



A COLD EVENING IN JUNEAU, AK

Risk Report: A Risk Assessment Database Summary

FEMA Region X – City and Borough of Juneau, Alaska



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Executive Summary

Due to its variety of natural hazards, its at-risk population, and recent events, the City and Borough of Juneau has been identified as a priority community by the State of Alaska to receive specialized risk data and other information to help community leaders and decision makers increase their resiliency. The Federal Emergency Management Agency (FEMA) partnered with the City and Borough of Juneau and the State of Alaska to deploy a Risk Mapping, Assessment, and Planning (Risk MAP) project with the goal of accurately and comprehensively depicting the risk in the community.

This **Risk Report** outlines the results from the natural hazard risk assessments captured in the **Risk Assessment Database**. The report includes information on best practices to integrate natural hazard mitigation into local planning and highlights potential mitigation actions throughout the City and Borough of Juneau. The data summarized in the report may be used to support day-to-day decision making and longer-term planning efforts, such as updates to comprehensive plans and other regulatory tools that inform land use decisions. The **Risk Report** and the **Risk Assessment Database** have the following aims:

- provide additional data to communities on local hazards;
- connect and integrate this data to pre-existing community planning mechanisms; and
- provide risk and vulnerability assessment results.

More specifically, the **Risk Assessment Database** aggregates the natural hazard data developed by various local, State, and partner organizations and quantifies the risks from those natural hazards using community assessor data to determine local risk.

1. Introduction

This **Risk Report** outlines the risk assessment results and findings for FEMA’s Risk MAP program study of the City and Borough of Juneau, Alaska. All results, databases, and maps used to generate this **Risk Report** are provided in the **Risk Assessment Database** included with this report. This risk assessment information can support the following local efforts:

- Updating local Hazard Mitigation Plans (HMPs), shoreline master plans, and community comprehensive plans;
- Updating emergency operations and response plans;
- Increasing and improving risk communication;
- Informing the modification of development standards; and
- Identifying mitigation projects.

The intended audience for this report includes, but is not limited to, the following:

- Elected officials;
- Tribal leaders;
- Floodplain administrators, engineers, community developers, planners, emergency managers, first responders, and Geographic Information System (GIS) technicians;
- Federal, State, regional, academic, and non-profit organizations interested in hazards or land use; and
- Other stakeholders.

2. Risk and Exposure Assessments

A **risk assessment** analyzes, in detail, how flooding and earthquake hazards affect the built environment, population, and local economy, and their likelihood of occurrence. In hazard mitigation planning, risk assessments are the basis for identifying resilience strategies and actions; they define the hazard and enhance the decision-making process. An **exposure assessment** identifies areas that would be affected by a hazard. This provides an opportunity for State and local officials to prioritize mitigation actions in these areas.

For the City and Borough of Juneau, the following assessments were completed to help individuals describe and visualize the risk for a variety of hazards throughout the City and Borough of Juneau:

- Flood Risk Assessment
- Earthquake Risk Assessment
- Tsunami Exposure Assessment

The risk assessments for flood and earthquakes in the City and Borough of Juneau were prepared using a free FEMA risk assessment tool, Hazus, which estimates losses due to flooding and earthquakes for specific buildings. The exposure assessment for tsunami highlights the areas affected by this hazard.

A detailed methodology of each risk assessment is described in Appendix B.

While this **Risk Report** provides a summary of the risk assessments, the **Risk Assessment Database** contains the data that is necessary to replicate and expand the results of the hazard analysis produced for the **Risk Report**. By aggregating natural hazard data and quantifying the risk to those natural hazards using community assessor data, this dataset can determine local risk to hazards for each structure in a community. This information can be used for grant applications, local planning and emergency management efforts, identifying vulnerable populations, and communicating risk to various audiences. The risk database is a very powerful dataset that can be used for multiple projects and planning efforts.

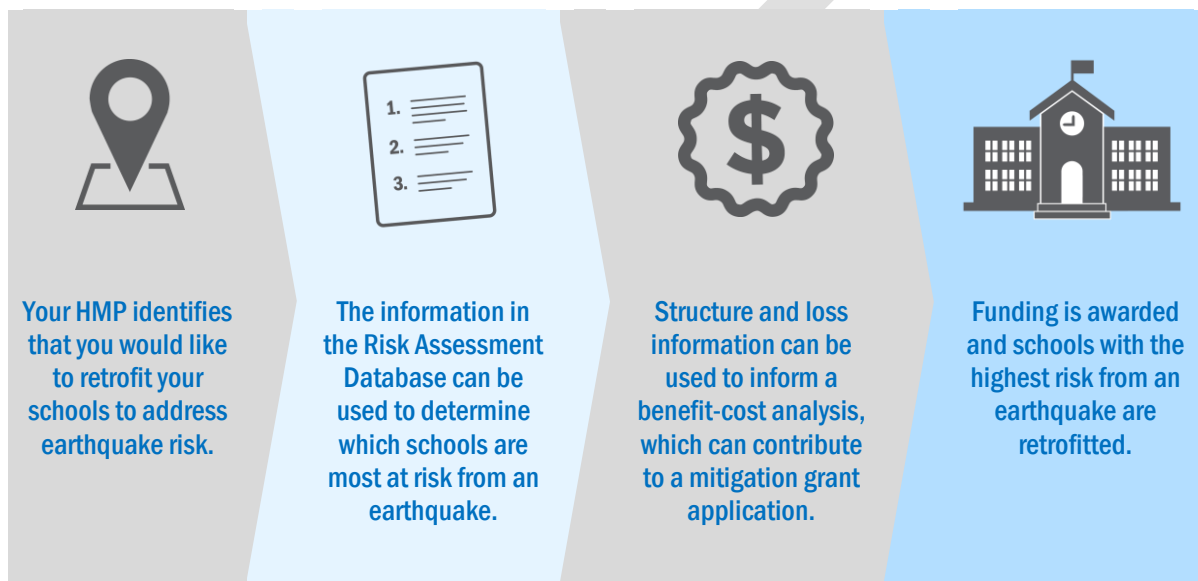


Figure 1: Example of a Risk Assessment Database Application

3. City and Borough of Juneau Risk MAP Overview

Project Scope

The City and Borough of Juneau Risk MAP flood study updates coastal and riverine flood hazard areas. The updated coastal analysis is focused on Auke Bay and Douglas Harbor. New hydrologic and hydraulic analyses were performed for Duck Creek and its tributaries, Lemon Creek, Jordan Creek, Auke Creek, and Gold Creek.

The FEMA Production and Technical Services provider (Strategic Alliance for Risk Reduction II, or STARR II), the FEMA Community Engagement and Risk Communication provider (*Resilience Action Partners*), and the Alaska Division of Community and Regional Affairs are contributors to this project.

PROJECT AREA

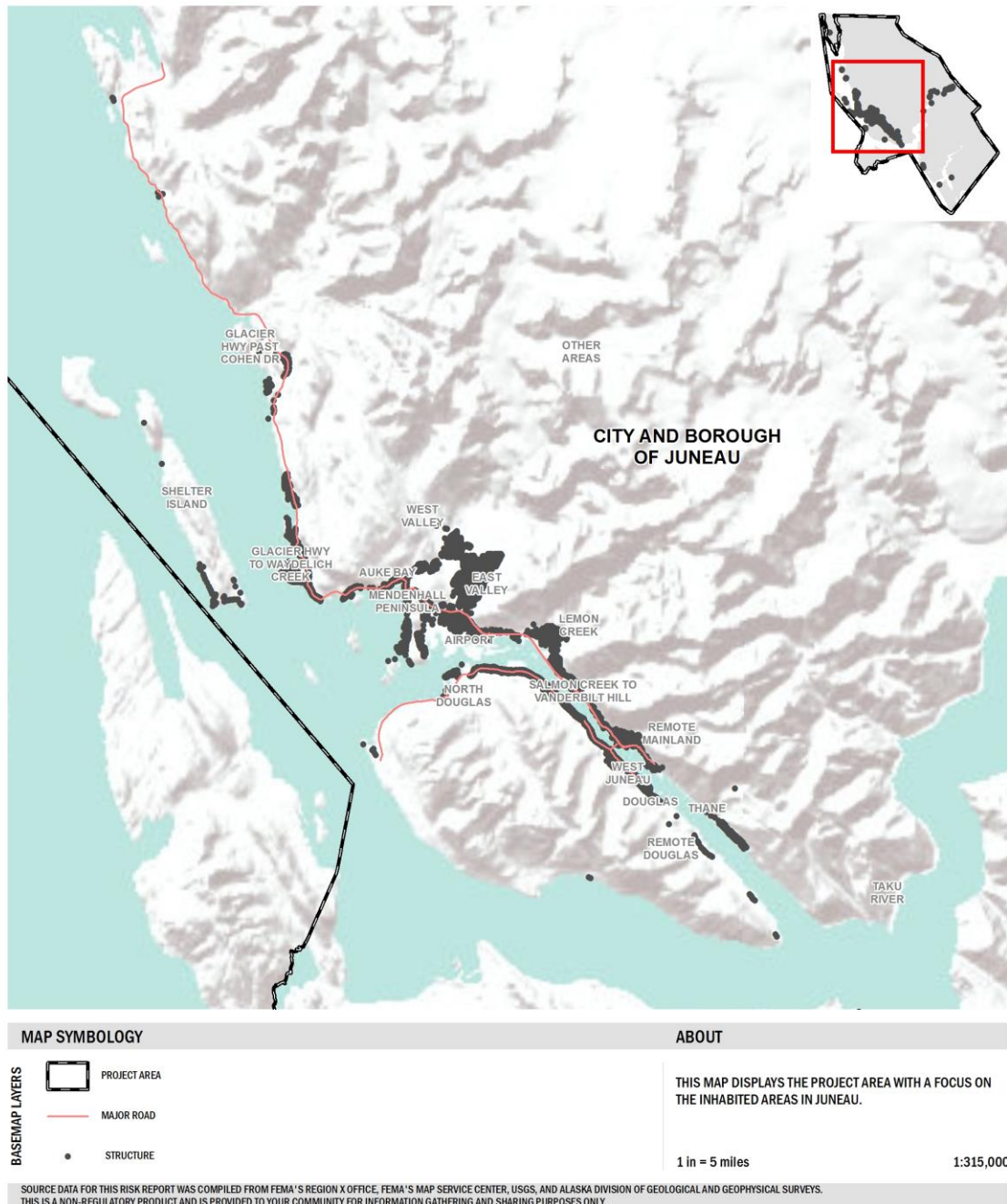



Figure 2: Project Area of the City and Borough of Juneau

Project Milestones

Table 1: Project Milestones and Deliverables



September 2013	Risk MAP Discovery Meeting
August 2016	Flood Risk Review
August 2017	Preliminary DFIRM/FIS Release
January 2018	Consultation Coordination Officers Meeting
April 2018	Public Meeting/Workshop
April 2018	Appeal Period Starts
July 2018	Appeal Period Ends
June 2019	FIRM and Flood Insurance Study report become effective as one borough-wide project*
TBD*	Resilience Meeting will be scheduled to identify and review resilience strategies and steps toward implementation

*Dates are shown as projected

4. Socioeconomic Vulnerability

A socioeconomic vulnerability section can be added to this Risk Report upon request, contingent upon available funding. Please contact [Sally Russell Cox](#) for more information.

5. Flood Risk Assessment

Flood Hazard Overview

The City and Borough of Juneau is prone to flooding and experiences large amounts of precipitation, mainly during the months of August through November. During these months, as much as 26 inches (half of the yearly total) of precipitation occurs, resulting in rainfall-runoff of saturated soils (Juneau HMP, 2012). To date, there have been no presidentially declared flood disasters in the City and Borough of Juneau. Figure 3 summarizes the flood events in the City and Borough of Juneau listed in the 2012 Juneau HMP and lists the related Hazard Mitigation Grant Program (HMGP) funding received.

2011

FLOODING OF THE MENDENHALL LAKE AND RIVER:

Flooding caused damage to, and required the evacuation of, the Mendenhall Campground and the View Drive subdivision. The potential for similar flooding is an annual concern.

2008

DR-1796 SEVERE STORMS, FLOODING, LANDSLIDES, AND MUDSLIDES:

- Feasibility, Engineering, and Design Study: Mt. Juneau Active Avalanche Control Study
 - Project Amount: \$34.5K
 - Federal Share Obligated: \$60K
- Feasibility, Engineering, and Design Study: Mt. Juneau Active Avalanche Control Study
 - Project Amount: \$34.5K
 - Federal Share Obligated: \$142K
- Local Multi-Hazard Mitigation Plan: Amendment 1 - Mt. Juneau Active Avalanche Control Study
 - Project Amount: \$28K
 - Federal Share Obligated: \$21K


1998

FLOOD:

Record rainfall caused substantial flooding to roads, parking lots, and properties. Several homes sustained water damage and numerous mudslides resulted in extensive damage to roads. One slide in particular completely destroyed a beachfront home.

FLOOD OCCURRENCES FOR THE CITY AND BOROUGH OF JUNEAU

There is very little recorded information pertaining to floods in the borough. Most of the damage from major floods occurred along the Mendenhall River. The frequency of these floods, however, is impossible to determine as no estimates of flow rates are available. The principal flood problems in the area, in addition to high tides and coastal storms, are inadequate culverts and bridges which become blocked by debris and ice, developments that encroach onto and obstruct the natural floodplains, high velocity flow, and siltation of culverts. Along some of the creeks, there are large stockpiles of logs which will increase flooding if carried downstream to a constriction. (Juneau HMP, 2012)

-  Flood Occurrences listed in the City and Borough of Juneau Hazard Mitigation Plan, 2012
-  Hazard Mitigation Grant Program Funding Allocations as of 1/5/18

Note: Information on the timeline has been pulled from the [FEMA Hazard Mitigation Program Summary - Open Government Dataset](#). The summaries listed above are categorized as having a flood disaster title.

