E. NEW BUSINESS

2. **Ordinance 2024-__: Adopting the updated 2024 Kenai Peninsula Borough Hazard Mitigation Plan, a multi-jurisdictional plan including the Cities of Seldovia and Seward.**

Kenai Peninsula Borough
Office of Emergency Management

MEMORANDUM

TO: _____, Assembly President

THRU: Peter A. Micciche, Mayor
Brenda Ahlberg, Emergency Manager
Robert Ruffner, Planning Director

FROM: Mary Toll, HMP 2024 Update Project Manager

DATE: September 23, 2024

RE: Ordinance 2024-___. Adopting the Kenai Peninsula Borough Hazard Mitigation Plan 2024 Update and amending KPB 2.80.010 to include the new Hazard Mitigation Plan title (Mayor)

In October 2004, the Kenai Peninsula Borough ("Borough") enacted Ordinance 2004-33, adopting a borough-wide All-Hazard Mitigation Plan ("Plan"). The Plan was subsequently update in 2010 by assembly enactment of Ordinance 2010-26, in 2010 by enactment of Ordinance 2010-26, in 2014 by enactment of Ordinance 2014-22, and in 2019 by enactment of Ordinance 2019-31. The current 2024 update revises the Plan to include the cities of Seldovia and Seward. Inclusion of the cities of Homer, Kachemak City, Kenai and Soldotna is not in the current update due to staffing shortages following the Covid-19 pandemic. The remaining cities and participating Tribal entities will be invited to participate in the next update cycle. The goals and proposed mitigation actions for the Seward Bear Creek Flood Service Area ("SBCFSA") are included in this update and the flood service area will no longer prepare a stand-alone Plan. As a service area, the SBCFSA is not included as a jurisdiction in this update, and having an independent Plan is unnecessary and a duplication of efforts; the Borough service areas fall under the Borough's Plan.

KPB 2.80.010 is being amended to reflect the updated name of the Plan.

The purpose of this hazard mitigation update planning effort is threefold: (1) as a viable tool for reducing community vulnerability to disaster loss and damage; (2) as a requirement for obtaining certain types of future federal and state hazard mitigation funding; and (3) as a means to begin the process toward a full multijurisdictional plan, providing a more cohesive and coordinated process between the Borough and the cities to mitigate hazards.

The Borough cooperated and coordinated the 2024 update with the Plan section of the Alaska Division of Homeland and Emergency Management ("DHS&EM") and with the local state representative for the Region X FEMA office. This coordination was especially important as the

State HMP office implemented a new "Executive Summary" spreadsheet on April 1, 2024, required to be submitted with the Plan for state review. This spreadsheet caused increased and unexpected data research and input in the middle of the process.

The plan is available for review at the borough clerk's office and online at the Emergency Management web page with a hyperlink under the 2024 Hazard Mitigation Plan Update:

KPB Hazard Mitigation Plan Update 2024 (arcgis.com)

The mitigation goals and strategies are provided in that link as an option for a minimal review, if desired.

A brief timeline of the update process follows:

RFP issued October 11, 2023
Bids due November 1, 2023
Notice to Proceed issued January 25, 2024

APC meetings attended:

- May 8, 2024 Hope/Sunrise
- May 8, 2024 Cooper Landing
- May 8, 2024 Nikiski
- May 15, 2024 Anchor Point
- June 6, 2024 Moose Pass

Community and other meetings attended:

- May 1, 2024 City of Seldovia administration
- May 18, 2024 Funny River Community annual meeting
- May 21, 2024 City of Seward Planning and Zoning Commission
- June 8, 2024 Kenai River Fair
- June 24, 2024 Planning Commission
- July 19, 2024 LEPC

Future Schedule:

- September 23, 2024 Planning Commission (for recommendation to Assembly)
- October 2 and 3 APC (final draft, Assembly memo and ordinance review and recommendation)
- Oct 8 Assembly (ordinance introduction) and Oct 22, 2024 (adoption)

The draft plan was made available on August 31, 2024 for the 30-day public and stakeholder review and comment period, ending September 1, 2024. Notice of plan availability for comment was sent out to stakeholders via direct email and the public was notified on the social media pages for the Office of Emergency Management, the city of Seldovia and the city of Seward. The comments received will be incorporated into the plan and the revised draft Plan will be sent to the DHS&EM for state review early in September. DHS&EM has 30 days to review the draft. The state comments will be incorporated into the plan and it will be sent to FEMA for their 45-day

review period. If they have any needed additions or revisions, they will be completed and FEMA will issue an 'Approval Pending Adoption ("APA")', unless the Assembly has already approved the adoption ordinance, in which case FEMA will approve the plan. Plan approval is valid for 5 years. The current 2019 plan expires December 18, 2024.

Introduced by:	Mayor
Date:	10/8/24
Hearing:	10/22/24
Action:	
Vote:	

KENAI PENINSULA BOROUGH
ORDINANCE 2024-XX

AN ORDINANCE ADOPTING THE UPDATED 2024 KENAI PENINSULA BOROUGH HAZARD MITIGATION PLAN, A MULTI-JURISDICTIONAL PLAN INCLUDING THE CITIES OF SELDOVIA AND SEWARD

WHEREAS, the Kenai Peninsula Borough ("Borough") is vulnerable to damages from natural and human-caused hazards which pose a threat to public health and safety and could result in property loss and economic hardship; and

WHEREAS, the Hazard Mitigation Plan ("Plan"), recommends actions to protect people and property at risk that may reduce future public and personal costs of disaster response and recovery as well as reinforce decisions in emergency preparedness efforts; and

WHEREAS, the 2024 Plan update incorporates the cities of Seldovia and Seward , resulting in a multi-jurisdictional hazard mitigation plan, with the remaining incorporated cities of Homer, Kenai, Kachemak City, Soldotna and Tribal entities invited to be included in the 2029 update cycle; and

WHEREAS, the assembly initially adopted the Plan in 2004, subsequently adopting updated Plans in July 2010, June 2014 and December 2019; and

WHEREAS, the Federal Emergency Management Agency ("FEMA") disaster recovery funding and grant programs require regular update to the Plan; and

WHEREAS, the 2024 Plan has been updated to meet FEMA's requirements through the work of the Borough Planning and Emergency Management Departments as well as the State of Alaska Division of Homeland Security & Emergency Management; and

WHEREAS, the Borough Planning Commission held a public hearing on this ordinance at its September 23 meeting and recommended approval by unanimous consent;

NOW, THEREFORE, BE IT ORDAINED BY THE ASSEMBLY OF THE KENAI PENINSULA BOROUGH:

SECTION 1. That KPB 2.80.010 is hereby amended as follows:

2.80.010. Adoption of the hazard mitigation plan.

The document entitled Kenai Peninsula Borough Hazard Mitigation Plan 2024 Update, a multi-jurisdictional plan which includes the cities of Seldovia and Seward, is hereby adopted as the hazard mitigation plan for the Kenai Peninsula Borough. The mayor is authorized to make administrative changes to the plan provided the assembly shall be advised of all such changes.

SECTION 2. That this ordinance takes effect immediately upon its enactment.

ENACTED BY THE ASSEMBLY OF THE KENAI PENINSULA BOROUGH THIS 22ND DAY OF OCTOBER, 2024.

_____

_____, Assembly President

ATTEST:

_____

Michele Turner, Borough Clerk

Yes:

No:

Absent:

Kenai Peninsula Borough
with the City of Seward & City of Seldovia
Hazard Mitigation Plan Update 2024 (Draft)

August 2024

Executive Summary

The Kenai Peninsula Borough (KPB) Hazard Mitigation Plan (HMP) aims to reduce and eliminate losses from natural and manmade hazards, protecting the people and property of the borough. Due to its large size and regional variations in climate and geography, the borough is vulnerable to multiple natural hazards. While natural disasters cannot be prevented, their impacts can be minimized through comprehensive hazard mitigation planning.

This plan assists borough government, residents, local and private organizations, and other interested parties in hazard mitigation planning and coordinates efforts between government agencies. It is a living document, updated every five years, or reviewed within 90 days of a Presidential Disaster Declaration and updated as necessary within the following twelve months.

The 2024 HMP Update, an update of the 2019 HMP, is administered through the KPB Office of Emergency Management (OEM) with support from the following organizations:

- KPB, OEM & Planning Departments
- City of Seldovia, Planning Department and City Government
- City of Seward, Community Development and Emergency Management Departments
- Seward Bear Creek Flood Service Area (SBCFSA) Board Members and Staff

The Alaska Division of Homeland Security and Emergency Management (DHS&EM), Federal Emergency Management Agency (FEMA), state and federal agencies, community members, KPB Local Emergency Planning Committee (LEPC) and Advisory Planning Commissions (APCs) provided updated information for the plan. This HMP update to the 2019 HMP gathered input from numerous stakeholders. It complies with federal and state hazard mitigation planning requirements, enabling eligibility for FEMA grant funding for all planning partners.

This HMP update includes the incorporated cities of Seward and Seldovia, as well as the unincorporated communities of the borough. Previously, the SBCFSA developed its own stand-alone HMP, but this KPB HMP Update fully integrates the service area and its goals. The City of Seward, within the SBCFSA, is also integrated into this update. The SBCFSA, a borough service area which includes Bear Creek and Lowell Point, faces unique and repetitive flooding and erosion issues that are specifically addressed in this Plan update.

Tribal entities and Old Believer communities in the borough were contacted for comments and suggestions for this plan. The borough plans to develop a full multi-jurisdictional hazard mitigation plan (MJHMP) in the next update cycle to include the remaining incorporated cities of Homer, Kenai, Soldotna, and Kachemak City. Although FEMA requires HMPs to be updated every five years, including the remaining cities based on their coverage timelines may necessitate an earlier update. The KPB will continue to involve these cities to ensure that they are included in a future MJHMP for FEMA and hazard mitigation funding.

This project was funded in part through the State of Alaska Department of Commerce, Community, and Economic Development Division of Community and Regional Affairs (DCCED), Community Development Block Grant - Disaster Recovery (CDBG-DR). Planning support is provided by Kuna Engineering.

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Appendix H. Critical Facilities Maps

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Acronyms and Abbreviations

AAC	Alaska Administrative Code
ACS	American Community Survey
ADEC	Alaska Department of Environmental Conservation
ADFCS	Alaska Department of Family and Community Services
ADF&G	Alaska Department of Fish and Game
ADH&HS	Alaska Department of Health and Human Services
ADNR	Alaska Department of Natural Resources
ADOT&PF	Alaska Department of Transportation and Public Facilities
AEC	Alaska Earthquake Center
ASHSC	Alaska Seismic Hazards Safety Commission
AHAB	All Hazard Alert Broadcast System
AI	Artificial Intelligence
AMHS	Alaska Marine Highway System
ANCSA	Alaska Native Claims Settlement Act
AOOS	Alaska Ocean Observing System
AS	Alaska Statute
ASHSC	Alaska Seismic Hazards Safety Commission
APC	Advisory Planning Commission
ARRC	Alaska Railroad Corporation
AVO	Alaska Volcano Observatory
BCWPD	Bridge Creek Water Protection District
BFE	Base Flood Elevation
BIA	Bureau of Indian Affairs
BIL	Bipartisan Infrastructure Law
BRIC	Building Resilient Infrastructure and Communities
CERT	Community Emergency Response Teams
CDC	Center for Disease Control and Prevention
CDBG-DR	Community Development Block Grant - Disaster Recovery
CDP	Census Designated Place
CNFAIC	Chugach National Forest Avalanche Information Center
CFR	Code of Federal Regulations
cfs	cubic feet per second
cms	cubic meters per second
CIPA	Coastal Impact Assistance Program
CIRCAC	Cook Inlet Regional Citizens Advisory Council
CIRI	Cook Inlet Regional Corporation
CIRT	Cook Inlet Response Tool
CISPRI	Cook Inlet Spill Prevention and Response, Inc
CMT	Crisis Management Team
COOP	Continuity of Operations Plan
CRS	Community Rating System

CWPP	Community Wildfire Protection Plan
DART	Deep-Ocean Assessment and Reporting of Tsunamis
DCCED	Department of Commerce, Community, and Economic Development
DGGS	Division of Geological and Geophysical Surveys
DHA	David Hamre and Associates, LLC
DHS&EM	Alaska Department of Homeland Security and Emergency Management
DMA	Disaster Mitigation Act
EAP	Emergency Action Plan
EAS	Emergency Alert System
EERI	Earthquake Engineering Research Institute
EEW	Earthquake Early Warning
EMPG	Emergency Management Performance Grant
EOC	Emergency Operations Center
EOP	Emergency Operations Plan
EPA	Environmental Protection Agency
ESRI	Environmental Systems Research Institute
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
GI	Geophysical Institute
GIS	Geographic Information System
HEA	Homer Electric Association
HFRA	Healthy Forests Restoration Act
HHPD	High Hazard Potential Dam
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
IBC	International Building Code
ICC	International Code Council
ICS	Incident Command System
ID	Identification
IFC	International Fire Code
IIJA	Infrastructure Investment and Jobs Act
ITB	Instruction to Bidder
K-Beach	Kalifornsky Beach
KPB	Kenai Peninsula Borough
KPBSD	Kenai Peninsula Borough School District
KWF	Kenai Watershed Forum
LEPC	Local Emergency Planning Committees

LIDAR	Light Detection and Ranging
LNG	Liquified Natural Gas
M	Richter Magnitude
MCE	Maximum Considered Earthquake
ML	local magnitude
MMI	Modified Mercalli Intensity
MP	Milepost
mph	miles per hour
MW	Megawatt
MWH	Megawatt Hours
NEHRP	National Earthquakes Hazards Reduction Program
NFIP	National Flood Insurance Program
NFMF	National Flood Mitigation Fund
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
NRC	National Response Center
NRCS	Natural Resource Conservation Service
NTHMP	National Tsunami Hazard Mitigation Plan
NTWS	National Tsunami Warning Center
NWS	National Weather Service
MJHMP	Multi-jurisdictional Hazard Mitigation Plan
OEM	Office of Emergency Management
PAS	Planning Assistance to States
PDC	Pacific Disaster Center
P.E.	Professional Engineer
PGA	Peak Ground Acceleration
PIO	Public Information Officer
POC	Point of Contact
PSHA	Probabilistic Seismic Hazard Analysis
PWS	Prince William Sound
RCP	Representative Concentration Pathway
RCRA	Resource Conservation and Recovery Act
RL	Repetitive Loss
RMRS	Rocky Mountain Research Center
RPC	Representative Concentration Pathways
RSA	Road Service Area
SBCFSA	Seward Bear Creek Flood Service Area
SDC	Seismic Design Categories
SERC	State Emergency Response Commission
SFHA	Special Flood Hazard Area
SHMP	State Hazard Mitigation Plan
SHSP	State Homeland Security Program
SLTT	State, Local, Tribal, and Territorial

SNAP	Scenarios Network for Alaska and Arctic Planning
SRL	Severe Repetitive Loss
STIP	State Transportation Improvement Program
SVT	Seldovia Village Tribe
SWIMS	Solid Waste Information Management System
UAF	University of Alaska Fairbanks
UAFGI	University of Alaska Fairbanks Geophysical Institute
USACE	United States Army Corps of Engineers
USC	United States Code
USCG	United States Coast Guard
USDA	US Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VUU	vacant, unappropriated, and unreserved
WEA	Wireless Emergency Alerts
WiRē	Wildfire Research Team
WPDG	Wetland Program Development Grants
WUI	Wildland–urban interface

Section 1 Introduction

Natural events such as earthquakes, floods, wildfires, and severe weather events affect all segments of the communities they strike, including individuals, businesses, and public services. While it is not possible to eliminate disasters, it is feasible to reduce their impacts. The Kenai Peninsula Borough (KPB or Borough) experiences a multitude of severe natural hazards; therefore, it is crucial to have a proactive and comprehensive strategy for hazard mitigation. Proactive planning is paramount to safeguarding communities against the impacts of natural and human-caused hazards. The implementation of mitigation measures can save lives, reduce injuries, protect critical infrastructure, protect community infrastructure, and reduce financial losses. By investing in mitigation measures today, we can mitigate the risks of tomorrow, ensuring that our communities thrive in the face of adversity.

The KPB is committed to preventing, reducing, or eliminating the impacts of natural hazards on its communities. As we confront the challenges posed by the functions of a changing climate and a complex landscape of hazards, this Hazard Mitigation Plan underscores the Borough's commitment to building a more resilient and sustainable future. This Hazard Mitigation Plan represents not only a document but a shared vision for a safer, more resilient community. Together, we can work towards a future where hazards are minimized, vulnerabilities are addressed, and the well-being of all residents is protected.

Section 1.1 Purpose and Intent of the Plan

This KPB Hazard Mitigation Plan (HMP) update adds the City of Seldovia and the City of Seward. This update also incorporates the concerns and proposed mitigation actions of the Seward Bear Creek Flood Service Area (SBCFSA) and the communities of Seward, Lowell Point, and Bear Creek which are located within the SBCFSA. The inclusion of the cities of Seward and Seldovia in this update is a precursor to a full multi-jurisdictional update that will occur in the next update cycle for the KPB HMP. The future fully inclusive multi-jurisdictional plan will include the cities of Homer, Soldotna, Kenai, and Kachemak City.

While the SBCFSA is a service area of the KPB, it is not a signatory of this Plan as an incorporated entity. The SBCFSA is a stakeholder and provided valuable comments and input to the update. The intention is to incorporate the goals of the service area communities, as well as any City-specific goals, into the KPB HMP and negate the need for the City or the service area to have a stand-alone HMP.

This 2024 KPB HMP update is a culmination of a cooperative partnership between the KPB, City of Seward, City of Seldovia, the SBCFSA, the Alaska Division of Homeland Security and Emergency Management (DHS&EM), the Federal Emergency Management Agency (FEMA), other State and Federal agencies, and local agencies and planning groups. This HMP presents a comprehensive strategy to reduce the vulnerability of the region to a wide array of hazards endemic to the Kenai Peninsula while also meeting DHS&EM and FEMA requirements for a five-year HMP update.

Through extensive collaboration and community engagement, this Plan update reflects the collective wisdom and priorities of the Borough's diverse population. It draws upon the latest scientific research, best practices in hazard mitigation, and lessons learned from past events to develop strategies that are both effective and adaptable to evolving threats. Based on the results of the risk assessment and review of the goals identified in previous Borough HMPs, the Borough revised and streamlined the goals included in this 2024 KPB HMP Update.

Section 1.2 Hazard Mitigation Planning Requirements

Pursuant to Title 44 of the Code of Federal Regulations (CFR), subpart M, Section 206.401, hazard mitigation is defined as "any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards." Hazard mitigation involves the identification of potential hazards, assessment of potential impacts, and the establishment of a coordinated process to implement measures focused on enhancing the safety and well-being of residents while safeguarding critical infrastructure and property.

Hazard mitigation planning is required and guided by the federal Disaster Mitigation Act of 2000 (DMA 2000) (Public Law 106-390) and the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (Stafford Act) (Title 42 of the United States Code Section 5121 et seq.). The Disaster Mitigation Act of 2000 amended the Stafford Act and replaced the mitigation planning section [Section 322 (a-d), Mitigation Planning]. The new section emphasizes the need for state, local, and tribal governments to coordinate mitigation planning and implementation efforts. As part of the implementation process, FEMA prepared an Interim Final Rule that clearly establishes the mitigation planning criteria for states and local and tribal governments. This Rule was published in the Federal Register on February 26, 2002, at 44 CFR Part 201. The Final Rule was published in the Federal Register on September 16, 2009, at 44 CFR Parts 59, 61, 78, 79, 80, 201 and 206. Section 201.3(d) establishes the requirement that local governments must have a locally adopted and FEMA approved jurisdiction wide HMP to apply for and receive FEMA Hazard Mitigation Grant Program (HMGP) grants.

FEMA's Building Resilient Infrastructure and Communities (BRIC) program provides annual grant funds to state, local, tribal, and territorial (SLTT) governments for hazard mitigation planning, mitigation projects, and building community capacity and capability. The BRIC program seeks to categorically shift the federal focus from reactive disaster spending toward research-supported, proactive investment in community resilience as identified in planning, so that when the hurricane, flood, or wildfire comes, communities are better prepared and can implement responses that utilize pre-planned efforts and community improvements.

The National Flood Insurance Act of 1968 (42 USC 4001 et seq.) as amended by the Flood Disaster Protection Act of 1973, reinforces the need and requirement for HMPs, linking Flood Mitigation Assistance (FMA) programs to State and Local HMPs. Section 4104c (a-k), Mitigation Assistance, requires that states or communities develop a flood risk mitigation plan that is consistent with the comprehensive mitigation strategy of the jurisdiction in which the affected area is located, to receive grants from the National Flood Mitigation Fund (NFMF). Section 4011(b) requires participating National Flood Insurance Program (NFIP) communities' risk

assessments and mitigation strategies to identify and address repetitively flood-damaged properties.

Section 1.3 Plan Development Guidelines

FEMA requires that Local Hazard Mitigation Plans be updated at least every five years to enable the jurisdiction to remain eligible for FEMA hazard mitigation project grant funding. This Plan updates the 2019 KPB HMP, providing current information and goals. Portions of previous plans have been reformatted and retained; overly detailed descriptions have not been carried forward but can still be viewed in the 2019 Plan. Additionally, the plan provides an update and integration of the 2020 City of Seward and 2018 City of Seldovia HMPs into the KPB HMP plan. This update will provide accurate information upon which updated and/or revised goals and proposed mitigation actions have been formulated based upon recent hazard events and updated information.

In accordance with FEMA's plan development principles, this Plan will:

- Focus on mitigation strategies
- Comply with and meet the intent of the requirements of 44 CFR §201.6 regulations governing plan updates
- Use a planning process that provides numerous opportunities and methods for public input and review by all those knowledgeable of and/or affected by hazards in the Borough
- Actively seek to identify and represent the current specific needs and values of the varied local communities that make up the Borough
- Foster the Borough's relationship with the State and FEMA through a cooperative update process

The basic review guidelines supplied by the FEMA Local Mitigation Plan Review Tool are used to guide the All-Hazard Mitigation Plan development:

- Implement a planning process that includes public involvement;
- Assess hazard associated risks;
- Determine the facilities or portions of infrastructure that are vulnerable to a disaster;
- Develop mitigation strategies to reduce the loss of life and property damage;
- Describe how the KPB will periodically evaluate, monitor, maintain and update the plan;
- Describe the process for implementing the plan after adoption by the KPB and receiving DHS&EM and FEMA approval.

Section 1.4 Planning Process Overview

The purpose and intent of this HMP update is to fulfill the FEMA requirement that the local Hazard Mitigation Plans be updated every five years to enable jurisdictions to be eligible for FEMA hazard mitigation project grant funding. FEMA requirements aside, the intent of the development and implementation of this HMP update is to lessen or eliminate injuries or fatalities, damages, and losses from natural and human-caused hazards. The Plan update

includes the incorporated cities of Seward and Seldovia, and the unincorporated communities of the Borough. In previous years, the SBCFSA developed its own stand-alone HMP. The 2024 KPB HMP update integrates the goals, concerns and planned or desired mitigation actions of this service area.

Section 1.5 Plan Goals and Objectives

The overall goal of this HMP is to provide a comprehensive identification of potential hazards and a detailed assessment of their potential impacts. It also provides a framework for the implementation of the mitigation measures described in the document to enhance the safety and well-being of residents while safeguarding critical infrastructure and property in the KPB.

The current update identifies the following objectives to further define and assist with development of hazard mitigation strategies:

- Modify impacts of hazard events by encouraging, assisting, and training individuals and communities to prepare for, respond to and recover from hazard events;
- Reduce susceptibility to damage and disruption by avoiding hazardous, costly and unwise development in known hazard areas;
- Protect natural and beneficial values of floodplains, coastal areas and water resources; and
- Reduce economic losses and promote economic development by incorporating hazard mitigation into land use and development decisions.

For each hazard, this Plan update develops mitigation strategies, expanding these into implementation ideas and action items.

Section 1.6 Plan Organization

The 2024 KPB HMP update, with the City of Seward, City of Seldovia, and SBCFSA included is organized into the following sections:

Executive Summary: Provides a summary of the KPB HMP Plan and an overview of the updates to the plan since the 2019 KPB HMP was developed.

Section 1 – Introduction: Provides a brief discussion on hazard mitigation planning, the purpose and intent of this HMP, the guidelines for developing the plan update, and brief descriptions of each section in the Plan.

Section 2 – Mitigation Goals & Strategy: This section provides the mitigation actions and goals and a blueprint for implementing hazard mitigation activities. This section lists the KPB and City governmental authorities, policies, programs and resources. The compliance information for each participating jurisdiction in the NFIP is also included in the section.

Section 3 – Planning Process: Provides a detailed description of the planning process, including a timeline for the process, public involvement, and engagement with State and Federal agencies and other relevant stakeholders.

Section 4 – Background & Detailed Community Profiles: Provides background information about the Kenai Peninsula Borough, including information about the location, geography, history, demographics, and economy of the Borough, its unincorporated cities, and the incorporated cities of Seldovia, and Seward.

Section 5 – Hazard Identification: Provides a general overview of the eight hazards addressed in this Plan: including Earthquakes, Flooding/Erosion, Avalanches/Landslides, Tsunamis/Seiches, Volcanoes, Severe Weather, Wildfires, and Human-caused Hazards.

Section 6 – Flooding & Erosion: Provides a detailed description of flooding and erosion, a listing of historical flooding/erosion events in the Borough, a hazard risk assessment, and a description of planned mitigation projects and programs available to reduce risks. A description of the effects that changes to climate have on the hazard, if any, is also included.

Section 7 – Wildfires: Provides a detailed description of wildfires, a listing of historical wildfire events in the Borough, a hazard risk assessment, and a description of planned mitigation projects and programs available to reduce risks. It also provides references and a link to the comprehensive 2022 CWPP. A description of the effects that changes to climate have on the hazard, if any, is also included.

Section 8 – Earthquakes: Provides a detailed description of earthquakes, a listing of historical earthquake events in the Borough, a hazard risk assessment, and a description of planned mitigation projects and programs available to reduce risks. A description of the effects that changes to climate have on the hazard, if any, is also included.

Section 9 – Severe Weather: Provides a detailed description of severe weather, a listing of historical severe weather events in the Borough, a hazard risk assessment, and a description of planned mitigation projects and programs available to reduce risks. A description of the effects that changes to climate have on the hazard, if any, is also included.

Section 10 – Tsunamis/Seiches: Provides a detailed description of tsunami and seiches, a listing of historical tsunami/seiche events in the Borough, a hazard risk assessment, and a description of planned mitigation projects and programs available to reduce risks. A description of the effects that changes to climate have on the hazard, if any, is also included.

Section 11 – Volcanoes: Provides a detailed description of volcanoes, a listing of historical volcanic events in the Borough, a hazard risk assessment, and a description of

planned mitigation projects and programs available to reduce risks. A description of the effects that changes to climate have on the hazard, if any, is also included.

Section 12 – Avalanches/Landslides: Provides a detailed description of avalanches and landslides, a listing of landslide and avalanche events in the Borough, a hazard risk assessment, and a description of planned mitigation projects and programs available to reduce risks. A description of the effects that changes to climate have on the hazard, if any, is also included.

Section 13 – Human-Caused Hazards: Provides a detailed description of human-caused hazards, a listing of human-caused hazard events in the Borough, a hazard risk assessment, and a description of planned mitigation projects and programs available to reduce risks.

Section 14 – Risk Assessment: This section includes tables of vulnerable populations and critical infrastructure within the Borough. An estimated cost analysis of potential impacts from hazards upon this infrastructure is also included in the assessment.

Section 15 – Plan Maintenance: Describes the process that will be used to evaluate and maintain the HMP on a regular basis, and the process for the complete five-year plan update cycle.

