategies

The MOA will implement the mitigation measures identified in this plan by using the comprehensive plan, Capital Improvement Plan, and other hazard mitigation tools they have at their disposal.

While there are many different ways to mitigate hazards, not all are appropriate for all situations. Each situation must be evaluated in order to decide what activities are the most appropriate. General strategies that can be used to mitigate hazards include:

Structural Features

Structural features are designed to control the hazard and restrict the exposed area. The construction of a structure such as a dam, levee, or avalanche deflection wall can lessen the impact of a hazard event. Structures can be incorporated into new development, but this should be discouraged in hazard-prone areas. The following departments can implement this strategy:

- PM&E
- Port of Anchorage
- Maintenance and Operations

Land Use Planning

Land use planning can guide development away from hazard-prone areas. Planning is more effective at protecting future development. The responsibility for land use planning is with the Planning and Development Services Department.

Zoning

Zoning ordinances regulate development by dividing a community into areas and by establishing development criteria for each area. They may restrict certain uses in hazard- prone areas or add restrictions such as minimum elevations. Zoning is more effective with future development. Zoning can:

- Prevent new development in hazard-prone areas
- Preserve or establish low densities in hazard-prone areas
- Control changes in use and occupancy of structures in hazard-prone areas
- Establish performance standards
- Require special use permits

The Planning Department and the Planning and Zoning Commission have the primary responsibility for zoning in the MOA.

Subdivision Regulations

Subdivision regulations govern how a parcel of land can be subdivided into two or more smaller parcels. It is better to incorporate mitigation measures into subdivision regulations before a parcel of land is developed. These regulations are better at protecting future development than existing development. The Planning Department, Development Services and the Platting Board administer the MOA’s subdivision regulations.

Capital Improvement Plan

A Capital Improvement Plan (CIP) is used to guide major public expenditures for physical improvements over a given period of time. These expenditures can be used to mitigate existing and future development. For example, funds could be used to retrofit an existing structure, build a new levee, or purchase property. The lack of investment in infrastructure in hazard-prone areas may also act to restrict development, as it is too costly for a private developer to build the necessary improvements. All municipal departments have input into the CIP, but the Office of Management & Budget is the coordinating department.

Open Space Preservation

Open space preservation is a tool to keep existing open spaces in hazard-prone areas from being developed. This prevents putting more people and facilities at risk. Typically, a municipal government will acquire the property from a private property owner. The property then becomes zoned as open space, which limits the future development of the property.

Property that is already government-owned can also be preserved as open space. Open space is usually managed by the Parks & Recreation Department.

Acquisition

Acquisition involves purchasing property in high-risk areas and demolishing any structures on it to prevent the structure from being damaged during a hazard event. The structure is demolished to ensure that it is not re-used in the future. This technique is appropriate for mitigation of existing structures. It can also be used to buy vacant land in high-risk areas to prevent development from occurring. Many departments would be involved in the acquisition of property and structures.

Relocation

Relocation is similar to acquisition, except that any structures on the property are relocated out of a hazard-prone area. The structure may be relocated to a different parcel or within the same parcel. This technique is also more appropriate for existing structures. Many departments would be involved in the relocation of structures.

Building Codes

Building codes are a compilation of laws, regulations, ordinances, or other statutory requirements adopted by a government legislative authority relating to the physical structure of buildings. They establish minimum requirements regarding the construction of a structure to protect public health, safety, and welfare. They apply to new buildings as well as those undergoing significant renovations, which makes building codes helpful in protecting new and existing development. Enforcement is essential in order for building codes to be an effective hazard mitigation tool. It is also less expensive and easier to incorporate mitigation measures into new structures than it is to retrofit existing ones. Development Services is responsible for administering the building code in Anchorage.

Insurance

Insurance provides funding to rebuild a structure and replace its contents after a hazard event. Insurance is appropriate for mitigating existing structures. The problem with insurance is that it can make it easier to rebuild in a hazard-prone area, thus creating a repetitive loss situation. Because municipal governments such as the MOA are typically self-insured, this strategy is used more by private property owners. The Risk Management Department is responsible for ensuring the MOA’s insurance needs are met.

Education

Education involves teaching the public about potential natural hazards, the importance of mitigation, and how to prepare for emergency situations. It is used to inform residents, business owners, visitors, etc. about the hazards in the area and what they can do to protect themselves and their property. Examples include real estate disclosure, homeowner wildfire reduction publications, and training. Many departments within the MOA can undertake education activities, including OEM, the Mayor's Office, AFD, Planning Department and Development Services.

5.3 Action Plan

The action plan consists of specific activities or projects that will be used to implement the goals and objectives of this hazard mitigation plan. The action items are categorized by the hazard being addressed with action items addressing more than one hazard being grouped in a multi-hazard category. The action plan contains many items that have no funding sources identified. The timelines are dependent upon obtaining funding. If and when funding becomes available, more specific timelines will be established. This list is in the early stages of development and will be updated as needed. For each item, several characteristics are listed, including:

- Purpose: Why this item is included in the action plan
- How Identified: How the action item was identified
- Coordination Organization: The primary organization to implement the action item
- Objective: The objectives being implemented
- Status/Timeline: What stage the project is at or the target start date
- Priority: The priority of the project as determined by the process established in Appendix G (Departments have not begun to use this tool and priorities will be included in the next version of the mitigation plan.)
- Cost: The estimated cost of the project (if known)
- Potential Funding Sources: Possible sources of funding (if known)
- Hazard: The hazard being addressed (for multi-hazard action items only)
- Benefit Cost: Determines the benefit to the community for the resources expended.

Goal 1: Implement and maintain the MOA All Hazards Mitigation Plan.

Action 1. The MOA shall establish a Mitigation Advisory Committee for the All Hazards Mitigation Plan and establish a consistent meeting schedule.

- Purpose: To review the status of the plan and make recommendations on updates and priorities.
- How Identified: Mitigation Planning Team
- Coordinating Organization: Office of Emergency Management
- Objective: 1.1
- Hazard: All
- Status/Timeline: 6 months from plan adoption
- Priority: High
- Cost: Staff time
- Potential Funding Sources: MOA Operating Budget
- Benefit Cost: Little to no cost to designate mitigation planning team members and will greatly aid the implementation of this plan.

Action 2. Review and update prioritization strategy (in Appendix F). Upon completion, prioritize action items.

- Purpose: Prioritizing the projects will help the MOA make decisions regarding how to allocate the resources available for hazard mitigation activities.
- How Identified: Mitigation Planning Team
- Coordinating Organization: Mitigation Advisory Committee
- Objective: 1.2

- Hazard: All
- Status/Timeline: 6 months from plan adoption
- Priority: High
- Cost: Staff time
- Potential Funding Sources: MOA Operating Budget
- Benefit Cost: Little to no cost and once a Mitigation Advisory Committee is designated this action item can easily be accomplished

Action 3. Ensure funding is provided for plan maintenance and revision. In year 3 of the plan the MOA should apply for State or Federal Grants for plan revision.