Figure 3: History of Floods in the City and Borough of Juneau

Risk MAP Program Study of Flood Hazards in the City and Borough of Juneau

The Flood Risk Assessment found in this **Risk Report** is a summary of information that can be found in the **Risk Assessment Database** and can be used to provide more details and a larger mapping footprint.

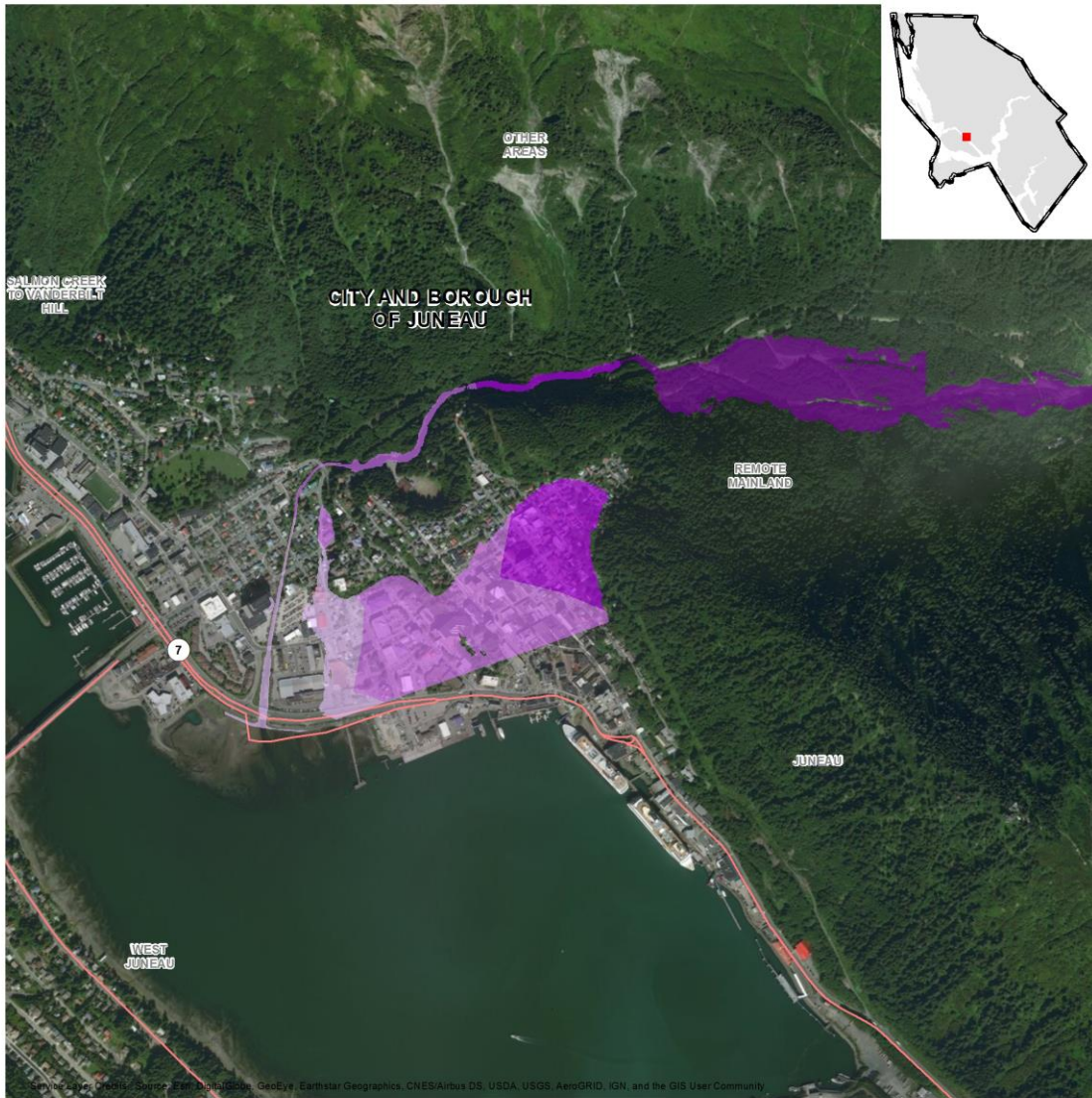
Table 2: Flood-Related Risk MAP Products, Study Areas, and Product Uses and Benefits








<p>FIRM</p>	<p>The result of a coastal and riverine flood study for the City and Borough of Juneau that created new draft and preliminary flood maps, called FIRMs.</p>	<p>FIRMs are regulatory resources that greatly help community officials and the public assess, visualize, and communicate local flood risk.</p>
<p>Flood Water Surface Elevation and Depth Grids</p>	<p>Spatial data identifies flood water surface elevation (Figure 5) and depth (Figure 6) for the 0.2-, 1-, 2-, 4-, and 10-percent-annual-chance floods for portions of the City and Borough of Juneau.</p>	<p>State, local, and Tribal officials also can use water surface elevation and depth grids as an outreach tool to show the flood risk. The properties identified as having a flood risk would be excellent locations for mitigation projects.</p>
<p>Flood Risk Assessment (Hazus)</p>	<p>An assessment of the total building values, number of buildings, losses by coastal and riverine flood hazards, respectively, and number of structures within Special Flood Hazard Areas (SFHAs).</p>	<p>The loss data from Hazus and the exposure analysis can highlight areas affected by flooding. This information can be used by State, local, and Tribal officials to identify properties for mitigation projects as well as additional outreach needs in the area.</p>
<p>Flood Exposure Assessment</p>	<p>Spatial and tabular data identifying the number of improved parcels in the SFHA.</p>	<p>Local officials can use the flood exposure assessment to identify properties for mitigation projects as well as areas for additional outreach.</p>

DRAFT

2018 FLOOD RISK PRODUCTS

WATER SURFACE ELEVATION - 1-PERCENT EVENT



MAP SYMBOLOLOGY		ABOUT	
WATER SURFACE ELEVATION	 WSE 0' to 50'	 WSE 250' to 350'	<p>THIS MAP DISPLAYS WATER SURFACE ELEVATION FOR A 1-PERCENT ANNUAL CHANCE FLOOD EVENT.</p> <p>1 in = 0.2 miles</p> <p>1:15,000</p>
	 WSE 50' to 150'	 WSE OVER 350'	
	 WSE 150' to 250'		
BASEMAP LAYERS		 PROJECT AREA	
		 MAJOR ROAD	

SOURCE DATA FOR THIS RISK REPORT WAS COMPILED FROM FEMA'S REGION X OFFICE, FEMA'S MAP SERVICE CENTER, USGS, AND ALASKA DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS. THIS IS A NON-REGULATORY PRODUCT AND IS PROVIDED TO YOUR COMMUNITY FOR INFORMATION GATHERING AND SHARING PURPOSES ONLY.

Figure 4: Water Surface Elevation Grid for a 1-Percent-Annual-Chance Event

2018 FLOOD RISK PRODUCTS

DEPTH GRID - 1-PERCENT EVENT

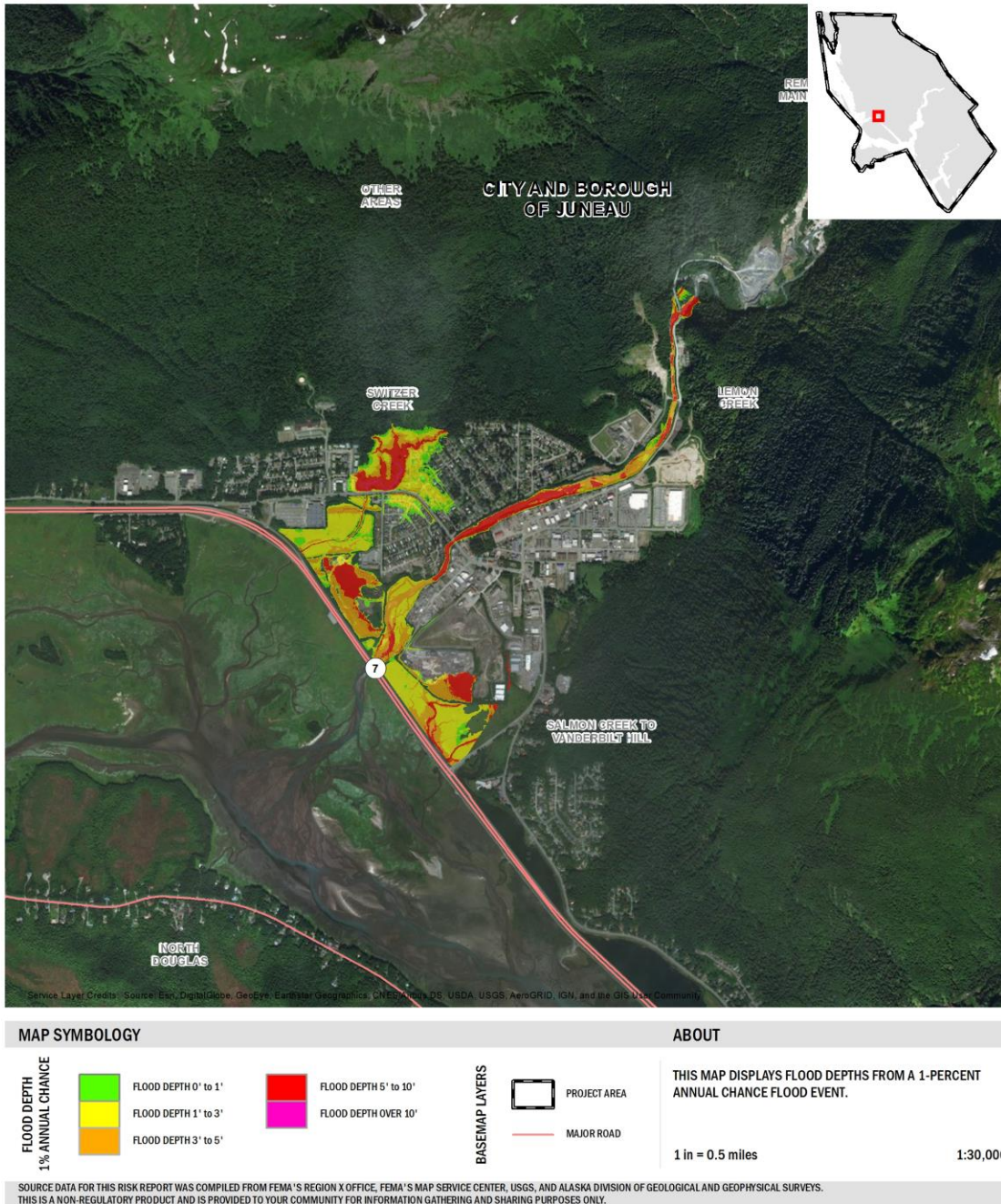


Figure 5: 1-Percent-Annual-Chance Flood Depth Focused on the Areas of Lemon Creek, Salmon Creek, and Switzer Creek for Detail

Flood Frequencies and National Flood Insurance Program Participation Information

Flood risk assessments in the City and Borough of Juneau were conducted for the 0.2-, 1-, 2-, 4-, and 10-percent-annual-chance flood events. While the SFHA focuses on the 1-percent-annual-chance event, it is important to note that flood frequencies can also be defined as other percent chances of occurrence, such as the 0.2-percent-annual-chance event or the 10-percent-annual-chance event. While these frequencies are referred to by alternative language, such as “the 100-year flood,” the percent chance of annual occurrence (1-percent chance) remains the same. The table below summarizes the terms used to categorize flood frequencies.

Table 3: Estimated Probability of a Flood Event

EVENT	ANNUAL CHANCE OF OCCURRENCE	ADDITIONAL WAYS TO REFERENCE THE OCCURRENCE
10-year flood	10-percent	<ul style="list-style-type: none"> During the span of a 30-year mortgage, a home has a 96-percent chance of being flooded at least once.
25-year flood	4-percent	<ul style="list-style-type: none"> During the span of a 30-year mortgage, a home has a 71-percent chance of being flooded at least once.
50-year flood	2-percent	<ul style="list-style-type: none"> During the span of a 30-year mortgage, a home has a 45-percent chance of being flooded at least once.
100-year flood	1-percent	<ul style="list-style-type: none"> SFHA During the span of a 30-year mortgage, a home has a 26-percent chance of being flooded at least once.
500-year flood	0.2-percent	<ul style="list-style-type: none"> During the span of a 30-year mortgage, a home has a 6-percent chance of being flooded at least once.

Note: It is important to note that each flood has its respective chance of occurrence each year. For example, if a 100-year flood occurred last year, there is a 1-percent chance that it will occur this year as well.

The City and Borough of Juneau participates in the National Flood Insurance Program (NFIP). Participating communities adopt and enforce floodplain management ordinances, and in return, federally backed flood insurance is available to community members. A Federal requirement to purchase flood insurance applies to structures in the SFHA that have a federally backed mortgage.

While the City and Borough of Juneau does not currently participate in the Community Rating System (CRS), doing so could provide discounts to its 324 active policies. More information can be found here: <https://www.fema.gov/community-rating-system>.