Section 16 – Plan Adoption: Provides details about the formal adoption process for the HMP update by the KPB Assembly, the City of Seward, and the City of Seldovia. Adoption documents are provided in Appendix E.

Section 17 – References: Provides a comprehensive list of the reference materials used to prepare this HMP update.

Appendix A. State Template (Executive Summary): Provides information required to meet the April 1, 2024, State of Alaska Executive Summary requirement.

Appendix B. Public Outreach Summary: Provides a summary of the public and stakeholder outreach process including public notices, flyers, meeting sign-in sheets, public comments, community survey results, and presentations.

Appendix C. Summary of Changes to 2024 KPB HMP: Provides a summary of the completed and deleted goals and those goals carried forward into this Plan update from the 2019 KPB HMP, the 2020 City of Seward HMP, and the 2018 City of Seldovia HMP. Also provides a list of the changes and updates included in the 2024 KPB HMP.

Appendix D. Completed FEMA Plan Review Tool and Approval Letter (After FEMA/State Review): Provides the FEMA Plan Review Tool and documents compliance if this HMP Update with FEMA Criteria.

Appendix E. Plan Adoption Legislation (Borough, City of Seldovia, City of Seward/SBCFSA): Provides the adoption resolutions passed by the KPB Assembly, the City of Seldovia, and the City of Seward. Recommendations from the SBCFSA are also included.

Appendix F. Funding Resources: Provides a detailed list of possible Federal, State, and Local funding sources available to aid in hazard mitigation planning, hazard mitigation strategy implementation, and post-disaster aid.

Appendix G. Benefit Cost-Analysis Spreadsheet: Provides the Benefit-Cost Analysis Fact Sheet used to prioritize mitigation actions.

Appendix H. Plan Maintenance Documents: Provides plan maintenance documents, such as an annual review documentation sheet, the progress report form, and a community survey.

Section 2 Mitigation Goals & Strategy

By failing to prepare, you are preparing to fail.
- Benjamin Franklin

The HMP identifies goals for reducing long-term vulnerabilities to identified hazards (44 CFR Section 201.6.c(3i)). The planning team established goals for actions to help reduce hazard risk in the KPB, the City of Seward, and the City of Seldovia. These mitigation goals and actions are included in the as part of the State executive summary template in Appendix A of this HMP update. Funding opportunities through grants and other resources are integral to the ongoing strategy to reduce hazard risk in the borough.

Section 2.1 Mitigation Plan Goals and Proposed Actions

In preparing this HMP update, the planning team reviewed or developed goals to reduce hazard risk in the Borough, the City of Seldovia and the City of Seward. These goals include a variety of examples and proposed implementation ideas that could be developed into implementation actions. Where possible, the proposed implementation ideas associated with the goals used in the previous HMPs for each entity are combined to reduce repetition. The following eight general mitigation goals will be pursued to reduce hazard risk in the borough:

Goal #1: Protect the Borough population by mitigating or lessening hazard effects.

Goal #2: Identify and expand on an understanding of the hazards that affect the Borough.

Goal #3: Identify and prioritize evaluations, upgrades and retrofit measures for KPB critical facilities and infrastructure that are hazard vulnerable.

Goal #4: Educate the Borough population on hazard awareness, personal responsibility, preparation and response.

Goal #5: Identify, enhance and utilize existing resources for hazard reduction.

Goal #6: Identify the hazards applicable to critical infrastructure and mitigation opportunities for reducing those hazards.

Goal #7: Prioritize and implement projects to reduce hazard risk and increase resilience.

Goal #8: Use each hazard event as an educational opportunity.

These goals have been determined to be as all-encompassing and inclusive of implementation ideas and actions as possible.

Implementation Goals serve as a means of conveying specific mitigation strategies that may be developed to reduce vulnerability and impacts from hazards.

Implementation Actions (Descriptions) serve as a means of conveying potential projects, partnerships, and collaborations that can develop into real world hazard mitigation actions. Actions will alleviate or reduce future hazard impacts. Implementation actions also include the

technical components, capabilities, and requirements for developing actions within a specific timeframe or as an ongoing measure.

The mitigation strategy for implementation actions also includes a number of additional items to achieve the mitigation goals, which are included in this HMP update:

Location Area: Area(s) affected by hazard, can be borough wide.

Hazard: Identified hazards to which the implementation idea applies; this could include specific hazards, a combination of hazards, or all hazards.

Responsible Department: Agency or entity responsible for the implementation of an idea or action and ensuring it can be developed, processed and completed.

Priority Rating: A qualitative ranking, either High, Medium or Low for the priority to implement the action:

- High priorities are associated with actions for hazards that impact the KPB on an annual or near annual basis and generate impacts to critical facilities and/or people.
- Medium priorities are associated with actions for hazards that do not typically generate impacts to critical facilities and/or people.
- Low priorities are associated with actions for hazards that have limited impact.

Potential Funding Sources: Potential grants or other assistance or agency support that can help pay for the implementation idea and/or action. See Appendix F for list of potential funding sources and a brief description of the type of mitigation projects they can support.

Cost Analysis: A qualitative assessment of the potential costs for the implementation idea or action:

- **High:** Existing funding will not cover the cost of the action; implementation would require new revenue (i.e., grants, state and federal appropriations)
- **Medium**: The action could be implemented with existing funding but would require a re-apportionment of the budget or a budget amendment, or the cost of the action would have to be spread over multiple years. (i.e. additional state or local funding)
- **Low:** The action could be funded under the existing budget. The action is part of or can be part of an ongoing existing program.

Benefit Analysis: A qualitative ranking of the potential benefits that may be realized through the implementation idea or action:

- **High:** Action will provide an immediate reduction of risk exposure for life and property.

- **Medium:** Action will have a long-term impact on the reduction of risk exposure for life and property, or action will provide an immediate reduction in the risk exposure for property.
- **Low:** Long-term benefits of the action are difficult to quantify in the short term

Timeline: The proposed time frame in which the implementation idea can be completed.

Plans Included in Development: Other plans that can be included to guide the Mitigation Action Plan.

HMP Mitigation Goal (Ongoing, New): Implementation ideas or actions that are new or ongoing.

In the review and integration of plan goals from the 2019 KPB HMP, the 2020 City of Seward HMP (including the SBCFSA goals), and the 2018 City of Seldovia HMP, the Planning Team removed implementation actions and ideas that were completed, integrated into ideas and actions, or were no longer relevant. These deleted goals and the actions taken by the planning team related to their removal are included in the mitigation strategy section of the HMP.

The following table presents the 2024 goals and proposed mitigation actions for the KPB, City of Seldovia and City of Seward.

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #1: Protect the Borough population by mitigating or lessening hazard effects.										
Protect Borough employees with continued and expanded hazard training and facility upgrades.	KPB Areawide	All Hazards	KPB Administration	High	Medium	Low	KPB, FEMA	3-5 Years	KPB Comprehensive Plan (2019)	New
Continue maintenance, upgrades and debris storage to help manage erosion and sediment accumulation. Including Lowell Creek Outfall, Lowell Point Road and culverts throughout the Borough. Also support coastal erosion mitigation along Kenai Spur Highway and Sterling Highway.	KPB Areawide, City of Seward, SBCFSA	Flooding, Coastal Erosion	City of Seward, SBCFSA, United States Army Corps of Engineers (USACE), ADOT&PF	High	High	High	USACE, KPB OEM, City of Seward, ADOT&PF, SBCFSA	3-5 Years	USACE Lowell Creek Flood Diversion Plan, City of Seward HMP (2020), State of Alaska HMP (2023).	Ongoing
Increase the number of slash disposal sites to serve all communities during increased spruce bark beetle infestation in the KPB.	KPB Areawide, City of Seward, SBCFSA	Wildfires	City of Seward, SBCFSA, USFS, ADNR Division of Forestry, KPB Solid Waste Department	High	High	High	EFRP, FEMA Hazard Mitigation Grant Program (HMGP)	3-5 Years	State of Alaska HMP (2023), City of Seward HMP (2020), City of Seldovia HMP (2018), KPB Community Wildfire Protection Plan (CWPP)	New
Partner with Division of Geological and Geophysical Surveys (DGGS) and United States Geological Survey (USGS) to establish monitoring of Lowell Point Road and Jakolof Bay Road as well as other areas in the KPB subject to landslides that can be a danger to residents and disrupt transportation.	KPB Areawide, City of Seldovia, City of Seward, SBCFSA	Landslides	KPB OEM, City of Seward, City of Seldovia, USGS, DGGS	High	Medium	Medium	USACE, KPB OEM, City of Seward, ADOT&PF, USGS, City of Seldovia	2-4 Years	USACE Lowell Creek Flood Diversion Plan, City of Seward HMP (2020), State of Alaska HMP (2023).	New
Obtain an exemption to the Alaska Department of Natural Resources (ADNR) Material Sales Fees on navigable rivers and streams and state lands for sediment and debris management, stream channel maintenance, and flood control or other mitigation projects.	KPB Areawide, City of Seward, SBCFSA	Flooding, Coastal Erosion	ADNR, City of Seward, SBCFSA, KPB OEM	High	High	Low	ADNR, SBCFSA, NCRS, City of Seward	2-4 Years	City of Seward HMP (2020), State of Alaska HMP (2023)	Ongoing

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #1: Protect the Borough population by mitigating or lessening hazard effects.										
Complete a Borough-wide flood and coastal erosion assessment and evaluation, using predictive modelling tools such as USGS CoSMoS, to identify mitigation targets, including areas that threaten infrastructure such as the Sterling Highway, Kenai Spur Highway and K Beach Road.	KPB Areawide	Flooding, Coastal Erosion, Landslides	KPB OEM, River Center, KPB Planning Dept	Medium	Medium	Low	BRIC, NCRF, DGGS	3-5 Years	KPB Comp. Plan (2019), DGGS Coastal Community Erosion Assessment, Kachemak National Estuarine Research Reserve (NOAA/UAA)	Ongoing
Identify and mitigate possible levee or dam failures in SBCFSA and Borough-wide. Work with residents, industry and government agencies to develop and disseminate information about areas in danger from levee or dam failure. Harden and/or retrofit existing levees per USACE guidelines. The City of Seldovia is working with the National Oceanic and Atmospheric Administration (NOAA) on improved upper dam access for fish passage from stream, and upgrades to aging dam infrastructure.	KPB Areawide, City of Seldovia, City of Seward, SBCFSA	Flooding, Erosion, Landslides, Earthquake	USACE, State (ADNR & ADOT&PF), Local Government, Utility Companies, SBCFSA	Medium	High	High	USACE, SBCFSA, FEMA, State, Cities	2-4 Years	State of Alaska HMP (2023City of Seward HMP (2020), City of Seldovia HMP (2018), City of Homer HMP (2022)	Ongoing
Identify and mitigate vulnerabilities in emergency transportation, including evacuation potential, for roads not on the road system. (as an example, Jakolof Bay Road, which is a State road).	City of Seldovia, Tyonek, Port Graham, Nanwalek, Bear Cove, Halibut Cove, and other areas off the road system in the KPB.	All Hazards	KPB OEM, ADOT&PF, KPB Road Service Area	Medium	High	High	State, HMGP, PDM, Tribal Governments	3-5 Years	Community Response Plans, Emergency Response Plans	Ongoing

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #1: Protect the Borough population by mitigating or lessening hazard effects.										
Pursue funding to improve and update Flood Insurance Rate Map (FIRMs), as well as other maps and plans, such as Drainage Plans, Sediment Management Plans, or Watershed Management Plans.	KPB Areawide, City of Seldovia, City of Seward, SBCFSA	Flooding, Coastal Erosion	KPB River Center, KPB Planning, City of Seward, City of Seldovia, SBCFSA, FEMA	Medium	High	Low	FEMA, DCRA, SBCFSA, BRIC and NCRF	3-5 Years	Flood Insurance Studies (FIS), City of Seldovia HMP (2018), City of Seward HMP (2020), KPB Comprehensive Plan (2019), State of Alaska HMP (2023)	Ongoing
Goal #2- Identify and expand on hazards that affect the Borough										
Develop and implement a floodplain ordinance within Seldovia City Code in compliance with the NFIP.	City of Seldovia	Flooding	City of Seldovia, KPB River Center	High	Medium	Low	City of Seldovia, FEMA: Hazard Mitigation Assistance (HMA), Flood Mitigation Assistance (FMA)	2-4 Years	City of Seldovia HMP (2018), State of Alaska HMP (2023)	Ongoing
Evaluate and upgrade Borough maintained roads for effects from hazards and for evacuation and mitigation potential; use as basis for CIP prioritization. Evaluate ingress and egress to communities and if it should be considered for upgrade as an evacuation option, such as for wildfire evacuation, or as an evacuation route such as Toklat Way subdivision through Moose Pass.	KPB Areawide	All Hazards	KPB Planning and Road Service Area, KPB OEM	High	High	Medium	KPB, BRIC	2-4 Years	KPB Comprehensive Plan (2019), State of Alaska HMP (2023)	New

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #2- Identify and expand on hazards that affect the Borough										
Identify special needs, at-risk and under-served populations including building or maintaining a database of voluntary registration for special needs and under-served populations, similar to Rapid Notify registration system.	KPB Areawide, City of Seldovia, City of Seward, SBCFSA	All Hazards	State Department of Health, Department of Corrections, KPB OEM, KPB Planning	High	High	Low	DCRA, Public Assistance Mitigation, KPB	1-3 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	Ongoing
Identify and map congregate living facilities and institutions with special needs populations, such as assisted living facilities, day care facilities, rehab facilities, senior housing, correctional facilities, halfway houses; some of this information may not be suitable for public access.	KPB Areawide, City of Seldovia, City of Seward, SBCFSA	All Hazards	State Department of Health and Human Services (DH&HS), Department of Corrections, KPB OEM, KPB Planning, KPB GIS	High	Medium	Low	Alaska Division of Community and Regional Affairs (DCRA), Public Assistance Mitigation, KPB	1-3 Years	State HMP (2023), KPB Comprehensive Plan (2019)	Ongoing
Identify areas of seasonal populations, such as campgrounds, RV parks, fish processing plants, and dipnet areas. Plan for their notification or alert of an applicable hazard event. Plan for their evacuation.	KPB Areawide, City of Seldovia, City of Seward, SBCFSA	All Hazards	KPB OEM, KPB Planning, KPB GIS, State DNR	High	High	Low	ADNR, KPB, BRIC, HMGP	1-3 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	New
Identify and protect public and private resource facilities such as water sources, wastewater treatment plants, cell towers and power substations	KPB Areawide, City of Seldovia, City of Seward, SBCFSA	All Hazards	KPB Administration, State (DHS&EM), Local and municipal utility providers	High	High	Low	State (DHSEM), Local Utility Companies, BRIC, HMGP, KPB	1-3 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019), Utility Company Plans	New

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #2- Identify and expand on hazards that affect the Borough										
Identify, improve and maintain roads that provide public access to beaches; these accesses may be needed for evacuation following a hazard event or emergency response. A large number of evacuees may need to be accommodated based on the time of year.	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB, ADNR, ADOT&PF, KPB Road Service Area	High	High	Medium	KPB, BRIC, HMGP	1-3 Years	State of Alaska HMP (2023)	New
Support ADEC's funded creation of a hazardous waste program under the Resource Conservation and Recovery Act (RCRA). This could be used to support ongoing cleanup efforts in the KPB	KPB Areawide	Human-Caused Hazards	ADEC	High	High	Low	ADEC	1-3 Years	KPB Comprehensive Plan (2019), EPA and ADEC RCRA State Plans.	New
Support the efforts of SBCFSA, City of Seward and the USACE to resolve the Lowell Creek Diversion Tunnel issues and outfall sediment.	City of Seward, SBCFSA	Flooding, Landslides	SBCFSA, City of Seward, KPB OEM, USACE	High	High	Low	USACE CWIFP, BRIC, KPB, City of Seward, SBCFSA	1-3 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019), City of Seward HMP (2020)	Ongoing
Minimize workplace violence by continuing installation of secured and controlled entries to Borough and school district buildings. Adopt threat response procedures and educate all Borough employees.	KPB Areawide	Human-Caused Hazard	KPB Risk Management, KPB Human Resources, KPBSD	High	High	Medium	KPB Risk Management, KPB Human Resources, KPBSD, FEMA, DHS	1-3 Years	State of Alaska HMP (2023)	Ongoing

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #2- Identify and expand on hazards that affect the Borough										
Verify that all critical function structures and available fuel supplies have alternate power sources during power outages and that portable power sources are available in the event critical response resources need to be moved during or after an event. If needed, upgrade fuel tanks and storage facilities to enable storage of sufficient fuel amounts. City of Seward: install generator for AVTEC with main power distribution disconnect switch. Homer Electric Association (HEA) is pursuing a grant with Seldovia Village Tribe and the City of Seldovia to develop fiber connection between Homer and the community.	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB OEM, Native Corporations and tribal entities	High	High	Medium	HMGP, BRIC, NEHRP, KPB	1-3 Years	State of Alaska HMP (2023), Tribal Hazard Mitigation Plans for KPB Tribal Entities.	New
Verify that all Emergency Operations Plans (EOP) are updated with current information. Update and maintain KPB EOP with reference in Hazard Mitigation Plan.	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB OEM	High	High	Low	KPB	1-3 Years	State EOP, KPB EOP, City of Seldovia EOP, City of Seward EOP	New
Verify that potable water can be made available to responders and residents during an event, even if bottled water availability is limited. This may require an inventory of private, high-volume wells that have been tested and are ADEC approved, such as seafood processors, ice producers, restaurants, senior centers, VSW project recipients etc.	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB OEM	High	Medium	Low	HMGP, BRIC, KPB	2-4 Years	State of Alaska HMP (2023)	New
Provide information and support for Continuity of Operations Plans (COOP) for KPB departments.	KPB Areawide	All Hazards	KPB OEM, KPB Administration, KPB River Center, KPB Planning	High	High	Low	KPB	1-3 Years	KPB Comprehensive Plan (2019)	New

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #2- Identify and expand on hazards that affect the Borough										
Establish a retaining structure in Lowell Canyon to prevent avalanches from disrupting the city water storage system.	City of Seward, SBCFSA	Landslides, avalanches	SBCFSA, City of Seward, KPB OEM, USACE	High	High	High	USACE, SBCFSA, FEMA, State, Cities	3-5 Years	USACE Lowell Creek Flood Diversion Plan, City of Seward HMP (2020), State of Alaska HMP (2023).	Ongoing
Review and appropriately revise KPB development standards and requirements, including floodplain standards, for permitting and construction, subdivision standards, road construction permitting and standards; adopt and implement development standards and permit requirements in hazard areas where applicable.	KPB Areawide	All Hazards	KPB Planning	Medium	Medium	Medium	KPB	2-4 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	Ongoing
Revise KPB 17.10 Borough Lands and Resources to enable or require tax foreclosure properties located in hazard zones to be classified as Preservation after foreclosure	KPB Areawide	All Hazards	KPB Land Management, KPB Assessing	Medium	High	Low	KPB	2-4 Years	KPB Comprehensive Plan (2019)	Ongoing
Construct a road to connect Nanwalek and Port Graham; work with both communities to facilitate a cooperative situation to maximize community use of facilities and evacuation route as needed during an event	Nanwalek, Port Graham	All Hazards	ADOT&PF, BIA, Native Village of Nanwalek, Native Village of Port Graham, Chugachmiut	Medium	Medium	High	Federal Highway Administration (FHWA), BIA Tribal Transportation Program (TTP), BRIC	3-5 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	New
Identify potentially harmful substances used or disposed of within the Borough that are inadequately regulated by government agencies to serve as a basis for future planning, monitoring, response or enforcement activity.	KPB Areawide, City of Seldovia, City of Seward,	Human-Caused Hazards	KPB Risk Management, KPB Solid Waste Department, ADEC Solid Waste Program	Medium	Low	Low	KPB	2-4 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019); 18 AAC 62	Ongoing

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #2- Identify and expand on hazards that affect the Borough										
Conduct joint site visits with key permitting agencies to evaluate repetitively damaged roads and formulate plans for flood mitigation.	KPB Areawide, City of Seldovia, City of Seward,	Flooding	SBCFSA, KPB River Center	Medium	Medium	Low	HMGP, BRIC, USDA Natural Resource Conservation Service (NRCS), KPB	1-3 Years	State HMP (2023), City of Seward HMP (2020), City of Seldovia HMP (2018)	New
Work with interested agencies to identify degraded floodplains and investigate the potential for restoring or improving water passage, removing repetitively damaged structures and/or acquiring land to restore or preserve floodplain function.	KPB Areawide, City of Seldovia, City of Seward,	Flooding	SBCFSA, KPB River Center, Kenai Watershed Forum	Medium	Medium	Medium	HMGP, BRIC, NRCS, EPA Wetland Program Development Grants (WPDG), KPB	2-4 Years	State HMP (2023), City of Seward (2020), KPB Comp Plan, City of Seldovia HMP (2018), Kenai Watershed Forum 2022 Freshwater Conservation Action Plan.	Ongoing
Create manuals for critical facilities to document AM and PM requirements; manuals to include lists of vulnerabilities that need mitigation.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM	Medium	Medium	Low	KPB	2-4 Years	State of Alaska HMP (2023), City of Seward HMP (2020), City of Seldovia HMP (2018)	New
Complete or update Small Community Emergency Response Plans (SCERPs) in collaboration with DHS&EM for those unincorporated communities that qualify for this program. Support community efforts to increase initial independent preparation and response, such as volunteer fire and emergency departments, community gardens, and community centers.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, State DHS&EM	Medium	Medium	Low	KPB, DHS&EM	1-3 Years	KPB EOP, State HMP (2023)	New

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #2- Identify and expand on hazards that affect the Borough										
Promote public awareness of potential hazards associated with transporting and handling toxic and hazardous substances in the community, including response actions.	KPB Areawide, City of Seldovia, City of Seward,	Human-Caused Hazards	KPB OEM, ADOT&PF	Low	Medium	Low	ADEC	1-3 Years	KPB Comprehensive Plan (2019), EPA and ADEC RCRA State Plans.	Ongoing
Research mitigation options for electric vehicles during power outages; educate public on charging locations.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, ADOT&PF	Low	Low	Medium	FHWA, PROTECT grant program	2-4 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	New
Goal #3- Identify and prioritize evaluations, upgrades and retrofit measures for KPB critical facilities and infrastructure that are hazard vulnerable										
Perform a Peninsula-wide assessment of communication systems vulnerabilities. There is a need to register cell phones with the KPB to receive emergency alerts and all-clears. A siren is no longer used in Hope and the community needs to alert people to emergencies.	KPB Areawide	All Hazards	KPB OEM, DHSEM, City of Seldovia, City of Seward	High	Medium	Medium	HMGP, BRIC, KPB, City of Seward, City of Seldovia, DHSEM	1-3 Years	State of Alaska HMP (2023), City of Seward HMP (2020), City of Seldovia HMP (2018)	Ongoing
Assemble prioritized lists of facilities owned by the Borough, City of Seldovia and City of Seward to identify changes, non-structural measures, evaluations of facilities, and upgrades or retrofits needed to meet current hazard standards and State Building Code. Prepare a funding plan and estimate for needed structural upgrades.	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB OEM, KPB Planning, KPB Maintenance, KPB Assessing Department, City of Seward, City of Seldovia,	Medium	Medium	High	HMGP, BRIC, KPB, City of Seward, City of Seldovia, DHSEM	3-5 Years	KPB COOP plans, KPB EOP, State of Alaska HMP (2023)	Ongoing

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #3- Identify and prioritize evaluations, upgrades and retrofit measures for KPB critical facilities and infrastructure that are hazard vulnerable										
Work with utility companies to encourage or require underground installation of facilities in new or upgraded developments; this may require changes to KPB Codes, grant funding, reduced rates, tax incentives, etc.	KPB Areawide	Flooding, Severe Weather, Avalanches, Earthquake, Human-Caused Hazards	KPB OEM, KPB Planning, Local Utility Companies	Medium	Medium	Low	KPB	3-5 Years	KPB Comprehensive Plan (2019), utility company COOPs	Ongoing
4 - Educate the Borough population on hazard awareness, personal responsibility, preparation and response										
Encourage residents to have a minimum 7-day emergency supply kit and a plan to address hazard impacts such as injuries, suspension or delay of emergency services, power outages, road blockages, loss of heat, frozen pipes, fallen trees, store closures, etc. Include emergency supplies and provisions for care of animals and pets. Pursue commercial participation with promotions on hazard kit supplies from local vendors	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, City of Seldovia, City of Seward, SBCFSA, Chambers of Commerce	High	Medium	Low	KPB, City of Seldovia, City of Seward, HMGP, BRIC	1-3 Years	State of Alaska HP (2023), City of Seward HMP (2020), City of Seldovia HMP (2018)	Ongoing
Work with tourism agencies to provide hazard preparation and response information to seasonal populations.	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB OEM, City of Seldovia, City of Seward, SBCFSA	High	High	Low	KPB, City of Seldovia, City of Seward, DHS&EM, State and local tourism bureaus	1-3 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	Ongoing
With cooperation from owners, identify and advertise successful private flood-proofing projects to foster a positive view of mitigation and preparation	KPB Areawide, City of Seldovia, City of Seward	Flooding	KPB OEM, KPB River Center, City of Seldovia, City of Seward, SBCFSA	High	High	Low	KPB, City of Seward, City of Seldovia	1-3 Years	City of Seward HMP (2020), City of Seldovia HMP (2018)	Ongoing

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
4 - Educate the Borough population on hazard awareness, personal responsibility, preparation and response										
Work with utility and fuel companies to educate customers on appropriate pre- and post-event actions and precautions	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB OEM, City of Seldovia, City of Seward, SBCFSA, ADEC	Medium	High	Low	KPB, City of Seldovia, City of Seward, Local Utility Companies	1-3 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	Ongoing
Promote Hazard Mitigation education to the public schools with a Hazard Education and Mitigation month. Support or provide avalanche awareness classes for outdoor recreationalists; work with KPB School District (KPBSD) to provide class credits to students	KPB Areawide	All Hazards	KPBSD, KPB OEM, City of Seldovia, City of Seward, SBCFSA	Medium	High	Low	KPB, City of Seward, City of Seldovia	2-4 Years	2022-2027 KPBSD Strategic Plan, KPB Comp Plan	Ongoing
Add hazard maps to GIS public access map options	KPB Areawide	All Hazards	KPB OEM, KPB GIS	Medium	Medium	Low	KPB	2-4 Years	City of Seward HMP (2020), City of Seldovia HMP (2018)	New
Work with vendors to provide incentives for public to purchase safety equipment	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB OEM, City of Seldovia, City of Seward, SBCFSA, avalanche organizations, boating safety organizations, USCG	Medium	Medium	Medium	KPB, DHSEM, HMGP, BRIC	2-4 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	Ongoing
Work with fuel suppliers to monitor fuel tank conditions and provide information to the public on safe fuel storage options. As an example, propane tanks are not elevated at the school in Hope, instead resting on the ground.	KPB Areawide	All Hazards	KPB OEM, City of Seldovia, City of Seward, SBCFSA, ADEC	Medium	Medium	Low	KPB, City of Seward, City of Seldovia, ADEC	1-3 Years	State of Alaska Hp (2023), City of Seward HMP (2020), City of Seldovia HMP (2018)	Ongoing