- Purpose: To ensure complete plan maintenance and revision with maximum agency and public involvement.
- How Identified: Planning Team
- Coordinating Organization: Mitigation Advisory Committee
- Objective: 1.3
- Hazard: All
- Status/Timeline: Ongoing
- Priority: High
- Cost: staff time and potential consultant contract.
- Potential Funding Sources: MOA Budget, State and Federal Grants
- Benefit Cost: This action will have little cost to the MOA with significant potential for benefit to the community to implement a plan update.

Goal 2: Inform the community on the local hazards and ways to be prepared if a hazard event occurs.

Action 4. The MOA will continue to review and advise the community on the various methods of making structures and their contents more disaster-resistant, which would include workshops, literature, and public safety announcements. The MOA will also partner with public, private, and non-profit agencies on a public outreach and education campaign. Multilingual outreach will also be used.

- Purpose: To educate people about hazard mitigation.
- How Identified: by Planning Team
- Coordinating Organization: All departments
- Objective: 2.1, 2.3, 2.4, 2.6
- Hazard: All
- Status/Timeline: The staff of some departments currently perform this function.
- Priority: Medium
- Cost: unknown, varies by department
- Potential Funding Sources: MOA Budget, State and Federal Grants
- Benefit Cost: This action item is currently ongoing with minimal cost and has a benefit to community outreach of pre-disaster preparation.

Action 5. Acquire updated air photos or LiDAR information for the entire MOA

- Purpose: To allow the MOA to provide more accurate information to the public.
- How Identified: Planning Team
- Coordinating Organization: PM&E/GIS
- Objective: 2.5
- Hazard: All
- Status/Timeline: Continuous, 2-3 years for air photos and 5 years for LIDAR

- Priority: Medium
- Cost: will be determined at the time of procurement
- Potential Funding Source: Municipal Budget, State and Federal Grants
- Benefit Cost: This process is ongoing and its cost is not budget breaking but it is not insignificant. Obtaining periodic updates to LIDAR and aerial imagery is important to maintaining hazard maps.

Action 6. Work Collaboratively with other departments to incorporate the All Hazards Mitigation Plan available into other municipal long-range plans, e.g. Anchorage Comprehensive Plan, 2040 Land Use Plan, Climate Action Plan, Metropolitan Transportation Plan. To the best of our ability, ensure mitigation strategies are integrated into MOA long-range plans and capital improvement budgets.

- Purpose: To ensure hazard concerns, mitigation strategies and goals are incorporated into public planning documents.
- How Identified: Planning Team
- Coordinating Organization: Municipal Manager, Planning Director
- Objective: 2.2
- Hazard: All
- Status/Timeline: Will be implemented as MOA plans are updated.
- Priority: High
- Cost: $3,140,000
- Potential Funding Sources: MOA Budget State and Federal Grants
- Benefit Cost: This will allow the MOA to focus development and management practices to reduce the risk or improve the recovery from local hazards

Goal 3: Increase the survivability and resiliency of municipal structures and functions against local hazards.

Action 7. Retrofit and enhance MOA-owned facilities that will be needed during and after a hazard.

- Purpose: To limit the amount of damage caused by an earthquake
- How Identified: Planning Team
- Coordinating Organization: M&O, Port, AWWU, PM&E, Chugach Electric, SWS, Merrill Field, ASD
- Objective: 3.3, 3.4, 3.5
- Hazard: All
- Status/Timeline: 3 to 5 years
- Priority: Medium
- Cost: Depends on facility
- Potential Funding Sources: MOA Budget, CIP bonds, State and Federal Grants
- Benefit Cost: This action item has significant costs. The Hazard Mitigation Committee will have to use their best judgement to determine which facilities will receive priority for this funding. The benefit is survivability of functions and facilities in a hazard event.

Action 8. Identify critical infrastructure and other facilities that need to be seismically retrofitted or rebuilt to current seismic standards.

- Purpose: To ensure emergency response capability and equipment after a hazard event.
- How Identified: AFD and APD Strategic Plans
- Coordinating Organization: AFD/APD/OEM/M&O/Development Services
- Objective: 3.1, 3.2, 3.5

- Hazard: Earthquake
- Status/Timeline: Initiate a survey of high priority municipal infrastructure not already evaluated within two years and develop a plan to address the retrofitting within three years. AFD Fire Stations 8,10,11, & 12 are the only stations that have not been upgraded to meet current seismic requirements.
- Priority: High
- Cost: Staff time to coordinate surveys of the buildings. The costs for the building analysis and retrofits are unknown.
- Potential Funding Sources: Capital Improvement Bonds, operations budget for smaller projects, state and federal funding sources for larger projects.
- Benefit Cost: This is a medium to high cost to implement. This action is essential for maintaining emergency services after a hazard event ensuring public safety.

Action 9. Retrofit or enhance to improve the resiliency of police stations as listed in the APD's Strategic Plan and CIB/CIP plan.

- Purpose: To ensure the availability of emergency response and equipment after a hazard event.
- How Identified: APD Strategic Plan/CIB Budget
- Coordinating Organization: APD, M&O
- Objective: 3.3, 3.4, 3.5
- Hazard: All
- Status/Timeline: 3 – 5 years
- Priority: Medium to High
- Cost: Phase II (Storage building $13.5 million) Phase III (Evidence Warehouse/ Tactical Storage $80 million) Phase IV (HQ retrofit $18 million)
- Potential Funding Sources: MOA Budget, Bonds, State and Federal Grants.
- Benefit Cost: This is a medium to high cost to implement. This action is essential for maintaining emergency services after a hazard event ensuring public safety.

Action 10. Complete the Port of Alaska modernization.

- Purpose: The port modernization project will replace the 55-year-old port with updated, robust infrastructure and systems, making it more hazard-resistant than the existing port.
- How Identified: Port of Alaska
- Coordinating Organization: Port of Alaska
- Objective: 3.3
- Hazard: Earthquake, extreme weather, hazardous materials, transportation accident
- Status/Timeline: This project is ongoing and is expected to be completed between 2022 and 2024. The actual completion date will depend on a variety of factors, including the availability of funding.
- Priority: High
- Cost: Approximately $600 million
- Potential Funding Sources: Federal appropriations and grants, State grants, Port profits, revenue bonds
- Benefit Cost: The Port of Alaska is the main hub for the majority goods and food delivered to Alaska. This infrastructure is critical to the daily lives of Alaskans. Improving the resiliency of this facility is a priority.

Action 11. Continue to strengthen the existing Port of Alaska pilings until they can be replaced.

- Purpose: The structural pile thicknesses are below standard and are likely to collapse during an earthquake.
- How Identified: Port of Alaska Pile Condition – Seismic Vulnerability Study (R&M, 2014)

- Coordinating Organization: Port of Alaska
- Objective: 3.3
- Hazard: All
- Status/Timeline: This project proceeds on an annual basis and will no longer be needed when the Port modernization is complete.
- Priority: High
- Cost: Between $1 and $3 million annually.
- Potential Funding Sources: Port Capital Budget, State and Federal Grants.
- Benefit Cost: This infrastructure is critical to the daily lives of Alaskans. Improving the resiliency of this facility is a priority.

Action 12. Install gas shut-off valves in MOA-owned public facilities used in response/recovery efforts.