The information in Table 4 can be used to highlight areas that are already affected by flooding, including repetitive loss properties and flood claims. In addition, the insurance coverage can be compared to the dollar losses to determine if enough coverage exists for a specific event.

Table 4: Community Characteristics in the City and Borough of Juneau

COMMUNITY NAME	TOTAL POPULATION	CRS COMMUNITY (AS OF OCT 2017)	FLOOD CLAIMS	TOTAL LOSSES PAID	REPETITIVE LOSS PROPERTIES	TOTAL POLICIES	TOTAL INSURANCE COVERAGE
CITY AND BOROUGH OF JUNEAU	30,711	No	30	\$413 K	9	324	\$89.3 M

The flood claims/policies information was obtained on July 5, 2018.

Special Flood Hazard Area Overview

The project team completed an exposure assessment of the areas affected by the 1-percent-annual-chance flood event, or the SFHA, for the City and Borough of Juneau. This assessment covered both coastal and riverine areas of the city and borough. Table 5 summarizes the total number of structures and their value (building and contents), the number and percent of structures exposed to a 1-percent-annual-chance flood, the exposed value at risk, and the percent of the exposed value relative to the total structure value within that jurisdiction or Tribe.

Table 5: Special Flood Hazard Area Exposure Assessment

BASE DATA			1-PCT-ANNUAL-CHANCE EXPOSURE			
CITY AND BOROUGH OF JUNEAU (AND GEOGRAPHIC AREAS)	TOTAL STRUCTURES	TOTAL VALUE	STRUCTURES EXPOSED IN A SPECIAL FLOOD HAZARD AREA	PERCENT OF STRUCTURES EXPOSED IN A SPECIAL FLOOD HAZARD AREA	EXPOSED VALUE (BUILDING AND CONTENTS)	PERCENT OF EXPOSED VALUE (BUILDING AND CONTENTS)
City and Borough of Juneau	8,466	\$4.4 B	208	2.46%	\$115.5 M	2.65%
Airport	39	\$22.9 M	1	2.56%	\$2.7 M	9.40%
Auke Bay	119	\$618 M	1	<1%	\$254 K	<1%
Douglas	431	\$187.1 M	4	<1%	\$1.7 M	<1%
East Valley	3,310	\$1.4 B	72	2.18%	\$32.5 M	2.32%
Glacier Hwy Past Cohen Dr	68	\$21.3 M	17	25.00%	\$5.3 M	25.08%
Glacier Hwy to Waydelich Creek	521	\$226.9 M	23	4.41%	\$18.8 M	8.30%
Juneau	894	\$728 M	17	1.90%	\$22.2 M	3.01%
Lemon Creek	459	\$279.4 M	4	<1%	\$798 K	<1%
Mendenhall Peninsula	313	\$142.6 M	15	4.79%	\$6.9 M	4.85%
North Douglas	561	\$216.5 M	15	2.67%	\$4.6 M	2.11%
Other Areas	84	\$222.2 M	10	11.90%	\$1.7 M	<1%
Remote Douglas	31	\$3.3 M9	2	6.45%	\$631 K	19.31%
Remote Mainland	2	\$8.2 M	-	-	-	-

Salmon Creek to Vanderbilt Hill	360	\$231 M	6	1.67%	\$8.3 M	3.57%
Shelter Island	49	\$5.7M	-	-	-	-
Switzer Creek	67	\$50.7 M	1	1.49%	\$252 K	<1%
Thane	68	\$25.6 M	1	1.47%	\$283 K	1.10%
West Juneau	362	\$170.4 M	1	<1%	\$2 M	1.18%
West Valley	728	\$347.6 M	18	2.47%	\$6.6 M	1.88%

“-“ Indicates that no risk was identified.

Borough-wide, there are 208 structures (roughly 2.7 percent of all structures) identified in the SFHA. The borough was further divided into geographic regions. These regions were derived from the City and Borough of Juneau’s GIS web portal resources (City and Borough of Juneau - Geographic Areas of Juneau, 2012). The highest percentage of exposed properties is in the geographic regions of Glacier Highway past Cohen Drive and “Other Areas.” “Other Areas” refers to areas outside of the city and heavily populated areas defined by other geographic regions. The region of Glacier Highway past Cohen Drive has 25 percent of its structures exposed to the SFHA. However, even with 25 percent of structures exposed, Glacier Highway past Cohen Drive has a relatively low economic value exposed at roughly \$5 million. The \$5 million in exposed value is minimal compared to the exposed value of the East Valley region. With only about 2 percent of structures exposed in an SFHA, East Valley could face up to \$32 million in building and contents value loss. The East Valley region accounts for 28 percent of all exposed value in the SFHA. Several of the geographic regions have only one structure within the SFHA. These areas present a good opportunity to reach out to the homeowners to ensure they have proper coverage and protection against a flood event. Figure 6 displays the location of exposed structures across the city and borough.

Flood risk varies across geographic regions in the City and Borough of Juneau, with the highest number of buildings in the SFHA located within the region of East Valley. Because the geographic regions used are not identified communities, the number of purchased insurance policies is only tracked at the borough level. The City and Borough of Juneau has a total of 324 purchased insurance policies, 116 more policies than there are structures exposed to the SFHA. Regions of major outreach opportunities include East Valley, Glacier Highway to Waydelich Creek, Juneau, Mendenhall Peninsula, and West Valley, which have exposed structures ranging from 15 to 72, or roughly 7 to 28 percent of all structures.

2018 FLOOD RISK PRODUCTS 1-PERCENT ANNUAL CHANCE

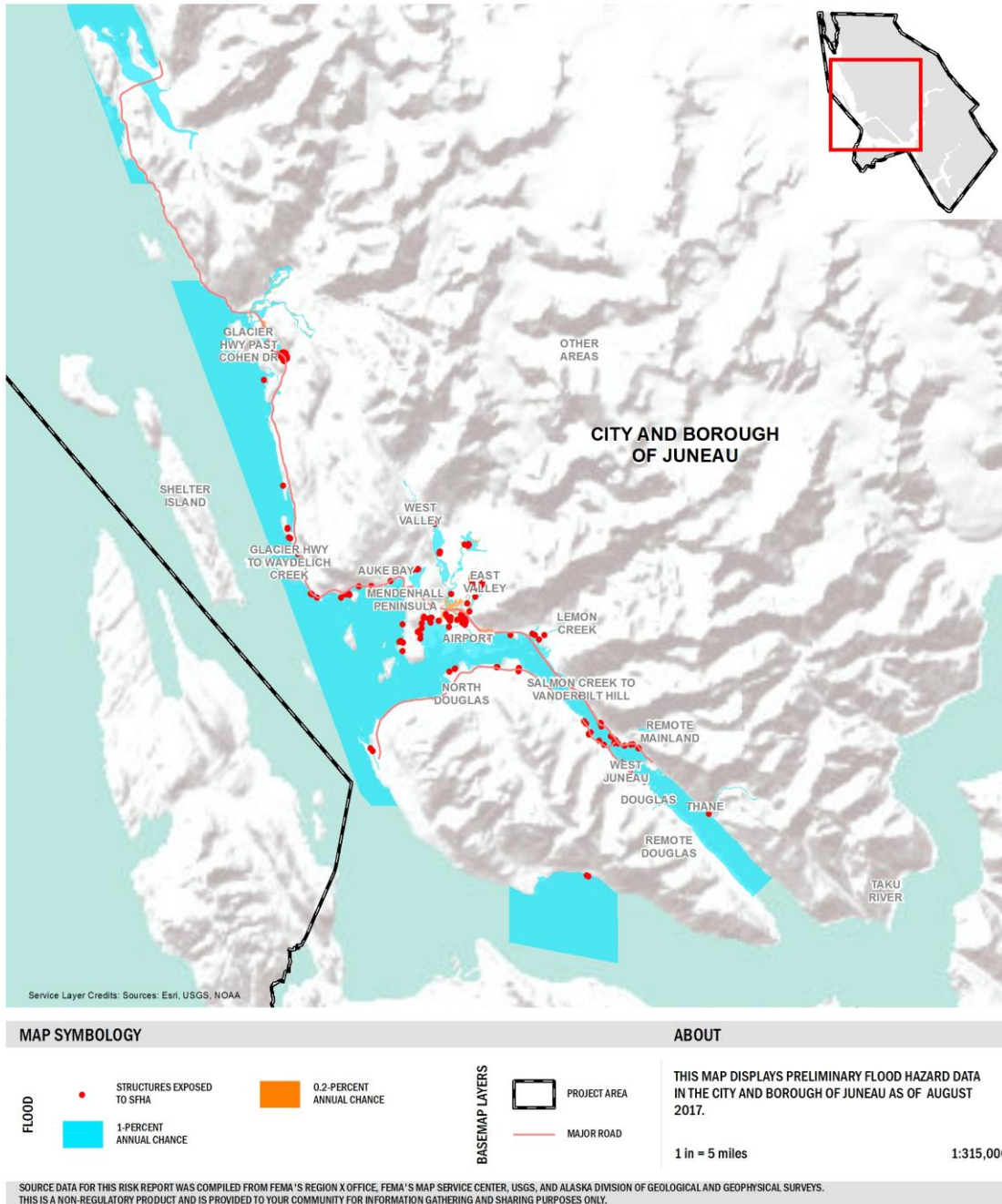


Figure 6: 1-Percent-Annual-Chance Flood Event Structure Exposure Assessment

Flood Risk Assessment Overview

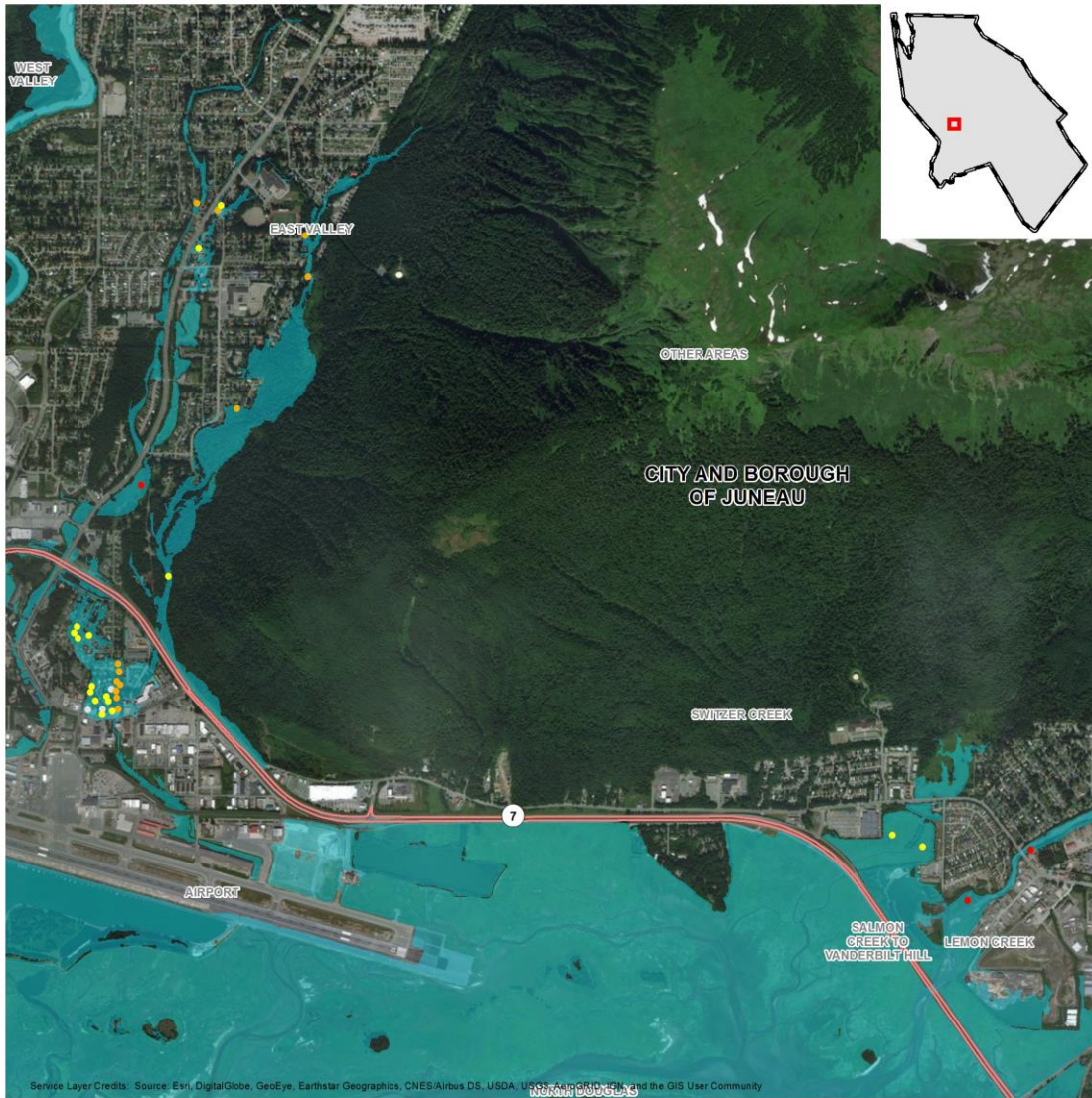
The project team completed the flood risk assessment using local parcel and assessors' data from the City and Borough of Juneau, as well as flood depth grids and water surface elevation grids derived from this Risk MAP project. The Hazus study incorporated individual building data which allowed losses to be reported at the building level. Due to the limited extent of the depth grids provided, building loss estimates were only shown for the regions of East Valley and Lemon Creek. Table 6 represents potential loss estimates for a 1-percent-annual-chance event. In Table 7, the exposed number of structures and total economic value exposed for a 0.2-, 1-, 2-, 4-, and 10-percent-annual-chance flood event are shown.