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
4 - Educate the Borough population on hazard awareness, personal responsibility, preparation and response										
Educate homeowners on potentially hazardous materials commonly found in homes or provide sources for such information	KPB Areawide	Human-Caused Hazards	KPB OEM, City of Seldovia, City of Seward, SBCFSA, ADEC	Medium	Medium	Low	KPB, City of Seward, City of Seldovia, ADEC	1-3 Years	State Hazard Mitigation Plan (2023), City of Seward HMP (2020), City of Seldovia HMP (2018)	Ongoing
Provide 'Best Practices' information to homeowners, realtors and contractors	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB Planning, KPB River Center, KPB Assessing, City of Seward, City of Seldovia	Medium	High	Low	KPB, City of Seward, City of Seldovia	1-3 Years	KPB Comprehensive Plan (2019), City of Seward HMP (2020), City of Seldovia HMP (2018)	Ongoing
Create electrical infrastructure redundancies to reduce the risk of prolonged power outages, such as completing the underground electrical loop on Lowell Pt. from Beach Drive to Lowell Pt. Rd., and the loop from Shady Ln. to Beach Drive.	KPB Areawide, City of Seldovia, City of Seward,	Avalanches, Landslides	#KPB OEM, City of Seward, City of Seldovia	Medium	High	High	Utility Companies, KPB OEM	2-4 Years	KPB Comprehensive Plan (2019), City of Seward HMP (2020), City of Seldovia HMP (2018)	Ongoing
Identify businesses and institutions in high-risk areas in the Borough and verify they have plans in place for hazard response.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, City of Seldovia, City of Seward, SBCFSA	Low	High	Low	KPB, City of Seward, City of Seldovia	2-4 Years	KPB Comprehensive Plan (2019)	Ongoing
Goal #5- Identify, enhance and utilize existing resources.										
Consistently provide KPB comments on proposed capital improvements for State-owned resources. Encourage public and Borough participation during comment periods for infrastructure funding, construction or facility upgrades.	KPB Areawide	All Hazards	KPB OEM, KPB Planning, KPB RSA, City of Seward, City of Seldovia	High	Low	Medium	KPB, ADOT&PF, ADNR	2-4 Years	KPB Comprehensive Plan (2019), City of Seward HMP (2020), City of Seldovia HMP (2018)	New

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #5- Identify, enhance and utilize existing resources.										
Fund a dedicated Geographic Information System (GIS) position in OEM to enhance hazard research, and response mapping utilized by OEM and various emergency services. Position will help to identify and map (or update mapping) high hazard areas in GIS, including critical infrastructure located in those areas.	KPB Areawide	All Hazards	KPB OEM, KPB Administration	High	High	Medium	KPB Administration	1-3 Years	KPB Comprehensive Plan (2019), City of Seward HMP (2020), City of Seldovia HMP (2018)	New
Update and upgrade Borough communications partnerships. Augment KPB communications and facility support to enhance interoperable communications. Perform a Borough-wide assessment of communication systems vulnerabilities. Encourage cell phones registration with the KPB to receive emergency alerts and all-clears. A siren is no longer used in Hope and the community still needs to alert people to emergencies.	KPB Areawide	All Hazards	KPB OEM, FEMA, NOAA, NWS	High	High	Low	BRIC, KPB, City of Seward, ADOT&PF, SBCFSA, City of Seward	3-5 Years	KPB Comprehensive Plan (2019), City of Seward HMP (2020), City of Seldovia HMP (2018)	New
Require department heads or managers to be familiar with and trained in FEMA's Incident Command System (ICS) for disaster response	KPB Areawide	All Hazards	KPB OEM, City of Seward, SBCFSA, City of Seldovia	High	Medium	Low	KPB Administration, City of Seward, SBCFSA, City of Seldovia	1-3 Years	KPB Comprehensive Plan (2019), City of Seward HMP (2020), City of Seldovia HMP (2018)	New
Goal #6- Identify hazards applicable to critical infrastructure and mitigation ideas.										
Evaluate evacuation routes for ability to handle estimated numbers of evacuees, suitability for seasons, alternate routes, likelihood of road damage, quality of construction, etc. Add alternative evacuation routes where possible.	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB OEM, City of Seward, SBCFSA, USACE, ADOT&PF, City of Seldovia	High	High	High	USACE, BRIC, KPB OEM, City of Seward, ADOT&PF, SBCFSA, City of Seward	3-5 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019), KPB EOP, City of Seward HMP (2020), City of Seldovia HMP (2018)	New

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #6- Identify hazards applicable to critical infrastructure and mitigation ideas.										
Construct vertical evacuation towers in appropriate locations if found to be a feasible alternative to traditional evacuation methods in areas at risk to Tsunami damage	KPB Areawide, City of Seldovia, City of Seward	Tsunami	KPB OEM, City of Seward, SBCFSA, USACE, NOAA, City of Seldovia	High	High	High	USACE, BRIC, KPB OEM, City of Seward, ADOT&PF, SBCFSA, City of Seward, HMGP,	2-4 Years	State Hazard Mitigation Plan (2023), KPB Comprehensive Plan (2019), City of Seward HMP (2020), City of Seldovia HMP (2018)	New
Pursue mitigation and maintenance measures along shorelines in City of Seward parks and camping areas, including the rock barrier in Waterfront Park area.	City of Seward	All Hazards	City of Seward, SBCFSA, USACE, ADOT&PF	High	High	High	USACE, BRIC, KPB OEM, City of Seward, ADOT&PF	2-4 Years	City of Seward HMP (2020)	Ongoing
Encourage local governments and the State to work together on projects that mitigate or minimize hazard effects, with coordinated priorities, funding, and/or work efforts where possible to increase efficiencies and reduce costs.	KPB Areawide, City of Seldovia	All Hazards	KPB OEM, City of Seward, SBCFSA, , City of Seldovia, DHS&EM	Medium	Low	Medium	KPB, BRIC, City of Seward, SBCFSA, City of Seldovia, HMGP, DHS&EM,	1-3 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019), City of Seward HMP (2020), City of Seldovia HMP (2018)	Ongoing
Goal #7- Prioritize and implement projects to reduce risk and increase resilience.										
Provide informational signage in areas subject to specific hazards such as avalanches, landslides and tsunami or in areas of public access or use.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, ADOT&PF, KPB RSA, City of Seward, City of Seldovia	High	Medium	Medium	KPB, BRIC, HMGP	2-4 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019), City of Seward HMP (2020), City of Seldovia HMP (2018)	Ongoing

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
Goal #7- Prioritize and implement projects to reduce risk and increase resilience.										
Verify that procedures exist for local provision of response operations during an event, in situations where State, federal or other sources of help are not immediately available. Include information on communities with a SCERP in place where it is applicable.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, City of Seward, City of Seldovia	High	High	Low	KPB	1-3 Years	KPB EOP, KPB Comprehensive Plan (2019), State of Alaska HMP (2023)	Ongoing
Encourage the state and KPB to include pedestrian and non-motorized travel ways on bridge upgrades or replacements.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, KPB RSA, KPB Land Mgmt, KPB Purchasing and Contracting, ADOT&PF, City of Seward, City of Seldovia	Medium	Medium	Medium	Emergency Management Performance Grant (EMPG), EOC, KPB	3-5 Years	KPB EOP, KPB Comprehensive Plan (2019), State of Alaska HMP (2023)	Ongoing
Provide consistent infrastructure inspection and maintenance.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, KPB RSA, KPB Maintenance, ADOT&PF, City of Seward, City of Seldovia	Medium	High	Medium	EMPG, EOC, KPB	3-5 Years	KPB EOP, KPB Comprehensive Plan (2019), State of Alaska HMP (2023)	Ongoing
Create, update, implement and exercise Continuity of Operations Plan (COOP) plans to mitigate effects of hazards to Borough operations and departments. Require department heads or managers to update and maintain COOP plans for all KPB Departments.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, KPB Dept Managers, City of Seward, City of Seldovia	Medium	High	Low	KPB	3-5 Years	KPB EOP, KPB Comprehensive Plan (2019), State of Alaska HMP (2023)	Ongoing
8- Use each hazard event as an educational opportunity.										
Take advantage of public interest immediately following an event with expanded public awareness and outreach programs.	KPB Areawide, City of Seldovia, City of Seward,	All Hazards	KPB OEM, City of Seward, City of Seldovia	High	High	Low	EMPG, EOC, KPB	1-3 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	New

Description	Location Area	Hazard	Responsible Department or Agency	Priority Rating	Cost Analysis	Benefit Analysis	Potential Funding Sources	Timeline (1-3 Yrs 2-4 Yrs, 3-5 Yrs)	Other Applicable Plans to include in Development	Mitigation Action (Ongoing, New)
8- Use each hazard event as an educational opportunity.										
Provide information about potential effects of severe weather, including mitigation ideas – power outages, road disruptions, roof collapses, health risks of shoveling snow, etc.	KPB Areawide, City of Seldovia, City of Seward	Severe Weather	KPB OEM, City of Seward, City of Seldovia	High	High	Low	EMPG, EOC, KPB	1-3 Years	State of Alaska HMP (2023), KPB Comprehensive Plan (2019)	New
Continue to refine and expand as needed, after-action information reporting/submittal procedures and training with targeted outreach to those affected or involved in response.	KPB Areawide, City of Seldovia, City of Seward	All Hazards	KPB OEM, City of Seward, City of Seldovia, DHS&EM	Medium	Medium	Low	EMPG, EOC, KPB, FEMA	1-3 Years	State of Alaska HMP (2023), FEMA ICS Training Plan	New

Table 1. Mitigation Action Plan Goals and Proposed Actions

Section 2.2 Progress in Local Mitigation Efforts

This HMP update deletes/removes several mitigation action plan goals that are completed, integrated, or removed to streamline and enhance efficiency. Goals such as the purchase of Repetitive Loss (RL) and Severe Repetitive Loss (SRL) properties in the Seward area (2011) and the siren upgrades completed in December 2023 have been marked as completed. Additionally, actions like the integration of the SBCFSA plan annex into the KPB HMP and the ongoing street renaming project for effective emergency response are integrated into this HMP update. By addressing these modifications, the plan ensures a more focused approach to mitigating future risks and enhancing community resilience. Table 1 highlights mitigation actions that are in ongoing development and/or implementation since the last plan update. The complete list of deleted or completed mitigation action plan goals can be found in Appendix C.

Table 2. Completed HMP projects or implementation ideas from past plan updates.

Category	Mitigation Actions	Details
Fire Mitigation	CWPP update (April 2022)	The Community Wildfire Protection Plan has been updated and is now a comprehensive plan.
Flooding Mitigation	Purchase of RL and SRL properties in Seward area (2011)	Most RL and SRL properties in the Seward area have been acquired. Two properties in the SBCFSA still need to be acquired. Properties are monitored as an ongoing process.
Tsunami Mitigation	Siren upgrades (Ord 2020-19-11)	The new siren system was commissioned in December 2023.
Flooding Mitigation	Perform flood studies for FIRM Unnumbered A and V Zones	The flood studies are out for public comment. Anticipated completion in Fall 2024.
Hazard Mitigation	Update Hazard Mitigation Plan for City of Seward and SBCFSA	The HMP for the City of Seward and SBCFSA was updated in January 2020 and is now included in this KPB HMP update.
Hazard Mitigation	Update Hazard Mitigation Plans for all cities in KPB	All Hazard Mitigation Plans for cities within the KPB will be updated but will be included as part of the MJHMP during the next KPB plan update cycle.
Hazard Mitigation	Move SBCFSA Plan Annex to be fully incorporated into the KPB HMP in next update	The SBCFSA Plan Annex has been fully integrated into the current KPB Plan update.
Hazard Mitigation	Verify response equipment functionality and integration	This information was verified and integrated into the EOP and COOPs in 2023.
Hazard Mitigation	Train Borough staff/personnel for standardized post-disaster assessments	The KPB is utilizing FEMA Preliminary Damage Assessment Guide to train Borough staff/personnel.
Volcano Mitigation	Map private/developed property within potential and previous ash cloud extents	Added previous AVO ash fallout boundaries to GIS database.
Volcano Mitigation	Coordinate with Alaska Volcano Observatory (AVO) and State for latest updates on ash plans	The 2022 update is available on the AVO website.
Human-Caused Hazard Mitigation	Install secured and controlled entries to Borough buildings and schools	Secured and controlled entries have been installed in all Borough schools; project is ongoing for Borough buildings.

Table 3. Completed KPB projects or mitigation actions

Category	Mitigation Actions
Hazard Mitigation	The Code for Disaster Declarations and Emergency Powers (Ord 2022-28) was updated in August 2022.
Hazard Mitigation	The Ready-Set-Go Preparedness campaign (Resolution 4395) commenced in January 2023.
Hazard Mitigation	Reactivated Emergency Services Communications Center Board (Ordinance 2022-12)
Future Climate Conditions Mitigation	Address climate change effects in KPB, with sustainable solutions (Ordinance 2020-25, Resolution 3150). Includes Community Compost & Food Waste Recovery Program (pilot program) 2021-2024. USDA funding plus KPB in-kind.
Hazard Mitigation Plan Funding	2024 HMP Update – KPB accepted grant funding for update (Ordinance 2023-19-01)
Hazard Mitigation	Delete duplicate street addresses for efficient emergency response.
Emergency Management	Accepted Emergency Management Operations grant funding from FEMA (EMPG) Annual grant (Resolution 2018-040).
Human-Caused Hazard Mitigation	Landfill leachate evaporation concentrator (Ordinance 2022-31); KPB Solid Waste Dept. working with HEA on a methane gas project.
Human-Caused Hazard Mitigation	Manage and utilize funds from Opioid Settlement (Ordinance 2021-19-50). KPB is one of nine political subdivisions in the State that signed on to the agreement; funds will be distributed over approximately 18 years.
Human-Caused Hazard Mitigation	Cybersecurity Vulnerability Assessment (Ordinance 2020-19-32): Accepting funding from DHS for Cybersecurity Vulnerability Assessment and Disaster Management Training (Ordinance 2019-19-17).
Human-Caused Hazard Mitigation	Hazardous building removal of Zipmart abandoned and collapsed structure (Ord 2023-13).
Hazard Mitigation	Upgrade Poppy Lane facility for better public separation (Covid protocols), provide Tech 911 Backup Dispatch Answering Center project. (Res 2020-071 CARES funds).
Hazard Mitigation	Established CARES fund spending plan (Resolution 2020-047 CARES funds)
Hazard Mitigation	Economic Disaster Declaration for Upper Cook Inlet Fisheries (Resolution 2018-052)
Earthquake Response	Accepting grant funds for reimbursing worksheet costs for eight projects from 2020 earthquake (Ord 2020-19-31).
Fire Mitigation	Authorizes submittal of grant requests for three HMGP projects: Homer HS Ignition Resistant Roof Project, Bruno Rd Revetment and Drainage Improvement, SBCFSA Areawide Sedimentation Plan (Resolution 2019-057).
Landslide Mitigation	Recommend funding for collaborative research partnership (Arctic T-SLIP) for landslide generated tsunamis (Resolution 2023-50)
Fire Mitigation	Establish Slash Disposal Sites (Ordinance 2022-19-01)
Fire Mitigation	Replace CES Station 1 (Ord 2022-24)
Fire Mitigation	Volunteer Firefighter Campaign (File Number KPB-4297)
Fire Mitigation	Emergency harvest of SBB infested trees (KPB SBB Forest Management Project)
Fire Mitigation	Resolution commending Emergency Responders for Mitigating and Suppressing Wildfires on Kenai Peninsula (Commending Resolution 2305). 2019 Fire Season.
Flooding Mitigation	Funding three fish passage culvert projects (Ordinance 2022-19-03). Addresses erosion issues.
Flooding Mitigation	Amend KPB 21.06 Floodplain Management code (Ordinance 2021-17)
Flooding Mitigation	Accepted land donation to SBCFSA for conservation and mitigation (ResolutionKPB-4730, 2022-xx)

Category	Mitigation Actions
Flooding Mitigation	Replenish budget for emerging situations; fund Lost Creek/Sawmill Creek site maintenance (Budget Ordinance 2022-19-29)
Flooding Mitigation	Flood response funding for Seward area for local emergency disaster declaration October 2, 2020 (Budget Ordinance 2020-19-10)
Fire Mitigation	Requesting public land managers to take reasonable actions to prevent, limit, and mitigate wildfires (Resolution 2019-054).
Hazard Mitigation	Supplement audio-video capabilities for remote meetings from CARES Act funds (Resolution 2020-083). (One of many spending resolutions for these funds)
Flooding Mitigation	Authorizing acquisition of donated 20-acre parcel of floodplain land, on behalf of the SBCFSA (Resolution 2020-011)

Section 2.3 Implementation of Mitigation Strategies

Mitigation strategies are developed or continued to align with the goals and objectives outlined in the plan for each hazard. As funding becomes available, mitigation projects will be prioritized based on the following criteria:

- Protection of human life, public infrastructure, property, and historic area
- A positive benefit/cost review to assess cost-effectiveness and maximize benefits.
- Integration potential with scheduled maintenance, repairs, or capital improvements.
- Reduction or elimination of repetitive losses.
- Consistency with other plans, such as the KPB Comprehensive Plan and Emergency Operations Plan.
- Preservation or restoration of areas with high natural mitigation value, such as floodplains, wetlands, and riparian buffers.

Implementation of mitigation strategies will involve review by several key entities including the KPB Local Emergency Planning Committee (LEPC), the SBCFSA, the City of Seward Community Development Department, and the City of Seldovia Planning Department. Additionally, other Borough, City, State, and Federal entities recognized for their expertise may also contribute to this process. Community engagement and support will be vital for successful mitigation strategy implementation. For example, collaboration with the SBCFSA may enable the implementation of projects like levee maintenance or construction in Seward. Partnerships with fire management agencies might involve hosting fire crews in KPB facilities for preseason training, which could include maintenance of campgrounds or trails in Refuge, State, or National Forest areas.

The LEPC will play a proactive role in prioritizing projects and proposing implementation plans. Drawing on their diverse representation across the Borough and their understanding of various agencies and stakeholders, their recommendations will guide and strengthen mitigation efforts.

Section 2.4 Mitigation Project Prioritization & Action Plan

The prioritization of mitigation projects within the Mitigation Action Plan is a dynamic process influenced by various factors. Priorities can shift quickly due to changes in political administrations, funding availability, social dynamics, natural events, population fluctuations, and recent hazard occurrences. While a cost-benefit analysis is typically a key consideration,

there are situations where other factors outweigh this criterion. For instance, sudden changes in local demographics, such as the relocation of oil company employees after layoffs, or the abrupt closure of a major chemical plant, can swiftly alter project priorities.

The LEPC, KPB administration, and city governments of Seldovia and Seward carefully consider all these factors when prioritizing projects on an annual basis. Many projects are long-term initiatives completed in phases. Projects that can achieve multiple objectives often receive priority consideration. Availability of grant funding can also elevate the priority of certain projects. Additionally, recent hazard events may reveal vulnerabilities that necessitate immediate action, such as constructing or upgrading alternative evacuation routes following a wildfire.

Project prioritization can hinge on several factors, including:

- Populations at risk, including responders
- Hazard Probability
- Mitigation Feasibility
- Hazard History
- Funding
- Administration Priorities
- Forecasts (weather, population, economy, political)
- Phased Project
- Response Enhancement

Potential projects undergo a thorough review by multiple stakeholders including the City of Seward, City of Seldovia, KPB Administration, OEM, the LEPCs, Service Area Boards, and other key stakeholders. As necessary, projects are assessed and selected for inclusion in the annual budget cycle. The budget and proposed projects are then submitted to the KPB Assembly for consideration and approval. Upon approval, funding is allocated, contracts are awarded, and project implementation commences. Grant funded projects include additional oversight and requirements from state and federal grants administrators. Many require project milestones and additional requirements to maintain funding throughout the grant aware period.

The management and oversight of each project varies depending on its specifics and its location within the Borough. Oversight responsibilities may fall under the purview of the KPB Administration, City of Seward, or City of Seldovia local governments. Collaboration and partnerships occur routinely for major projects such as Seward area flood mitigation efforts led by the SBCFSA with support from ADNR or the Lowell Creek Diversion Tunnel Project led by USACE with support from the City of Seward.

Section 2.5 Mitigation Strategy Recommendations

The 2017 FEMA Risk MAP Report for the Borough compiled a list of areas of mitigation interest and recommended strategies for the City of Seward, City of Seldovia, and the unincorporated areas of the Borough. The Risk MAP Report identified specific projects and locations that warrant consideration. While the recommendations from the City of Seward, City of Seldovia, and KPB Hazard Mitigation Strategies may not be as detailed as those from FEMA, they are

intentionally broader. This approach allows for flexibility to address a wider range of potential projects that may evolve due to hazard events, economic changes, administrative shifts, development patterns, or population fluctuations.

FEMA's specific recommendations can be integrated within the broader strategies outlined in the Borough plan. Many of the strategies and statements remain relevant, and updates or changes over time are noted in the table below. Additionally, projects developed after the completion of the Risk MAP Report are included as examples of implemented mitigation strategies. Adjustments to these strategies will be incorporated into future updates, aligning with new FEMA Risk MAP Reports as they become available.

Table 4. City of Seldovia Mitigation Interest Areas

Hazard	Problem Statement	Recommended Strategy
Multi-Hazard	Compared to Alaska and the Nation, the Kenai Peninsula Borough has a higher percentage of residents living with a disability. In Seldovia, 25% of residents live with a disability. (2017 FEMA Risk Report)	• Know where vulnerable populations are located and assist with personal preparedness, appropriate evacuations and after-event repairs.
Earthquake	The City of Seldovia would experience loss ratios of 0.34% ($310K) and 5.15% ($4.6M) following the M7.1 event or M9.2 scenario, respectively. (2017 FEMA Risk Report) Additionally, 39.33% of the buildings were built with moderate building codes. Moderate building codes are regulations that ensure a balance between safety, sustainability, and affordability in construction, providing essential protections without imposing overly stringent requirements. They focus on maintaining reasonable standards for structural integrity, energy efficiency, and accessibility while considering the economic impact on builders and homeowners. (International Code Council 2021)	• Adopt and enforce updated building code provisions that reduce earthquake risk. • Develop a priority list for essential facility earthquake retrofits. • Develop an outreach program about earthquake risk and mitigation activities for homes, schools, and businesses.
Tsunami	In the City of Seldovia, 13.79% of improved parcels are within the tsunami zone, with an estimated value of $6.5M. (2017 FEMA Risk Report) Tsunami Inundation Maps Updated, future update for 2024 is planned to document and show updated data from local input. (2024 DGGS Mapping)	• Adopt and enforce building codes and design standards for tsunami-resistant design. • Limit new development in tsunami run-up areas. • Elevate or relocate critical infrastructure. • Provide education and outreach materials to educate residents showing risks and evacuation routes.

Table 5. City of Seward Mitigation Interest Areas

Hazard	Problem Statement	Recommended Strategy
Flood	There are 21 buildings in Zones A, AE, AH, and AO, and 4 buildings in Zone VE. The building dollar loss ratio for a 1-percent-annual-chance flood event totals roughly $1.9M, or a 9.66% loss ratio. (2017 FEMA Risk Report) The City of Seward and SBCFSA are currently developing updated Flood Insurance Rate Maps (FIRMs), which plan to become officially recognized in Fall 2024. (2023 FIRM & FIS Study)	• Consider limiting new development in flood hazard zones. • Prioritize enhancing flood capabilities for essential facilities. • Establish a buyout program for properties with repeated flood losses. • Educate homeowners and businesses about flood risks through outreach. • Implement floodplain management and train local staff accordingly.
Flood: Gravel and Sediment	Several million cubic yards of silt comes from glacial melting each year, resulting in increased flooding in multiple areas. This issue will only get worse as more silt builds up. Identified floodplains are based on historic flood levels and may not adequately account for changes associated with rising stream floors. There is limited developable land in Seward and much of what appears to be appropriate for development is at risk of flooding due to sediment issues and related channel migration. (2017 FEMA Risk Report) SBCFSA performs ongoing mitigation action projects in specific flood prone areas. Recent projects include: • Bruno road armoring- 1000' rip rap revetment along the east side of Kwechak Creek starting downstream of the Bruno bridge. • Box Cannon Creek revetment- 2000' revetment to replace berm along Box Cannon Creek • Lost Creek bridge relocation. • Scheffler Creek improvements in partnership with the City of Seward. (2024 SBCFSA Mitigation Plans)	• Develop a Sediment Management Plan. • Identify sources for directional maps that track sediment movement, implement effective sediment detection methods, and pinpoint suitable locations for sediment deposition. It is essential to reframe sediment removal as more than routine maintenance, underscoring its critical role in mitigating the exacerbation of flood events caused by sediment build-up. • Additionally, exploring opportunities for beach nourishment projects using extracted gravel can further enhance flood resilience efforts.
Earthquake	The City of Seward would experience loss ratios of 0.01% ($58K) and 3.04% ($17M) following the M7.1 event or M9.2 scenario, respectively. Additionally, 46.06% of the buildings in Seward were built with moderate building codes. (2017 FEMA Risk Report)	• Adopt and enforce updated building code provisions that reduce earthquake risk. • Develop a priority list for essential facility earthquake retrofits. Develop an outreach program about earthquake risk and mitigation activities for homes, schools, and businesses.
Tsunami	In the City of Seward, 13.14% of improved parcels are within the tsunami zone, with an estimated value of almost $62M. (2017 FEMA Risk Report)	• Adopt and enforce building codes and design standards for tsunami resistant construction. • Limit new development in tsunami run-up areas. • Elevate or relocate critical infrastructure. • Provide education and outreach materials to residents about risks and evacuation routes.

Hazard	Problem Statement	Recommended Strategy
Dam Failure	USACE completed a 2019 feasibility study and received funding in 2021 to update Lowell Point Flood Diversion System. Upgrades include a new 18-foot diameter tunnel and diversion dam upstream from the current tunnel. Planned engineering construction is for the next six years starting in 2024. (2019 Feasibility Study)	• Map dam failure inundation areas. Provide outreach to homeowners and business owners regarding risk. • Adopt higher regulatory floodplain standards in mapped dam failure inundation areas. • Establish early warning capability downstream of listed high-hazard-potential dams. • Traffic management and road improvements for Lowell Creek Road will be needed over the course of the 6-year construction period of the Lowell Creek Diversion Tunnel. Alternative means including boat ferry and taxi services may be needed in case of potential road closures during the completion and development of the diversion tunnel.
Levees	Numerous levees (many of which are essentially just gravel banks), constructed at different times in and around the city to protect different areas, are well beyond their original intended useful life and could be at risk of breaching. Salmon Creek revetment completed to include levee placement along problem flood areas near Alaska Railroad Corporation (ARRC) Milepost 5.2 through 5.7 (2021 ARRC)	• Conduct regular maintenance for drainage systems and flood control structures. • Map potential levee failure inundation areas. • Provide outreach to residents and businesses in levee failure inundation areas. • Work with landowners, businesses, and levee partners to gather information about levee stability and maintenance.

Table 6. KPB Mitigation Interest Areas

Hazard	Problem Statement	Recommended Strategy
Multi-Hazard	Compared to Alaska and the Nation, the Kenai Peninsula Borough has a higher percentage of residents living with a disability. Homeowners often lack the funds to take proactive steps to retrofit houses or take other steps to reduce risk. Tourism and dip netting at Kenai and Kasilof beaches during the summer creates evacuation challenges. Home buyers are not informed about relevant hazards at the point of sale. There is a need to transfer local environmental knowledge to the public. There is no central location for dissemination of environmental information on the Kenai Peninsula. There is a lack of knowledge among individuals about the best ways to site and develop responsibly. There is limited authority of the government regarding regulatory and enforcement issues; social norms generally resist government intervention into private property rights. While mitigation projects have been identified, funding is always a challenge. (2017 FEMA Risk Report) Recent KPB Mitigation grants included funding siren upgrades in coastal communities, development of 2022 CWPP and the 2024 HMP update. Clearing of SBB problem areas is an ongoing mitigation effort. 2024 cleared areas include Cooper Landing, Seldovia, and Kenai/Soldotna.	• Know where vulnerable populations are located and assist with personal preparedness, appropriate evacuations, and after-event repairs. • Update evacuation plans to include tourism impacts and to address instances of large gatherings of people. • Develop a central clearinghouse for Kenai Peninsula hazard data and information. Develop risk communication education materials for property owners, real estate agents, and others. • Work with FEMA and State partners to develop successful grant applications to fund mitigation projects.