- Purpose: To reduce the possibility of gas leaks after a hazard event.
- How Identified: Planning Committee
- Coordinating Organization: M&O
- Objective: 3.3
- Hazard: All
- Status/Timeline: In progress; several MOA facilities have already been retrofitted.
- Priority: Medium
- Cost: To be completed (approximately $5,000 to $7,000 per facility)
- Potential Funding Sources: MOA Budget, Bonds, State and Federal Grants
- Benefit Cost: The MOA is currently funding portions of this project. Installing gas shut-off valves reduces the risks to people and facilities during and after a seismic event.

Action 13. Perform seismic and structural analysis of all ASD owned facilities.

- Purpose: To identify and prioritize structural deficiencies.
- How Identified: ASD's Capital Improvement Planning process.
- Coordinating Organization: ASD
- Objectives: 3.1
- Hazard: Earthquake
- Status/Timeline: Within 1 Year.
- Priority: High
- Cost: $500,000.00
- Potential Funding Sources: ASD General Funds, Bonds, State and Federal Grants.
- Benefit Cost: The school facilities are occupied by our children much of the time and are planned to be used as shelters after a hazard event if necessary. Determining which structures need seismic upgrades and which building need upgrades the most, allow proper prioritization for the use of available funds. This analysis may also be used to determine if a facility should not be planned for use as a shelter. This will improve safety for the citizens in the community.

Action 14. Construct necessary seismic and structural upgrades of all ASD owned facilities.

- Purpose: To address deficiencies and identified in the districtwide seismic analysis.
- How Identified: Future district wide seismic analysis.
- Coordinating Organization: ASD
- Objectives: 3.3
- Hazard: Earthquake
- Status/Timeline: As funds become available.

- Priority: High
- Cost: To be determined
- Potential Funding Sources: ASD General Funds, Bonds, State and Federal Grants.
- Benefit Cost: The school facilities are occupied by our children much of the time and are planned to be used as shelters after a hazard event if necessary. Conducting the seismic and structural upgrades ensures safety of the building occupants (children) and will ensure resilient structures to be used as shelters for the community post-earthquake.

Goal 4: Improve the resiliency of essential private sector functions.

Action 15. Develop a recovery plan for essential private sector functions.

- Purpose: Develop a plan to determine which private sector functions are essential and will receive priority from the MOA for re-construction after a hazard event
- How Identified: Planning Team
- Coordinating Organization: Development Services and Planning Department
- Objective: 4.1, 4.2, 4.3, 4.4
- Hazard: All
- Status/Timeline: This will be work into department schedules as time allows.
- Priority: Low
- Cost: Unknown
- Potential Funding Sources: MOA Budget, State or Federal Grants
- Benefit Cost: Local government must plan for or determine which private service functions/facilities must receive priority to re-establish operations to serve the public after a hazard event. These services would probably be focused on energy, safety, shelter, transportation, communications, medical and food distribution facilities which would be essential for a post hazard event recovery.

Goal 5: Land Use Planning: Develop land use regulations to reduce the hazard risk to the general population and property.

Action 16. Continue to implement the policies and strategies in Anchorage 2020-Anchorage Bowl Comprehensive Plan that addresses crime prevention and public safety, natural and man-made hazards, and emergency response.

- Purpose: To implement community safety/hazard mitigation in Anchorage through applicable functional, neighborhood, and district plans. Update the APD 5-year Strategic Plan and the APD Emergency Management Plan.
- How Identified: Through inter-agency coordination, Anchorage 2020 Plan, AO-2002-119.
- Coordinating Organization: OEM/APD/AFP/Planning Department/Development Services
- Objective: 5.1, 5.2
- Hazard: All
- Status/Timeline: 3 to 5 years
- Priority: High
- Cost: MOA staff and GIS resources.
- Potential Funding Sources: MOA budget, State and Federal Grants
- Benefit Cost: Land use planning that considers hazards as an integral component to
- policies cans be established that will ensure reductions of loss and damage to structures.

Action 17. Incorporate the action items identified in the Downtown Seismic Risk Assessment into local ordinances.

- Purpose: To help ensure the action items identified in this assessment are coordinated with other MOA activities
- How Identified: Consultant, Planning Team

- Coordinating Organization: Planning Department and Development Services
- Objective: 5.1, 5.2
- Status/Timeline: By 2024
- Priority: Medium
- Cost: Under $10,000
- Potential Funding Sources: MOA Budget, State and Federal Grants
- Benefit Cost: Land use planning that considers hazards as an integral component to policies cans be established that will ensure reductions of loss and damage to structures.

Action 18. Update snow avalanche mapping for Chugiak/Eagle River, Anchorage Bowl, and Turnagain Arm/Girdwood.

- Purpose: Update snow avalanche hazard maps.
- How Identified: From 2011 Plan, Public Requests and the Planning Committee.
- Coordinating Organization: Planning Department, Development Services
- Objective: 5.1,5.2
- Hazard: Avalanche
- Status/Timeline: 3 years
- Priority: Low
- Cost: Staff and GIS resources, Avalanche Consultant
- Potential Funding Sources: MOA Budget, State or Federal Grants
- Benefit Cost: This would allow for more accurate hazard maps for the community to protect people and structures. This would also allow for improved land use planning as the community expands into more rural areas.

Action 19. Update Seismic Hazard Mapping.

- Purpose: Update seismic hazard maps.
- How Identified: From 2011 Plan, Public Requests and the Planning Committee.
- Coordinating Organization: Planning Department, Development Services
- Objective: 5.1, 5.2
- Hazard: Avalanche
- Status/Timeline: 3 years
- Priority: Low
- Cost: Staff and GIS resources, seismic mapping consultant
- Potential Funding Sources: MOA Budget, State or Federal Grants
- Benefit Cost: This would allow for more accurate hazard maps for the community to protect people and structures. This would also allow for improved land use planning as the community expands into more rural areas.

Goal 6: Reduce the flood risk to the community.

Action 20. The MOA shall continue to apply floodplain management regulations for development in the flood plain and floodway.

- Purpose: To continue to minimize vulnerability to flooding.
- How Identified: NFIP requirement
- Coordinating Organization: PM&E
- Objective: 6.1
- Hazard: Flood
- Status/Timeline: Ongoing
- Priority: Mandatory function

- Cost: Included in the PM&E Watershed Management Budget.
- Potential Funding Sources: MOA Budget
- Benefit Cost: This is an ongoing function that protects people and structures from flood hazards.

Action 21. The MOA shall continue to utilize the FEMA Flood Insurance Rate Map to define the special flood hazard area, the floodway, and the floodplain.

- Purpose: To define the special flood hazard area, the floodway, and the floodplain in a consistent manner.
- How Identified: NFIP requirement
- Coordinating Organization: PM&E
- Objective: 6.1
- Hazard: Flood
- Status/Timeline: Daily Function
- Priority: Mandatory function
- Cost: Staff Time included in the PM&E Watershed Management Budget.
- Potential Funding Sources: MOA Budget
- Benefit Cost: This is an ongoing function that protects people and structures from flood hazards.

Action 22. Annually review and amend, as appropriate, a list of potential flood mitigation projects such as culvert replacement, channel rehabilitation and property acquisition.