Figure 7 visually depicts the areas at greatest risk during a 1-percent-annual-chance event. This risk assessment includes information for the building stock in each community. This allows for a targeted assessment of buildings at high risk to flooding events.

In the City and Borough of Juneau, modeled flood losses resulting from the 1-percent-annual-chance flood event are projected at roughly \$1.6M. Losses are seen only in the geographic regions of East Valley and Lemon Creek due to the extent of the depth grids produced. Loss estimate data is not available for the remaining geographic regions and is therefore not shown.

The loss data from Hazus and exposure analysis findings can highlight areas affected by or susceptible to flooding. This information can be used by local, Tribal, and State officials to identify properties for mitigation projects as well as additional outreach needs in the area. Highlighted areas of greatest impacts and potential mitigation actions are shown in the community-specific discussions in Section 9, Areas of Mitigation Interest (AOMI).

2018 FLOOD RISK PRODUCTS 1-PERCENT-ANNUAL-CHANCE LOSS



MAP SYMBOLOGY		ABOUT			
FLOOD <ul style="list-style-type: none"> ● LOW DAMAGE PROBABILITY ● LOW-MID DAMAGE PROBABILITY ● MID-HIGH DAMAGE PROBABILITY ● HIGH DAMAGE PROBABILITY 	<ul style="list-style-type: none"> ● MINIMAL RISK FLOOD HAZARD AREA 	BASEMAP LAYERS <ul style="list-style-type: none"> PROJECT AREA MAJOR ROAD 	<p>THIS MAP DISPLAYS PRELIMINARY FLOOD HAZARD DATA AND CORRESPONDING LOSS ESTIMATES IN THE CITY AND BOROUGH OF JUNEAU AS OF AUGUST 2017.</p> <p>1 in = 0.5 miles 1:30,000</p>		
			<small>*LOSS RATIO: 0-15% LOW 15-25% MID-LOW 25%-50% MID-HIGH 50%-100% HIGH</small>		
			<small>SOURCE DATA FOR THIS RISK REPORT WAS COMPILED FROM FEMA'S REGION X OFFICE, FEMA'S MAP SERVICE CENTER, USGS, AND ALASKA DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS.</small>		
			<small>THIS IS A NON-REGULATORY PRODUCT AND IS PROVIDED TO YOUR COMMUNITY FOR INFORMATION GATHERING AND SHARING PURPOSES ONLY.</small>		

Figure 7: Loss Ratios Expected for a 1-Percent-Annual-Chance Flood Event

Table 6: Loss Estimates for a 1-Percent-Annual-Chance Flood Event

GEOGRAPHIC AREA	STRUCTURES EXPOSED TO LOSS VALUES	TOTAL VALUE (BUILDING AND CONTENTS)	LOSS ESTIMATES (BUILDING AND CONTENTS)	PERCENT OF TOTAL VALUE EXPOSED (BUILDING AND CONTENTS)
East Valley	30	\$11.9 M	\$1.4 M	11.66%
Lemon Creek	4	\$798 K	\$282 K	35.40%
Grand Total	34	\$12.7 M	\$1.7 M	13.15%

Table 7: Flood Hazard Exposure Assessment for a 0.2-, 1-, 2-, 4-, and 10-Percent-Annual-Chance Flood Event

GEOGRAPHIC AREA	0.2-PERCENT-ANNUAL-CHANCE		1-PERCENT-ANNUAL-CHANCE		2-PERCENT-ANNUAL-CHANCE		4-PERCENT-ANNUAL-CHANCE		10-PERCENT-ANNUAL-CHANCE	
	STRUCTURES EXPOSED IN A SPECIAL FLOOD HAZARD AREA	EXPOSED VALUE (BUILDING AND CONTENTS)	STRUCTURES EXPOSED IN A SPECIAL FLOOD HAZARD AREA	EXPOSED VALUE (BUILDING AND CONTENTS)	STRUCTURES EXPOSED IN A SPECIAL FLOOD HAZARD AREA	EXPOSED VALUE (BUILDING AND CONTENTS)	STRUCTURES EXPOSED IN A SPECIAL FLOOD HAZARD AREA	EXPOSED VALUE (BUILDING AND CONTENTS)	STRUCTURES EXPOSED IN A SPECIAL FLOOD HAZARD AREA	EXPOSED VALUE (BUILDING AND CONTENTS)
East Valley	113	\$44.8 M	30	\$11.9 M	22	\$9.8 M	16	\$6.7 M	11	\$5 M
Lemon Creek	4	\$798 K	4	\$798 K	4	\$798 K	4	\$798 K	3	\$798 K
Total	117	\$45.6 M	34	\$12.7 M	26	\$10.6 M	20	\$7.5 M	14	\$5.7 M

6. Earthquake Risk Assessment

Earthquake Hazard Overview

The City and Borough of Juneau is subject to numerous earthquake events of varying magnitudes. There are two major faults in proximity to the City and Borough of Juneau, the Queen Charlotte-Fairweather fault and the Denali fault. The Queen Charlotte-Fairweather fault historically results in events of magnitude (M) 7.0 or greater.

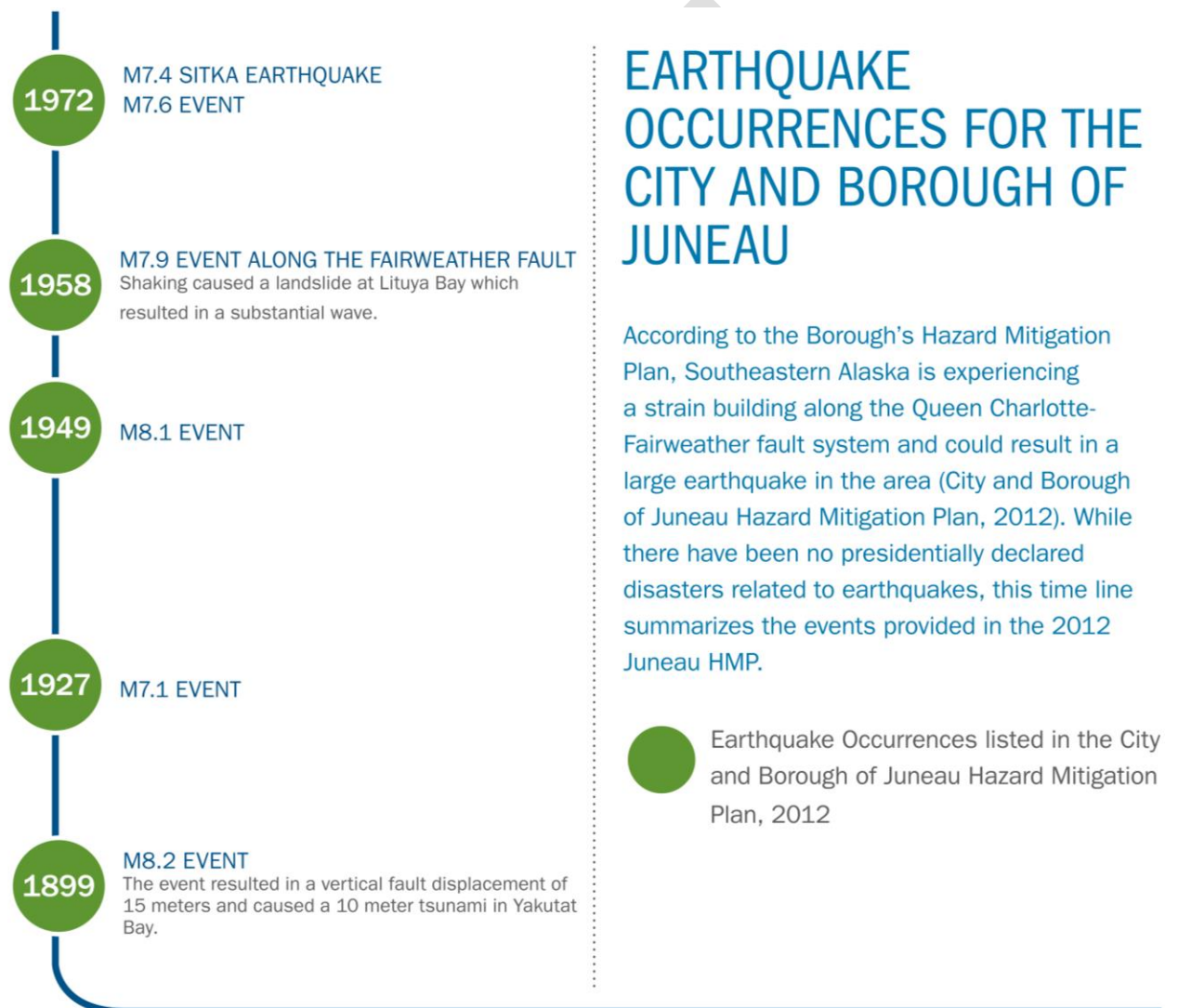


Figure 8: Earthquake Occurrences for the City and Borough of Juneau

Earthquake Risk Assessment Overview

The Flood Risk Assessment found in this **Risk Report** is a summary of information that can be found in the **Risk Assessment Database** and can be used to provide more details and a larger mapping footprint.

The project team completed the earthquake risk assessment using local county assessor parcel data and earthquake scenarios described below. The team incorporated site-specific data from Juneau and inputted it into Hazus, which allowed losses to be reported at the building level. The team utilized an arbitrary scenario centered around an M7.6 Queen Charlotte-Fairweather Fault and a probabilistic M6.0 500-year event.

Table 8: Earthquake-Related Risk MAP Products, Study Areas, and Product Uses and Benefits

<p>Earthquake Risk Assessments (Hazus)</p>	<p>Spatial and tabular data providing specific building and content loss data for properties affected by M6.0 Probabilistic 500 Year and M7.6 Queen Charlotte-Fairweather Fault.</p>	<p>The Hazus loss data and the design level analysis can highlight the buildings and areas affected by earthquakes to identify properties for mitigation projects, as well as areas for additional outreach.</p>
<p>Building Code Analysis</p>	<p>Structures categorized by Low Code (LC), Moderate Code (MC), and High Code (HC) help to determine overall damage to structures in an earthquake event.</p>	<p>The information can be used by local officials as a general planning tool until more information on the local code can be acquired.</p>

Hazus models were produced for two earthquake scenarios within the City and Borough of Juneau. The table below summarizes the Hazus results for each of the scenarios run for the city and borough. Both loss values and loss ratios are a calculation of total building and value contents. It is important to note both the location of the fault scenario as well as the magnitude. For instance, while the Queen Charlotte event has the potential to generate an M7.6 earthquake, the losses experienced are far lower than the M6.0 Probabilistic event. Table 9 includes information regarding the number of structures experiencing losses.

The M6.0 Probabilistic 500-Year earthquake scenario is expected to cause the most damage in the City and Borough of Juneau. For this event, a total building and contents loss of an estimated \$151 million compared to the \$178 thousand experienced in the Queen Charlotte Fault event. This is 0.18 percent of the losses experienced in the M6.0 Probabilistic 500-Year event. The highest economic losses (contents and building value) are in the regions of East Valley, Juneau, and Other Areas. The losses for these areas total roughly \$81.5 million, or 53.9 percent, of all losses in the city and borough. The areas with the largest loss ratio are Glacier Highway past Cohen Drive and Other Areas.

Loss estimates for the Queen Charlotte Fault event are minimal with loss ratios less than 1 percent across the city and borough. The highest losses for this scenario are seen in the region of East Valley with approximately \$52 thousand in losses. This is a small 0.17 percent of the total losses experienced for the same area in the M6.0 Probabilistic 500-Year scenario.

Local officials can use the earthquake risk assessments to identify properties for mitigation projects as well as areas for additional outreach. Community-specific areas of greatest impact and potential mitigation actions are discussed in Section 9, Areas of Mitigation Interest.