Hazard	Problem Statement	Recommended Strategy
Flood	There are 79 buildings in Zones A, AE, AH, and AO, and 6 buildings in Zone VE. The building dollar loss ratio for a 1-percent-annual-chance flood event totals roughly $1.6M, or a 13.3% loss ratio. Additionally, of the 51 flood claims and 4 repetitive loss properties identified for the total project area, all were within the unincorporated areas of Kenai Peninsula Borough. (2017 FEMA Risk Report) FIRM project for Kenai River to Skilak Lake, Moose Pass, and Anchor Point Special Flood Hazard Areas (SFHAs) areas is ongoing with a planned completion and implementation of new floodplain maps in fall 2024. (2023 FIRM & FIS Study)	• Develop a priority list for essential facility flood capability enhancements. • Provide outreach to homeowners and business owners regarding flood risk, and the importance of permitting when developing. • Consider developing an animation of historic flood events, flood frequencies, and base flood elevation (BFE)+ scenarios. Continue to conduct routine assessments of bridges and identify those most at risk of severe flooding events. • ADOT conducts routine bridge assessments based on condition and need for replacement but does not determine risk of bridge to flooding. (2023 ADOT Bridge Inventory)
Earthquake	Unincorporated areas of Kenai Peninsula Borough, in total, would experience loss ratios of 0.15% and 2.91% following the M7.1 event or M9.2 scenario, respectively. Of these areas, Happy Valley would experience the greatest building damage from the M7.1 event, and Primrose would be most affected by the M9.2 scenario. Additionally, 14.7% of the buildings in the unincorporated areas were built with moderate building codes. Primrose has the highest percentage of moderately coded buildings at 40%.	• Develop a priority list for essential facility earthquake retrofits. • Develop an outreach program about earthquake risk and mitigation activities for homes, schools, and businesses.
Erosion	**Coastal Erosion Areas -Nikiski, Salamatof**: The erosion rate in Nikiski is 0.8 feet per year, with "hot spot" rates of 4 to 5.7 feet per year. From Nikiski to the Kenai River, the erosion rate is 2.2 feet per year, with "hot spot" (beaches that exhibit anomalously high erosion rates, relative to the surrounding beach) rates of 4 to 5.7 feet per year. **Clam Gulch, Cohoe, Kalifornsky:** The erosion rate from the Kenai River to the Kasilof River is 1.6 feet per year, with "hot spot" rates of 2.3 to 4 feet per year. From the Kasilof River to Ninilchik River, the erosion rate is 0.6 feet per year, with "hot spot" rates of 2.3 to 4 feet per year. **Anchor Point, Diamond Ridge, Happy Valley, Ninilchik:** The erosion rate from the Ninilchik River to the Stariski Creek is 0.6 feet per year, from the Stariski Creek to Anchor River the erosion rate is 1 foot per year, and from Anchor Point to Homer the erosion rate is 0.7 feet per year. (2007 USACE Erosion Study) Coastal Erosion Mapping is ongoing within the DGGS Coastal Hazards Program. Western Alaska coastal communities have been mapped with plans to develop future maps for Southcentral coastal communities including those in the KPB. (2024 DGGS Coastal Erosion Mapping)	• Local City governments work with the KPB and ADOT to determine areas in developed areas or on road networks most at risk of erosion. • Promote site and building design standards including foundation design and building placement. • Provide information on stabilizing erosion hazard areas with proper bank stabilization techniques and prevent vegetation removal. • Develop a buyout program for homes in high-risk areas. • Provide education and outreach materials to educate residents of risks and add erosion control methods.

Section 2.6 Mitigation Efforts Overview

While ensuring preparedness and response capabilities for hazard events is crucial, mitigation efforts play a significant role in reducing their impact, thereby lessening the necessity for

emergency response. Certain Borough functions and facilities, such as the solid waste facility, exemplify effective mitigation efforts by providing safe disposal of hazardous waste, thereby minimizing potential human-caused hazards like groundwater pollution. Maintaining well-equipped fire and emergency response capabilities is essential for mitigating wildland fires and preventing their spread to forested areas from structure fires.

Table 6 summarizes appropriations by the Borough Assembly from 2010 to 2023 for both response and mitigation efforts in the KPB. Equipping the 911 Communications Center with advanced technology and efficient software enables faster and more accurate dispatching of emergency services, further mitigating the impacts of hazard events.

The fiscal year 2023 budget provides greater details on mitigation and response spending.

Table 7. KPB Mitigation and Response Spending

Year	Mitigation ($)	Response ($)	Large Project Categories and Expenses
2010	$1,267,747	$2,404,097	Response - $1.5m Nikiski Fire Station 2 construction
2011	$10,551,514	$3,151,006	Mitigation - $8.998m Homer solid waste transfer facility
2012	$3,745,774	$7,470,494	Response - $3.976m Bear Creek Fire SA multi-use facility
2013	$6,641,619	$3,567,463	Mitigation - $3,472,619 leachate evaporator at landfill Response - $1.4m Bear Creek Fire SA station
2014	$1,870,000	$998,103	Mitigation - $1.37m school safety and security
2015	$3,330,987	$355,266	Mitigation - $1.16m for Salmon Creek flood risk management
2016	$380,000	$4,261,685	Response - $2.8m for emergency response vehicles
2017	$519,594	$1,219,841	Response - $491,000 Soldotna Pub Safety Communications Center remodel
2018	$345,306	$1,440,000	Mitigation- $350,000 Central Peninsula Landfill C and D Expansion
2019	$372,015	$4,472,903	Response - $3.2m for Nikiski Fire Station #3 construction funding
2020	$247,350	$1,590,000	Response - $900,000 land acquisition for Soldotna Fire Station #1 replacement
2021	$390,277	$1,415,235	Mitigation - $150,000 All Hazard Siren System Upgrades
2022	$444,625	$1,869,217	Response- $1m replacement funding for Soldotna Fire Station #1
2023	$296,442	$1,410,000	Response- $1.05m Fire Engine for Nikiski Fire Service Area and Tanker Replacement for Bear Creek Fire Service Area

(KPB Finance Department through December 30, 2023)

Section 2.7 Capability Assessment

The KPB, City of Seward, and City of Seldovia each utilize integrated regulatory tools to establish authority and oversight over various departments and functions in the plan development process. These tools encompass planning, administrative support, technical expertise, and staffing essential for ongoing hazard mitigation activities. Table 8 outlines the policies, programs, and resources employed by these entities and highlights their respective contributions. The table also highlights the opportunities that could help expand and improve the identified capabilities to achieve mitigation improvements in the future.

Table 8. KPB Capability Assessment

KPB – Capability Assessments – Planning and Regulatory		
Plans	**Yes/No**	**Comments and Expansion Opportunities**
Comprehensive Plan	Yes	Updated by adoption of KPB Ordinance 2019-25, KPB Comprehensive Plan.
Capital Improvements Program	Yes	Capital improvement projects are approved through the annual KPB budget process with a five-year outlook; may also be appropriated through assembly ordinance if timing does not align with the budget process, allowing hazard response. Approved Projects can be seen using the KPB budget page or through GIS viewer.
Economic Development Plan	Yes	Through Borough-funded Kenai Peninsula Economic Development District (KPEDD) 2021-2026
Local Emergency Operations Plan	Yes	Developed in 2004, Managed and updated by KPB Office of Emergency Management: KPB EOP Plan
Continuity of Operations Plan	Yes	COOP Plan approved in 2023, Managed and updated by KPB Office of Emergency Management.
Transportation Plan	Yes	Developed in 2003, Transportation Plan needs to be updated to a more comprehensive plan. Safe Streets for All Plan is a project currently being developed by the Borough with planned completion in 2025. 2003 Transportation Plan
Land Use Plans	Yes	Developed by or in cooperation with KPB Land Management Division, these include plans for specific Borough Lands: Land Use Plans
Stormwater Management Plan	Yes/No	Individual plans developed and maintained by cities within the Borough; no overall Borough plan
Community Wildfire Protection Plans	Yes	2022 CWPP encompasses all the KPB communities into a comprehensive plan including cities: 2022 CWPP
Building codes, permitting, inspections	**Yes/No**	**Comments and Expansion Opportunities**
Building Codes/Inspections	Partial	The cities within the borough have been delegated zoning powers by the KPB, the cities have adopted and enforce building codes; *KPB Code Chapter 21.18* Anadromous Waters Habitat Protection contains building restrictions; some portions of the Borough code place building setback restrictions on development; some development in the KPB is subject to International Building Code (IBC) under Alaska Administrative Code (13 AAC 50.020). Added building code requirements would require additional funding through federal or state funding resources. However, there is currently not enough public support in the borough for more restrictive building codes that could deter building development.
Land Use Planning and Ordinances	**Yes/No**	**Comments and Expansion Opportunities**
Hazardous Materials Reporting and Placarding	Yes	*KPB Code Chapter 10.20 Hazardous Materials and Reporting* requirements aid in mitigation from hazardous materials; organizations such as Cook Inlet Regional Citizens Advisory Council (CIRCAC), and private industry plans/training further aid in mitigation. ADEC plays a fundamental role in HazMat regulation.

Conditional Land Use Permits	Yes	Required for Correctional Community Residential Centers (CCRCs), material sites and Concentrated Animal Feeding Operations (CAFOs) by *KPB Code Chapter 21.25 Conditional Land Use Permits*; administered and enforced by KPB Planning Department.
Subdivision Ordinance	Yes	Administered by the KPB Planning Department under KPB Title 20 -Subdivisions; major code update in 2014, minor updates as needed.
Floodplain Ordinance	Yes	Administered by KPB Planning Department River Center under KPB Code Chapter 21.06 Floodplain Management
Natural Hazard Specific Ordinance	Partial	Some of the cities have codified specific restrictions such as for development on steep slopes; the KPB subdivision code (Title 20) restricts design or development in some areas, such as near water bodies or on steep slopes, thereby providing hazard mitigation
Flood Insurance Rate Maps	Yes	Adopted and administered in association with Floodplain Management by the KPB, providing effective hazard mitigation. These are being updated in Summer 2024 for the Kenai River, SBCFA, Anchor Point and Moose Pass watershed areas.
KPB – Capability Assessments – Administrative and Technical		
Administration	**Yes/No**	**Comments and Expansion Opportunities**
Assembly	Yes	A 9-member elected government under Code of Ordinances Chapter 4.10 General Provisions
Planning Commission	Yes	A 13-member commission appointed by the mayor and confirmed by the Assembly, responsibilities include application of many Borough codes, development of plans, and recommendations to the Assembly
Plat Committee	Yes	A 5-member sub-committee of the Planning Commission tasked with reviewing and approving the large number of subdivision proposals in the Borough.
Advisory Planning Commission (APC)	Yes	Provide residents with an additional avenue to participate in land use planning activities proposed for their community; provides recommendations to the Kenai Peninsula Borough Planning Commission and to the Assembly, when requested by majority vote of the Assembly, on land use planning and public land management issues which may affect the existing and/or future character of the community. Current active APCs in 2024 include Cooper Landing, Hope/Sunrise, Funny River, Moose Pass, and Nikiski.
Hazard Mitigation Plan Update Planning Team	Yes	A temporary planning team that is tasked with designing and reviewing the update procedure and progress; following review, the plan is to have the team meet annually to prepare for migration towards future MJHMP.
Local Emergency Planning Committee (LEPC)	Yes	A committee including representatives from various government agencies, emergency service providers, local industry and health care services tasked with preparing and reviewing emergency response plans for the KPB LEPD.
Mutual Aid Agreements	Yes	Numerous agreements are maintained by KPB OEM
Maintenance Programs to Reduce Risk	Yes	The KPB Spruce Bark Beetle program for 2024 is currently working in areas in Cooper Landing, Seldovia and areas around Kenai/Soldotna to mitigate fire danger with tree removal and clearing; SBCFSA works to mitigate flooding issues in the Seward area; individual cities administer local programs such as waterfront improvement projects done by City of Seward.
All Lands All Hands Interagency Group	Yes	An interagency group of private, local, state and federal entities that have completed joint mitigations projects to reduce hazardous fuel loads since 2004. The group came together in 2022 to help support the development of the CWPP. ALAH Action Plan updated in 2023.
Staff	**Yes/No**	**Comments and Expansion Opportunities**
Chief Building Official	Partial	The KPB does not have this position; the individual cities do. Some duties applicable to this position are undertaken by staff in the KPB Purchasing and Contracting Department as well as the Assessing Department. The Fire Marshalls for each service area in the KPB assume responsibility where applicable. If restrictive building codes are eventually adopted by the KPB, there will be a need to fund and staff a Building Officer position at the Borough level.

Floodplain Administrator	Yes	Full-time position through KPB Planning Department at River Center
Emergency Manager	Yes	Full-time position in charge of KPB OEM
Community Planner	Yes	Full-time position in KPB Planning Department
Civil Engineer	No	Engineering services are contracted out as needed. Funding and staffing such a position could help improve the overview of construction and development within the borough, versus relying on contracted engineering consultants performing these duties.
GIS Coordinator	Yes	Full-time position in charge of the GIS Division within Planning Department
Public Information Officer	Yes	A representative within the Administrative Office assumes these duties.
Technical Support	Yes	The KPB has full time Information Technology (IT) and database support staff
Grant writing	Yes	Full-time Community & Fiscal Projects Manager is funded through the KPB Administrative Mayors Office
Hazus analysis	Yes	KPB GIS personnel are trained to utilize hazard analysis programs. FEMA provides models for use in maps when available, most recently for updated FIRMs.
KPB – Capability Assessments – Financial		
Funding Resources	**Access/ Eligibility**	**Comments and Expansion Opportunities**
Capital improvements project funding	Yes	Included in annual KPB budget with a five-year outlook.
Authority to levy taxes for specific purposes	Yes	Requires voter approval. More input would be needed from the public to implement any taxes in the future.
Fees for water, sewer, gas or electric services	No	While the City of Seldovia and City of Seward charge for these services, the Borough does not. The fees are determined by the public works departments for each City Government.
Impact fees for new development	No	Further input is required from the KPB Administration and would require public input before these fees could be instituted. May not have general public support at this time.
Storm water utility fee	No	Utility oversight and costs are part of City of Seldovia and City of Seward public works departments' procedures. Fees are determined by the local utility and may include additional storm water utility fees as part of monthly billing.
Incur debt through general obligation bonds and/or special tax bonds	Yes	Requires voter approval. More input would be needed from the public to evaluate implementation of any taxes in the future.
Incur debt through private activities	No	This is currently not something the KPB wishes to pursue and there are no plans to pursue this in the near future.
Federal funding	Yes	Including BRIC, USACE Planning Assistance to States (PAS) 205 program, US Economic Development Disaster Fund program, NOAA tsunami program, FEMA Hazard Mitigation grant program, FEMA pre disaster assistance program, FEMA Flood Mitigation Assistance grant program, US Homeland Security Grant program, USFA grants, assistance to Fire Fighters grant program, USDOT grant program, and Coastal Impact Assistance Program (CIAP) grant program.
State funding	Yes	State Transportation Improvement Program (STIP), State capital budget funding, State Dept of Military and Veterans Affairs Division of Homeland Security grant program, State DNR Division of Forestry grant program, State Commerce, Community and Economic Development grant program, Southern Region EMS council grant program. Community Development Block Grant, the 2024 KPB HMP Update was funded in part through the State of Alaska Department of Commerce, Community, and Economic Development Division of Community and Regional Affairs (DCCED), Community Development Block Grant - Disaster Recovery (CDBG-DR).

Private, non-profit or corporate support	Yes	Including Conoco Philips, Lowell Point Community Council, Hilcorp Alaska LLC, Moose Pass Volunteer Fire Company, Marathon and additional oil and gas support service companies.
KPB – Capability Assessments – Education and Outreach		
Program/Organization	**Yes/No**	**Comments and Expansion Opportunities**
Local citizen groups or non-profit organizations	Yes	Includes LEPC, APCs, American Red Cross, numerous local faith- based groups, Civil Air Patrol, local community Facebook pages, local Senior Centers, local food banks.
Ongoing public education or information programs	Yes	KPB OEM web site, KPB Alerts Facebook page, Ready Set Go!, Know Your Zones Program, KPBSD Educational Outreach.
Natural disaster or safety related school programs	Yes	KPBSD adopted the ALICE protocols, provides 'KPBSD Emergency Guidelines for Parents and Guardians', schools participate in numerous emergency drills throughout the school year, the district maintains and updates an Emergency Action Plan (EAP).
StormReady certification	Partial	The cities of Homer and Seward participate in the program; the KPB does not.
Firewise Communities certification	No	Through the Spruce Bark Beetle Program (Ordinance 2000-50) the KPB sponsored a State Forestry Firewise program for Borough residents. SBB eradication is currently being funded through USFS as a mitigation action developed from the CWPP.
Warning Systems	Yes	Includes KPB Alerts; KPB Facebook page; NOAA weather stations (partner with NWS); stream gages (partner with USGS); KPB participates in the Emergency Alert System (EAS); new warning sirens installed in 2023.
Public-private partnership initiatives addressing disaster – related issues	Yes	Including CIRCAC, Project Impact.
Hazard data and information	Yes	OEM, GIS, Planning and River Center monitor and utilize hazard data

Table 9. City of Seward/SBCFSA Capability Assessment

City of Seward – Capability Assessments - Planning and Regulatory		
Plans	**Yes/No**	**Comments and Expansion Opportunities**
Comprehensive Plan	Yes	Explains the Seward's land use initiatives and natural hazard impacts: 2017 Comprehensive Plan Vol I & Vol II
Land Use Plan	Yes	2023 Municipal Lands and Inventory Management Plan, explains Seward's land use goals and initiatives. Also, a function of Planning and Zoning Commission
Emergency Response Plan	Yes	City of Seward Emergency Operations Plan: City of Seward EOP
Wildland Fire Protection Plan	Yes	City is included in 2022 KPB CWPP Plan
Building codes, zoning ordinances, minimal subdivision code, special purpose ordinances or regulations	Yes	2014 Municipal Lands Plan The City exercises this authority: 2017 Comprehensive Plan
City of Seward – Capability Assessments - Administrative and Technical		
Staff	**Yes/No**	**Comments and Expansion Opportunities**
Community Planner	Yes	Seward City Planner.
Community Development Staff	Yes	This office has four staff members and is currently fully staffed. Positions include a Planning Director, Planner, Executive Planning Assistant and GIS Technician.
Floodplain Manager	No	The City does not currently have a certified floodplain manager on staff. The Office of Community Development oversees the Floodplain Development Permit process for the City. There is support from the SBCFSA staff when reviewing requirements and permits for construction in floodplain areas.

Emergency Manager	Yes	The City Manager serves in this role.
Finance (Grant writers)	No	The City does not have a dedicated position for grant writing. If the City were to apply and/or receive a grant, the grant writing would be done by the individual department staff and the Finance Department would provide support on the logistical end of the process. There is a need for ongoing support through grant funding or other funding opportunities to fund a full-time grant writer for the City of Seward.
Public Information Officer (PIO)	Yes	The City does not have an assigned PIO. In the event one is needed, that responsibility is typically carried out by either the City Clerk's Office or City Manager's Office.

(Financial & Education/Outreach overlap with KPB Table)

Table 10. City of Seldovia Capability Assessment

City of Seldovia – Capability Assessments - Planning and Regulatory		
Plans	**Yes/No**	**Comments and Expansion Opportunities**
Comprehensive Plan	Yes	A 2021 review of the plan was completed with additional information provided: 2021 Review Update of 2014 Comprehensive Plan
Land Use Plan	Yes	Seldovia has a plan that outlines land use goals and initiatives. 2023 Land Use Plan
Emergency Response Plan	Yes	City of Seldovia Emergency Operations Plan
Wildland Fire Protection Plan	Yes	The City is included in the 2022 KPB CWPP Plan
Building code, Zoning ordinances, Subdivision, special purpose ordinances or regulations	Yes	Included under planning and zoning, updated applications have been developed for permitting related to building development: Forms and Publications
City of Seldovia – Capability Assessments - Administrative and Technical		
Staff	**Yes/No**	**Comments and Expansion Opportunities**
Community Planner	Yes	The City Administration has staff with knowledge of land development and land management practices and an understanding of natural and/or human-caused hazards. There is a need for a fully staffed position to fulfil these duties on a regular basis if grant funding or funding opportunities become available.
Community Development Staff	Yes	The City Community Planner and staff can provide information related to community infrastructure.
Floodplain Manager	Yes	Managed through the Kenai Peninsula Borough River Center.
Emergency Manager	Yes	Heidi Geagel – City Manager
Finance (Grant writers)	No	Jan Yaeger- (Finance Officer), The finance officer currently fulfills this role. However, if available the City of Seldovia would like to get grant writing support. This could be accomplished through mitigation funding available
Public Information Officer	Yes	Liz Diament- (City Clerk)

(Financial & Education/Outreach overlap with KPB Table)

Section 2.8 NFIP Compliance

The KPB River Center oversees NFIP compliance through a focused approach that includes enforcing regulations, educating the public, and coordinating with stakeholders across the

Borough. Additionally, the River Center supports the City of Seward and SBCFSA in meeting NFIP compliance requirements.

SBCFSA is responsible for assessing flood planning needs and facilitating flood hazard reduction measures. They collaborate closely with the City of Seward, Borough departments, and various state and federal agencies to achieve watershed-wide goals.

Section 2.8.1 Seldovia NFIP Participation

While the City of Seldovia is not currently participating in the NFIP, it is working to join the program as part of its mitigation goals outlined in this Plan Update. The KPB River Center supports floodplain management efforts in Seldovia and would offer ongoing support if the City were to be included in NFIP.

Section 2.8.2 KPB River Center

The KPB River Center ensures that local floodplain management ordinances align with NFIP standards. This includes adopting and enforcing building codes and land use regulations that mitigate flood risks and fish habitat protections (KPB Code 21.18 and 21.06). The River Center reviews all development proposals within flood-prone areas to ensure that new construction and substantial improvements comply with elevation requirements, structural standards, and other floodplain regulations. The River Center permits include KPB Habitat, Floodplain, Conditional Use and Floodway Development permits. The KPB Multi-Agency Permit Application encompasses most of these permit requirements into one form.

The River Center plays a critical role in floodplain management by reviewing, adopting and disseminating the latest effective Flood Insurance Rate Maps (FIRMs) provided by FEMA. These maps are essential for identifying Special Flood Hazard Area (SFHAs) and guiding development decisions. Residents, developers, and planners have access to these FIRMs through the center, enabling informed choices regarding flood risks.

Following flood events, the River Center conducts damage assessments to evaluate structural impacts. Structures requiring repairs or improvements exceeding 25 percent of their pre-damage market value must adhere to current floodplain management regulations. The River Center ensures that buildings meeting substantial improvement or damage criteria are retrofitted, elevated, or modified to meet NFIP standards.

The River Center also conducts outreach through educational programs aimed at raising awareness about flood risks, flood insurance, and NFIP regulations. Targeting residents, developers, and community stakeholders, these programs utilize brochures, workshops, and online resources to promote best practices for construction in floodplains and compliance with NFIP standards.

Furthermore, the River Center facilitates coordination with federal, state, and local agencies to implement and update floodplain management practices. This includes collaborating with FEMA to adopt new FIRMs and NFIP regulations. The center provides technical assistance to property

owners and developers to ensure understanding and compliance with floodplain management requirements, while monitoring NFIP compliance to maintain transparency and accountability.

Section 2.8.3 City of Seward and SBCFSA

The City of Seward collaborates with SBCFSA and the KPB River Center to oversee NFIP requirements. This role involves reviewing and approving development permits in flood-prone areas, coordinating with federal, state, and local agencies to ensure unified floodplain management efforts, and conducting community outreach to enhance awareness of flood risks and NFIP compliance.

Major development projects within the City of Seward and SBCFSA falls under federal regulations and the City's floodplain management requirements. City ordinances mandate that a permit must be obtained from the City Building Department prior to any construction, alteration, re-grading, or filling that may occur on a property. The permit application process is overseen by the Community Development Department.

The City of Seward has incorporated floodplain management criteria into its municipal code (Code of Ordinances 15.25 Floodplain Management). This involves establishing regulations that mandate the elevation of structures in flood-prone areas, the use of flood-resistant materials, and the implementation of other flood mitigation measures. Additionally, zoning laws are enforced to restrict certain types of development in SFHAs to reduce flood risks.

The City of Seward plans to adopt the most current FIRMs provided by FEMA to ensure accurate risk assessment. By utilizing the latest data to identify SFHAs and guide development and land-use planning, the city ensures that current FIRMs are available to the public to inform residents, developers, and planners about flood risks. The current updated FIRM maps for the City of Seward and SBCFSA are scheduled to be approved and adopted in 2024.

The City of Seward ensures strict enforcement of floodplain management regulations through its Floodplain Development Program. This involves reviewing all development proposals within SFHAs to ensure compliance with NFIP standards, verifying that structures meet elevation and flood-proofing requirements, and conducting on-site inspections during and after construction to ensure adherence to approved plans and NFIP regulations. Non-compliant developments are addressed through enforcement actions that could include removal of structures at owners' expense.

Following flood events, Building Department staff conduct damage assessments to determine if repairs or improvements exceed 25 percent of the building's pre-damage market value, qualifying as substantial. Structures meeting this criterion must adhere to current floodplain management regulations. Requirements may include raising structures to or above the base flood elevation, implementing floodproofing measures, or, in some cases, relocating or demolishing structures to mitigate flood risks.

Public education initiatives are primarily led by SBCFSA with support from the KPB OEM. Outreach activities encompass participation in local fairs, events, community meetings, and schools to educate the public about flood preparedness and mitigation strategies.

Section 2.8.4 NFIP Repetitive Loss Properties

The NFIP defines Repetitive Loss Properties (RLPs) as properties that have experienced two or more claims exceeding $1,000 each within any rolling ten-year period since 1978. Identifying and analyzing these properties are crucial steps in hazard mitigation planning. Mitigation strategies for RLPs may involve structural measures like building elevation or relocation, improving drainage systems, or installing flood barriers. Non-structural measures could include stricter zoning laws, public education campaigns, and enhanced emergency response plans.

By focusing on RLPs, the KPB can prioritize high-risk areas, efficiently allocate resources, and pursue grant opportunities available through NFIP, FEMA, and other agencies dedicated to reducing flood risks. Implementing tailored mitigation actions not only reduces future flood damage but also lowers insurance premiums for property owners and reduces the overall burden on the NFIP.

KPB has utilized grant funding from the USDA / Natural Resource Conservation Service (NRCS) Emergency Watershed Protection (EWP) program to purchase flood-prone properties, such as those in the Old Mill Subdivision near Seward in 2011. These properties are now under government authority with protective non-development covenants in place. This approach not only alleviates long-term economic and emotional impacts on residents but also initiates flood mitigation measures to prevent flooding in adjacent properties.

According to the State of Alaska NFIP Coordinator, and River Center staff there are currently no repetitive loss properties listed within the City of Seward. The only two repetitive loss properties are located outside the city limits in the SBCFSA. Most RLPs have been mitigated using grants and have been removed from FEMA's inventory database. Although the City of Seldovia does not currently participate in the NFIP program, it has plans to join the program in the future as part of its mitigation goals outlined in this Plan Update. The following tables provide detailed information regarding current RLPs in the KPB, the City of Seward, and the SBCFSA.