- Purpose: To identify sites the MOA would like to consider purchasing.
- How Identified: PM&E Drainage Studies
- Coordinating Organization: PM&E
- Objective: 6.3, 3.1, 3.3
- Hazard: Flood
- Status/Timeline: Part of ongoing activities.
- Priority: Low
- Cost: Staff time
- Potential Funding Sources: MOA Budget, Bonds, State and Federal Grants.
- Benefit Cost: This is an ongoing function that protects structures from localized flooding.

Action 23. Annually identify and prioritize Flood Insurance Rate Maps that need to be updated.

- Purpose: Because all the FIRMs cannot be updated simultaneously, having a prioritized list would tell the city what to update when resources are available.
- How Identified: Planning Team, Community Input
- Coordinating Organization: PM&E
- Objective: 6.2
- Hazard: Flood
- Status/Timeline: Initial list should be developed within one year of plan adoption.
- Priority: Low
- Cost: Staff time
- Potential Funding Sources: MOA Budget, State and Federal Grants
- Benefit Cost: This allows the local government to better mitigate the flood risk to the community and to allow the community to benefit from flood hazard mitigation projects.

Action 24. Update the Flood Insurance Study.

- Purpose: To update information about the flooding hazard in the MOA.
- Coordinating Organizations: PM&E

- Objective: 6.2, 2.5
- Hazard: Flood
- Status/Timeline: to be completed in early 2024.
- Priority: Medium
- Cost: Depends on the scope of the update.
- Potential Funding Sources: MOA Budget, Bonds, State or Federal Grants
- Benefit Cost: This allows the local government to better mitigate the flood risk to the community and to allow the community to benefit from flood hazard mitigation projects. It would also allow for improved land use planning for flood hazards.

Action 25. Convert the local vertical datum to a national standard vertical datum.

- Purpose: To reduce the risk to people and property from flooding.
- How Identified: by FEMA
- Coordinating Organization: PM&E
- Objective: 6.1, 6.2, 2.5
- Hazard: Flood
- Status/Timeline: 3 years
- Priority: Medium
- Cost: $300 - $500 Thousand
- Potential Funding Sources: MOA Budget, Bonds, State and Federal Grant
- Benefit Cost: This is the first step in obtaining updated Flood Insurance Rate maps and Flood Insurance Studies for the community. It will allow for protection against flooding.

Action 26. Annually review the list of drainage studies that need updating.

- Purpose: To identify which drainage studies need to be updated and the order in which they should updated
- How Identified: AHMP Planning Committee, community input
- Coordinating Organization: Watershed Management
- Objective: 6.2, 6.3, 3.2
- Hazard: Flood
- Status/Timeline: Ongoing
- Priority: Low
- Cost: To be completed
- Potential Funding Sources: MOA Budget, Bonds, State and Federal Grants
- Benefit Cost: This will allow for better planning of performing and implementing drainage studies to prevent localized flooding. This will prevent property damage and improve quality of life in poorly drained neighborhoods.

Action 27. Map estimated dam inundation areas within the Municipality and evaluate alternative methods to mitigate the potential risk of a dam failure in these areas.

- Purpose: To assess and recommend alternative methods to mitigate the risk of dam failure on residents and structures located within estimated dam inundation areas
- How Identified: Planning Team
- Coordinating Organization: PM&E, Development Services
- Objective: 6.2, 4.4
- Hazard: Flood

- Status/Timeline: A GIS layer for the Lake O' the Hills Dam is completed. An electronic version of the Eklutna Lake Dam inundation area by 2023.
- Priority: Medium
- Cost: 1 week of staff time (may be less if the GIS layer can be acquired from the firm that developed the inundation area map)
- Potential Funding Sources: MOA Budget, Bonds, State and Federal Grants
- Benefit Cost: This will allow the MOA to meet a State of Alaska Dam Safety Requirement and will allow local government to use the inundation studies to determine if additional pre-disaster mitigation planning should be done.

Goal 7: Emergency Management

Action 28. Identify ways to improve local public information and warning capabilities.

- Purpose: To provide improved warnings to the residents of Anchorage
- How Identified: By OEM
- Coordinating Organization: OEM
- Objective: 7.1, 2.1
- Hazard: All
- Status/Timeline: Ongoing
- Priority: Medium
- Cost: To be determined
- Potential Funding Sources: Current funding, although grants and other funds may be needed to implement the improvements.
- Benefit Cost: This will allow local government to better prepare the public for local hazards and warn them of imminent disasters.

Action 29. Update the MOA Continuity of Operations Plan (COOP)

- Purpose: To ensure essential functions of Municipal Government during a crisis
- How Identified: By OEM
- Coordinating Organization: OEM
- Objective: 7.1, 7.3, 2.3
- Hazard: All
- Status/Timeline: 2 years
- Priority: Medium
- Cost: To be completed
- Potential Funding Sources: MOA Budget, State or Federal grants
- Benefit Cost: This will allow local government to update the COOP for current needs and situations. This will allow the MOA to continue essential government and or emergency functions during and after a disaster event.

Action 30. Update the MOA Comprehensive Emergency Operations Plan (CEOP), and Damage Assessment Plan

- Purpose: To ensure essential functions of Municipal Government during a crisis
- How Identified: By OEM
- Coordinating Organization: OEM
- Objective: 7.1, 7.3, 2.3
- Hazard: All
- Status/Timeline: 2 years
- Priority: Medium
- Cost: To be completed

- Potential Funding Sources: MOA Budget, State or Federal grants
- Benefit Cost: This will allow local government to update the CEOP for current needs and situations. This will allow the MOA to continue essential government and or emergency functions during and after a disaster event.

Goal 8: Reduce the urban rural wildfire risk.

Action 31. Review existing zoning ordinances to determine if additional wildfire mitigation measures could be incorporated to address wildfire mitigation which has been proposed for inclusion in updates to Title 21. Consider adoption of the International Code Council Wildland Urban Interface Code (current edition).

- Purpose: To help incorporate wildfire mitigation measures into future development
- How Identified: AFD Wildfire Strategic Plan
- Coordinating Organization: AFD, Development Services, Planning Department, Parks and Recreation
- Objective: 8.1,
- Hazard: Wildfire
- Status/Timeline: Tied to the update of Title 21
- Priority: medium
- Cost: Staff time to develop code language and code adoption process
- Potential Funding Source: Operations budget, Bonds, State and Federal Grants
- Benefit Cost: Land use planning that considers hazards as an integral component to policies cans be established that will ensure reductions of loss and damage to structures and safety of the public.

Action 32. Conduct fire-wise home assessments.

- Purpose: Conduct Firewise home assessments to enable homeowners in certain parts of the MOA to obtain insurance.
- How Identified: AFD Wildfire Strategic Plan
- Coordinating Organizations: AFD
- Objective: 8.2, 8.1, 2.1, 4.4
- Hazard: Wildfire
- Status/Timeline: ongoing
- Priority: Medium
- Cost: Varies by year
- Potential Funding Sources: MOA Budget, Bonds, State and Federal Grants
- Benefit Cost: This ongoing program improves the safety of residents and structures in areas with limited firefighting capabilities. It encourages homeowners to develop and maintain their property in a manner that reduces the fire risk.

Action 33. Update the wildfire risk model.