HAZUS EARTHQUAKE ASSESSMENT (500-YEAR PROBABILISTIC)

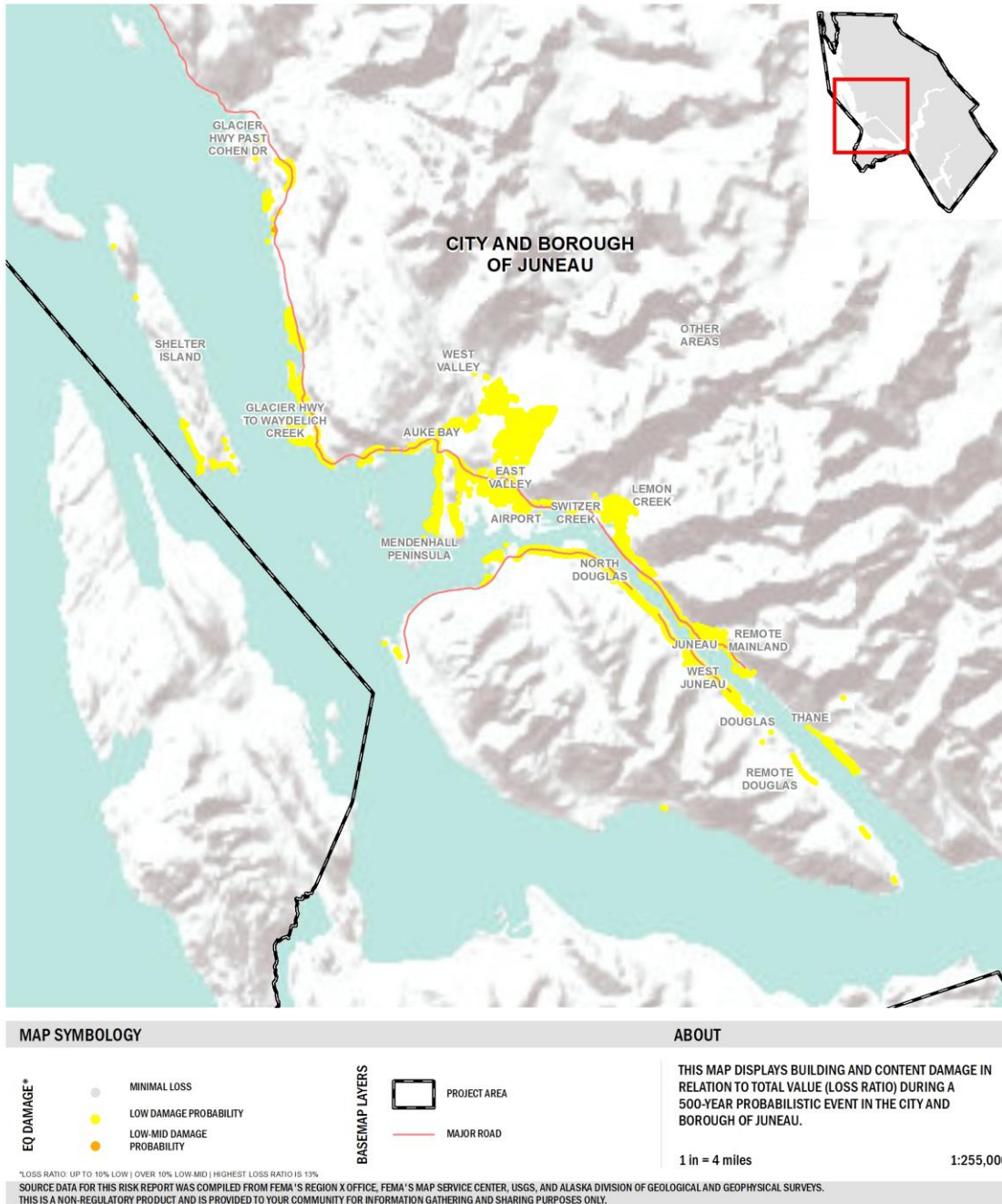


Figure 9: Loss Ratios Expected After an M6.0 500-Year Probabilistic Earthquake Event

Table 9: Hazus Earthquake Scenario Results

BASE DATA			M6.0 PROBABILISTIC 500-YEAR EARTHQUAKE		M7.6 QUEEN CHARLOTTE EARTHQUAKE	
GEOGRAPHIC AREA	TOTAL STRUCTURES	TOTAL VALUE	LOSS VALUE (BUILDING AND CONTENTS)	LOSS RATIO (BUILDING AND CONTENTS)	LOSS VALUE (BUILDING AND CONTENTS)	LOSS RATIO (BUILDING AND CONTENTS)
City and Borough of Juneau	8,466	\$4.4 B	\$151.4 M	3.47%	\$179 K	<1%
Airport	39	\$28.9 M	\$926 K	4.04%	\$1,783	<1%
Auke Bay	119	\$61.8 M	\$3.1 M	4.95%	\$4,413	<1%
Douglas	431	\$187.1 M	\$6.4 M	3.41%	\$5,747	<1%
East Valley	3,310	\$1.4 B	\$44.9 M	3.21%	\$52 K	<1%
Glacier Hwy Past Cohen Dr	68	\$21.3 M	\$1.2M	5.79%	\$1,385	<1%
Glacier Hwy to Waydelich Creek	521	\$226.9 M	\$11.4 M	5.01%	\$21 K	<1%
Juneau	894	\$737.7 M	\$25 M	3.43%	\$29 K	<1%
Lemon Creek	459	\$279.4 M	\$9.1 M	3.27%	\$11 K	<1%
Mendenhall Peninsula	313	\$142.6 M	\$5 M	3.53%	\$8,596	<1%
North Douglas	561	\$216.6 M	\$6.8 M	3.12%	\$7,637	<1%
Other Areas	84	\$222.2 M	\$11.8 M	5.31%	\$5,318	<1%
Remote Douglas	31	\$3.3 M	\$78 K	2.39%	\$128	<1%
Remote Mainland	2	\$8.2 M	\$206 K	2.49%	\$80	<1%
Salmon Creek to Vanderbilt Hill	360	\$231.4 M	\$6.7 M	2.92%	\$6,230	<1%
Shelter Island	49	\$5.7 M	\$263 K	4.66%	\$498	<1%
Switzer Creek	67	\$50.7 M	\$1.7 M	3.42%	\$1,698	<1%
Thane	68	\$25.6 M	\$587 K	2.29%	\$576	<1%
West Juneau	362	\$170.4 M	\$5.2 M	3.06%	\$4,399	<1%
West Valley	728	\$347.6 M	\$11.1 M	3.21%	\$17 K	<1%

Building Code Analysis

The project team also completed an analysis to identify how many buildings were built to a specific building code. High loss ratios in earthquake events are typically attributed to the number of pre-code and low-code buildings in each community. Because of their age and code status, these buildings will not perform as well during an earthquake. Homes built prior to 1950 that are not constructed with a wood frame are considered pre-code; they were constructed before earthquake building codes were put in place. Homes constructed after 1950, or built prior to 1950 but with a wood frame, are considered low code and may include some earthquake building components. Buildings built after 1975 are considered moderate code. The dates for local building codes may be slightly different than the dates shown below, but the information can be used as a general planning tool until more information on the local building code can be acquired.

Table 10 shows the dispersion of pre-code, low-code, and moderate-code facilities in the City and Borough of Juneau. The geographic area of Juneau has the highest number of pre-code structures, with roughly 16 percent of their structures as pre-code compared to only 21 percent of structures in moderate code. This would be a great location for earthquake mitigation and outreach to reduce potential losses. The area of the Airport has nearly all structures set to moderate code, which is essential due to the critical nature of airport facilities. Other outreach opportunities include Douglas, Glacier Highway Past Cohen Drive, and Mendenhall Peninsula, where 37 structures are at risk to greater losses due to being pre-code.

Table 10: Building Codes in the City and Borough of Juneau

BUILDING CODE							
GEOGRAPHIC AREA	TOTAL NUMBER OF STRUCTURES	NO. OF PRE-CODE STRUCTURES	PERCENT OF PRE-CODE	NO. OR LOW-CODE STRUCTURES	PERCENT OF LOW-CODE	NO. OF MODERATE-CODE STRUCTURES	PERCENT OF MODERATE-CODE
Airport	39	0	0.00%	2	5.13%	37	94.87%
Auke Bay	119	1	<1%	52	43.70%	66	55.46%
Douglas	431	26	6.03%	220	51.04%	185	42.92%
East Valley	3,310	3	<1%	871	26.31%	2436	73.60%
Glacier Hwy Past Cohen Dr	68	2	2.94%	22	32.35%	44	64.71%
Glacier Hwy to Waydelich Creek	521	6	1.15%	160	30.71%	355	68.14%
Juneau	894	141	15.77%	569	63.65%	184	20.58%
Lemon Creek	459	0	0.00%	127	27.67%	332	72.33%
Mendenhall Peninsula	313	9	2.88%	110	35.14%	194	61.98%
North Douglas	561	1	<1%	131	23.35%	429	76.47%
Other Areas	84	0	0.00%	28	33.33%	56	66.67%
Remote Douglas	31	0	0.00%	5	16.13%	26	83.87%

BUILDING CODE							
GEOGRAPHIC AREA	TOTAL NUMBER OF STRUCTURES	NO. OF PRE-CODE STRUCTURES	PERCENT OF PRE-CODE	NO. OR LOW-CODE STRUCTURES	PERCENT OF LOW-CODE	NO. OF MODERATE-CODE STRUCTURES	PERCENT OF MODERATE-CODE
Remote Mainland	2	0	0.00%	0	0.00%	2	100.00%
Salmon Creek to Vanderbilt Hill	360	7	1.94%	60	16.67%	293	81.39%
Shelter Island	49	0	0.00%	3	6.12%	46	93.88%
Switzer Creek	67	2	2.99%	12	17.91%	53	79.10%
Thane	68	2	2.94%	22	32.35%	44	64.71%
West Juneau	362	4	1.10%	100	27.62%	258	71.27%
West Valley	728	0	0.00%	83	11.40%	645	88.60%
Total	8,466	204	2.41%	2,577	30.44%	5,685	67.15%

Note: The analysis in Hazus used the following dates: Pre-code buildings are any buildings built prior to 1950. Moderate-code buildings are any buildings built after 1975, which is the default Hazus methodology. These dates are based on when the seismic provisions were incorporated into the building code statewide. Please refer to the appendix for additional information.

The 1988 UBC and later adoptions of the UBC and International Building Code (IBC) provisions statewide may have been integrated into local building codes at dates slightly different than those shown in the table.

7. Tsunami Risk Assessment

Tsunami Hazard Overview

The City and Borough of Juneau is generally sheltered from the open ocean due to its position between other islands and distance from the ocean. However, the City and Borough of Juneau may still feel the effects of a locally generated tsunami event or may need to aid adjacent communities (City and Borough of Juneau Hazard Mitigation Plan, 2012). Alaska is home to historically large tsunamis, with notable events occurring near the City and Borough of Juneau. Notable events include the 1958 Lituya Bay Tsunami and the 1994 Skagway Tsunami. The Skagway Tsunami resulted in more than \$25 million in damages (City and Borough of Juneau Hazard Mitigation Plan, 2012). While the City and Borough of Juneau is at low risk of a tsunami event, there remains a potential for damages and losses, especially with a landslide-generated tsunami following an earthquake.



Note: Information on the timeline has been pulled from the [FEMA Disaster Declarations Summary - Open Government Dataset](#), the [FEMA Hazard Mitigation Program Summary - Open Government Dataset](#), and [FEMA's Disasters web page](#). The summaries listed above are categorized as having a tsunami disaster type.

Figure 10: History of Presidential Disaster Declarations Including Tsunami for the West Coast

Tsunami Exposure Assessment

The Flood Risk Assessment found in this **Risk Report** is a summary of information that can be found in the **Risk Assessment Database** and can be used to provide more details and a larger mapping footprint.

A tsunami exposure assessment was completed using maximum composition inundation data from the Alaska Department of Natural Resources Division of Geological and Geophysical Surveys. For this assessment, buildings were intersected with the maximum inundation zone to determine possible exposure to a tsunami event. For additional information on the inundation zones used for this study, please refer to Alaska's Division of Geological and Geophysical Surveys online Juneau tsunami portal at this [link](#).

Due to its location, it is unlikely the City and Borough of Juneau would be impacted by tsunamis in the same way as the rest of the west coast. The complex coastline of southern Alaska would likely act as a buffer for tsunamis generated in the Pacific.

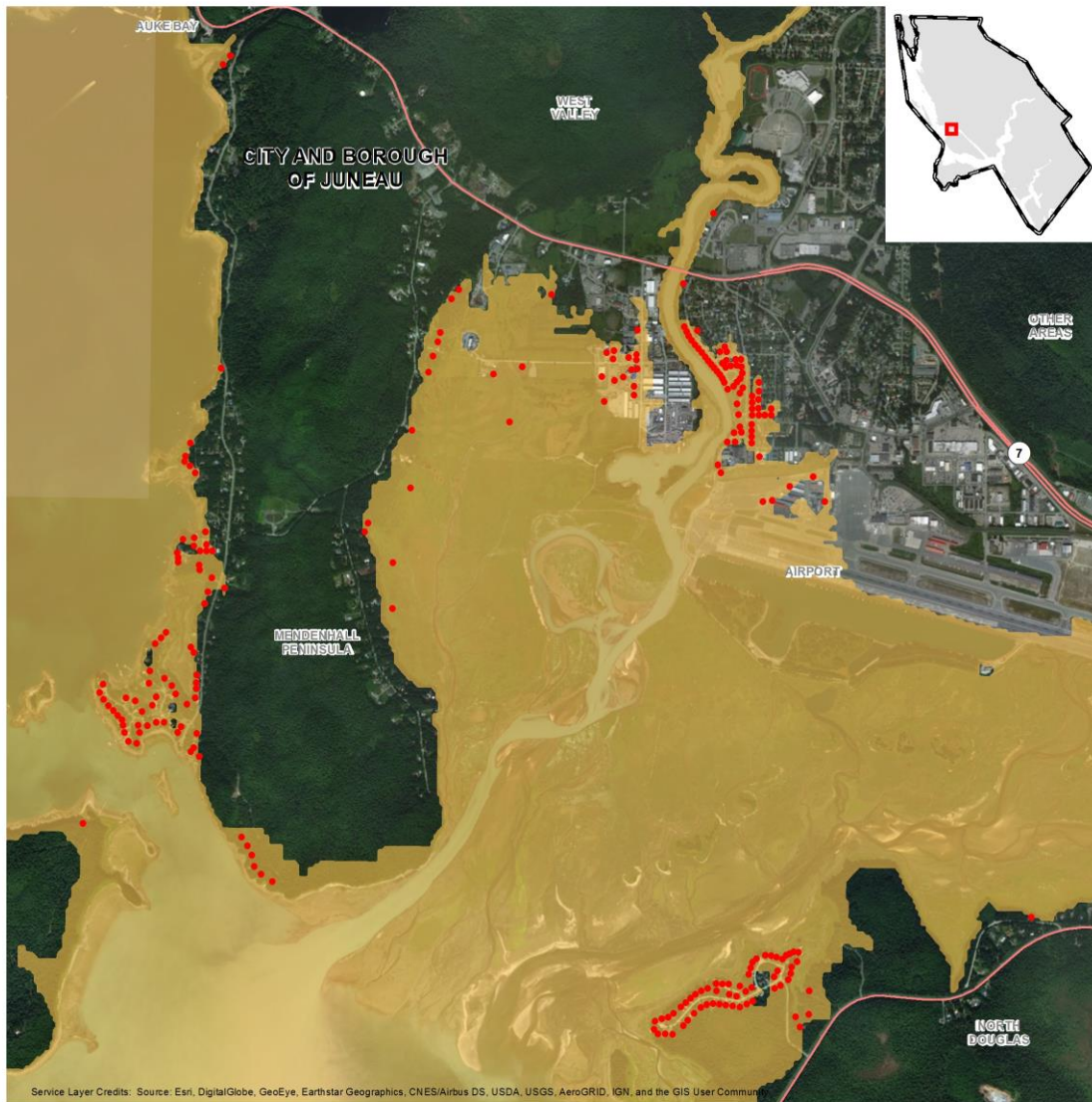
Table 11: Tsunami-Related Risk MAP Products, Study Areas, and Product Uses and Benefits