Table 11. NFIP Data: City of Seward

Category	Date	Category	Date
Date joined NFIP:	11/20/1986	Number of policies in force as of 5/29/2024	13
CRS class / discount:	10 / 0%	Insurance in force as of 4/30/2024	$5,472,000
CAV date:	08/24/2016	Number of claims 1/1978 to 2/7/2024	2
CAC date:	06/18/2010	Total claims paid 1/1978 to 2/7/2024	1
Date of current FIRM:	10/20/2016	Total claim payments 1/1978 to 2/7/2024	$40,342

Table 12. NFIP Data: Kenai Peninsula Borough

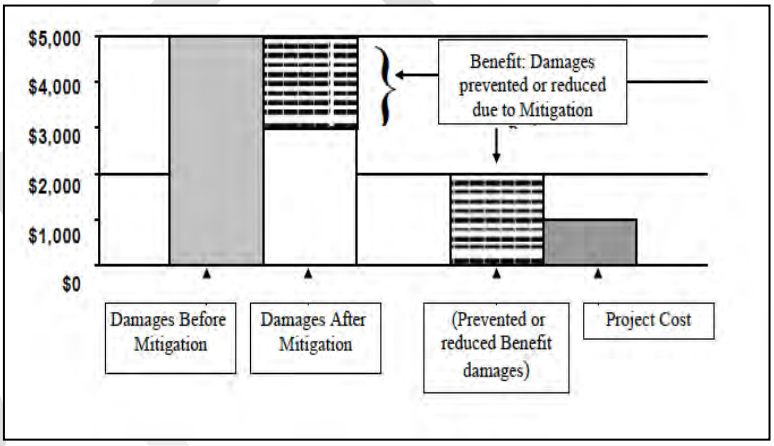
Category	Date	Category	Date
Date joined NFIP:	11/20/1986	Number of policies in force as of 5/29/2024	168
CRS class / discount:	10 / 0%	Insurance in force as of 4/30/2024	$8,866,000

Category	Date	Category	Date
CAV date:	08/24/2022	Number of claims 1/1978 to 2/7/2024	2
CAC date:	10/09/2003	Total claims paid 1/1978 to 2/7/2024	1
Date of current FIRM:	10/20/2016	Total claim payments 1/1978 to 1/31/2018	$40,342

SBCFSA Community Identification Number (CID): 020012

Section 2.9 Benefit-Cost Analysis

FEMA utilizes Benefit-Cost Analysis (BCA) to assess the cost-effectiveness of proposed mitigation projects. This process quantifies the expected benefits of a project—such as reduced property damage, prevention of injuries and fatalities, and minimized economic disruption—relative to its implementation costs. By assigning monetary values to both tangible and intangible benefits, including environmental protections and enhanced community resilience, BCA offers a structured framework for decision-making within the Borough.



Example of comparative benefit and cost data after benefit-cost analysis has occurred (FEMA)

FEMA funds hazard mitigation projects aimed at reducing future damages, losses, casualties, and other impacts from disasters. Examples include elevating buildings in flood-prone areas and retrofitting structures in earthquake zones. A crucial eligibility criterion for funding is that projects must demonstrate cost-effectiveness: if projected benefits exceed costs, the project is deemed viable for funding through grants and submissions in the event of a declared disaster.

Section 3 Planning Process

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

Section 3.1 Overview and Methodology

This HMP update started in 2023 using grant funding provided through the State of Alaska Department of Commerce, Community, and Economic Development Division of Community and Regional Affairs (DCCED), Community Development Block Grant - Disaster Recovery (CDBG-DR). This HMP update is administered through the KPB Office of Emergency Management (OEM) and includes a core planning team with individuals from OEM, the KPB Planning Department, and personnel from the City of Seward, the SBCFSA, and the City of Seldovia. State and federal agencies, along with the LEPC, community members and APCs also provided updated information. The team contacted tribal entities and unique communities in the Borough for comments and suggestions. Stakeholder input played a crucial role in the development of the draft and final Plan update.

After the Notice to Proceed was issued in January 2024, an initial kick-off meeting with the plan consultant, Kuna Engineering, was conducted in February 2024. A follow-up meeting in February with the State DHSEM and FEMA led to discussion on future movement towards a full multi-jurisdictional hazard mitigation plan (MJHMP) for the Borough. The expired City of Seldovia HMP (2018) was discussed and planning team staff reached out to the Seldovia City Manager for input on being a part of the Plan Update. The City of Seldovia officially joined the planning and development process at the end of February 2024. Discussions with FEMA and the State DHS&EM also included the integration of the concerns, goals and projects of the SBCFSA into the Plan update cycle. The SBCFSA developed its own HMP in 2013 and was later incorporated as part of the 2020 City of Seward HMP update. The City of Seward was incorporated into the KPB Plan update process in February (2024), after recognizing that their standalone plan expires in January 2025.

Other municipal city governments as well as State and federal agencies, community members and APCs were consulted for updated information. Tribal entities and unique communities in the borough were contacted for comments and suggestions for the HMP Update. Stakeholder input played a crucial role in the development of the draft and final Plan update.

Section 3.2 Planning Team

The Core KPB HMP update Planning Team consisted of the following individuals:

- Brenda Ahlberg, Emergency Manager, KPB Office of Emergency Management
- Mary Toll, HMP Update Project Manager, KPB Office of Emergency Management
- Celina Robinson, GIS Coordinator, KPB Planning Department

- Robert Ruffner, Planning Director, KPB Planning Department
- Julie Hindman, Floodplain Administrator, KPB River Center
- Adeena Wilcox, Borough Assessor, KPB Assessing Department
- Samantha Lopez, River Center Manager, KPB River Center
- Nick Chapman, Service Area Program Manager, SBCFSA
- Heather Cinereski, Administrative Assistant, SBCFSA
- Clinton Crites, Fire Chief, City of Seward Fire Department
- Daniel Meuninck, Community Planner, City of Seward Community Development
- Jason Bickling, Deputy City Manager, City of Seward
- Liz Diament, City Clerk, City of Seldovia
- Heidi Geagel, City Manager, City of Seldovia
- Joe Rolfzen, Project Consultant, Kuna Engineering

Many additional individuals contributed with maps, data searches, advice, suggestions, and personal knowledge. The update would not have been possible without their help and input. New data and information were added to the plan where relevant, existing data and information was reinforced with expert knowledge where relevant. Data contributors to the 2024 update include:

- Alaska DCCED – Harmony Curtis, CFM, Alaska NFIP Coordinator
- FEMA – Scott Van Hoff, Regional Flood Insurance Liaison
- FEMA – Kristin Minich, Regional Support Liaison
- FEMA – Jennifer Adleman, Community Planner
- DHSEM- John Andrews, Hazard Mitigation Plan Manager
- United State Geological Survey (USGS) – Jeff Conaway, Alaska Science Center, Associate Center Director
- Kenai Watershed Forum – Benjamin Meyer, Water Quality Coordinator
- ADOT&PF, Bridge Design – Julie Tibor, P.E. Bridge Management Engineer
- ADOT&PF, Public Facilities – Eric Hershey, P.E., Projects Engineer
- ADOT&PF M&O – Sean Montgomery, Kenai Peninsula District Superintendent
- ADOT&PF Statewide Aviation – Rebecca (Raul) Douglas, C.M. Aviation System Planner
- FAA Alaskan Region Airports Katrina C. Moss, AICP, PMP, Lead Community Planner
- Alaska Division of Insurance – Michael Ricker, Property & Casualty Actuary
- Alaska Volcano Observatory – Tom Parker, Volcano Seismologist
- Alaska Earthquake Center – Dmitry Nicolsky, Tsunami Modeler
- Alaska Earthquake Center – Lea Gardine, Outreach Coordinator
- Alaska Department of Environmental Conservation (ADEC) – Young Ha, Cook Inlet/Kodiak
- David Hamre and Associates, LLC (DHA) Avalanche Safety-David Hamre, Project Supervisor
- City of Seward – Tony Sieminski, Seward Harbormaster
- City of Seldovia – Jesseca "Jos" Lowdermilk, Seldovia Harbormaster
- State of Alaska Division of Geological and Geophysical Surveys (DGGS) – J. Barrett Salisbury, Ph.D., Geologic Hazards Geologist

- DGGS – De Anne Stevens, Chief, Engineering Geology Section
- DGGS – Mike Hendricks, GIC / GIS Section Chief
- Alaska Avalanche Information Center – Sarah Carter, Education Director
- Kenai Watershed Forum – Brandon Drzazgowski, Stream Watch Coordinator
- KPB Planning Department – Bobbi Lay, GIS Specialist
- KPB Planning Department – Morgan Aldridge, Planner
- KPB Planning Department – Ryan Raidmae, Planner
- State of Alaska Division of Geological and Geophysical Surveys DGGS – Nora Nieminski, Coastal Hazards Program
- KPB Emergency Services – Paul McBride, Emergency Preparedness
- KPB Emergency Services – Tim Weekly, Emergency Preparedness
- City of Seward – Courtney Bringhurst, City Planner
- City of Seward – Clara Brown, Executive Planning Assistant
- City of Seward – Doug Schoessler, Public Works Director

The inclusion of the cities of Seward and Seldovia in this update is a precursor to a fully multi-jurisdictional update that will occur in the next update cycle. The future fully inclusive multi-jurisdictional plan will include the cities of Homer, Soldotna, Kenai and Kachemak City. The KPB intends to make the HMP fully multi-jurisdictional in the next update cycle. The Cities of Seward and Seldovia will be signatory to the current plan update as well as being included as local jurisdictions in this HMP update. In the past, the HMPs for the cities of Homer, Soldotna, and Kenai were included as annexes to the KPB plan. Because the plans for these cities have been developed separately from the KPB HMP update they are no longer listed as annexes in supporting documentation or submittal information to FEMA and DHS&EM. This will maintain clear timelines for when each entity's HMP updates are taking place, which are separate from the Borough HMP.

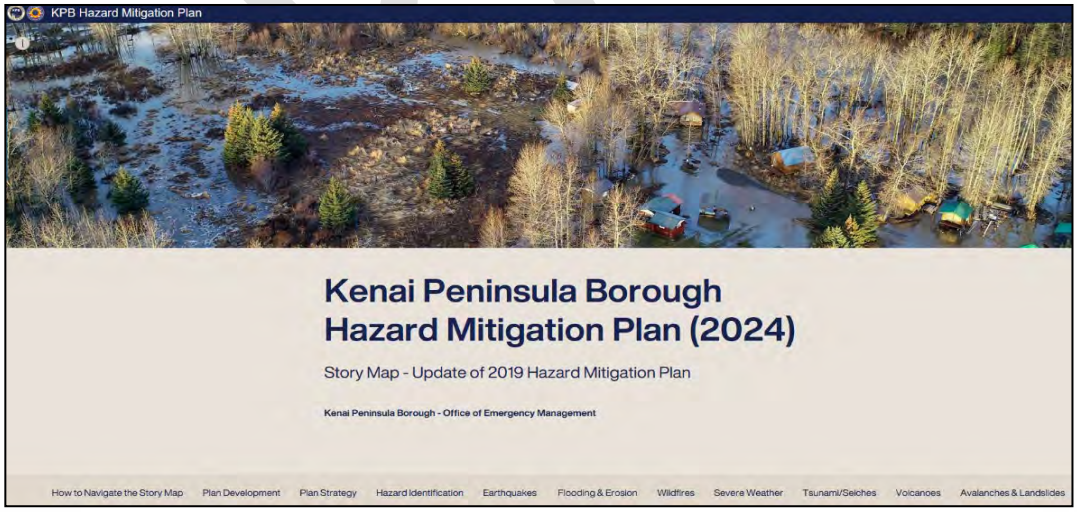
The planning process consists of the following steps:

1. Review of the existing plan document for needed changes, revisions or updates;
2. Solicitation of public involvement;
3. Communication with agencies and organizations within the borough;
4. Coordination with the incorporated borough cities, and DHS&EM during the development of their associated hazard mitigation plans;
5. Assessment and inventory of borough-wide hazards;
6. Review of existing mitigation activities;
7. Formulation of mitigation strategies and implementation ideas;
8. Development of the draft HMP update;
9. Issuance of the draft HMP update for public review and comments;
10. Preparation of the final HMP update, incorporating any public comments;
11. Adoption of the HMP update by the signatory communities (City of Seldovia, City of Seward and the KPB); and
12. Establishment of a schedule for maintaining and updating the HMP.

Section 3.3 Public Involvement

The public participation process for the Hazard Mitigation Plan update ensured comprehensive community involvement and input throughout the Plan's development. This process included a series of public APC meetings and outreach events such as the Kenai River Fair where community members could voice their concerns, share local knowledge, fill out a short survey and provide feedback on proposed mitigation strategies. The planning team actively engaged with a broad range of stakeholders, including agency representatives, and residents of the Borough, City of Seldovia, and the City of Seward. Also included in outreach efforts were representatives from non-profit community organizations, many of which represent under-served communities and populations, and federal and state partnership organizations such as the Chugach National Forest Avalanche Information Center (CNFAIC).

In addition to traditional public input methods including in-person meetings, telephone outreach, flyer postings at public community sites, announcements were also made on social media and web sites for the KPB, City of Seldovia and City of Seward. The KPB developed an ArcGIS Story Map (online web content) and hub site to disseminate interactive information to the public and provide them with an avenue to give input on the Plan update. The story map presents the HMP in a web layout with accompanying web maps and includes a project schedule and a general overview of each of the hazards reviewed in the plan. In addition to providing the opportunity for information sharing, the story map and hub site also provides the Borough with a platform that can readily be updated to show changes or updates to the HMP over time. The KPB HMP draft will be shared on the Borough's website and the KPB HMP Hub Site and will allow for a 30-day public comment period.



2024 KPB HMP Update Story Map website

Surveys were distributed to gather additional input and identify specific areas of concern at public APC meetings, community meetings, planning meetings, and local fairs; the surveys were also available online. Public notices and updates were regularly shared through social media and

local community resource platforms to keep the community informed and encourage ongoing participation. This inclusive approach ensured that the Plan content was reflective of the community's needs and priorities, fostering a sense of ownership and support for the proposed mitigation actions.

A breakdown in the solicitation of public input in various ways includes:

- Online Community Hazard Awareness and Mitigation Survey
- Paper surveys provided at APC meetings and in-person public events
- Comment cards were provided at public meetings and outreach events
- Review opportunities for the Draft Hazard Mitigation Plan was made available both on the KPB OEM website and Hazard Mitigation Plan Hub Site

The aspects and components of the planning and public outreach process, including maps, questionnaires, community survey results and public comments are available in the Planning and Public Outreach Appendix (Appendix B). Table 12 shows the scheduled outreach events, their dates and locations. Notices for these events were included on the Hazard Mitigation Plan hub site and Story Maps page.

Seldovia Community Meeting and Outreach Material, May 2, 2024.

Table 13. KPB HMP Plan Update Public Meeting and Outreach Schedule

Date	Location	Planning or Public Outreach Activity
April 15, 2024	Seward	Seward/Bear Creek Flood Service Area Board Meeting
May 1, 2024	Seldovia	Seldovia Community Meeting
May 8, 2024	Cooper Landing	Cooper Landing APC Meeting
May 8, 2024	Hope/Sunrise	Hope/Sunrise APC Meeting
May 9, 2024	Nikiski	Nikiski APC Meeting
May 15, 2024	Anchor Point	Anchor Point Community Meeting
May 18, 2024	Funny River	Funny River Community Annual Meeting
May 21, 2024	Seward	Seward Planning and Zoning Commission Meeting
June 6, 2024	Moose Pass	Moose Pass APC Meeting
June 8, 2024	Soldotna	Kenai River Fair
June 24, 2024	Kenai	Kenai Peninsula Borough Planning Commission Meeting

Section 3.4 Coordination with Other Agencies and Stakeholders

3.4.1 State and Federal Agencies

The KPB Planning Team worked closely with the State of Alaska Department of Homeland Security and Emergency Management (DHS&EM) and FEMA staff in the development of this update. This included multiple meetings during the plan development process in February, May and June. An in-person meeting and plan update session with the FEMA Community Planner was held at the KPB OEM office on June 10, 2024.

Additional state and federal agencies were solicited for feedback on the KPB HMP update. Individuals and their respective agencies that provided feedback and plan input are included in the planning team data contributors section above. Table 13 provides a list of agencies consulted for local Alaskan knowledge and information on hazard risks in the state.

Table 14. Federal, State and Local Agencies part of Outreach Efforts

Organization	Subdivision/Region/Group
University of Alaska Fairbanks (UAF), Geophysical Institute (GI), Alaska Earthquake Information Center	Scenarios Network for Alaska & Arctic Planning
Kenai Watershed Forum (KWF)	
FEMA	Region 10 Office - Alaska
Alaska Department of Environmental Conservation (ADEC)	Solid Waste, Contaminated Sites Programs
Alaska Department of Transportation and Public Facilities (ADOT&PF)	Central Region
Alaska Department of Community, Commerce, and Economic Development (DCCED)	Community and Regional Affairs Office
Division of Homeland Security and Emergency Management (DHS&EM)	Hazard Mitigation Section
US Environmental Protection Agency (EPA)	Alaska Operations Office
National Weather Service (NWS)	Southcentral Region
US Department of Agriculture (USDA)	Alaska Office Rural Development
USDA	Division of Rural Development - Natural Resources Conservation Service (NRCS)
US Army Corps of Engineers (USACE)	Alaska Region
Alaska Department of Natural Resources (ADNR)	Division of Forestry, DGGS
US Forest Service (USFS)	Alaska Region 10 Office
US Geological Survey (USGS)	Alaska Science Center
Alaska SeaLife Center	

3.4.2 Local Jurisdictions

APCs, KPB Planning Commission, Seldovia and Seward Planning and Zoning Commission members, and key community representatives were contacted by phone or email throughout

the planning process. These outreach methods included facilitation through invitations for to the public to participate in the HMP planning process via public meeting attendance. See Table 14 for the community representative from each community who helped facilitate these important outreach events. Community representatives were provided flyers announcing the public meetings with QR code links to the questionnaire and were encouraged to post the flyers on their individual websites/social media pages and in buildings where community members commonly receive information (e.g., post offices, libraries, community centers). Public meetings were all attended in person by at least two Planning Team members. Meeting notes were collected and feedback for mitigation goals and hazard mitigation suggestions were reviewed by the Planning Team and included in the Plan Update, where applicable.

Hazard Maps at Kenai River Fair outreach event

Local jurisdictions and their community leads were contacted again when the Draft HMP update was available for public comment. APC members and attendees at planning meetings were encouraged to utilize the Hazard Mitigation Plan Hub Site and Story Maps page to follow updates to the plan development process. Those APCs that are not active but had interested members were asked to attend public community meetings either online or in person if near their region in the Borough. Inactive APC representatives from Anchor Point attended the Anchor Point community meeting in May 2024 at the Anchor Point Senior Center. Inactive members from Funny River were invited to attend the annual Funny River Community Meeting in May 2024. Kachemak Bay APC members coordinated with the planning team and anticipated providing feedback on the Draft HMP update when it was available.

Table 15. KPB HMP Plan Update – APC, Planning Commission, and Community Contacts

Community	Name, Title
City of Seldovia	Liz Diament, City Clerk
Cooper Landing	Chris Degernes, Cooper Landing APC Chair
Hope/Sunrise	Jim Skogstad, Hope/Sunrise APC Chair
Nikiski	Len Niesen, Nikiski APC Chair
Anchor Point	Cindy Burns, Anchor Point Senior Center
Funny River	Ron Gherman, Funny River Community Council
Seward	Carol Griswold, Planning & Zoning Commission Chair
Moose Pass	Bruce Jaffa, APC Chair
KPB Planning Commission	Jeremy Brantley, Planning Commission Chair

3.4.3 Tribal Representatives & Old Believer Communities

To include input from Alaska Native Tribes and Old Believer Communities, the KPB sent out an initial outreach letter in April 2024 to facilitate input in the plan development process. This initial letter provided background and a description of the planning process. It requested their input and feedback, which was needed and appreciated.

The Qutekcak Native Tribe was a part of the 2020 Seward HMP development process and was included with the understanding that the plan would be a MJHMP. However, since the Qutekcak Native Tribe is not officially recognized by the Bureau of Indian Affairs (BIA) it was not included in the final approved plan as a signatory. Outreach to the Qutekcak Native Tribe focused on involvement in this Plan update with the understanding that future integration into planning efforts regarding Tribal Hazard Mitigation Plan or MJHMP inclusion will be dependent on federal recognition as a tribal entity.

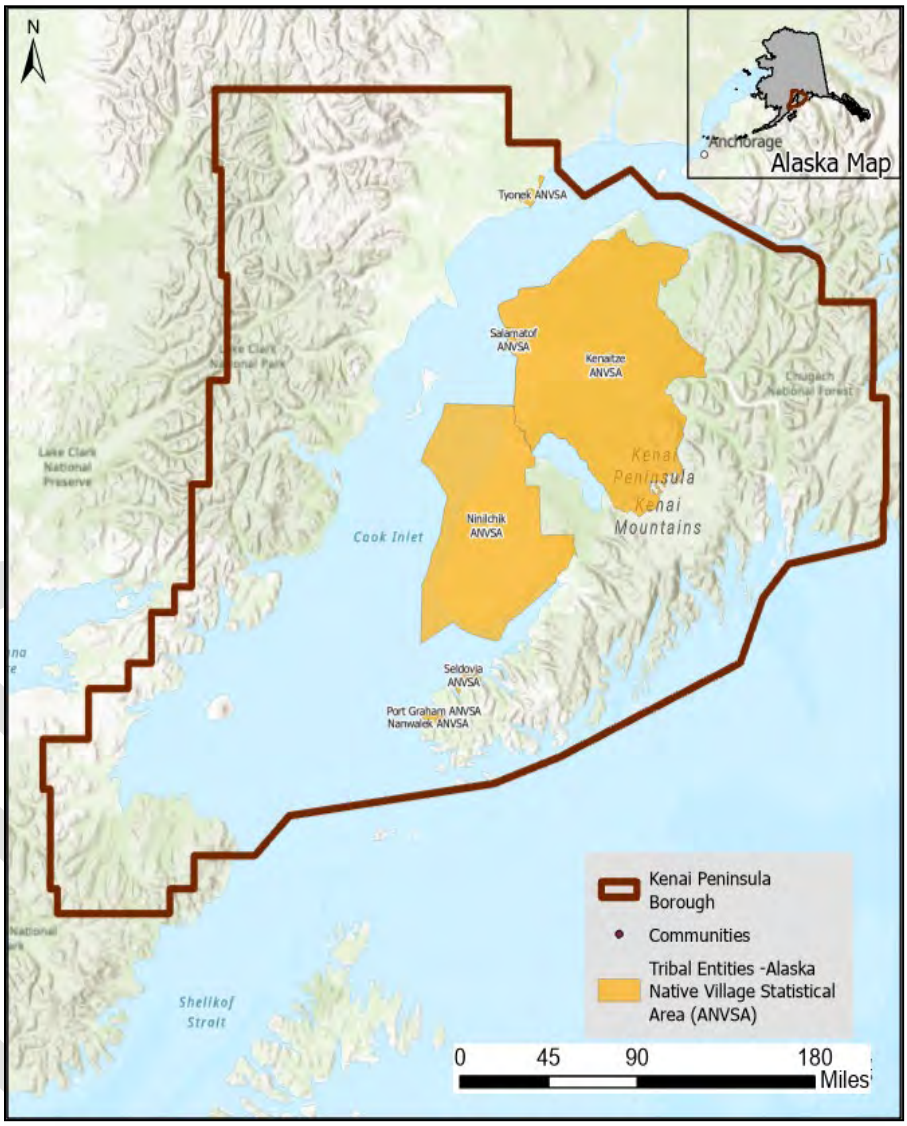


Figure 1. Tribal Entities in KPB based on Alaska Native Village Statistical Area (US Census)

In addition to the letter, planning team members reached out to leadership and local contacts in these communities through phone and email. Tribal and Old Believer representatives that were contacted, and input received from that outreach, is included in the public involvement section of Appendix B.

The Tribal and Old Believer representatives contacted are listed in Table 15.

Table 16. Tribe/Old Believer Communities Contacted

Native Villages, Tribes, and Corporations	
Entity	**Name(s) and/or Title**
Chugachmiut	Charlie Sink, Enterprise and Trust Division Director
Kenaitze Indian Tribe	Frank Lamb, Dietrick Tillis
Nanwalek – IRA Council	Katrina Hetrick
Ninilchik - Tribe	Darrel Williams
Ninilchik – Native Village	Ivan Encelewski
Port Graham – Native Village	Patrick Norman
Qutekcak Native Tribe	Dolly Wiles
Seldovia Village	Mark Ball
Seldovia Village Corporation	Crystal Collier
Tyonek – Native Village	Janelle Baker
Tyonek Native Corporation	Connie Downing
Old Believer Communities	
Kachemak Selo	Dionici "Dennis" Reutov
Nikolaevski	Efrosinia Yakunin, Anitta Roberts
Razdolna School	Fenya Basargin
Voznesenka	Stephan Polushkin, Akcinia Kulikov

Section 3.5 Incorporation of Existing Plans and Relevant Documents

The planning team reviewed plans, reports, and documents provided in new plans and reports as well as plans and reports from past HMPs for the KPB, City of Seward, and City of Seldovia. Where relevant, these plans were integrated into the Plan update. The 2023 State Hazard Mitigation Plan was integrated and incorporated into this Plan update, where relevant. Table 16 provides a summary of the plans and documents incorporated into the 2024 HMP Update.

Table 17. Plans, Studies and Reports reviewed for incorporation into current plans and plan updates

Plans, Studies and Reports	Overview of information incorporated into the Plan	Planned integration of 2024 HMP into plan updates
State of Alaska Hazard Mitigation Plan, 2023	Provides a statewide framework and guidance for mitigating hazards. Key strategies and policies were adopted and localized to the Kenai Peninsula Borough context.	The future State of Alaska Hazard Mitigation Plan should include Risk Assessment data updates provided in the 2024 KPB HMP update. Inclusion of hazards affecting the borough should be highlighted where relevant in the State Hazard Mitigation Plan, in particular recent hazard events since that Plan was updated
City of Seward Hazard Mitigation Plan, 2020	Specific risks and mitigation measures from City of Seward's past Plan were integrated into the KPB Plan Update.	Seward's plan has been fully integrated into the 2024 KPB HMP, it will be part of future KPB Plan updates.
City of Seldovia Hazard Mitigation Plan, 2018	Specific risks and mitigation measures from City of Seldovia' s past Plan were integrated into the Plan Update.	Seldovia's plan has been fully integrated into the 2024 KPB HMP Update, it will be part of future KPB Plan updates.