- Purpose: The 2009 wildfire risk model is currently in use. AFD needs to update the model to 2016.
- How Identified: AFD Wildfire Strategic Plan
- Coordinating Organization: AFD
- Objective: 8.1, 8.4, 2.1, 2.3, 2.5
- Hazard: Wildfire
- Status/Timeline: The update will be completed if Federal Wildland Urban Interface grant is secured.
- Priority: medium
- Cost: Staff time to make the necessary updates
- Potential Funding Sources: MOA Budget, Bonds, State and Federal Grants

- Benefit Cost: The current risk model is outdated. Updating the model will allow local government to plan and manage firefighting resources for the current needs of the community and will provide information for land use planning inputs.

Action 34. Continue and maintain vegetation management.

- Purpose: To provide public lands vegetation management when DOF has personnel available for mitigation; To provide homeowner assessments and education so that homeowners can manage vegetation on their private property; and to provide wood lots for the disposal of vegetation from private properties through rant funds and business partnerships.
- How Identified: Wildfire Strategic Plan
- Coordinating Organization: AFD/SOA Division of Forestry
- Objective: 8.1, 8.2, 8.3
- Hazard: Wildfire
- Status/Timeline: The vegetation management is an ongoing program that supported with federal funding. This is an AFD long term project
- Priority: Medium
- Cost: Staff resources to manage the vegetation, funding for the wood lot usage and funding for the Firewise Program to encourage private homeowners to address residential areas
- Potential Funding Sources: MOA Budget, Bonds, State and Federal Grants
- Benefit Cost: This ongoing program improves the safety of residents and structures in areas with limited firefighting capabilities. It encourages homeowners to develop and maintain their property in a manner that reduces the fire risk. It allows local government to reduce the fire hazard of publicly owned greenbelts thereby reducing the risk to adjoining structures.

Action 35. Develop additional water resources for wildfire response purposes.

- Purpose: Develop additional water resources would assist in fighting wildfires.
- How Identified: AFD Strategic Plan
- Coordinating Organization: AFD/AWWU
- Objective: 8.1, 8.5
- Hazard: Wildfire
- Status/Timeline: No action has been taken due to insufficient funding and staff resources.
- Priority: Medium
- Cost: AFD Staff resources to identify locations. The development of water resources for firefighting is very costly (drilling wells, installing hydrant systems, installing drafting equipment).
- Potential Funding Sources: MOA Budget, Bonds, State or Federal Grants.
- Benefit Cost: Large sections of the local community do not have public water systems which make firefighting in extremely difficult due to limited water supply. Having an adequate water supply can mean the difference between containing a fire or extinguishing the fire.

Action 36. Update the MOA Community Wildfire Protection Plan

- Purpose: To ensure wildfire preparedness is an essential function of Municipal Government
- How Identified: By Hazard Mitigation Committee
- Coordinating Organization: AFD
- Objective: 7.1, 7.3, 2.3
- Hazard: Wildfire
- Status/Timeline: 3 years
- Priority: Medium
- Cost: To be completed
- Potential Funding Sources: MOA Budget, State or Federal grants

- Benefit Cost: This will allow local government to update the Wildfire Protection Plan for current needs and situations. This will allow the MOA to continue essential government and or emergency functions during and after a disaster event.

KEY CATEGORIES	
Goal kept - with no changes	
Goal kept - with changes	
Goal deleted - no longer viable as is	

Table 5.1: All Hazards Mitigation Plan.

Goal	Action Items	Description	Action Coordination Organization	Comments	Priority	Date
1		**Implement and maintain MOA All Hazard Mitigation Plan**	Office Emergency Management	OEM updating All Hazard Mitigation Plan with grant funding 19-CDBG-DR-02.		
	A1	**Establish Mitigation Advisory Committee (MAC)**	OEM	Ongoing. Review and Update prioritization. Upon completionprioritize action items.	High	8/05/2025
	2022 Status: All Hazards Mitigation Plan approved 5/13/2022. Staff made formatting updates. **2023 Status: Collaborated with stakeholders to review and determine plan updates to formally document hazards in the MOA. Utilizing Anchorage Local Emergency Planning Committee as Hazard Mitigation Advisory Committee update briefed.** **-1/2023 -8/2023 Cook Inlet Tsunami Study finalized. Finding released with coordinated Joint Information System with Federal/State/Local partners. Press release, media availability, social media, and community meetings conducted.** **-2/2023 -Attended Permafrost Instabilities meetings with Eklutna.** **-3/2023 to 6/2023 – Beetlekill removal outreach project with Park and Recreation planned and implemented.** **2024 Status: OEM Hazard Mitigation Officer conducted comprehensive review of the plan and established priorities and strategies to reflect an updated hazard risk picture. Conducted Hazard Identification and Risk Analysis in 2024. Utilizing Anchorage Local Emergency Planning Committee as Advisory committee.2025 Status: Continuous updates of MOA hazard profile and mitigation strategies. . Utilizing Anchorage Local Emergency Planning Committee as Advisory committee.**					
	A2	**Review and Update Prioritization**	Mitigation Advisory Committee (MAC)	Pends establishment of MAC. Review and Update prioritization. Upon completionprioritize action items.	Medium	8/05/2025
	2022 Status: : Annual review and maintenance **2023 Status: Annual review and maintenance** **2024 Status: Annual review and maintenance** **2025 Status: Updated and reviewed in conjunction with Emergency Management Accreditation compliance project 2022 All-Hazard Mitigation Plan (Table 5.1) updated with Action Item prioritization, replacement of Action Coordination Organization from Municipal Manager to Office Emergency Management.**					
	A3	**Ensure Funding sources**	OEM	Apply for Federal/ State funding for maintenance and revisions. Each dept will seek funds. Ensure funding for 5-year comprehensive revision.	Medium	8/05/2025
	2022 Status: Annual review and maintenance.					

	2023 Status: Annual review and maintenance. 4/2023 Public hearing on project for funding through 2028 Point Mackenzie Earthquake Community Development Block Grant for Disaster Recovery (CDBG-DR) . 19-CDBG-DR-02 approved for grant-funded projects in support of 2027 AHMP Update and incorporation of updates into MOA Neighborhood Plans. 2024 Status: Hired staff and begin procurement for update. Annual review and maintenance. 2025 Status: Annual review and maintenance.					
2		**Community Outreach of Hazards**	Office Emergency Management	Inform public of hazards, mitigation, and preparedness options.		
	A4	**MOA review and Advise public of Mitigation/Pre-paredness**	All Departments	Public forums, OEM website enhancements, translated hazard personal preparedness plans.	High	8/05/2025
	2022 Status: HMGP-DR-4413-04 may be used for grant services. Translation services produced an initial group of emergency management documents that were translated into non-English languages common to residents and visitors to the MOA. 2023 Status: -Annual review and maintenance. 2024 Status: Annual review and maintenance. 2025 Status: Ongoing development of translation services for new or updated Personal Preparedness Plans.					
	A5	**Updated Air Photo/ LIDAR**	PM&E/ GIS	Acquire updated imagery and/or LIDAR information for MOA	High	8/05/2025
	2022 Status: Annual review and maintenance. 2023 Status: Annual review and maintenance. 2024 Status: Active development of project task order. Secured funding for project. 2025 Status: HMGP-DR-FMAG-5282-03 is actively conducting LiDAR and data collection for Phase 1 of the Wildfire Risk Reduction.					
3		**MOA structure resiliency**		Increase the survivability and resiliency of municipal structures and functions against local hazards		
	A6	**Retrofit/ enhance MOA facilities**	Planning/M&O/Port/AWWU/ML&P/PM&E/CEA/SWS	19-CDBG-DR-09 approved for grant-funded projects in support of seismic analysis and mitigation planning.	Medium	8/05/2025
	2022 Status: Annual review and maintenance. 2023 Status: Annual review and maintenance. 2024 Status: Work continues throughout MOA. 2025 Status: MOA Planning Department recently held planning meetings for a seismic study and established the project area's boundaries.					