<p>Tsunami Exposure Assessment</p>	<p>Spatial and tabular data identifying the number of improved parcels in the tsunami hazard zone.</p>	<p>Local officials can use the tsunami exposure assessment to identify properties for mitigation projects as well as areas for additional outreach.</p>
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Table 12 summarizes the identified tsunami hazard area as established from the maximum composite inundation area. Maximum composite inundation data is spatially derived data combined to represent an area of exposure to tsunami risk. Spatial data scenarios that were combined to create the area of inundation risk included composite landslide inundation, composite landslide tectonic inundation, max tectonic inundation, tectonic inundation scenario 1d, and tectonic inundation scenario 4. Overall, the City and Borough of Juneau can expect nearly 4 percent of all structures to be exposed to a tsunami event. The highest areas of exposure are the areas of the Airport and Mendenhall Peninsula with roughly 15 percent and 27 percent of structures exposed, respectively. The areas of largest exposed value include Mendenhall Peninsula and North Douglas with a combined total of roughly 42 percent of all exposed value. It would be recommended that the areas of Airport, Mendenhall Peninsula, and North Douglas be a focus of mitigation efforts due to their susceptibility in a tsunami event and their economic value. The airport is of concern due to its need to provide evacuation and support to the community.

Local officials can use the tsunami exposure assessment to identify properties for mitigation projects as well as areas for additional outreach. Community-specific areas of greatest impact and potential mitigation actions are discussed in Section 9.

MAXIMUM COMPOSITE TSUNAMI INUNDATION



MAP SYMBOLOGY

- TSUNAMI**
- STRUCTURES EXPOSED TO INUNDATION
 - TSUNAMI INUNDATION

BASEMAP LAYERS

- PROJECT AREA
- MAJOR ROAD

ABOUT

THIS MAP DISPLAYS THE MAXIMUM COMPOSITE TSUNAMI INUNDATION.

1 in = 0.5 miles

1:30,000

SOURCE DATA FOR THIS RISK REPORT WAS COMPILED FROM FEMA'S REGION X OFFICE, FEMA'S MAP SERVICE CENTER, USGS, AND ALASKA DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS. THIS IS A NON-REGULATORY PRODUCT AND IS PROVIDED TO YOUR COMMUNITY FOR INFORMATION GATHERING AND SHARING PURPOSES ONLY.

Figure 11: Exposure of Structures to Maximum Composite Tsunami Inundation

Table 12: Tsunami Exposure Assessment – Maximum Composite Inundation

BASE DATA			EXPOSURE TO TSUNAMI INUNDATION			
GEOGRAPHIC AREA	TOTAL STRUCTURES	TOTAL VALUE	NO. OF STRUCTURES	PERCENT OF ALL STRUCTURES	VALUE OF STRUCTURES	PERCENT OF ALL VALUE
City and Borough of Juneau	8,466	\$4.4 B	323	3.82%	\$192.4 M	4.41%
Airport	39	\$28.9 M	6	15.38%	\$4.7 M	16.40%
Auke Bay	119	\$61.8 M	6	5.04%	\$4.8 M	7.69%
Douglas	431	\$187.1 M	3	<1%	\$1,3 M	<1%
East Valley	3,310	\$1.4 B	62	1.87%	\$27.7 M	1.98%
Glacier Hwy Past Cohen Dr	68	\$21.3 M	8	11.76%	\$4.6 M	21.54%
Glacier Hwy to Waydelich Creek	521	\$226.9 M	25	4.80%	\$19.6 M	8.59%
Juneau	894	\$737.7 M	15	1.68%	\$26.7 M	3.66%
Lemon Creek	459	\$279.4 M	1	<1%	\$308 K	<1%
Mendenhall Peninsula	313	\$142.6 M	84	26.84%	\$46.3 M	32.47%
North Douglas	561	\$216.6 M	77	13.73%	\$34.1 M	15.76%
Other Areas	84	\$222.2 M	3	3.57%	\$1.5 M	<1%
Remote Douglas	31	\$3.3 M	1	3.23%	\$324 K	9.90%
Remote Mainland	2	\$8.2 M	-	-	-	-
Salmon Creek to Vanderbilt Hill	360	\$231.4 M	2	<1%	\$5.9 M	2.56%
Shelter Island	49	\$5.7 M	2	4.08%	\$432 K	7.64%
Switzer Creek	67	\$50.7 M	1	1.49%	\$252 K	<1%
Thane	68	\$25.6 M	5	7.35%	\$997 K	3.89%
West Juneau	362	\$170.4 M	2	<1%	\$2.2 M	1.31%
West Valley	728	\$347.6 M	20	2.75%	\$10.7 M	3.09%

“-“ Indicates that no risk was identified.

8. Plan Integration

A community is best able to reduce its risk when hazard mitigation becomes a fully considered part of its normal planning processes. That means the community's existing planning mechanisms—the plans, policies, codes, and programs that guide development—are informed by data on natural hazards, support the community's mitigation goals, and are used to implement its mitigation strategy. When these tools all reference and support each other, it helps the community protect people and property, identify actions and activities to reduce losses, and maintain important services after a hazard event.

This Risk Report and accompanying Risk Assessment Database should therefore not be viewed in isolation; it can be an integrated part of planning processes within the City and Borough of Juneau. The data summarized in the report may be used to support day-to-day decision making and longer-term planning efforts, such as updates to comprehensive plans and other regulatory tools that inform land use decisions.

This section will provide a brief overview of how risk data, hazard mitigation, and local plans can work together and strengthen each other; highlight some of the ways that the City and Borough of Juneau is already doing this; identify additional steps to take; and describe the benefits of these efforts. For a more in-depth look at this topic, visit <https://www.fema.gov/media-library/assets/documents/89725> for guidance on plan integration, or visit <https://www.fema.gov/media-library/assets/documents/31372> for additional recommendations, case studies, and tools.

Using the Risk Report

Among the ways that local officials can use this report is in the development of community plans. The risk assessment can help communities generate appropriate strategies and avoid decisions that increase exposure to risk. Communities may wish to consult this report when developing or updating the following:

- Local HMP
- Comprehensive plan
- Land use maps or designations
- Zoning ordinance
- Subdivision regulation
- Building codes
- Future planned development areas
- Capital improvement plan
- Transportation projects
- Utility projects
- Economic or community development strategies
- Evacuation routes
- Emergency response plans
- Continuity of operations plans
- Growth management plans
- Conservation and restoration priorities
- Water resource inventory areas
- Critical area regulation

The datasets delivered with this report can be incorporated into any mapping used to support the development of these plans and projects. The risk assessment can also be used in stakeholder outreach and public meetings that are part of planning processes. Specific sections may be useful in certain planning contexts.

Overall Integration

In addition to the potential uses of this Risk Report and Risk Assessment Database, there are steps communities can take to make natural hazard mitigation an integrated part of local planning. The community’s comprehensive plan, HMP, and other tools that inform land use decisions should all work together toward unified goals and objectives.

Integrating natural hazard mitigation into comprehensive planning has many benefits. Integration will:

- Enhance both the comprehensive planning process and the natural hazard mitigation strategy;
- Reduce a community’s vulnerability to disasters;
- Support effective pre- and post-disaster decision making;
- Create effective planning tools;
- Help to efficiently return an affected community to normalcy following a hazard event;
- Provide a forum for analysis of potentially sensitive issues;
- Improve coordination and information sharing among departments; and
- Increase awareness and implementation of natural hazard mitigation.

The relationship between a community’s comprehensive plan and HMP is key to achieving this. The comprehensive plan establishes policies that are intended to guide day-to-day land use decisions and capital facilities expenditures. These policies have a major impact on whether people and property are exposed to natural hazards. Meanwhile, the HMP forms the groundwork for a community’s long-term strategy to reduce disaster losses.

Table 13: Interconnection of the Comprehensive Plan and HMP

HOW THE COMPREHENSIVE PLAN SUPPORTS THE HMP	HOW THE HMP SUPPORTS THE COMPREHENSIVE PLAN
<ul style="list-style-type: none">• The comprehensive plan is a key regulatory capability that can be used to implement the HMP’s mitigation strategy and guide development away from high-hazard areas.• Including hazard information and goals in the comprehensive plan elevates the importance of mitigation and makes it part of the community’s overall vision.	<ul style="list-style-type: none">• Through the HMP planning process, the community has already identified its biggest risks and vulnerabilities, most important goals, and top mitigation priorities.• The HMP identifies data sources for obtaining up-to-date information on natural hazards and high-hazard areas.

Integration in the City and Borough of Juneau

In 2012, the City and Borough of Juneau’s HMP was approved and adopted. Plan integration was only briefly discussed in the HMP when related to plan research, and it referenced multiple local plans including the 1996 Comprehensive Plan of the City and Borough of Juneau. It should be noted that since the development of the 2012 HMP, the City and Borough of Juneau has developed and adopted an updated Comprehensive Plan—the 2013-2026 Comprehensive Plan of the City and Borough of Juneau. The HMP also mentions plan integration in the Plan Implementation Section stating that, “the Hazard Mitigation Plan will be assimilated into other CBJ plans and documents as they come up for review according to each plan’s review schedule (Juneau HMP, 2012).”

The 2013-2026 City and Borough of Juneau Comprehensive Plan devotes an entire section to natural resources and hazards. In Chapter 7, the Hazards section directly links to the 2009 HMP and outlines policies, standard operating procedures, development guidelines, and actions for landslides and avalanches, earthquakes, and flooding. A few are sampled below:

- **Policy 7.1:** To protect the region’s scenic, environmental, and economically valuable natural resources from the adverse impacts of urban development. Development shall be controlled carefully and, if necessary, prohibited in natural hazardous and ecologically productive or sensitive areas.
- **Policy 7.17:** To minimize the threat to human safety and development posed by landslides (mass wasting) and avalanches.
- **Policy 7.18:** To prohibit residential, commercial, and industrial development in floodways, to regulate development in floodplains, and to maintain a program of education, assistance, and information in order to maintain eligibility for the NFIP for the benefit of local property owners and the lending industry.
- **Policy 7.19:** To work to protect the interests of the community by taking an active role in developing mapping and policy changes at the State and Federal level.

In addition to linking to natural hazards in Chapter 7, Chapter 11 presents land use maps and outlines the natural resources and hazards present in each sub-area map.

The City and Borough of Juneau Comprehensive Plan achieves citing and integrating hazard profiles and information from the 2009 Hazard Mitigation Plan. More recently, there has been an update to the HMP. A review of hazard profiles, data, and mitigation strategies could be conducted to ensure that the policies, standard operating procedures, development guidelines, and actions are up to date.

Improving Integration

To achieve effective integration, communities should make sure their comprehensive plans include background information on natural hazards; clearly identify any hazard-prone areas in the community; and incorporate mitigation goals, objectives, policies, and projects into the appropriate plan sections.

While the hazardous areas component provides a clear opportunity to integrate hazard mitigation into the comprehensive plan, it is not the only element pertinent to hazard mitigation. Language on hazard mitigation strategies or actions may be integrated across all elements of the plan. Communities may want to consider how their mitigation priorities relate to these components:

- Rural areas and natural resource lands
- Services, facilities, and utilities
- Transportation
- Shorelines
- Urban Communities
- Economic development
- Parks, open space, and cultural resources

Other specific steps that the City and Borough of Juneau can take to improve plan integration include the following:

- Within the Hazards section of the comprehensive plan, address all hazards found in the HMP and reflect their rankings.
- Increase the connection between economic preservation and hazard mitigation efforts throughout the document including more connections to hazard-sensitive areas within the Housing Element, Economic Development, and Land Use chapter.
- Expand the Future Growth maps in the Comprehensive Plan to include data from Risk MAP's spatial analysis of hazard extents to ensure that growth is not occurring in high-hazard areas.
- Update Juneau's floodplain ordinance to reference the HMP and evaluate whether the ordinance reflects the HMP's and comprehensive plan's flood-specific prioritized actions.