Plans, Studies and Reports	Overview of information incorporated into the Plan	Planned integration of 2024 HMP into plan updates
KPB Community Wildfire Protection Plan, 2022 (CWPP)	Incorporated CWPP wildfire mitigation and hazard analysis in the KPB Plan. The wildfire hazard section of the KPB HMP update was updated to include new information provided from the CWPP.	Future updates to the CWPP will include information provided in the Mitigation Goals Section as well as the Wildfire Section of this Plan Update.
SBCFSA Hazard Mitigation Plan, 2013	Specific risks and mitigation measures from Seward Bear Creek Flood Service Area's past plan were integrated into borough-wide Plan Update.	Fully integrated into the 2024 HMP Update, will be part of future Plan updates.
Kenai Peninsula Borough Comprehensive Plan, 2019	Reviewed and included relevant hazard and background information for future and sustained planning efforts in the Borough.	Include hazard risk assessment and hazard mitigation goals in future Kenai Peninsula Borough Comprehensive Plan updates. Make sure goals in both Plans align to reinforce efficiencies and support future projects.
2030 Seward Comprehensive Plan Update - Volume 1 & II, 2017	Reviewed background information that could be integrated into plan. Included relevant hazard and background information for future and sustained planning efforts in the Borough.	Include hazard risk assessment and hazard mitigation goals in future Seward Comprehensive plan updates. Make sure goals align between both plans to reinforce efficiencies and support future projects.
City of Seldovia Comprehensive Plan, 2014	Reviewed background information that could be integrated into plan. Included relevant hazard and background information for future and sustained planning efforts in the Borough.	Include hazard risk assessment and hazard mitigation goals in future City of Seldovia Comprehensive plan updates. Make sure goals align between what is included in both plans to reinforce efficiencies and support future projects.
All Lands All Hands Action Plan, 2023-2028	Incorporated plan information in wildfire hazard section of the HMP Update as well as forest health and future climate conditions sections.	Future All Lands All Hands Action Plan update should include information provided in Mitigation Goals as well as Wildfire Section of the KPB HMP Plan update.
Alaska Disaster Response Plan, 2018	While there is a difference between mitigation and response, the KPB HMP occasionally needs to include some discussion about disaster response measures. They integrated into the plan primarily within the Human-Caused hazards section	The future State Disaster Response Plan should include referenced hazard response initiatives included in 2024 KPB HMP. Such as hazard response initiatives found in the human-caused hazards section including Cook Inlet Spill Prevention and Response, Inc. (CISPRI) Oil Spill Response initiatives in the Cook Inlet.
Alaska Forest Action Plan, 2020	Integrated forest management and hazard mitigation strategies from federal lands into KPB HMP update, specifically related to wildfire and future climate conditions sections	Future Alaska Forest Action Plan updates should include information provided in Mitigation Goals as well as Wildfire Section of the Plan update
Alaska Interagency Wildland Fire Management Plan, 2021	Integrated forest management and hazard mitigation strategies from federal lands into KPB HMP update, specifically related to wildfire and future climate conditions sections	Future Alaska Interagency Wildland Fire Management Plan updates should include information regarding information provided in Mitigation Goals as well as Wildfire Section of the Plan Update
Chugach National Forest Land Management Plan, 2020	Integrated forest management and hazard mitigation strategies from federal lands into KPB HMP update, specifically related to wildfire and future climate conditions sections	Future Chugach National Forest Land Management Plan updates should include information regarding information provided in Mitigation Goals as well as Wildfire Section of the Plan Update.
KPB FEMA FIS Study Vol 1 and 2, 2023	Incorporated flood risk data and maps as well as other relevant data and studies into the KPB HMP update	Future FEMA FIS Studies or additional information developed to support studying the effects of flooding in the Borough should be included as part of future studies.

Section 4 Background & Detailed Community Profiles

Section 4.1 Kenai Peninsula Borough

Section 4.1.1 Location, Geography, and History

The Kenai Peninsula Borough lies directly south of Anchorage, the State's principal population center. The waters of the Gulf of Alaska and Prince William Sound border the borough on the south and east with the dramatic Chigmit Mountains of the Aleutian Range rimming the borough to the west. Cook Inlet divides the borough into two land masses. The peninsula itself, on the east side of Cook Inlet, encompasses 99 percent of the Borough's population and most of the development. The Kenai Mountains run north and south through the peninsula, contrasting to the lowlands lying to their west. The west side of Cook Inlet is not road accessible and is sparsely inhabited, with the village of Tyonek (population 270) being the largest populated community. The boundaries of the borough encompass a total of 24,752 square miles which is comparable in size to the state of West Virginia. Sixty-five percent of the KPB, or 16,013 square miles, is composed of land area and fresh waterbodies; the remaining thirty-five percent, or 8,741 square miles, includes Cook Inlet and coastal areas of the Gulf of Alaska. Some of the land area is covered in glaciers. The western area of the Borough includes the small communities of Beluga and Tyonek, two of the region's three national parks, and other protected state-owned lands. Pursuant to Alaska Statute (AS) Title 29, Chapter 65, Section 010 (AS 29.65.010), the KPB is entitled to 155,780 acres of vacant, unappropriated, and unreserved (VUU) general grant land. The Borough currently owns and manages approximately 117,000 acres of land, most of which has been officially conveyed through the General Grant Land (AS 29.65.010.140).

Strong maritime influences from Cook Inlet, Prince William Sound (PWS) and the Gulf of Alaska keep temperatures relatively mild, although climate varies within the Borough due to weather influencing features. In addition to ocean influences, the Harding Icefield, Chugach Mountains, and Skilak and Tustumena Lakes also influence area climate. Due to the large size and varied topography of the Borough, weather varies by location. July is generally the warmest month of the year in the KPB, while January is the coldest month. Within the KPB, maximum mean annual temperatures vary even less with a range from 43.5 degrees Fahrenheit in City of Kenai to 46.3 degrees Fahrenheit in Seward. The mean annual precipitation within the KPB is light to moderate, with an average of 69.71 inches a year in Seward. The highest precipitation levels typically occur from late summer to early fall in the KPB. September and October are usually the wettest months of the year. The lowest precipitation levels occur from spring to early summer. March through June are typically the driest months of the year, with monthly precipitation ranging from 0.34 inch in April to 2.34 inches in June in the City of Seward.

The KPB was incorporated on January 1, 1964, as a second-class borough under the authority of the State of Alaska Borough Act of 1961. The Borough is run by an elected mayor and nine-member Assembly (three-year terms). Areawide Borough powers include tax assessment/collection, education, planning/zoning, solid waste disposal, 911 emergency communications, emergency management, senior citizen centers/adult daycare grant funding,

postsecondary education funding, and general administrative services. Non-areawide Borough powers include ports/harbors, tourism promotion, and special assessment authority for utility extensions. Service area powers include hospitals, fire protection, emergency medical/ambulance services, recreation, senior citizen services, and road maintenance/construction. The Borough maintains 15 fire stations, full-service hospitals in Homer and Soldotna, a critical access hospital in Seward, 44 schools, eight landfills with two recycling/baling facilities, five transfer facilities, eight drop box transfer sites, and 645 miles of maintained roads.

The KPB, including the Cities of Seldovia and Seward, features a diverse pattern of land ownership that includes federal, state, borough, private, and Native corporation lands. Land ownership within the Borough is comprised of 66 percent Federal, 20 percent State, 10 percent Native, 2.5 percent Private, and less than 1 percent Borough. The significant portion of land that is federally owned is managed by agencies such as the U.S. Forest Service (Chugach National Forest), the National Park Service (Kenai Fjords National Park), and the U.S. Fish and Wildlife Service (Kenai National Wildlife Refuge). Chugach National Forest, Kenai National Wildlife Refuge, Kenai Fjords National Park, Lake Clark National Park and Katmai National Park lie partially or wholly within the KPB. These lands are often preserved for conservation, recreation, and resource management purposes. The State of Alaska owns and manages lands for various uses, including state parks, wildlife management areas, and public use lands, as well as resource extraction managed by the ADNR. The KPB itself owns lands used for public services, schools, recreational areas, and municipal purposes, supporting community development and infrastructure. Private land ownership encompasses residential, commercial, and industrial properties. Native corporations, established under the Alaska Native Claims Settlement Act (ANCSA), hold significant land areas for economic development and cultural preservation.

Improved parcels, which include properties with buildings or other structures, are predominantly found in private ownership but are also borough and state lands where development is necessary to support public services and infrastructure. This mixed ownership creates a complex landscape for land use planning, development, and resource management, requiring coordinated regulations and strategies to address the needs and interests of all stakeholders in the region. See Land Ownership Maps for detailed information regarding land ownership and improved parcel locations.

Throughout much of history, the Kenai Peninsula was occupied by Kenaitze Indians (Dena'ina), although archaeological evidence suggests that the area was first occupied by the Kachemak people from 1000 B.C., until they were displaced by the Dena'ina Athabaskan people around 1000 A.D. Russian fur traders arrived in Kenai in 1741 and the City of Kenai was established as a Russian fur trading post in 1791. The Russians referred to the Dena'ina people living in Kenai as "Kenaitze," the Russian term for "people of the flats" or "Kenai people." In the local Dena'ina language, the word Kenai means "flat, meadow, open area with few trees" (James, 2007). In the early 1970s, the name Kenaitze was formally adopted by the local people when they were incorporated as the Kenaitze Alaska Natives. In the early 1900s, cannery operations and construction of the Alaska Railroad spurred growth and development on the Kenai Peninsula.

The Peninsula was also the site of the first major Alaskan oil strike in 1957 and has continued to be a prominent area of oil and gas exploration and development since.

Section 4.1.2 Demographics

The Kenai Peninsula Borough in Alaska is characterized by a diverse and dynamic population, influenced by its varied economic base and seasonal tourist influx, which significantly boosts the local economy. Key demographic characteristics include:

- Population Size and Growth: The KPB has a population of approximately 58,000 residents (see further details below). The borough has experienced modest growth over the years, with fluctuations influenced by economic conditions, particularly in industries like oil and gas, fishing, and tourism.
- Age Distribution: The population is spread across various age groups, with a significant number of working-age adults at 59%. The population of children under 18 is 22% of the population and the population 65 and over is 19%.
- Ethnic and Racial Composition: Most residents in the Kenai Peninsula Borough are White with a notable representation of Alaska Natives, particularly from the Dena'ina and Sugpiaq/Alutiiq communities. Other racial and ethnic groups are present in smaller numbers, contributing to the borough's cultural diversity.
- Gender Distribution: The gender distribution in the borough is relatively balanced, with a nearly equal number of males and females.
- Household Composition: Households in the KPB include a mix of family households, single-person households, and non-family households. There are 23,201 households in the KPB and 62% of households are married couples.
- Education and Employment: Education levels vary, with many residents holding high school diplomas, with 28% of residents having some college education or higher degrees. Employment is diversified across several key sectors, including oil and gas, fishing, tourism, public services, education, and healthcare.
- Income Levels: Income levels in the borough can vary widely, reflecting the diverse economic activities including the oil and gas industry, fishing and tourism. The median household income is generally in line with state averages at $76,272, though it can fluctuate based on economic conditions.
- Cultural and Community Life: The KPB has a vibrant cultural scene, with numerous events, festivals, and recreational activities that reflect the region's heritage and natural beauty. Community organizations and cultural institutions play a significant role in maintaining the borough’s cultural vitality and community cohesion. Examples include the Seward Mermaid Festival, Kenai Peninsula Fair and Rodeo as well as the Seldovia Arts Council which puts on a summer music festival every year.

Each year the State of Alaska Department of Labor and Workforce Development (DLWD), Research and Analysis Section conducts a survey of all cities, boroughs, and municipalities around the State of Alaska. Based on the 2020 U.S. Census, the population of the Borough was 58,799 residents. The most recent 2023 DCCED certified population is 60,898. The median age is 42.9 years.

The KPB has experienced steady, modest population growth over the last several years. Components of population change are summarized in Table 18. The modest increase in population is unusual in comparison to other areas of Alaska, most of which lost population in the same period. This trend suggests some degree of resilience against the impacts of Alaska's current issues with outmigration. In the KPB there is the potential for continued modest growth depending on the state and region's economic outlook in future years.

Table 18. Components of Population Change for the Kenai Peninsula Borough 2020 to 2023

Period (July-based)	End of Population Period	Population Change	Growth Rate (Percent)	Births	Deaths	Natural Increase	Net Migration
April 2020-July 2020	58,849	50	0.34	165	109	56	-6
2020-21	59,049	200	0.34	679	482	197	3
2021-22	60,000	951	1.61	627	629	-2	953
2022-23	60,898	898	1.50	601	521	80	818

(DLWD 2023)

Table 19. KPB Population Estimate by Borough, Census Area, City, and CDP, 2020 to 2023

Area	Census Total April 2020	Estimate Total July 2021	Estimate Total July 2022	Estimate Total July 2023	Census Group Quarters* April 2020	Estimate Group Quarters* July 2021	Estimate Group Quarters* July 2022	Estimate Group Quarters* July 2023
Kenai Peninsula Borough	58,799	59,049	60,000	60,898	1,969	1,834	1,790	1,891
Anchor Point CDP	2,105	2,155	2,202	2,295	17	17	17	17
Bear Creek CDP	2,129	2,073	2,050	1,987	23	23	23	23
Beluga CDP	34	35	33	32	12	12	12	12
Clam Gulch CDP	207	202	241	255	0	0	0	0
Cohoe CDP	1,471	1,527	1,492	1,536	0	0	0	0
Cooper Landing CDP	344	364	365	361	8	8	8	8
Crown Point CDP	119	88	106	111	38	0	21	25
Diamond Ridge CDP	1,330	1,336	1,366	1,344	5	5	5	5
Fox River CDP	644	643	653	662	0	0	0	0
Fritz Creek CDP	2,248	2,288	2,417	2,458	0	0	0	0
Funny River CDP	1,103	1,112	1,166	1,199	0	0	0	0
Halibut Cove CDP	60	64	65	61	0	0	0	0
Happy Valley CDP	713	696	715	781	0	0	0	0

Area	Census Total April 2020	Estimate Total July 2021	Estimate Total July 2022	Estimate Total July 2023	Census Group Quarters* April 2020	Estimate Group Quarters* July 2021	Estimate Group Quarters* July 2022	Estimate Group Quarters* July 2023
Homer city	5,522	5,509	5,516	5,669	178	169	176	175
Hope CDP	161	153	165	169	0	0	0	0
Kachemak city	576	622	656	669	0	0	0	0
Kalifornsky CDP	8,487	8,587	8,782	8,945	148	148	148	148
Kasilof CDP	525	520	525	529	0	0	0	0
Kenai city	7,424	7,400	7,510	7,614	61	29	37	47
Lowell Point CDP	79	90	93	79	0	0	0	0
Moose Pass CDP	228	232	232	228	0	0	0	0
Nanwalek CDP	247	245	241	239	0	0	0	0
Nikiski CDP	4,456	4,430	4,533	4,518	25	0	0	20
Nikolaevsk CDP	328	344	356	361	0	0	0	0
Ninilchik CDP	845	846	916	955	0	0	0	0
Pt. Possession CDP	9	10	6	13	0	0	0	0
Port Graham CDP	162	160	151	155	0	0	0	0
Primrose CDP	96	89	96	90	21	21	21	21
Ridgeway CDP	2,136	2,079	2,102	2,151	4	4	4	4
Salamatof CDP	1,078	1,062	1,097	1,041	443	450	497	463
Seldovia city	235	259	261	250	0	0	0	0
Seldovia Village CDP	199	201	204	194	0	0	0	0
Seward City	2,717	2,608	2,483	2,582	819	781	634	736
Soldotna City	4,342	4,461	4,520	4,574	90	90	110	110
Sterling CDP	5,918	6,014	6,101	6,225	17	17	17	17
Sunrise CDP	15	14	16	13	0	0	0	0
Tyonek CDP	152	151	153	143	0	0	0	0

(DLWD 2023)

The KPB is a diverse community with individuals from different ethnicities and age groups. According the to the 2023 DLWD report, the median age in the Borough is 42.9, which is slightly higher than the median age in the 2020 Census. Table 20 includes detailed information about the population by age in the 2020 US Census and 2023 DLWD report. Table 21 includes detailed ethnicity and age group information from the 2023 DLWD report.

Table 20. KPB Population by Age

Age	April 2020 Census	Percentage of Population	July 2023 Estimate	Percentage of Population
Under 5 years	3,332	5.65	3,182	5.22
5 to 9	3,478	5.91	3,616	5.93
10 to 14	3,734	6.35	3,926	6.44
15 to 19	3,573	6.01	3,783	6.21
20 to 24	2,707	4.60	2,758	4.52
25 to 29	3,329	5.66	2,983	4.89
30 to 34	3,795	6.45	4,043	6.63
35 to 39	3,781	6.43	3,846	6.31
40 to 44	3,365	5.72	3,938	6.46
45 to 49	3,419	5.93	3,456	5.67
50 to 54	3,574	6.07	3,588	5.89
55 to 59	4,345	7.40	3,776	6.20
60 to 64	5,066	8.61	4,831	7.93
65 to 69	4,580	7.78	4,858	7.97
70 to 74	3,146	5.35	3,818	6.26
75 to 79	1,952	3.31	2,378	3.90
80 to 84	945	1.60	1,349	2.21
Over 85 years	678	1.15	769	1.26
TOTAL	**58,799**		**60,898**	
Median Age	**42.5**		**42.9**	

(DLWD 2023)

Table 21. KPB Population by Age, Race (Alone or in Combination) and Hispanic Origin, Sex and Borough/Census Area, July 2022

Age	Alaska Native or American Indian	Asian	Black or African American	Native Hawaiian or Pacific Islander	White	Hispanic Origin (of any race)
Under 5 years	655	163	97	43	2,898	226
5 to 9	672	162	103	48	3,309	287
10 to 14	679	199	99	44	3,510	251
15 to 19	671	203	97	39	2,936	228
20 to 24	548	100	64	23	1,954	140
25 to 29	476	88	70	19	2,616	202
30 to 34	531	141	80	26	3,414	240
35 to 39	541	144	56	23	3,559	227
40 to 44	474	129	49	29	3,371	203
45 to 49	357	124	43	16	2,853	161
50 to 54	386	168	39	18	3,079	127
55 to 59	402	93	34	26	3,516	128
60 to 64	420	99	46	16	4,264	112
65 to 69	359	88	32	13	4,225	76
70 to 74	288	62	25	9	3,276	72
75 to 79	155	37	12	11	2,168	46
80 to 84	79	11	6	3	1,047	18
Over 85 years	31	24	5	4	831	11
TOTAL	**7,724**	**2,035**	**957**	**410**	**52,826**	**2,755**

Section 4.1.3 Economy

The economy of the Kenai Peninsula Borough is diverse, leveraging its abundant natural resources, strategic location, and thriving tourism sector. The foundation of the Borough's economy includes fishing, tourism, oil and gas, refining and government. Key components of the borough's economy include:

- Oil and Gas Industry: The Kenai Peninsula has significant oil and gas reserves, making this industry a major economic driver. The borough hosts several oil and gas production facilities, a refinery, and related services, contributing substantially to local employment and revenue.
- Fishing and Seafood Processing: Commercial fishing is vital to the Kenai Peninsula's economy, with abundant fisheries supplying salmon, halibut, and other seafood. The borough is home to numerous seafood processing plants that support both local and export markets, providing jobs and bolstering the local economy.
- Tourism: Tourism is a significant economic pillar for the Kenai Peninsula, attracting visitors with its stunning natural landscapes, outdoor recreational opportunities, and wildlife. Key attractions include Kenai Fjords National Park, Homer's arts scene, and fishing hotspots like the Kenai River. The tourism sector supports a wide range of businesses, including hotels, restaurants, and tour operators.
- Agriculture: The Kenai Peninsula has a growing agricultural sector, with farms producing vegetables, fruits, and livestock. Local farmers' markets and agricultural events help promote this industry, contributing to the region's economy and food security.
- Transportation and Logistics: The borough benefits from a well-developed transportation network, including connections to the Port of Anchorage, the Seward Highway, and the Alaska Railroad. These transportation links facilitate the movement of goods and people, supporting various economic activities.
- Retail and Services: A variety of retail and service businesses cater to the needs of residents and tourists. Shopping centers, restaurants, healthcare facilities, and other services form a crucial part of the local economy, providing employment and supporting daily life.
- Education and Public Services: Educational institutions and public services are significant employers in the Kenai Peninsula Borough. Schools and government services play essential roles in the community, contributing to economic stability and quality of life.
- Renewable Energy and Sustainability: There is growing interest in renewable energy and sustainable practices on the Kenai Peninsula. Initiatives in wind, hydroelectric, and solar power, along with efforts to promote environmental conservation, are emerging as important components of the local economy. The state's largest hydroelectric operation is located on the peninsula and plans for expansion of this resource are currently underway.

The KPB sees a large growth in transient summer population due to tourism, sportfishing, and commercial fishing activity. The Alaska Railroad, cruise ship traffic, sightseeing activities, wildlife viewing, hiking and camping also provide increased population to the borough particularly

during the summer months. Commercial fishing activities in coastal areas and along streams and rivers result in an increase in fishermen. This population of fish processors, charter boat services and guides as well as fishing related economic purchases help support the economy throughout the summer months. The Kenai and Kasilof Rivers host a large influx of statewide residents into those river areas to participate in the personal use and dipnet fisheries and sportfishing. It is a particular challenge to mitigate hazards not only for the local populations but also for the large swell in temporary tourist populations and seasonal employees in the summer months.

The Alaska Department of Labor and Workforce Development Department of Research and Analysis conducts a quarterly and annual census of employment and wages. The results of the Quarterly Census of Employment and Wages (QCEW) for the Kenai Peninsula Borough for the period of January to December 2023 are found in Table 23.

Table 22. Quarterly Census of Employment and Wages for the Kenai Peninsula Borough: January – December 2023

Description	Average Employment	Average Monthly Wages ($)	Total Wages ($)
TOTAL INDUSTRIES	21,330	4,947	1,266,329,037
TOTAL GOVERNMENT	5,170	5,718	1,266,329,037
FEDERAL GOVERNMENT	376	7,936	354,726,008
STATE GOVERNMENT	1,241	5,885	35,808,234
LOCAL GOVERNMENT	3,553	5,424	87,644,561
PRIVATE OWNERSHIP	16,161	4,701	231,273,213
GOODS-PRODUCING	3236	7,493	911,603,029
NATURAL RESOURCES AND MINING	968	10,707	124,367,589
Agriculture, Forestry, Fishing, Hunting	155	4,150	7,719,305
Mining	813	11,957	116,648,284
Construction	1,076	5,474	70,683,663
Manufacturing	1,192	6,706	95,926,234
SERVICE-PROVIDING	12,926	4,001	620,625,543
TRADE, TRANSPORTATION, AND UTILITIES	4270	4,005	205,239,362
Wholesale Trade	215	7,017	18,102,929
Retail Trade	2,884	3,101	107,331,769
Transportation and Warehousing	959	4,788	55,097,813
Utilities	212	9,712	24,706,851
INFORMATION	202	4,479	10,857,191
FINANCIAL ACTIVITIES	539	5,205	33,663,349
Finance and Insurance	283	5,823	19,775,364
Real Estate, Rental and Leasing	256	4,521	13,887,985
PROFESSIONAL AND BUSINESS SERVICES	893	4,968	53,242,408
Professional, Scientific, Tech.	504	5,568	33,677,811
Mgmt. of Companies & Enterprises	287	7,930	2,664,550
Administrative and Waste Services	360	3,912	16,900,047
EDUCATIONAL AND HEALTH SERVICES	3,291	5,157	203,671,348
Educational Services	166	2,574	5,127,920
Health Care and Social Assistance	3,126	5,293	198,543,428

Description	Average Employment	Average Monthly Wages ($)	Total Wages ($)
LEISURE AND HOSPITALITY	2,889	2,411	83,583,388
Arts, Entertainment and Recreation	280	2,284	7,674,403
Accommodation and Food Services	2,609	2,425	75,908,985
OTHER SERVICES	832	3,009	30,041,009
UNCLASSIFIED ESTABLISHMENTS	10	2,729	327,488

(DLWD QCEW 2023)

Section 4.2 City of Seldovia

Section 4.2.1 Location, Geography, and History

Seldovia is a small, picturesque community located approximately 247 miles south of Anchorage and 15 miles across Kachemak Bay from Homer. Seldovia is a small community, covering only 0.55 square miles of which 0.39 square miles is land and 0.16 square miles is water. No road system connects Seldovia to other communities or the rest of the Kenai Peninsula; the community is only accessible via airplane or boat.

Seldovia is surrounded by steep mountains and dense coastal Sitka Spruce forests that extend up to the tree line (approximately 2,000 feet in elevation). The overall elevation of the area increases very rapidly from sea level to 3,245 feet (Red Mountain). Due to the steep slopes and geologic history, firm soil structure is not easily formed, and the ground is predominantly gravel and stony glacial till with areas of poorly drained peat. These poor soil conditions make the area vulnerable to high water tables or saltwater intrusion.

Seldovia has a rich history that reflects the broader narrative of Alaskan development and Indigenous heritage. Before the Russians arrived in search of sea otter pelts and timber to repair ships, Seldovia was the traditional homeland of the Sugpiaq and Alutiiq people. These Alaska Natives thrived on the abundant natural resources, particularly fishing and hunting. Today, Seldovia remains an Alutiiq village with Alaska Native residents from the Dena'ina Athabascan, Alutiiq, and Sugpiaq groups. In the Sugpiaq language, the name for the Seldovia is Angagkitaqnuuq.

In the late 18th century, Russian explorers and traders arrived in the region, establishing Seldovia as a significant trading post. The Russian influence is evident in the town's name and some cultural aspects. The fur trade was the primary economic activity during this period. The name Seldovia is derived from "Seldevoy," the Russian word for herring bay, due to the plentiful herring found in the waters. After the Alaska Purchase in 1867, Seldovia continued as an important trading post. The late 19th and early 20th centuries saw an influx of settlers drawn by the prospects of fishing and later, canneries. For many years, Seldovia was a crucial shipping and supply center for the region, serving as the first stop for ships sailing from Seward and Kodiak. Seldovia developed as a vital supply point and commercial center for the surrounding region, with a particular emphasis on the fishing industry. To this day, commercial fishing and subsistence are an integral part of the community's culture and existence.

The mid-20th century brought significant changes to Seldovia. The town was an important regional hub, but like many coastal communities, it faced challenges such as the decline of the fur trade and fluctuations in the fishing industry. In 1964, the Good Friday Earthquake caused massive subsidence, which led to flooding and extensive damage. The rebuilding process reshaped the town, with raised structures and improved infrastructure. In the latter part of the 20th century and into the 21st, Seldovia transitioned more towards tourism and cultural preservation. The town's remote charm, beautiful natural surroundings, and rich history attract visitors seeking an authentic Alaskan experience. The Seldovia Village Tribe plays a crucial role in preserving and promoting the cultural heritage of the Alutiiq people, contributing to the town's unique cultural landscape.

Today, Seldovia is known for its picturesque setting, vibrant cultural life, and friendly community. The economy is a mix of tourism, commercial fishing, and small businesses. Events such as the Seldovia Summer Solstice Music Festival and the Fourth of July festivities draw visitors, while the town's trails, wildlife, and waterfront provide ample opportunities for outdoor recreation. Seldovia remains a testament to resilience and adaptation, balancing the preservation of its rich cultural heritage with the demands of modern life. Its history, from indigenous roots through Russian and American influences through its current status, makes it a unique and fascinating Alaskan town. The following is a brief summary of the community's history:

1787 The Russian fur trade post of Aleksandrovskaia was established in what is now Seldovia
1820 The early Russian St. Nicholas Orthodox Church was established in Seldovia
1884 Seldovia was first included in the US Census with a population of 74
1898 The first public school and Post Office were established in Seldovia
1910 The first salmon cannery opened
1925 Seldovia served as the point of supply for more than fifty fox farms in the bays and coves of the peninsula
1945 Seldovia was incorporated as a second-class city; the community's first airplane service was established
1962 Seldovia was established as a first-class city

Section 4.2.2 Demographics

Seldovia is a small, remote community with distinct demographic characteristics shaped by its history, geography, and cultural heritage. The predominant employers in Seldovia include the KPB School District, the Seldovia Village, Tribe, the City, and commercial fishing related businesses. Overall, Seldovia's demographics reflect a small, culturally rich community with strong ties to its indigenous heritage and natural surroundings. The population is characterized by its stable size, diverse cultural background, and a mix of age groups that contribute to the town's unique identity and close-knit social fabric. Key aspects of Seldovia's demographics include:

- Population Size and Growth: Seldovia has a small population, typically around 200-300 residents depending on the time of year. The population size has declined in recent years from its peak population of 479 in 1980.