<table>
<tr><th>Goal</th><th>Action Items</th><th>Description</th><th>Action Coordination Organization</th><th>Comments</th><th>Priority</th><th>Date</th></tr>
<tr><td></td><td>A7</td><td>Identify Critical facilities</td><td>AFD/APD/OEM/M&O/Development Services</td><td>ID critical facilities that may need to be retrofitted or rebuilt to meet seismic standards.</td><td>Medium</td><td>8/05/2025</td></tr>
<tr><td></td><td colspan="6">2022 Status: GDIC working on updating database of critical facilities
2023 Status: Annual review and maintenance.
2024 Status: Annual review and maintenance.
2025 Status: OEM supporting use of CDBG-DR-09 for mitigation study of seismic hazards.</td></tr>
<tr><td></td><td>A8</td><td>APD station resiliency</td><td>APD/M&O</td><td>ID/retrofit and enhance APD stations to meet current seismic standards</td><td>Medium</td><td>8/05/2025</td></tr>
<tr><td></td><td colspan="6">2022 Status: Seismic retrofitting still needed in some APD facilities to be brought upto code.
2023 Status: Annual review and maintenance.
2024 Status: Annual review and maintenance.
2025 Status: Seismic retrofitting still needed in some APD facilities. OEM supporting use of CDBG-DR-09 for mitigation study of seismic hazards.</td></tr>
<tr><td></td><td>A9</td><td>Complete Port of Anchorage modernization</td><td>Port of Anchorage</td><td>Drainage improvements Peach, Brown, Wynn, Page, Farmer, and 1st streets.</td><td>High</td><td>8/05/2025</td></tr>
<tr><td></td><td colspan="6">2022 Status: Additional funds are being sought for ongoing port modernization.
2023 Status: Annual review and maintenance.
2024 Status: Continued work on completing project goals, including completion of petroleum/cement dock.
2025 Status: Ongoing port modernization efforts.</td></tr>
<tr><td></td><td>A10</td><td>Port of Anchorage pilings repair</td><td>Port of Anchorage</td><td>Continue to strengthen Port pilings until they can be replaced</td><td>1</td><td>8/05/2025</td></tr>
<tr><td></td><td colspan="6">2022 Status: Additional funds are being sought for ongoing port modernization.
2023 Status: Annual review and maintenance.
2024 Status: Jacketing of damaged/corroded piles continues. Additional funds are being sought for ongoing port modernization.
2025 Status: Annual review and maintenance.</td></tr>
<tr><td></td><td>A11</td><td>Gas shut off valves</td><td>M&O</td><td>Install gas shut off valves in MOA owned facilities used for response / rescue operations</td><td>Low</td><td>8/05/2025</td></tr>
<tr><td></td><td colspan="6">2022 Status: Pursuing grant-dependent projects.
2023 Status: Identifying gas shut-off valves in MOA facilities.
2024 Status: Annual review and maintenance.
2025 Status: Mitigation work continues throughout MOA.</td></tr>
<tr><td></td><td>A12</td><td>Seismic and structural analysis of all ASD owned facilities</td><td>ASD</td><td>19-CDBG-DR-09 approved for grant-funded projects in support of seismic analysis and mitigation planning</td><td>High</td><td>8/05/2025</td></tr>
<tr><td></td><td colspan="6">2022 Status: Half of ASD buildings have had Tier 1 seismic analysis completed.
2023 Status: 5 projects identified for mitigation application. Projects being scoped currently. Ceiling stabilization, lightingstabilization. Mechanical/electrical bracing.
2024 Status: Walls have been identified to be made more stable and up to code. Came up with a 1-10 scale with FEMA for rating buildings. Wanting to bring all ASD buildings up to a 6.5 level (mostcurrently at 3-5 range)
-working on pipe strapping as an on-going effort
2025 Status: OEM supporting use of CDBG-DR-09 for mitigation study of seismic hazards. Annual review and maintenance.</td></tr>
</table>

	A13	**Upgrade all ASD owned facilities to meet seismic and structural codes.**	ASD	19-CDBG-DR-09 approved for grant-funded projects in support of seismic analysis and mitigation planning	Medium	8/05/5025

2022 Status: Half of ASD buildings have had Tier 1 seismic analysis completed.
2023 Status: 5 projects identified for mitigation application. Projects being scoped currently. Ceiling stabilization, lightingstabilization. Mechanical/electrical bracing.
2024 Status: Walls have been identified to be made more stable and up to code. Came up with a 1-10 scale with FEMA for rating buildings. Wanting to bring all ASD buildings up to a 6.5 level (mostcurrently at 3-5 range)
-working on pipe strapping as an on-going effort
2025 Status: Annual review and maintenance.
2025 Status: OEM supporting use of CDBG-DR-09 for mitigation study of seismic hazards.

Goal	Action Items	Description	Action Coordination Organization	Comments	Priority	Date
4		**Improve resiliency of essential private sector functions**	Office Emergency Management	Develop public information campaign to disseminate best practices pertaining to hazard recovery plans.		
	A14	**Develop recovery plan for essential private sector functions**	Development Services/Planning Section/OEM	Develop best practice hazard recovery plan template for posting on Planning/OEM websites.	Medium	8/05/2025
	2022 Status: Dev Services continues to work with private sector to meet code standards. No additional costs associated with code enforcement outside normal costs. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Annual review and maintenance.**					
5		**Develop land use regulations to reduce hazard risk to general population and property**	Planning/OEM	19-CDBG-DR-08 approved for grant-funded projects.		
	A15	**Continue to implement Anchorage 2020-Anchorage Bowl Comprehensive Plan**	OEM/APD/AFD/Planning Dept./Devel-opment Services	Continued execution of projects in support of the 2020 Anchorage Bowl Comprehensive Plan	Low	8/05/2025
	2022 Status: Work continues IAW 2020 plan. **2023 Status: Annual review and maintenance.** **2024 Status: Planning support of 2040 Anchorage Bowl Comprehensive plan.** **2025 Status: Annual review and maintenance.**					
	A16	**Incorporate action items ID in Downtown Seismic Risk Assessment into local ordinances**	Planning Dept./Development Services	19-CDBG-DR-02 and 19-CDBG-DR-09 support grant-funded projects.	Low	8/05/2025
	2022 Status: Work continues IAW 2020 plan. **2023 Status: Annual review and maintenance.** **2024 Status: Planning support of 2040 Anchorage Bowl Comprehensive plan.** **2025 Status: Annual review and maintenance.**					

	A17	**Update Avalanche mapping**	Planning Dept./Development Services	19-CDBG-DR-02 and 19-CDBG-DR-09 support grant-funded projects.	Medium	8/05/2025
	2022 Status: Annual review and maintenance. 2023 Status: 11/2023 Support letter written for OEM for DGGS (Dr. Gabe Wolken) cooperating technical partner project to access avalanche date in MOA. Annual review and maintenance. 2024 Status: Avalanche mapping needs updating, as do seismic and wind zone maps. 2025 Status: Annual review and maintenance.					
6		**Reduce Flood risk**	PM&E	19-CDBG-DR-02 supports grant-funded projects.		