FEMA can assist communities that are preparing to update an existing planning document, provide examples of successful integration, and/or help communities come up with an integration strategy.

9. Areas of Mitigation Interest

This section of the Risk Report takes risk findings from Hazus models and other hazard overlays and focuses on specific areas where mitigation efforts should occur. These areas are called AOMIs and were developed through conversations with each community during the Risk MAP process as well as through analysis of various datasets for flood, earthquake, and tsunami hazards. The AOMI targets areas where potential damage, economic loss, and casualties could occur from a hazard event.

FEMA has provided strategies for mitigation in these specific areas. These resilience strategies advise ways the risks to hazards can be reduced, thereby decreasing potential damage, economic loss, and casualties during hazard events. The resilience strategies suggest potential projects for hazard mitigation, encouraging local collaboration, and communicating how various mitigation activities can successfully reduce risk. This information is intended to serve as a tool for discussion among local stakeholders to develop strategies specific to a community's socioeconomic and political geographies. The strategies are samples of a starting point. The AOMI section in this **Risk Report** provides a high-level summary of the critical facilities that will be most impacted by a chosen hazard scenario. **The Risk Assessment Database** provides a comprehensive analysis of all critical facilities provided in the City and Borough of Juneau assessor's dataset and the estimated damage costs from all the hazard scenarios presented in this Risk Report. Other plans, such as the Juneau HMP and Comprehensive Plan, provide additional details that complement the information provided here and they are reviewed in this section.

City and Borough of Juneau

Areas of Mitigation Interest and Recommended Resilience Strategies

Based on the Hazus risk assessment, the project team completed an overall hazard assessment for the City and Borough of Juneau that includes the buildings most affected by multiple hazards. Table 14 highlights examples of the buildings at risk from local hazards in the City and Borough of Juneau. For a

more comprehensive list of hazard impacts on critical facilities and all other structures in the City and Borough of Juneau, please reference the [Risk Assessment Database](#).

Table 14: City and Borough of Juneau Areas of Mitigation Interest

LOCATION	CATEGORY	NAME	TOTAL VALUE (BUILDING AND CONTENTS)	ESTIMATED LOSS FROM M6.0 PROBABILISTIC 500-YEAR EARTHQUAKE	M6.0 PROBABILISTIC 500-YEAR EARTHQUAKE LOSS RATIO	IDENTIFIED HAZARDS
W NINTH ST	EDU1	ASSOCIATION OF ALASKA SCHOOL BOARDS	\$1.5 M	\$35,557	2.4%	Flood
GLACIER AVE	GOV1	CITY AND BOROUGH OF JUNEAU	\$5.0 M	\$123,789	2.5%	None
GOLD ST	EDU1	ALASKA COUNCIL OF SCHOOL ADMINISTRATORS	\$607 K	\$14,626	2.4%	None
S SEWARD ST	GOV1	CITY AND BOROUGH OF JUNEAU	\$5.9 M	\$186,328	3.1%	None
GLACIER AVE	GOV1	JUNEAU SPORTS ASSOCIATION	\$116 K	\$2,800	2.4%	None
JORDAN AVE	GOV1	JUNEAU YOUTH SERVICES INC	\$2.7 M	\$72,950	2.7%	None
GLACIER AVE	GOV1	CITY AND BOROUGH OF JUNEAU	\$11.9 M	\$288,363	2.4%	None
HOSPITAL DR	GOV1	CITY AND BOROUGH OF JUNEAU	\$6.1 M	\$148,726	2.4%	None
HOSPITAL DR	GOV1	CITY AND BOROUGH OF JUNEAU	\$4 M	\$96,469	2.4%	None
WILLOUGHBY AVE	GOV1	STATE OF ALASKA	\$5.9 M	\$142,809	2.4%	None
CREST ST	GOV1	CITY AND BOROUGH OF JUNEAU	\$10.2 M	\$275,913	2.7%	None
GLACIER HWY	GOV1	CENTRAL COUNCIL TLINGIT AND HAIDA INDIANS	\$4.3 M	\$114,967	2.7%	None
SIXTH ST	GOV1	STATE OF ALASKA	\$2.9 M	\$74,885	2.6%	None

Note: Hazards are considered identified if the following applies:

1. Earthquake: Subject is at risk (included as an identified hazard) to earthquake if it held greater than 10% damage. However, earthquake building and contents losses below 10% are shown for the M6.0 probabilistic 500-year scenario.
2. Flood: Subject is within a 1-percent-annual-chance flood hazard area
3. Tsunami: Subject is within a parcel along an identified tsunami hazard area

Program Plan Analysis

Table 15 highlights how the information in this Risk Report, and the corresponding Risk Assessment Database, could be leveraged to support future updates to existing plans. The overall goal of this table is to provide examples of how Risk MAP data can support ongoing planning processes and potentially reduce the resources required to update plans such as the 2012 City and Borough of Juneau All-Hazards Mitigation Plan and the 2013-2026 Comprehensive Plan of the City and Borough of Juneau.

Information is organized first by the local plan from which it was pulled. Next, there is a “Plan Link,” which lists the specific action number or section for referencing the original documents. Several “Plan Goals and Objectives” which could be supported by data in this report are highlighted in the next column. To make connections between the information in this report and the existing local plan, the “Relevant Risk MAP products” column points to the most closely connected Risk MAP data sources. Finally, the “How to Use Risk MAP Products” column explains some of the ways in which the data and products could be used to move strategies and actions forward, and how they could be used to provide more detail in future plan updates.

This is not an exhaustive list of plan integration opportunities. For example, though not included in this table, Risk MAP data could also be used to support any future update to the city and borough’s floodplain management ordinances. **Contact your Risk MAP Coordinator, [Sally Russell Cox](#), for further clarification or technical assistance requests to follow up on any of the information listed below.**

Table 15: Existing Local Planning and Related Risk MAP Support for the City and Borough of Juneau

LOCAL PLAN	PLAN LINK	PLAN GOALS AND OBJECTIVES	RELEVANT RISK MAP PRODUCTS	HOW TO USE RISK MAP PRODUCTS
2012 City and Borough of Juneau All-Hazards Mitigation Plan	Flood Mitigation Goal	Relocate and/or protect structures in flood zones that are not eligible for NFIP.	<p>FIRM: The result of a coastal and riverine flood study for the City and Borough of Juneau that created new draft and preliminary flood maps, called FIRMs.</p> <p>Flood Water Surface Elevation and Depth Grids: Spatial data identifies flood water surface elevation and depth for the 0.2-, 1-, 2-, 4-, and 10-percent-annual-chance floods for portions of the City and Borough of Juneau.</p> <p>Flood Risk Assessment (Hazus): An assessment of the total building values, number of buildings, losses by coastal and riverine flood hazards, respectively, and number of structures within SFHAs.</p>	Utilize flood risk products to identify structures within the SFHA. The Hazus assessment can support cost/benefit analysis necessary for mitigation project prioritization. Water surface elevation and depth grids can also support project prioritization as they can be used to estimate the depth of water impacting structures.

LOCAL PLAN	PLAN LINK	PLAN GOALS AND OBJECTIVES	RELEVANT RISK MAP PRODUCTS	HOW TO USE RISK MAP PRODUCTS
			<p>Flood Exposure Assessment: Spatial and tabular data identifying the number of improved parcels in the SFHA.</p>	
	Flood Mitigation Goal	Increase awareness of floodplains in Juneau.	<p>Flood Water Surface Elevation and Depth Grids: Spatial data identifies flood water surface elevation and depth for the 0.2-, 1-, 2-, 4-, and 10-percent-annual-chance floods for portions of the City and Borough of Juneau.</p>	Flood water surface elevation and depth grids are great tools to show community residents how high the water is projected to rise. This can help support outreach efforts and provide visual examples of the flood risk.
	Earthquake Mitigation Goal	Reduce vulnerability of structures to earthquake damage.	<p>Earthquake Risk Assessment (Hazus): Spatial and tabular data providing specific building and content loss data for properties affected by the M6.0 Probabilistic 500-Year and M7.6 Queen Charlotte Fault.</p> <p>Building Code Analysis: Structures categorized by Low Code (LC), Moderate Code (MC), and High Code (HC) help to determine overall damage to structures in an earthquake event.</p> <p>AOMI Dataset: Tabular data showing hazard impacts to structures within the City and Borough using local building assessors' data.</p>	The Hazus risk assessment and the AOMI dataset can help identify structures that will experience the highest building and content losses for the analyzed earthquake scenarios. Furthermore, the building code analysis can help support the identification of structures that are most vulnerable to an earthquake event. All of these products can be used to identify structures most at risk and to prioritize mitigation projects.

LOCAL PLAN	PLAN LINK	PLAN GOALS AND OBJECTIVES	RELEVANT RISK MAP PRODUCTS	HOW TO USE RISK MAP PRODUCTS
	Tsunami Mitigation Goal	Promote recognition of tsunamis as a potential Juneau-area hazard.	Tsunami Exposure Assessment: Spatial and tabular data identifying the number of improved parcels in the tsunami hazard zone.	Utilize the exposure assessment to communicate the modeled tsunami hazard extent to residents. Develop response and evacuation plans using the hazard data. Identify residential or critical facility structures located within or near the hazard area and prioritize mitigation projects.
2013-2026 Comprehensive Plan of the City and Borough of Juneau	1.18 – SOP1	Use floodway and floodplain boundary links outlined on maps and prepared by FEMA as the basis for defining flood boundaries.	<p>FIRM: The result of a coastal and riverine flood study for the City and Borough of Juneau that created new draft and preliminary FIRMs.</p> <p>Flood Water Surface Elevation and Depth Grids: Spatial data identifies flood water surface elevation and depth for the 0.2-, 1-, 2-, 4-, and 10-percent-annual-chance floods for portions of the City and Borough of Juneau.</p>	Once final, adopt the updated FIRM and utilize it as the basis for providing flood boundaries. The water surface elevation and depth grids can support defining flood boundaries for frequencies outside of the 1-percent-annual-chance.

LOCAL PLAN	PLAN LINK	PLAN GOALS AND OBJECTIVES	RELEVANT RISK MAP PRODUCTS	HOW TO USE RISK MAP PRODUCTS
	Policy 10.12	To designate and reserve waterfront land with adequate services and in appropriate locations for water-dependent recreation, public access, and commercial/industrial activities while protecting important fish and wildlife habitat and other coastal resources.	<p>Flood Water Surface Elevation and Depth Grids: Spatial data identifies flood water surface elevation and depth for the 0.2-, 1-, 2-, 4-, and 10-percent-annual-chance floods for portions of the City and Borough of Juneau.</p> <p>Flood Risk Assessment (Hazus): An assessment of the total building values, number of buildings, losses by coastal and riverine flood hazards, respectively, and number of structures within SFHAs.</p> <p>Tsunami Exposure Assessment: Spatial and tabular data identifying the number of improved parcels in the tsunami hazard zone.</p>	Utilize products related to water inundation levels to identify waterfront locations that are prone to flooding and/or tsunami events. In addition to protecting coastal resources, structural and development mitigation efforts can protect business- and tourism-based income.

Recommended Resilience Strategies

Based on the assessment above, FEMA recommends the strategies summarized in Table 16. Additional strategies can be found by referencing the FEMA document, *Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards*, available at <https://www.fema.gov/media-library/assets/documents/30627>.

Table 16: Recommended Resilience Strategies for the City and Borough of Juneau

HAZARD	PROBLEM STATEMENT	RECOMMENDED STRATEGIES
Multi-Hazard	Placeholder if Socioeconomic section is completed.	<ul style="list-style-type: none"> Assist vulnerable populations with personal preparedness, appropriate evacuations, and after-event repairs.

HAZARD	PROBLEM STATEMENT	RECOMMENDED STRATEGIES
Flood	<p>Borough-wide, there are 208 structures (roughly 2.7 percent of all structures) identified in the SFHA.</p> <p>In the City and Borough of Juneau, modeled flood losses resulting from the 1-percent-annual-chance flood event are projected at roughly \$1.6M.</p>	<ul style="list-style-type: none"> • Consider limiting development in flood hazard areas identified in the risk assessment and identified as “frequently flooded areas” based on borough zoning code. • Use flood risk assessment data, including projected damage, to prioritize essential facilities for floodproofing/flood mitigation. • Develop a buyout program for repetitive loss properties. • Continue outreach to homeowners and business owners regarding flood risk and flood insurance options.
Earthquake	<p>The M6.0 Probabilistic 500-Year Earthquake scenario is expected to cause the most damage in the City and Borough of Juneau. For this event, a total building and contents loss of an estimated \$151 million is predicted, compared to the \$178 thousand experienced in the Queen Charlotte Fault event. This is 0.18 percent of the losses experienced in the Probabilistic 500-Year event. The highest economic losses (contents and building value) are in the regions of East Valley, Juneau, and Other Areas. The losses for these areas total roughly \$81.5 million, or 53.9 percent, of all losses in the borough. The areas with the largest loss ratio are Glacier Highway past Cohen Drive and Other Areas.</p> <p>The geographic area of Juneau has the highest number of pre-code structures at nearly 16 percent. Other geographic areas analyzed in this assessment report the percentage of pre-code structures as ranging from 0 to 6 percent.</p>	<ul style="list-style-type: none"> • Adopt and enforce updated building code provisions or development restrictions to reduce earthquake risk. • Develop a priority list for essential facility earthquake retrofits. • Develop an outreach program about earthquake risk and mitigation activities in homes, schools, and businesses.
Tsunami	<p>The borough can expect nearly 4 percent of all structures to be exposed to a tsunami event. The highest areas of exposure are the areas of the Airport and Mendenhall Peninsula, with roughly 15 percent and 27 percent of structures exposed, respectively. The areas of largest exposed value include Mendenhall Peninsula and North Douglas, with a combined total of roughly 42 percent of all exposed value.</p>	<ul style="list-style-type: none"> • Educate citizens regarding the dangers of tsunami and inform them of emergency procedures should a tsunami warning be issued. • Identify and equip facilities to function as public shelters.