- Age Distribution: The population of Seldovia includes a mix of age groups, with a significant proportion of middle-aged and older adults. There are fewer children and young adults compared to larger communities, which is common in remote towns with limited employment opportunities.
- Ethnic and Racial Composition: Seldovia has a diverse population with a notable representation of Alaska Native peoples, particularly those of Alutiiq/Sugpiaq descent. The community also includes individuals of European descent and other racial and ethnic backgrounds, contributing to a rich cultural tapestry.
- Gender Distribution: The gender distribution in Seldovia is fairly balanced, with a roughly equal number of males and females. This balance can vary slightly but generally remains stable.
- Household Composition: Households in Seldovia vary, including families, single individuals, and non-family groups. The town features a mix of single-family homes, rental properties, and seasonal housing options that accommodate temporary workers and visitors.
- Education and Employment: The education levels in Seldovia range from high school diplomas to some higher education, there is a local school in Seldovia that covers grades K-12. Employment opportunities are largely centered around fishing, tourism, public services, and small businesses.
- Income Levels: Income levels in Seldovia are modest, reflecting the town's reliance on industries like fishing and tourism. The median household income is generally lower than in larger urban areas, with economic activities often tied to seasonal employment.
- Cultural and Community Life: Seldovia has a vibrant cultural life, heavily influenced by its Alaska Native heritage and traditions. Community events, cultural festivals, and local organizations play a central role in community cohesion and cultural preservation. The small population fosters a close-knit community atmosphere where residents often participate in communal activities and support each other.

Based on the 2020 U.S. Census, the population of Seldovia was 235 residents. The most recent 2023 DCCED certified population is 250. Table 23 and Table 24 provide detailed information about the population by race alone and ethnicity of the city of Seldovia.

Table 23. City of Seldovia Population by Race Alone 2020 U.S. Census

Race	Total	Percent of Population
Alaska Native/American Indian	27	11.48%
Asian	0	0%
Black or African American	4	1.70%
Native Hawaiian or Pacific Islander	0	0%
White	131	55.74%
Other Race	2	0.85%
Two or More Races	46	19.57%
TOTAL	235	

Table 24. City of Seldovia Ethnicity – 2020 U.S. Census

Ethnicity	Total	Percentage of Population
Hispanic	6	2.55%
Non-Hispanic	229	97.44%
TOTAL	235	

Each year, the U.S. Census Bureau conducts an American Community Survey (ACS) annually to help local officials, community leaders, and businesses understand the changes taking places within their respective communities. The ACS provides detailed population and housing information. Table 25 includes the five-year average (2018-2022) of Seldovia's population by age from the ACS and Table 26 provides the five-year average of Seldovia's gender population.

Table 25. Seldovia Population by Age: five-year Average, 2018-2022

Age	Percent of Population
Under 5 years	9.34%
5 to 9	1.65%
10 to 14	3.85%
15 to 19	10.99%
20 to 24	2.2%
25 to 34	4.4%
35 to 44	0.0%
45 to 54	12.09%
55 to 59	7.14%
60 to 64	16.48%
65 to 74	23.08%
75 to 84	8.79%
Over 85 years	0.0%

(DCCED 2023)

Table 26. Current Population by Sex: five-year Average, 2018-2022

Sex	Percent of Population
Male	49.45
Female	50.55

(DCCED 2023)

Section 4.2.3 Economy

Seldovia's economy is primarily driven by its natural resources, tourism, and strong sense of community. The city's remote location and scenic beauty make it a unique and attractive destination, while its fishing heritage and local businesses form the backbone of its economic life. The key components of Seldovia's economy developed from information gathered through the DCCED include:

- Fishing and Seafood: Historically, fishing has been a cornerstone of Seldovia's economy. Commercial fishing, including the harvesting of salmon, halibut, and other seafood, is a major economic activity. Local seafood processing also contributes to the town's economic base.
- Tourism: Tourism is a vital part of Seldovia's economy. The town attracts visitors with its picturesque setting, outdoor recreational opportunities, and cultural events. Popular activities include fishing, hiking, wildlife viewing, and kayaking. Seldovia's unique charm and small-town atmosphere draw visitors looking for a more intimate Alaskan experience.
- Transportation: Seldovia is accessible primarily by boat or plane, with ferry and charter air services connecting it to Homer. The transportation sector supports the local economy by facilitating tourism and the movement of goods and people.
- Retail and Services: Local businesses, including shops, restaurants, and accommodations, cater to both residents and tourists. These small businesses are essential to the town's economy, providing jobs and supporting the community's needs.
- Education and Public Services: The local school and public services, including healthcare and municipal services, are important employers in Seldovia. These institutions not only provide essential services but also contribute to the stability of the local economy.
- Cultural and Community Activities: Seldovia hosts various cultural events and festivals, such as the annual Seldovia Summer Solstice Music Festival. These attract visitors and promote community engagement. These events help stimulate the local economy and enhance the town's appeal as a tourist destination.

The predominant employers in Seldovia include the KPBSD, the Seldovia Village Tribe, the City, and commercial fishing related businesses. According to the ACS, the five-year average (2018-2022) median household income in Seldovia is $84,375 and the median family income is $90,375. According to the Kenai Peninsula Economic Development District, Inc., Seldovia has a four percent unemployment rate, which is the lowest unemployment rate in the Borough. The community benefits from a diversified water-based economy and the potential for expanded mariculture. Table 27 includes information about employment by sector in Seldovia (from the 2020 U.S. Census).

Table 27. Seldovia Employment by Sector

Description	Average Employment
PUBLIC ADMINISTRATION	19
NATURAL RESOURCES AND MINING *(Agriculture, Forestry, Fishing, Hunting, Mining, Construction)*	21
TRADE (*Retail trade, Wholesale trade)*	16
TRANSPORTATION, AND UTILITIES *(Transportation, Warehousing, and Utilities)*	11
EDUCATIONAL AND HEALTH SERVICES *(Educational Services, Health Care and Social Assistance)*	17
LEISURE AND HOSPITALITY (*Arts, Entertainment, Recreation, Accommodation and Food Services*)	9
PROFESSIONAL AND BUSINESS SERVICES (*Professional, Scientific, Management of Companies & Enterprises, Administrative, and Waste Services)*	10
OTHER SERVICES	2

(DLWD QCEW 2023)

Section 4.3 City of Seward

Section 4.3.1 Location, Geography, and History

Seward, Alaska, is a city with a rich history dating back to its founding in 1903. The city is situated on Resurrection Bay on the east coast of the Kenai Peninsula, approximately 125 miles south of Anchorage. The city sits at the base of Mount Marathon, home of the grueling July 4 Mount Marathon race. Seward covers 21.5 square miles, of which 14.4 square miles is land and 7.1 square miles is water. Seward is connected to the Alaska Highway system by the Seward Highway. Seward serves as the southern terminus of the Alaska railroad and the historic starting point of the original Iditarod Trail to Interior Alaska. Seward was named after William H. Seward, the U.S. Secretary of State who orchestrated the purchase of Alaska from Russia in 1867.

The area's natural deep-water harbor was recognized early on by Russian explorers and later by American settlers as a strategic location. Seward was established as a fur trade post in 1873 by Alexander Baranov of the Shelikhov-Golikov Company, which became the Russian American Company. The City of Seward was officially founded in 1903 when John and Frank Ballaine and a group of settlers began constructing the Alaska Central Railway, aiming to connect the port to the interior of Alaska. The railway was crucial for the town's development, serving as a supply line for the gold rush era and later for other industries. Seward became a key port, transportation hub, and gateway to the vast resources of Alaska. The town grew steadily through the early 20th century, particularly during the construction of the Alaska Railroad between 1915 and 1923. This connection solidified Seward's role in Alaska's transportation network and allowed Seward to be developed as an ocean terminus and supply center. This connection also allowed the economy of Seward to diversify.

During World War II, Seward's strategic location and ice-free harbor made it an important military hub. The town experienced significant growth and infrastructure development during this period. However, in 1964, the Good Friday Earthquake devastated Seward, causing extensive damage and altering the town's landscape and infrastructure. In the latter part of the 20th century and into the 21st, Seward rebuilt and thrived, focusing on tourism, commercial fishing, and marine research. The establishment of the Kenai Fjords National Park in 1980 boosted tourism, drawing visitors to its stunning natural beauty and abundant wildlife. The town is also home to the Alaska SeaLife Center, a research and rehabilitation facility for marine wildlife.

Today, Seward is known for its vibrant tourism industry, with attractions such as the historic Iditarod Trail, Exit Glacier area, and opportunities for outdoor activities like hiking, fishing, and wildlife viewing. The town's history is celebrated through various events and landmarks, making Seward a unique blend of historical significance and modern Alaskan life.

Section 4.3.2 Demographics

Seward has a diverse and dynamic population. The key demographic characteristics of Seward according to the DCCED include:

- Population Size and Growth: Seward has a relatively small population, with the number of residents fluctuating based on seasonal employment trends, particularly in tourism and fishing. The year-round population is typically around 2,500-3,000 people, but this can increase significantly during the summer months. According to the Seward Visitors Bureau, upwards of 30,000 people descend on Seward during the Mount Marathon Race over the Fourth of July. Additionally, the City of Seward indicates that roughly 320,000 cruise ship passengers visit the community annually.
- Age Distribution: The population of Seward includes a mix of age groups, with a notable proportion of working-age adults. There is also a significant number of retirees and a smaller, but important, younger demographic, including children and teenagers.
- Ethnic and Racial Composition: Seward's population is predominantly White, with smaller representations of Native Alaskans, particularly from the Alutiiq/Sugpiaq and other indigenous groups. There are also small communities of other racial and ethnic backgrounds, contributing to the town's cultural diversity.
- Gender Distribution: The gender distribution in Seward is fairly balanced, with slightly more males than females. This balance can shift slightly due to the seasonal nature of certain industries that attract temporary male workers.
- Household Composition: Households in Seward vary widely, including families, single individuals, and non-family groups. There are both owned and rented housing options, with a mix of single-family homes, apartments, and seasonal housing for temporary workers.
- Education and Employment: The education levels in Seward range from high school diplomas to advanced degrees, reflecting the presence of various educational institutions and employment opportunities. Key employment sectors include tourism, fishing, public services, education, and healthcare.
- Income Levels: Income levels in Seward can vary, with median household incomes reflective of the town's mix of industries. While some residents work in well-paying sectors like oil, gas, and public administration, others are employed in lower-wage seasonal jobs related to tourism and fishing.
- Cultural and Community Life: Seward has a vibrant community life, with cultural events, festivals, and recreational activities playing a central role. The town's small size fosters a close-knit community atmosphere, with various clubs, organizations, and events bringing residents together.

Overall, Seward's demographics reflect a small, active community with a strong connection to its natural surroundings and economic base. The population is characterized by its seasonal fluctuations, diverse age groups, and a mix of cultural backgrounds, all contributing to the town's unique identity.

Table 28. City of Seward Population by Race Alone

Race	Total	Percent of Population
Alaska Native/American Indian	27	11.48%
Asian	0	0%
Black or African American	4	1.70%
Native Hawaiian or Pacific Islander	0	0%
White	131	55.74%
Other Race	2	0.85%
Two or More Races	46	19.57%
Total	235	

(2020 US Census Data)

Table 29. City of Seward Ethnicity

Ethnicity	Total	Percentage of Population
Hispanic	6	2.55%
Non-Hispanic	229	97.44%
Total	235	

(2020 US Census Data)

Each year, the U.S. Census Bureau conducts an American Community Survey (ACS) annually to help local officials, community leaders, and businesses understand the changes taking places within their respective communities. The ACS provides detailed population and housing information. Table 30 includes the five-year average (2018-2022) of Seward's population by age from the ACS and Table 31 provides the five-year average of Seward's gender population.

Table 30. Seward Population by Age: Five-Year Average, 2018-2022

Age (years)	Percent of Population
Under 5 years	3.72
5 to 9	5.92
10 to 14	8.13
15 to 19	3.36
20 to 24	3.0
25 to 34	15.07
35 to 44	15.9
45 to 54	12.25
55 to 59	7.26
60 to 64	8.24
65 to 74	12.03
75 to 84	1.99
Over 85 years	0.03

(DCCED 2023)

Table 31. Current Population by Sex: Five-Year Average, 2018-2022

Sex	Percent of Population

Male	34.72%
Female	65.28

(DCCED 2023)

Section 4.3.3 Economy

Seward has a diverse and resilient economy, significantly influenced by its geographic location, natural resources, and tourism appeal. Seward's economy is dominated by commercial fishing, government employment, commerce, tourism, and education. Key components of Seward's economy from DCCED include:

- Tourism**:** Seward is a popular tourist destination, attracting visitors with its scenic beauty, outdoor activities, and attractions like the Alaska SeaLife Center, Kenai Fjords National Park, and Exit Glacier. The town hosts various events, such as the annual Mount Marathon Race, which draw significant numbers of tourists.
- Fishing and Seafood Processing: The fishing industry plays a crucial role in Seward's economy. The town has a thriving commercial fishing sector, with numerous vessels operating out of Seward's harbor. Seafood processing facilities in Seward contribute to the local economy by providing jobs and supporting the fishing industry.
- Transportation and Logistics: Seward serves as an important transportation hub, with its deep-water port facilitating the shipment of goods. The Alaska Railroad also plays a significant role in transporting freight and passengers, linking Seward to Anchorage and other parts of the state.
- Education and Research: The University of Alaska Fairbanks operates the Seward Marine Center, which supports marine research and education. The presence of educational institutions and research facilities contributes to the local economy by providing employment and attracting researchers and students.
- Retail and Services: A variety of retail businesses and service providers cater to both residents and visitors. Local shops, restaurants, and accommodations benefit from the influx of tourists and the needs of the local population.
- Healthcare: Healthcare services are provided by local clinics and the Seward Community Health Center, which support the well-being of the community and provide employment opportunities.

The largest employers in the city are the State of Alaska, City of Seward, Spring Creek Correctional Facility, Providence Medical Center, the Alaska SeaLife Center, the Kenai Peninsula Borough School District, and Safeway (the local grocery store). According to the ACS, the five-year average (2018-2022) median household income in Seward is $77,850 and the median family income is $113,750. There are 138 people in the community that fall below the poverty line and 307 that fall below 125 percent of the poverty line. According to the Kenai Peninsula Economic Development District, Inc., Seward has a 7.1 percent unemployment rate, which is on par with the State and Borough's unemployment averages.

Table 32 includes information about employment by sector in Seward from the 2020 U.S. Census.

Table 32. City of Seward Employment by Sector

Description	Average Employment
PUBLIC ADMINISTRATION	206
NATURAL RESOURCES AND MINING *(Agriculture, Forestry, Fishing, Hunting, Mining, and Construction)*	173
TRADE (*Retail trade, Wholesale trade)*	87
TRANSPORTATION, AND UTILITIES *(Transportation, Warehousing, and Utilities)*	24
EDUCATIONAL AND HEALTH SERVICES *(Educational Services, Health Care and Social Assistance)*	192
LEISURE AND HOSPITALITY (*Arts, Entertainment, Recreation, Accommodation and Food Services*)	260
PROFESSIONAL AND BUSINESS SERVICES (*Professional, Scientific, Management of Companies & Enterprises, Administrative, and Waste Services)*	51
FINANCE ACTIVITIES *(Finance, Insurance, Real Estate, Rental and Leasing)*	50
MANUFACTURING	67
INFORMATION	13
OTHER SERVICES	71

(DLWD QCEW 2023)

Section 5 Hazard Identification

Section 5.1 Hazards Included in the Plan

This HMP update reviews various types of hazards identified as common or possible in the KPB. Each hazard's analysis includes identifying, screening, and detailing its potential effects on the Borough. Hazard identification involves recognizing natural events that pose a threat to the area. Natural hazards are unexpected or uncontrollable events of sufficient magnitude that they are notable to scientists or the general public. Even if a particular hazard has not occurred recently, all potential natural hazards affecting the Borough are included in this HMP Update. Hazards deemed unlikely or those that have not occurred are also considered but were not included in this plan update.

The Planning Team reviewed data and discussed the impacts of each of the hazards required by FEMA for consideration. Of the FEMA hazards considered, eight were identified as applicable to the KPB in the HMP:

- **Flooding and Erosion**
- **Wildfires** (covered more fully in the KPB Community Wildfire Protection Plan)
- **Earthquakes**
- **Severe Weather**
- **Tsunamis/Seiches**
- **Volcanoes**
- **Avalanches/Landslides**
- **Human-Caused Hazards**

Each of the Hazard Sections (Sections 6 – 12) in this plan includes a description of the hazard, a history of hazard occurrences, locations of hazard occurrences, effects of hazard occurrences, facilities and populations at risk, and potential strategies and implementation ideas to reduce loss from future hazard events. Although not natural hazards, human-caused hazards are included in the plan as they pose risks to the Borough that involve mitigation, emergency management and response. Human-caused hazards can also affect natural hazards, such as flooding due to dam releases or erosion and landslides caused by construction or development on unstable ground.

The KPB's emergency response powers do not extend to public health declarations, such as the COVID-19 pandemic response measures. Additionally, this 2024 HMP update does not include KPB as the lead agency for responses related to terrorism. These responsibilities and the Borough's response coverage areas are outlined in Ordinance 2022-28 new section 1.12.080. In relation to other agencies' direct responses to terrorism, the KPB OEM would support alert and warning dissemination as requested by the responding agencies.

Section 5.2 Impact of Future Climate Conditions

In addition to each hazard listed, this 2024 HMP update reviews the effects of future climate conditions specific to each hazard, where relevant. Future climate conditions refer to the

anticipated state of the Earth's climate in the coming decades and centuries, based on scientific projections and models. Each hazard will also be monitored for the impacts of cryosphere change where relevant. Cryosphere change refers to alterations in parts of the earth's surface where water is in solid form, such as glaciers, ice caps, and snow-covered mountains. These changes can significantly impact global climate patterns, sea level rise, and local ecosystems.

For example, in August 2019, the KPB signed a disaster declaration for a drought affecting the communities of Seldovia and Nanwalek. Drought conditions depleted local water reservoirs to levels below intake valves that supply the community water systems. Drinking water in five-gallon jugs was transported to both communities, with over 10,000 pounds brought into each community during the drought.

Section 5.3 Hazard Profiles

The Planning Team selected specific hazards for profiling and examined them along with additional factors that have or could affect the KPB. This examination highlights the following key factors for each hazard:

- **Description**: A brief synopsis of the hazard profiled
- **Overview**: A general analysis of the hazard
- **Type**: The specific defined and identified types of hazard occurrences
- **History**: Recent and historical notable hazard events
- **Mitigation Projects**: Initiated projects and planned efforts to reduce hazard risk
- **Risk Assessment**: The assessed risk based on scientific research and analysis
- **Future Climate Conditions**: The anticipated impact of future climate conditions on the hazard, where relevant

A more in-depth analysis of each hazard's effect on critical infrastructure and residents in the KPB can be found in the risk assessment portion of the plan. Since hazards occur regularly, the hazard profile is a snapshot in time. Any notable or historical hazards occurring after the plan's implementation should be acknowledged and analyzed in future HMP updates.

Section 6 Flooding and Erosion

All water has a perfect memory and is forever trying to get back to where it was.

- Toni Morrison

Section 6.1 Hazard Overview

With roughly 1,300 miles of coastline, and numerous rivers, streams and lakes, many Kenai Peninsula Borough communities are subject to several types of flood hazards. The National Oceanic and Atmospheric Administration (NOAA) Storm Events Database documents 20 significant flood events in the KPB since 2000. Ten of those events resulted in local, state, and/or federal disaster declarations.

2019 Anchor River - Winter Storm Flooding

As development occurs in flood-prone areas, flood mitigation planning becomes essential to limit or prevent future loss of life and property. The NFIP typically covers in-kind repairs, which provide short-term benefits but may result in similar damage during subsequent floods. Proactive mitigation efforts can break the cycle of repetitive loss and lead to long-term solutions for reducing ongoing flood issues.

The SBCFSA was established in 2003 (Ordinance 2003-30) to address persistent and severe flooding issues in the Seward area. This Borough service area was formed in response to historical and recurring flood events, highlighting the need for a unified flood management strategy. Since its inception, the SBCFSA has been instrumental in minimizing flood damage and strengthening community resilience. Additionally, the KPB River Center oversees floodplain management efforts for streams, rivers, and waterways across the borough, including the Seward area.

Rising sea levels, increased storm frequency and intensity, and natural geological processes contribute to the erosion of KPB coastal and river areas. Key areas affected include communities along Cook Inlet and Kachemak Bay, where land loss threatens residential properties, infrastructure, and critical habitats. Coastal erosion can lead to property damage, increased vulnerability to storm surges, and loss of valuable land, which can impact the local economy and environment. Mitigation efforts include constructing seawalls, riprap barriers, and planting vegetation along river embankments to reinforce ground stability.

Another related hazard affecting Resurrection Bay and rivers in the Seward area is the increased deposition of sediment, which fills waterways and contributes to flooding incidents, habitat loss, and navigation concerns.

Section 6.2 Types of Flooding & Erosion

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

Three primary types of flooding occur in the KPB: flash flooding, coastal flooding, and river/stream flooding. These types of flooding are primarily related to rainfall, snowmelt, and storm surge. In addition to flooding concerns, coastal and riverine scour (erosion) is an ongoing concern, particularly in coastal areas along Cook Inlet and the mouths of major rivers including the Kenai River. Definitions from NOAA of the most common types of flooding and erosion in the KPB are listed below:

- **River and Stream Flooding** typically occurs in late summer and early fall. The rainfall intensity, duration, distribution, and geomorphic characteristics of the watershed all play a role in determining the magnitude of the flood. Rainfall runoff flooding is the most common type of flood. This type of flood event generally results from weather systems that have associated prolonged heavy rainfall. Glacial dam release, also known as glacial outburst (jökulhlaup) flooding, is also a frequent cause of this type of flooding in the KPB.
- **Flash Floods** typically originate from slow-moving storms that can generate immense rainfall and snow melt volumes which rapidly raise water levels, bursting levees and seeking new routes to lower ground. Flash floods quickly reach high velocities, often carrying debris. Flash flooding has been of particular concern within the SBCFSA as this type of flooding offers little response time to mitigate flooding issues.

Flash flood event at the Lowell Creek Tunnel outflow in Seward (City of Seward)

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

- **Storm Surge (Coastal Floods)** occur when seawater is pushed inland above the normal high-tide level onto typically dry land. When combined with high tides, storm surges can lead to severe flooding in coastal areas. Often accompanied by heavy surf generated by high winds, storm surges significantly increase the destructive force of coastal waves. These conditions not only cause flooding but also contribute to substantial shoreline erosion, undermining roads and structures. Storm surge is a common cause of property damage in Alaska, affecting various communities and villages along low-lying coastal areas such as Seward, Lowell Point, Homer, Hope and Seldovia.
- **Scour (Erosion)** Both coastal and riverine erosion can cause property damage, restrict development, and impact community infrastructure. Erosion can occur suddenly during floods or storms, or gradually due to long-term environmental changes in topography. Areas particularly vulnerable include Kalifornsky Beach (K-Beach) Road, Lowell Point Road, the mouth of the Kenai River, coastal communities along Cook Inlet, and stretches of the Kenai Spur Highway and Sterling Highway between Nikiski and Anchor Point. While erosion is a natural process, human activities can worsen its effects. Coastal and riverine erosion pose ongoing threats to borough infrastructure, built environments, and utilities near embankments and shorelines.

Section 6.3 Historic Events

Numerous flood events are recorded throughout the KPB and its history, especially in the SBCFSA. The SBCFSA conducts ongoing mitigation efforts in areas prone to repeated flooding. Some notable recent flooding incidents, documented by the Kenai River Center, National Weather Service (NWS) and FEMA, include the following major flooding events over the last 10 years:

- **October 2013:** The Kenai Peninsula received substantial amounts of rain following several weather systems that had previously inundated low-lying areas. Seward, Homer, and other areas of the Kenai Peninsula received heavy rain and flooding which caused landslides, and bridge, airport and road closures. Flood damage affecting many individual homes were reported and several businesses were also impacted. Disaster declarations were received from the KPB and the City of Seward.
- **October 2018:** Numerous areas of the Kenai Peninsula and the City of Seward suffered widespread flooding and related damages because of unusually heavy and persistent rainfall. The City of Seward and the KPB issued local declarations of disaster emergency in response to this event.
- **May 2023:** The K-Beach area in/around Soldotna faced persistent flooding due to snowmelt from an exceptionally snowy winter. This flooding caused widespread damage to properties, including yards, septic systems, and homes.
- **July 2023:** Heavy summer rains compounded the existing flooding issues in the K-Beach area, leading to further property damage and ongoing concerns from residents. The borough worked on both short-term and long-term solutions to manage water flow and alleviate flooding.

- **September 2023:** A combination of high precipitation and glacial dam outbursts led to significant flooding in several areas, including the Kenai Keys subdivision, the Big Eddy subdivision in Soldotna, and areas around Salmon Run Drive in Funny River. This prompted the borough to extend its state of emergency to better manage the ongoing high-water conditions.

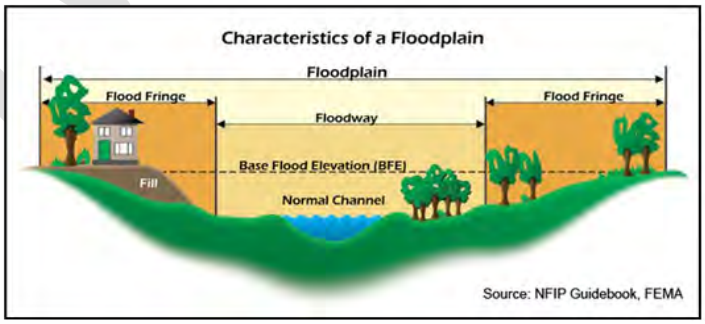
More detailed information regarding these flooding events related to severe weather, including disaster declaration information, can be found in the Severe Weather section (Section 9) of this HMP Update.

Section 6.4 Floodplain Management

Floodplain management in the KPB is guided by federal, state, and local regulations. The NFIP provides a framework for managing floodplains and offers flood insurance to property owners in participating communities. The KPB adheres to NFIP guidelines and has implemented local ordinances that regulate development within flood-prone areas. These ordinances include requirements for building elevations, floodproofing, and land use controls to prevent increases in flood risks.

Accurate flood hazard mapping is crucial for effective floodplain management. The KPB collaborates with FEMA to update FIRMs. These maps identify flood zones and help in assessing flood risks for specific areas. Updated mapping ensures that new developments are adequately protected and that existing structures are aware of their flood risk. 2024 FIRMs are currently being finalized by FEMA for the Kenai River below Skilak Lake. This is an update from the previous FIRM dating back to 1981. A Flood Insurance Study (FIS) is also being finalized for 2024 and will include updated data from the study areas. The covered area includes Sterling, Funny River, Soldotna, and Kenai. Outreach efforts are being facilitated through the Donald E. Gilman River Center (River Center) with additional input and feedback provided by the SBCFSA.

The KPB Floodplain Program working out of the Kenai River Center manages flood risk resources in all areas of the Kenai Peninsula with the exceptions of the cities of Seward, Kenai, and Homer (which manage their own floodplain programs), and the City of Seldovia (which does not participate in the NFIP, but is working toward participation). The KPB Floodplain Program website provides clear and concise information that property owners and jurisdictions can use to understand their risks and how they relate to flood insurance and property development within a floodplain; when elevating a structure may be necessary, and what permits are required.