Goal	Action Items	Description	Action Coordination Organization	Comments	Priority	Date
	A18	**Continue to apply floodplain management regulations in flood plain and floodway**	PM&E	Ongoing	High	8/05/2025
	2022 Status: Annual review and maintenance. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Operations continue IAW current floodplain management regulations.**					
	A19	**MOA will continue to utilize FEMA Flood Insurance Rate Map**	PM&E	Ongoing	Low	8/05/2025
	2022 Status: Annual review and maintenance. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Operations continue IAW current floodplain management regulations.**					
	A20	**Annual review/amendment of flood mitigation projects**	PM&E/OEM	19-CDBG-DR-02 supports grant-funded projects	Medium	8/05/2025
	2022 Status: Annual review and maintenance. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Operations continue IAW current floodplain management regulations.**					
	A21	**Annually ID and Update Flood Insurance Rate Maps**	PM&E	Ongoing/seeking funding	Medium	8/05/2025
	2022 Status: Annual review and maintenance. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Operations continue IAW current floodplain management regulations.**					
	A22	**Update Flood Insurance Study**	PM&E	Ongoing/seeking funding	Medium	8/05/2025
	2022 Status: Annual review and maintenance. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Annual review and maintenance.**					
	A23	**Convert Local vertical datum to a National vertical datum.**	PM&E/GDIC	Ongoing/seeking funding	Medium	8/05/2025
	2022 Status: Annual review and maintenance.					

	2023 Status: Annual review and maintenance. Through State of Alaska partnership w/ DCRA, applied for waiver for Housing and Urban Development (HUD) Community Development Block Grant (CDBG) for Mitigation funds to address the whole of the jurisdiction with updated datum. **2024 Status: Annual review and maintenance.** **2025 Status: Annual review and maintenance.HUD approved waiver for vertical datum update in the whole MOA. Grant award will be in 2025, work likely to begin in 2026.**					
	A24	**Annually review/update drainage studies**	Watershed Management	Ongoing/seeking funding	Medium	8/05/2025
	2022 Status: Annual review and maintenance. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Annual review and maintenance.**					
	A25	**Map estimated dam inundation areas**	PM&E / Development Services	19-CDBG-DR-02 supports grant-funded projects	High	8/05/2025

Goal	Action Items	Description	Action Coordination Organization	Comments	Priority	Date
	2022 Status: Annual review and maintenance. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Annual review and maintenance.**					
7		**Emergency Management**	Office Emergency Management	Ensure MOA departments are capable to conduct COOP at a pre-identified COOP site		
	A26	**ID ways to improve public information and warning capabilities**	OEM	HMGP-DR-4413-04 supports grant-funded projects	Medium	8/05/2025
	2022 Status: Translation services produced an initial group of emergency management documents that were translated into non-English languages common to residents and visitors to the MOA. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Ongoing development of translation services for new or updated Personal Preparedness Plans.**					
	A27	**Update MOA Continuity of Operations Plan (COOP)**	OEM	HMGP-DR-4413-04 supports grant-funded projects	Medium	8/05/2025
	2022 Status: Annual review and maintenance. **2023 Status: Annual review and maintenance. C OOP guidelines devekoped and workshoped with departments. Reviews and approvals begin.** **2024 Status: COOP template disseminated to MOA departments. Reviews and approvals begin.** **2025 Status: Continuity of operations (COOP) for essential departments and Continuity of Government (COG) compiled into overall MOA COOP and COG plan. Annual review and maintenance.**					
8		**Reduce urban/rural wildfire risk**	AFD	Update Community Wildfire Protection Plan		
	A28	**Review existing zoning ordinance for wildfire mitigation**	AFD/Development Services/Planning Dept.	Ongoing	Low	8/05/2025
	2022 Status: Annual review and maintenance. **2023 Status: Annual review and maintenance.** **2024 Status: Conducted Hazard Identification and Risk Analysis and documented updated risk and consequences profile for MOA.** **2025 Status: CWPP update project initiated 2025. OEM also has HMGP-DR-FMAG-52-82-03, Wildfire Risk Reduction for grant-funded projects.**					
	A29	**Conduct Fire-wise home assessments**	AFD	Ongoing	Low	8/05/2025
	2022 Status: Grant funding will fund inspections for the next 2-3 years. Will be applying for additional funding. **2023 Status: Working with UA system to make campuses Firewise. APU needs a lot of inspection and Firewise mitigation.** **2024 Status: Annual review and maintenance.** **2025 Status: Annual review and maintenance.**					

	A30	**Update wildfire risk model**	AFD	HMGP-DR-4413-04 supports grant-funded projects	Medium	8/05/2025
	2022 Status: AFEM (Anchorage Fire Exposure Model) has changed. Vegetation and spruce barkbeetle data missing and NEEDED (GIS) **2023 Status:** **2024 Status: Conducted Hazard Identification and Risk Analysis and updated risks and consequences associated with fire in the MOA.** **2025 Status: Annual review and maintenance.**					
	A31	**Continue and maintain vegetation management**	AFD	Ongoing. 19-CDBG-DR-02 supports grant-funded projects	High	8/05/2025
	2022 Status: Annual review and maintenance. **2023 Status: Work with Parks and Recreation on Beetlekill Mitigation Outreach Project. Annual review and maintenance.** **2024 Status: OEM supporting GDIC's use of HMGP-DR-FMAG-5282-03 to identify vegetative fuel for mechanical removal.** **2025 Status: Developing mitigation strategy to reduce losses resulting from fire.**					
	A32	**Develop additional water resources for wildfire response**	AFD/AWWU	Ongoing. Seeking funding for study	Medium	8/05/2025
	A33					

Goal	Action Items	Description	Action Coordination Organization	Comments	Priority	Date
	2022 Status: Study needed to expand water service to Hillside remote areas. Also researching urban water sources. Funding sources needed. **2023 Status: Annual review and maintenance.** **2024 Status: Annual review and maintenance.** **2025 Status: Annual review and maintenance.**					

Chapter 6 Plan Maintenance

6.1 Plan Adoption

The Municipality of Anchorage's Assembly will be responsible for adopting the Anchorage All-Hazards Mitigation Plan Update.

Prior to being adopted, the department responsible for the plan will submit it to the State Hazard Mitigation Officer (SHMO) at DHS&EM for review and approval. The SHMO will then submit the plan to the FEMA Region X for review and pre-adoption approval. The plan will be adopted for approval by the Anchorage Assembly. FEMA will then grant full approval of the plan and the MOA will be eligible for Hazard Mitigation Grant Programs funds.