While Federal funding for the above projects is limited, FEMA recommends incorporating these projects into the HMP should disaster funds become available. Additional funding may be available through the community Capital Improvement Planning process; bond authority; or other local, State, or private funding source. More information on how to mitigate for natural hazards can be found in the FEMA *Local Mitigation Planning Handbook* at <http://www.fema.gov/media-library/assets/documents/31598?id=7209>.

Additional information on integrating the HMP with the local planning process can be found at <http://www.fema.gov/media-library/assets/documents/19261?id=4267>.

10. Additional Resources

The City and Borough of Juneau Risk Assessment Database: To obtain, email the Alaska Risk Map Coordinator sally.cox@alaska.gov.

The Risk Assessment Database provides the base data for the City and Borough of Juneau Risk Report. The database aggregates natural hazard data by various local, State, and Federal partners and quantifies risk to those natural hazards using community assessor data to determine local risk. Furthermore, the database includes:

- Hazard layers and mapping footprints; and
- A complete and comprehensive analysis of all critical facilities provided in the City and Borough of Juneau assessor's dataset and the estimated damage costs from all hazard scenarios analyzed for the city and borough

[Alaska Risk MAP Website](#)

The Department of Commerce, Community, and Economic Development, Division of Community and Regional Affairs has partnered with FEMA to provide state-wide Risk MAP support. Through this partnership, the Division of Community and Regional Affairs assists FEMA in implementing the Risk MAP program to reduce flood hazards and mitigate natural hazards in Alaska's communities.

[FEMA Risk MAP Website](#)

This FEMA website discusses the Risk MAP program and what the program can mean to communities. This website is intended for a variety of audiences, including State and community officials; homeowners, renters, and business owners; real estate, lending, and insurance professionals; and engineers, surveyors, and architects.

Alaska State Resource Guide: To obtain, email the Alaska Risk MAP Coordinator sally.cox@alaska.gov.

The guide contains Alaska State Risk MAP contacts and funding, training, and community support and technical assistance opportunities.

[National Flood Insurance Program](#)

FloodSmart.gov is the official website of the NFIP. Find information about why and how to buy or renew insurance, what to do before and after a flood, and a guide to understand the costs of insurance.

[FEMA – Local Mitigation Planning Handbook](#)

The Local Mitigation Planning Handbook is the official guide for local governments to develop, update, and implement local mitigation plans.

[FEMA – Hazard Mitigation: Integration Best Practices into Planning](#)

This document, prepared by the American Planning Association (APA) and supported through a contract with the FEMA, seeks to close the gap that often exists between hazard mitigation planning and other local planning and regulatory land use processes. It introduces hazard mitigation as a vital area of practice for planners; provides guidance on how to integrate hazard mitigation strategies into

comprehensive, area, and functional plans; and shows where hazard mitigation can fit into zoning and subdivision codes. Best practices and practical applications are provided.

[FEMA – Mitigation Ideas: A Resource for Reducing Risk to Natural Hazards](#)

The purpose of this document is to provide a resource that communities can use to identify and evaluate a range of potential mitigation actions for reducing risk to natural hazards and disasters. The focus of this document is mitigation, which is action taken to reduce or eliminate long-term risk to hazards. Ideas for mitigation actions are presented for the following natural hazards: Drought, Earthquake, Erosion, Extreme temperatures, Flood, Hail, Landslide, Lightning, Sea level rise, Severe wind, Severe winter weather, Storm surge, Subsidence, Tornado, Tsunami, and Wildfire.

11. References Cited

Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys. 2010.
<http://dggs.alaska.gov/pubs/tsunami>

City and Borough of Juneau All-Hazards Mitigation Plan. 2012.

City and Borough of Juneau. Geographic Areas of Juneau. 2012.
<http://www.juneau.org/cddftp/maps/documents/geoareas2012.pdf>

United States Census Bureau. American Fact Finder. 2016
<https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>

12. Appendices

Appendix A. Acronyms and Definitions

AOMI	Area of Mitigation Interest
CRS	Community Rating System
DFIRM	Digital Flood Insurance Rate Map
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
GIS	Geographic Information System
HMP	Hazard Mitigation Plan
M	Magnitude
NFIP	National Flood Insurance Program
Risk MAP	Risk Mapping, Assessment, and Planning
SFHA	Special Flood Hazard Area
STARR	Strategic Alliance for Risk Reduction
UBC	Uniform Building Code
USGS	U.S. Geological Survey

Appendix B. City and Borough of Juneau, Alaska - Hazus User-Defined Facility Data Creation Process

- Looked at the two spreadsheets provided by Juneau. The difference between the two appear to be that the “revised” spreadsheet has an additional column relating to number of structures. More important, it also appears to have revised building values.
- Imported both spreadsheets into SQL. Spreadsheets were then joined together and the CBJ_2017_Bldg_Extract file was updated with the updated building values from the “revised” file.
- Renamed CBJ_2017_Bldg_Extract to CBJ_Master and going forward this will be the master tax spreadsheet used.
- Joined the master tax table to the parcel data.
- Discovered 191 records that are in the “revised” dataset that are not in the Master table. Merged the data together and then joined with the parcel data.
- Joining the parcel data and the Master file resulted in a match of 9,718 records. This means that about 3,400 parcels did not have any assessment data available. Most of the parcels that did not match are government properties; religious, education, or vacant land; and may not have any tax value. It is possible that there are duplicate parcel IDs (one ID for many parcels) which can be edited out. According to the Juneau Tax Assessment web page (provided by the parcel layer hyperlink), it can be confirmed that structures are located on the remaining parcels and have a monetary value associated with them.
- Data was searched for parcels that had no joined data but appeared to have buildings. If buildings were found, the assessor’s website was checked to extract additional information such as building value or year built. The master feature class was then updated.
- Removed duplicate parcels based on the PCN. A single building can have points located on multiple parcels, which will inflate the dollar loss values.
- Data Mapping:
 - OCCUPANCY – used BuildingSubmodel, BuildingModel, BuildingUseCode, and Propertytype
 - YearBuild – YearBuilt
 - COST – Building Value multiplied by Hazus defaults
 - Numstories – Building Model (one story, two story). Half-story buildings were rounded down and null values were changed to one story. For anomalies (ex: A building had a large sq. footage (40,000) but it was a one story), Google was referenced to verify the structure height. Changes were made where necessary.
 - Area – BuildingSizeSqFt
 - Buildingtype:
 - RES1 = W1
 - RES2 = W1
 - RES3* = W2
 - COM1 = W2
 - COM10 – C1
 - Others – W2
 - ContentCost – Hazus defaults
 - DesignLevel

- EQ: Hazus defaults (EQ, FL) EQ – Juneau area is considered 2B according to the UBC Seismic Zone Map for EQ
- FL – used the Hazus defaults based on YearBuilt Table 6.2 Flood Manual
- Foundation – used Hazus foundation distribution types found in Table 3.10 for Alaska of the FL Manual
 - Basement – 1101
 - Crawlspace – 3811
 - Slab – 3557
- FirstFloorHeight – used default floor height values from Table 3.11 in the FL Manual
 - Basement – 4ft
 - Crawlspace – 3ft
 - Slab – 1ft
- Damage IDs
 - Hazus
- Soils – s9445 soildb_AK_2002.mdb (USGS soils database) Soiltype - D
 - Typic Hunicryods -
<http://cookinletwetlands.info/Seward/SubGroupDescriptions/typic%20humicryods.htm>
 - Typic Cryohemists -
<http://cookinletwetlands.info/Seward/SubGroupDescriptions/typiccryosaprists.htm>
- Liquefaction
 - <http://www.juneau.org/emergency/Earthquakes.php>
 - <https://beta.juneau.org/emergency/juneau-hazards>
- Landslides
 - <http://www.juneau.org/emergency/Landslides.php>
 - Downloaded a USGS DEM 2m for the Juneau area and used the Slope tool in Pro to get an idea of the slope for Juneau area. There are some areas that have slope in the 30- to 40-degree range and a little higher in other spots.
- Water Level
 - https://waterdata.usgs.gov/ak/nwis/uv/?site_no=582359134352103&PARAMeter_cd=72019.72020
 - Water depth at time of data collection: 8.3ft

Appendix C. City and Borough of Juneau, Alaska – Risk Database

The information contained in this section describes the Risk Database, features, assumptions, and limitations.

Building All: Aggregated output dataset of all building points with total building and content value, estimated loss totals and ratios for all earthquake and flood scenarios, a dummy “yes – 1”, “no – 0” value if a particular hazard impacts the building point, and a hazard count totaling the dummy variables.

Field	Type (Length)	Description
NAME	String (255)	Used as a common identifier for the property (e.g., the name of the fire station or the owner name).
ADDRESS	String (255)	The physical address of the structure.
JURISDICTION	String (255)	The community the structure resides in. Typically, the preliminary DFIRM political layer is utilized. If Tribes reside within the study area, the best available Tribal boundary will be incorporated.
CATEGORY	String (255)	The occupancy code as identified in the Hazus input dataset.
ID	String (255)	The Unique ID as identified in the Hazus input dataset. Enables linking of Earthquake and Flood Hazus outputs into one dataset.
COST_TOTAL	Double	The sum of Building Replacement Value and Content Cost
COST_BUILDING	Double	Building Replacement Value as identified in the Hazus input dataset.
COST_CONTENTS	Double	Content Cost as identified in the Hazus input dataset.
EQ_LOSS_TOTAL_M#.#_SCENARIO	Double	AEBM: LossTotEconomic (loss of building and contents) as identified in the Hazus output dataset. UDF: Sum of BldgLossUSD and ContentLossUSD as identified in the Hazus output dataset.
EQ_LOSS_RATIO_M#.#_SCENARIO	Double	The result of EQ_LOSS_TOTAL_M#.#_SCENARIO divided by COST_TOTAL. Result is left as a decimal.

Field	Type (Length)	Description
FL_LOSS_TOTAL_##PCT	Double	Sum of BldgLossUSD and ContentLossUSD as identified in the Hazus output dataset.
FL_LOSS_RATIO_##PCT	Double	The result of FL_LOSS_TOTAL_##PCT divided by COST_TOTAL. Result is left as a decimal.
HAZ_XX	Short	A dummy variable where "1" suggests the structure is at risk to the hazard and "0" suggests the structure is minimally at risk to the hazard.
HAZ_COUNT	Short	The sum of all HAZ_XX values. The higher the value relative to other structures may suggest an Area of Mitigation Interest.

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Appendix D. AK – City and Borough of Juneau | Risk Database Overview

Base Data

- Borough Political Boundary layer outlining the City and Borough of Juneau.
- Geographic Areas Derived from CBJ’s web portal, a breakdown of neighborhoods throughout the city and borough.
- Parcel Parcels located within the city and borough.

Building Input

- Building Input Buildings are attributed with basic information including cost, content cost, design quality, area, building type, year built, location, etc., to input into Hazus.

Building Output

- Building All Building All
Aggregated output dataset of all building points with total building and content value, estimated loss totals and ratios for all earthquake and flood scenarios, a dummy “yes – 1”, “no – 0” value if a particular hazard impacts the building point, and a hazard count totaling the dummy variables.
- Essential Facilities All Essential Facilities All
Aggregated output dataset of all essential facilities with total building and content value, estimated loss totals and ratios for all earthquake and flood scenarios, a dummy “yes – 1”, “no – 0” value if a particular hazard impacts the building point, and a hazard count totaling the dummy variables.

Hazard Layers

- Earthquake (M7.6 Queen Charlotte; M6.0 Probabilistic 500-Year Event) No ShakeMap data was provided for this analysis. Intentionally left empty.
- Flood Flood
Flood Hazard Area: Draft flood hazard areas as of 2017.
Depth Grids: Depth of flood water in a 1-percent-annual-chance event.
Water Surface Elevation: Elevation of water in a 1-percent-annual-chance event.
 - Flood Hazard Area (Draft)
 - Depth Grids
 - Water Surface Elevation
- Tsunami (Maximum Composite Inundation) Tsunami
Tsunami hazard areas for a maximum composite inundation zone.

Binary Variable Analysis

Buildings were assigned a hazard value of “1” in the hazard binary field if:

Hazard	Building All	Essential Facilities All
Earthquake	Subject is at risk to earthquake if the estimated loss ratio is greater than 10 percent for any studied earthquake event.	Subject is at risk to earthquake if the estimated loss ratio is greater than 10 percent for any studied earthquake event.
Flood	Subject intersects a 1-percent-annual-chance flood hazard area.	Subject intersects a 0.2-percent or 1-percent-annual-chance flood hazard area.
Tsunami	Subject intersects an identified tsunami hazard area.	Subject intersects an identified tsunami hazard area.

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