6.2 Monitoring and Evaluation

The Anchorage All-Hazards Mitigation Plan, like all plans, requires periodic review to ensure that it remain up to date, reflects current information, and still meets the goals of Anchorage. The MOA Hazard Mitigation Planning Committee will review the plan annually and after every federally declared disaster. The review will determine if there have been any significant changes in the Municipality that affect the Plan. If it is determined that significant changes have occurred, the plan will be amended to remain current.

Issues that may be addressed during the evaluation include:

- Are new or different goals, objectives, and action tasks needed?
- Are there any implementation problems?
    - Not enough funding?
    - Conflicts with other goals?
    - Is the plan achieving the desired result?
- Should other hazards be addressed?
- Do we have new information that should be incorporated?
- Does the prioritization of tasks/goals reflect current priorities?

6.3 Updating

This plan is intended to be a "living" document that will help inform all interested parties about the MOA's natural hazard mitigation policies and projects. It will be reviewed and updated on a regular basis in accordance the OEM documentation guidance and planning process. The mitigation strategies identified will act as a guide for MOA departments in determining projects for which to seek FEMA and other mitigation funds from outside sources.

6.3.1 Annual Review

The Office of Emergency Management Director or designee is responsible for monitoring, evaluating, and updating the plan. The review and update process are as follows:

1. The MOA Hazard Mitigation Committee will meet to consider:

- Progress made on plan recommendations during the previous 12 months.
- Mitigation accomplishments in projects, programs, and policies.
- Status of mitigation projects included on the MOA's CIP list.
- New mitigation needs identified
- Cancellation of planned initiatives, and the justification for doing so
- Changes in membership to the Committee

2. The Office of Emergency Management will request input from other departments and outside entities not represented on the MOA Hazard Mitigation Planning Committee on issues listed above. A special effort will be made to gather information on non-capital projects and programs important to mitigation.

3. The Office of Emergency Management will make "minor" changes to the Plan, such as updates to the CIP, without seeking outside approval.

4. "Major" changes—those related to new policies or recommended projects—will go through a more formal review process, including a possible review by the MOA Hazard Mitigation Planning Committee.

5. To allow for ongoing public input, the Office of Emergency Management will post the plan permanently on the MOA's website along with contact information that will encourage people to submit questions or comments.

6.3.2 Following A Major Disaster

If disaster warrants Presidential Disaster Declaration, the Office of Emergency Management will convene the MOA Hazard Mitigation Planning Committee within 2 months of the declaration date. For other events, the Office of Emergency Management will determine if the committee should meet. Because recovery can be a long process and the full impact of a disaster may not be known for many months, this initial meeting may need to be followed by additional meetings over time. The annual update process described above will also be used following a major disaster. However, post-disaster deliberations will also consider the following:

- "Lessons Learned" from the disaster, and what new initiatives should be added to the plan to help reduce the likelihood of similar damage in the future.
- Follow-up needed on items relevant to mitigation from any after-action reports produced by the Municipality.
- Integration of mitigation into the recovery process.

6.3.3 Five Year Update

Every five years, the plan will be updated and re-submitted for adoption to the MOA Assembly. Prior to this, the Office of Emergency Management will use the following process to make sure all relevant parties are involved:

1. At year three the Office of Emergency Management will make an application to the State/FEMA for a grant to fund the 5-year update of this plan.

2. Follow steps 1 and 2 of the Annual Review process (Section 6.3.1).

3. Hold public meetings and meetings with identified groups of interested parties and outside organizations to gain input and feedback.

4. Integrate relevant feedback and circulate revised plan to the Hazard Mitigation Committee.

5. Upon incorporation of the stakeholder comments, the revised plan will be submitted to the Alaska State Hazard Mitigation Officer, and FEMA concurrently for their review. The plan will be updated based on their comments.

6. The revised plan will then be submitted to FEMA for review. The plan will be updated based on FEMA's comments and re-submitted to FEMA if necessary, to obtain a Criteria Met/Plan Not Adopted determination.

7. Submit the plan to the MOA Assembly for adoption by resolution.

8. Submit the adopted plan to FEMA.

The next five-year update process should begin in 2025, with Assembly Adoption occurring in 2026.

6.4 Continued Public Involvement

Before the Assembly approves the plan, it will be presented to the public. Two public meetings will be held, and a 30-day comment period provided before the plan is presented to the Assembly. However, because the plan is a living document, public involvement in the plan should be always encouraged. The MOA website will have a page devoted to the Anchorage All-Hazards Mitigation Plan. This page will have the most recent approved plan, a method of providing feedback on the plan, and notices about plan activities such as updates and public meetings.

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Appendix A

Summary of Changes

This addendum is a summary of the substantive changes made during the 2022 update of the MOA All-Hazards Mitigation Plan.

Section	Summary of Change
	No changes in priorities are necessary.
Various	All demographic tables were updated with current information if it was available.
3/4	Maps of schools, fire stations, urbanized area and medical facilities were updated
3	Provided additional information on other plans that influence future development in the Municipality.
3	Lists of fire stations, police stations, schools and medical facilities were updated
4	Updated an approximate value of parcels without a taxable value. The value was provided by the Municipality's Tax Assessor office.
4	All vulnerability tables were updated to reflect 2021 tax assessment values. Where possible, additional information about vulnerabilities was included.
5.3	Each Action Item was updated to reflect its current status. Based on input from MOA staff, additional action items were added to the plan.
5.1	The goals and objectives were completely rewritten to meet current FEMA requirements for local hazard mitigation plans
5.3	All action items were completely reviewed by the planning committee and were rewritten, added or deleted. Two meetings of the planning committee were conducted along with electronic correspondence for this review and revision.
Annex	Added Flood Insurance Risk Maps, Watershed Maps, updated planning team participation, community participation, flood community risk score.

This addendum is a summary of the changes made during the 2023 update of the MOA All-Hazards Mitigation Plan.

Section	Summary of Change
	Formatting and spelling update throughout whole document.
Pg 1	Added wildfires to list of hazards in the executive summary.
Pg 5-6	Add all hazards that were listed in Table 1.1 to 1.2.
Pg 21-23	Updated ASD schools and designation of which schools are shelters.
Pg 38-39	Updated the text/definition of Peak Ground Acceleration (PGA). Updated the percentage to 2% instead of 10%.
Pg 40	Added language that Anchorage is more densely populated now and that tourism would likely decrease following an earthquake.
Pg 123	Added public and non- profit agencies to Goal 2 Action 4.
Pg 126	Changed Port of Anchorage to Port of Alaska
Pg 127	Added energy, safety, shelter, transportation, and communications to Goal 4 Action 15.
Pg 136	Changed Port of Anchorage to Port of Alaska

This addendum is a summary of the changes made during the 2024 update of the MOA All-Hazards Mitigation Plan.

Section	Summary of Change
Chapter 4	Conducted comprehensive Hazard Index Risk Assessment (HIRA) and reconfigured all hazard identification and risk assessments including continuity of operations, public confidence in governance, responders, and economic conditions in compliance with Emergency Management Accreditation Standards.

This addendum is a summary of the changes made during the 2025 update of the MOA All-Hazards Mitigation Plan.

Section	Summary of Change
Chapter 4	Added results from the HIRA to Chapter 4.- Risk Assessment overview, hazard ranking, consequence analysis and updated hazards
Chapter 5	Updated Action List in an Excel table showing oversight of the mitigation action plan, progress monitoring and ranking.