Floodplain Diagram (FEMA)

Section 6.4.1 River Center

The Donald E. Gilman River Center (River Center) serves as a multi-agency hub for permitting, outreach, and education focused on managing and mitigating flood risks along the Kenai River and its tributaries. It plays a crucial role in overseeing the permitting process for development projects, ensuring compliance with floodplain regulations to reduce flood damage and preserve natural floodplain functions. Collaborating with FEMA, and other federal, state, and local agencies, the River Center ensures that accurate flood hazard maps essential for effective planning and risk assessment are developed and maintained. It also provides applications and guidance for all agency permit requirements for development. Moreover, through public education initiatives, the Kenai River Center informs residents and stakeholders about flood risks, safety protocols, and sustainable land use practices. These efforts support the Borough's floodplain management code (21.06 -Floodplain Management), aiming to safeguard both human life and the environment from the adverse impacts of flooding.

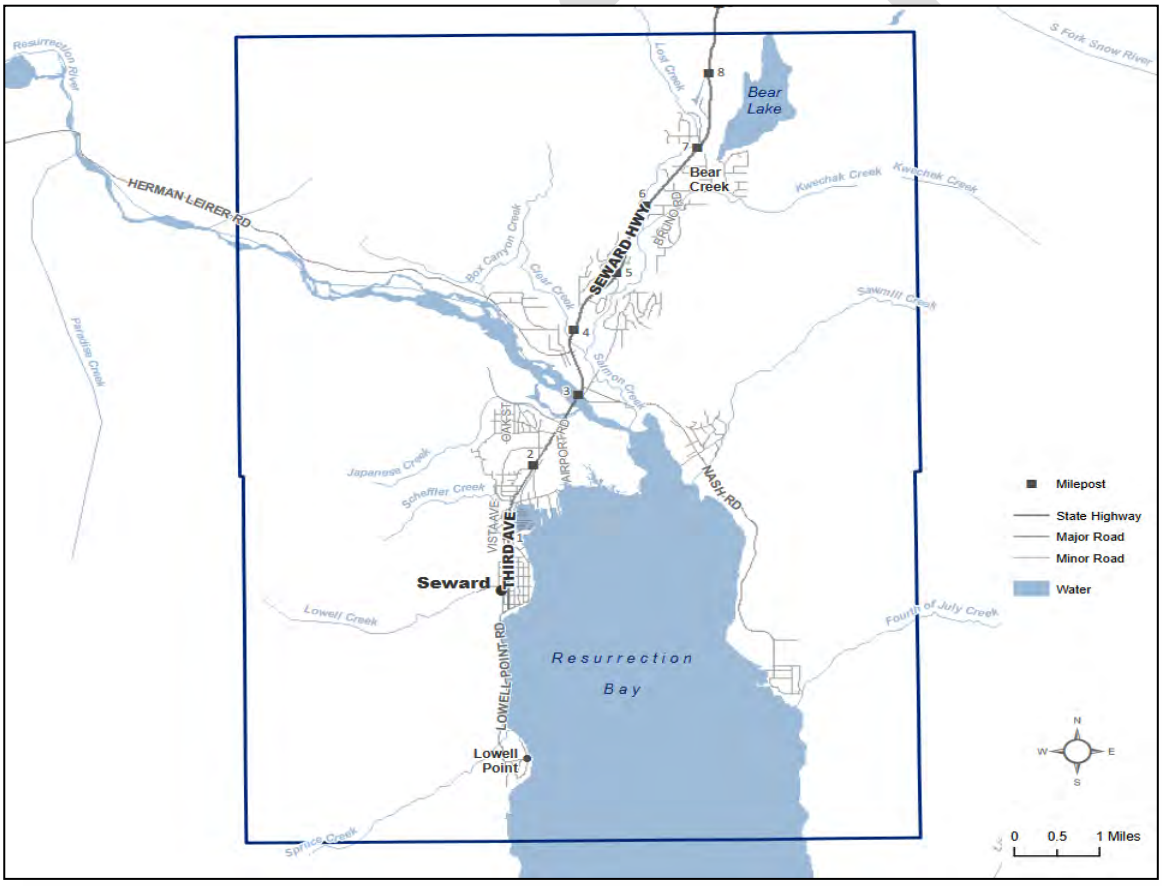


Figure 2. SBCFSA boundary with waterways and communities in area

Section 6.4.2 Seward Bear Creek Flood Service Area

The SBCFSA is integral to floodplain management for the communities of Seward, Bear Creek, and Lowell Point. The SBCFSA is responsible for developing and implementing strategies to mitigate flood risks and managing the floodplain effectively. This includes conducting flood risk assessments, maintaining and improving flood control infrastructure like levees and drainage systems, and ensuring compliance with federal, state, and local floodplain regulations. The service area also prioritizes public education, informing residents about flood risks, emergency preparedness, and the importance of flood insurance. By collaborating with various governmental agencies and community stakeholders, the SBCFSA aims to enhance the region's resilience to flooding, protect properties and natural resources, and ensure safe and sustainable development within the floodplain.

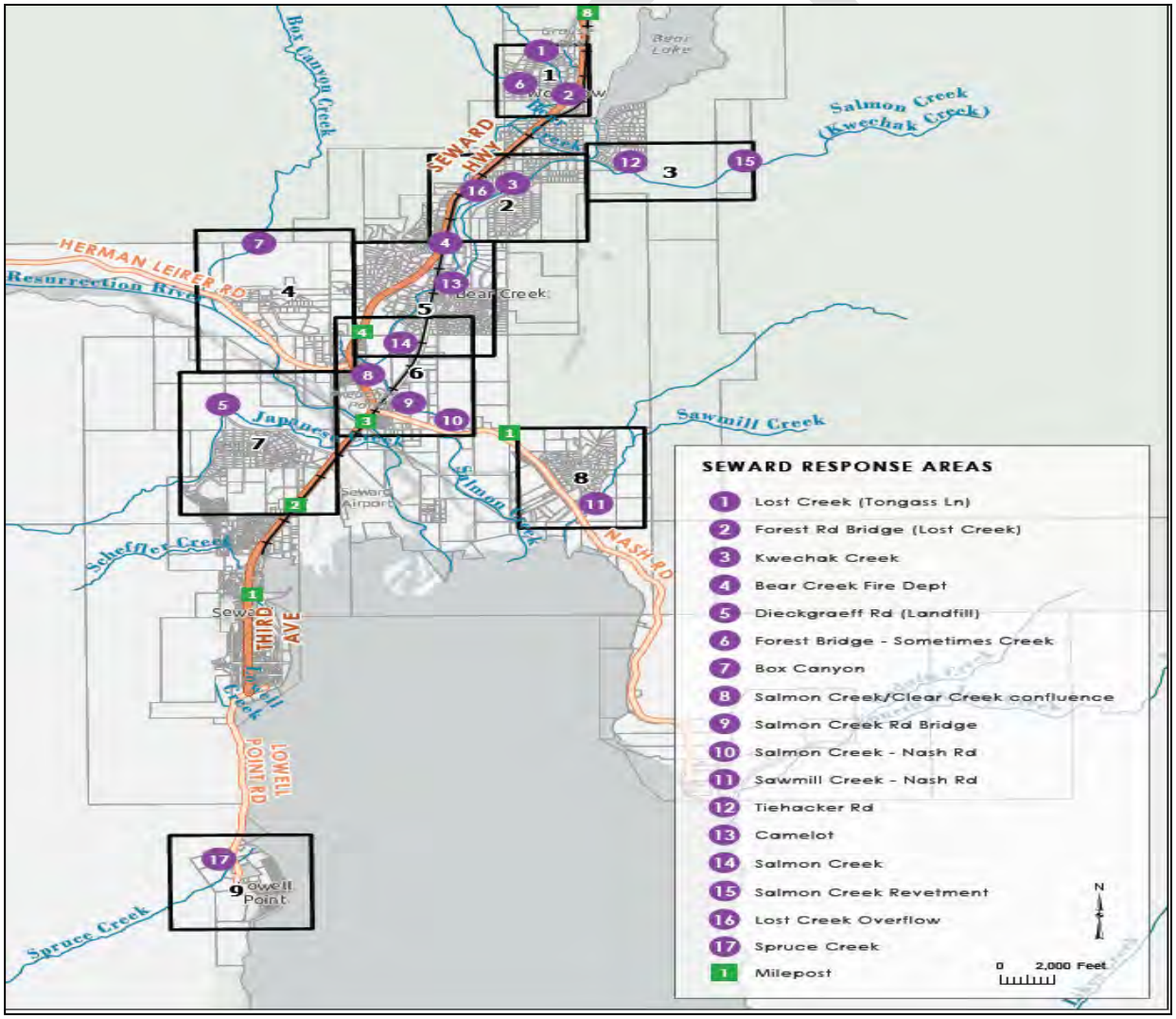


Figure 3. Seward Response Areas for streams and rivers in the SBCFSA.
These response areas include preparation for flooding events including staging areas, work areas, and required equipment.

The SBCFSA holds regular public meetings, on the first Monday of each month, to discuss flood management activities, review ongoing projects, and make key decisions. Work Sessions are held on the third Monday of each month. These meetings encourage community participation and input, ensuring transparency and responsiveness to local concerns. SBCFSA Agendas and meeting minutes are publicly accessible (SBCFSA Meetings (kpb.us)). The SBCFSA Board is comprised of seven elected local residents and oversees compliance with federal, state, and local floodplain regulations, including those mandated by the NFIP. Requirements for property development in the flood service area include obtaining necessary permits, adhering to floodproofing standards, and consulting updated flood hazard maps. The SBCFSA also prioritizes public education through workshops and informational resources and collaborates with emergency management agencies to enhance community preparedness and resilience against flooding. Table 33 shows the watersheds of the Seward Bear Creek flood service area.

Table 33. Seward Bear Creek Flood Service Area Watersheds

Seward Bear Creek Flood Service Area Watersheds		
Bear Creek	Japanese Creek	Salmon Creek
Box Canyon Creek	Kwechak Creek	Sawmill Creek
Clear Creek	Lost Creek	Scheffler Creek
Fourth of July Creek	Lowell Creek	Sometimes Creek
Grouse Creek	Resurrection River	Spruce Creek

Section 6.5 Flood Insurance

Section 6.5.1 National Flood Insurance Program (NFIP)

The KPB, along with the City of Seward and City of Homer, actively participate in the NFIP. The City of Seldovia is in the process of becoming a participant in the NFIP as well. The NFIP is a federal initiative managed by FEMA, aimed at reducing flood risks and providing affordable flood insurance. Through its involvement in the NFIP, KPB adopts and enforces floodplain management regulations designed to mitigate the impact of flooding on new and existing developments. These regulations include specific building standards, land use practices, and floodproofing measures to ensure community safety and reduce flood damage. The Borough provides updated FIRMs to inform property owners and developers about flood-prone areas, guiding

Flood mitigation efforts after severe flooding in Seward, October 2020

appropriate development and land use decisions. Additionally, KPB offers public education on flood risks and the benefits of flood insurance, helping residents understand flood hazards and take necessary precautions.

The number of policies and coverage amounts within the NFIP for properties in the Borough have decreased in recent years, despite the state having the lowest average NFIP flood insurance prices in the nation. Both the State NFIP Coordinator and the FEMA Region 10 NFIP Regional Support Liaison note this trend. Concurrently the market share of private flood insurance in Alaska has increased. FEMA Region 10 is promoting ongoing outreach and information campaigns about the benefits of NFIP insurance for affected areas. One potential reason for the decrease in NFIP participation could be that the KPB and the City of Seward no longer participate in the Community Rating System (CRS). The CRS is an incentive program that reduces premiums when communities exceed the minimum NFIP requirements. The City of Seward left the CRS program in 2020, and the KPB exited in 2023. Both have decided to focus their CRS efforts on integrating education, outreach, and administration within their respective floodplain programs.

Table 34. NFIP Flood Insurance Information

Community	No. of policies as of 5/29/24	No. of policies as of 1/31/18	Total current coverage as of 04/30/24	Total current premiums as of 5/29/24	Total claims (1/1978 – 5/29/24	Paid claims (1/1978 – 5/29/24)	Total net payment (1/1978 – 5/29/24)
City of Homer	11	26	$5,442	$3,312	2	1	$28,030.64
City of Seward/ Seward Bear Creek Flood Service Area	14	18	$8,866,000	$15,360	2	1	$40,342
Kenai Peninsula Borough	168	298	$80,975,000	$70,811	75	50	$601,822.68

(FEMA)

Section 6.5.2 Flood Insurance Study (FIS)

The 2024 FEMA FIS Report revises and updates information on the existence and severity of flood hazards throughout the Kenai Peninsula Borough (KPB), with a focus on the Kenai River and its streams and tributaries. The report compiles flood hazard data used to establish flood insurance rates and assist communities in implementing effective floodplain management. Additional information on floodplain management and improvements in the KPB can be found in the December 2017 KPB FEMA Risk Report or from past FIS Reports listed in Table 35, based on their analysis dates.

Floodplain maps, used by FEMA and the KPB, depict various floodplain zones, including SFHAs, moderate-risk zones, and low-risk zones. SFHAs are of particular concern as they face the highest risk of flooding. Properties in SFHAs must have flood insurance if they have a mortgage

from a federally regulated or insured lender. Development in SFHAs is subject to stricter regulations, including elevation requirements and restrictions on certain types of construction.

Moderate-risk and low-risk floodplain zones are still susceptible to flooding but have lower insurance requirements and less stringent development regulations compared to SFHAs. Property owners in these zones are encouraged to take precautions and consider purchasing flood insurance to protect against potential flood damage. Table 36 lists the SFHA zones subject to inundation by the one percent annual chance flood:

Table 35 Special Flood Hazard Areas Legend

Zone	Description
A	Areas with a one percent annual chance of flooding and a 26 percent chance of flooding over the life of a 30-year mortgage.
AE	Flood Zone AE is one of the most common high-risk flood areas. It differs from Flood Zone A in that Flood Zone AE is mapped to determine the BFE.
AE - Floodway	Similar to AE but a "Regulatory Floodway" means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.
V	The flood insurance rate zone that corresponds to the one percent annual chance coastal floodplains that have additional hazards associated with storm waves. Base flood elevations are not shown within this zone.
X	Area of moderate flood hazard, usually the area between the limits of the 100- year and 500-year floods. This Zone is used to designate base floodplains of lesser hazards, such as areas protected by levees from 100-year flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than one square mile.

(FEMA)

Flooding sources in the FIS were developed to list each flooding source, including its study limits, affected communities, mapped zone on the FIRM, and the completion date of its engineering analysis from which the flood elevations on the FIRM and in the FIS Report were derived. Floodplain boundaries for these flooding sources are shown on the FIRMs using the Zones shown on Table 36. On the FIRM Map, the one percent-annual-chance floodplain corresponds to the SFHAs. The 0.2-percent-annual-chance floodplain shows areas that although out of the regulatory floodplain, are still subject to flood hazards.

Table 37 is a table list of the streams, rivers and waterways that are flooding sources in the KPB and SBCFSA. Rivers such as the Kasilof River and Ninilchik River do flood seasonally but were not included in the FEMA study shown in the table below.

Table 36 Stream, River and Water Body Flooding Sources in the KPB

Flood Source	Community	Downstream Limit	Upstream Limit	Length (mi) (streams or coastlines) or Area (mi2) (estuaries or ponding)	Floodway (Y/N)	Zone shown on FIRM	Date of Analysis
Anchor River	Kenai Peninsula Borough	Mouth at Cook Inlet	Approximately 500 feet upstream of Sterling Highway	7.4	Y	AE	03/27/2014
Bear Creek	Kenai Peninsula Borough	Confluence with Salmon Creek	At inlet of Bear Lake	1.2	Y	AE	December 2009
Bear Lake	Kenai Peninsula Borough	Entire lake shore	Entire lake shore	0.6	N	A	December 2009
Beaver Creek	Kenai Peninsula Borough; City of Kenai	Confluence with Kenai River	Approximately 0.5 miles upstream of Kenai Spur Hwy	3.3	N	A	06/07/2022
Beluga Lake	City of Homer	Entire lake shore	Entire lake shore	0.3	N	A	07/08/2016
Cook Inlet	Kenai Peninsula Borough	Portion of coastline within Kenai Peninsula Borough	Portion of coastline within Kenai Peninsula Borough	2.1	N	VE, AE	January 1978
Cook Inlet	Kenai Peninsula Borough; City of Kenai	Approximately 0.9 miles northwest of Transect 1	Approximately 4.9 miles southwest of Transect 5	25.3	N	VE, AE	03/27/2014
Cook Inlet	Kenai Peninsula Borough	Approximately 1.0 miles northeast of Transect 6	Approximately 12.3 miles southwest of Transect 8	24.6	N	VE, AE	03/27/2014
Cook Inlet	Kenai Peninsula Borough	Portion of coastline within Kenai Peninsula Borough	Portion of coastline within Kenai Peninsula Borough	2.7	N	VE, AE	03/27/2014
Funny River	Kenai Peninsula Borough	Confluence with Kenai River	Approximately 1.4 miles upstream of Funny River Rd	1.7	N	A	06/07/2022
Grouse Creek	Kenai Peninsula Borough	Confluence of Salmon Creek	At inlet of Grouse Lake	0.6	N	AE	December 2009

(FEMA 2023 FIS Study)

Section 6.6 Erosion Management

Coastal and riverine erosion management in the KPB is primarily managed by the River Center with support in the Seward area from the SBCFSA. Additional work is done by local non-profits including the Kenai Watershed Forum (KWF) and Cook Inletkeeper. These non-profit groups primarily work in outreach and assisting property owners by providing information on proper methods of planting or adding natural features to reinforce stream and riverbanks. However, many of these non-profit groups have also pursued grants and larger scale projects that include embankment reinforcement through contracted larger scale development. Erosion mitigation work conducted by the Borough is primarily focused on developing projects that can eliminate or reduce erosion in problem areas and provide natural improvements that can reduce erosion. USACE, within its erosion information study for Seward, listed areas of concern along Japanese Creek near the bridge on Dieckgraeff Road, areas around the Resurrection River Bridge and areas of Lowell Point Road near the tunnel outfall.

SBCFSA Salmon Creek Revetment Project

Structural solutions such as seawalls, revetments, and levees are deployed to protect vulnerable infrastructure and properties, while nature-based approaches such as beach nourishment, riparian buffer restoration, and habitat enhancement are utilized to stabilize banks and promote natural resilience. Additionally, zoning regulations, setback requirements, and land use planning strategies are enforced to guide responsible development practices and minimize erosion risk. Public engagement and collaboration with stakeholders play a crucial role in raising awareness, fostering community involvement, and implementing effective erosion management strategies. By integrating science, policy, and community participation, KPB strives to mitigate erosion impacts, protect valuable assets, and preserve the ecological integrity of coastal and riverine environments for future generations.

A recent example of successful embankment and flood mitigation efforts in the SBCFSA includes armored revetment along Upper Salmon Creek. Construction started February 13, 2018, with snow on the ground, and used the snow to divert flow to the far bank of the creek, allowing stone to be placed in dry conditions. This project was completed in 2019 with 1,750 feet of revetment placed at a final cost of $2.9 million. Additional revetment projects are planned along the Salmon Creek floodplain that will also help in flood mitigation efforts. SBCFSA is planning mitigation projects related to flood and erosion issues along Scheffler Creek; these are currently in the design and engineering review process.

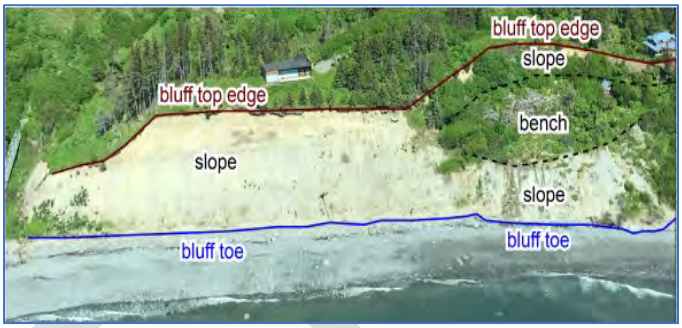


Image of a coastal bluff erosion with delineated toe/bottom (blue) and top edge (maroon) with slope area in between. (DGGS)

Section 6.6.1 Coastal Erosion

The areas of the Kenai Peninsula facing Cook Inlet are primarily composed of poorly consolidated materials deposited by glaciers and rivers. Based on the observations from the 2007 USACE Kenai River Bluff Erosion Study, during the period 1952-2004 the bluff eroded an average of one foot per year. Areas experiencing high erosion rates are called "hot spots" and are identified in the study. The area north of the Kenai River to the east Forelands has the greatest incidence of hot spot erosion. The area north of Anchor Point to the Kasilof River has the fewest such areas. The most significant hot spots experience erosion at the average rate of roughly two to six feet per year. It is important to note that erosion does not usually occur gradually, but rather as an episodic process.

Coastal erosion severely impacts the communities of Anchor Point, Homer, Hope, Nanwalek, Ninilchik, Port Graham, Seldovia, and Seward. Erosion rates along the coastline within these communities vary from a few inches to several feet a year. These varying rates are heavily dependent on weather events. A landscape that appears to be virtually untouched for years can succumb to several feet of erosion in a matter of days during a significant storm event. Erosion from riverine flooding is also problematic for the Borough in coastal areas and has been identified as an issue at the mouth of the Kenai River. The City of Kenai is currently working on a

Cook Inlet Coastal Erosion - Tyonek Bluffs (NOAA)

bank stabilization project for this area; see the City of Kenai HMP for more detailed information on this project.

DGGS Coastal Hazards calculated bluff recession over time at approximately 100-meter intervals within an 86-mile study area from Homer to Nikiski. While some areas experience little or no erosion, other areas are experiencing significant erosion. DGGS has been closely monitoring coastal erosion along Cook Inlet through studies and mapping projects. DGGS's research has highlighted the significant threat erosion poses to infrastructure, local communities, and the main access roads along the bluffs. For example, the Village of Tyonek has been identified by DGGS as one of its high-risk areas where erosion has already led to property damage and poses ongoing risks to public safety and infrastructure (both community and oil and gas related).

Section 6.7 Hazard Assessment

Given the Borough's large size and diversity of topography, geology, hydrology and weather, the flood hazard risk assessment process looks at specific flood impacts in problem areas. These areas are outlined in the 2024 FIS based on the flooding source as well as the description of associated flooding problems in the table below.

Table 37. Principal Flood Problem Areas in KPB

Flooding Source	Description of Flood Problems
Anchor River	Three road crossings constrict the river in the Anchor River study area. The Sterling Highway crossing of the North Fork of the Anchor River is an earth fill structure with four eight-foot diameter corrugated metal pipe culverts that may be subject to hydraulic seepage due to water elevations on the upstream side of the road. The Sterling Highway crossing of the South Fork of the Anchor River is a concrete span bridge. Although its bridge abutments are well armored, the crossing is subject to erosion due to high velocities of flood flows and the Sterling Highway could potentially be overtopped. Both of these river crossings are critical to the region as the Sterling Highway is the only road access to a sizable portion of the Kenai Peninsula. The third river crossing is a trestle bridge on Old Sterling Highway over the main stem of the river. In October 2002, the road leading up to the Sterling Highway bridge was washed out. Nikolaevsk Village was also isolated because of bridge failure on the North Fork of the Anchor River. Less damage occurred during the November 2002 flood, but road access to the lower Kenai Peninsula was cut off for a second time when bridge approaches washed out on the Anchor River crossings on the Sterling Highway and Old Sterling Highway. Flooding in October and November 2002 also occurred at the Anchor River State Campground downstream of the Old Sterling Highway bridge crossing, inundating the entire area and damaging several cabins. According to the NWS, highways in the area begin to experience flooding at one foot below the flood stage.
Cook Inlet/English Bay (now Nanwalek)	An 1883 Augustine eruption caused wave heights of 20 to 30 feet on low tide; minor damage.

Flooding Source	Description of Flood Problems
Kenai River	Two other situations causing flooding can occur on the Kenai River. The first, known as jökulhlaup, occurs when a glacier-dammed lake is suddenly released (NOAA). When this happens during the winter, the sudden increase in flow raises the ice cover and attempts to move it downstream. Ice jams result and flooding to depths far greater than either the 1- or 0.2-percent-annual-chance flood can occur. The second, ice jams, occurs during spring break up, and it can also cause flooding to depths greater than either the 1- or 0.2-percent-annual chance year flood. When there is a heavy ice cover on the river, untimely breakups (or jökulhlaups) can cause the ice to jam. Ice jams usually occur at natural restrictions or bends in the river and can cause water to back up and flood low areas. Floods resulting from the sudden release of glacier-dammed lakes have occurred on the Kenai River in past years. This type of flooding was most recently recorded in the fall of 2023 (NWS Glacier Dammed Lakes Page). These floods originate from lakes formed either by Snow Glacier, at the head of Snow River, or by Skilak Glacier.
Resurrection River	Resurrection River has overflowed its banks several times and has caused flood damages to the developed areas near its mouth.
Salmon Creek	Salmon Creek has overflowed its banks several times and with areas of flood damages occurring primarily near the mouth of the creek.
Borough Wide Flood Areas	Floods on the Kenai Peninsula can occur as a result of a combination of factors, which include heavy snowpack and snowmelt, high tides, and heavy precipitation. High winds when combined with a high tide create a storm surge and wave runup, which flood coastal areas. Spring floods on streams may result when an above normal snowfall during the winter is followed by an unusually warm spring and a rapid snowmelt. Summer and autumn floods usually result from intense precipitation. Future floods from most glacier-dammed lakes cannot be estimated reliably by using standard statistical procedures because the hydrologic characteristics of the drainage basin may change suddenly and discontinuously. Glacier dammed lakes which have no previous record of dumping may abruptly begin to do so. In addition, the flood sequence may change drastically, or the reservoir may cease filling due to changes in the glacier. Therefore, peak flows during a flood of this type have not been assigned a frequency nor have jökulhlaups been considered in the development of the maps and flood profiles in the 2023 FEMA FIS Study. As a means of comparison, the September 1974 jökulhlaup attained a peak discharge of 26,800 cfs at Soldotna, and the one percent-annual-chance flood, as determined by means of conventional storm runoff computations, would reach 37,500 cfs at the same location. As is typical of most of Alaska, there is little information available concerning historical floods on the Kenai Peninsula during periods of time prior to the 1900s. Recent historical flood information for the KPB is primarily part of modern records and information related to historical flooding only exists via native and tribal accounts of past historical flooding events.

(FEMA 2023)

The 2017 FEMA Risk Report looked at the preliminary flood hazard data available for select locations throughout the KPB. The Hazus flood analysis that was part of the Risk Report was based on 147 structures located within identified coastal or riverine hazard areas in specified communities in the Borough. A large portion of the flood risk assessment analyzes flood losses due to riverine flooding: of the buildings included, 122 are in Zones A, AE, AH, or AO. The remaining 25 are subject to coastal flooding (Zone VE). The loss data from the Hazus and the

exposure analysis, which highlight the areas affected by flooding, can be used to identify properties for mitigation projects as well as areas to target for additional outreach.

Table 38. SFHAs in the Borough by structure risk and loss ratio

Community Name	Structures in the HAZUS Flood Analysis	Zone A, AE, AH, AO	Zone VE	Building Dollar Loss for a 1% Annual Chance Flood Event	Loss Ratio (Dollar Losses/Total Building Value)
Incorporated Areas					
City of Seward	25	21	4	$1,952,753	9.66%
Unincorporated Areas					
Anchor Point	9	9	0	$7,378	1.43%
Cooper Landing	15	15	0	$316,952	11.32%
Happy Valley	5	0	5	$23,542	2.44%
Kalifornsky	1	1	0	$309	0.90%
Lowell Point	41	41	0	$1,033,131	16.40%
Ninilchik	13	13	0	$162,914	15.23%
Salamatof	1	0	1	$12,282	46.00%
Unincorporated. Total	85	79	6	$1,556,508	13.29%

(FEMA 2017)

In the KPB those residing in a SFHA can have significant costs associated with flooding. Flooding can result in costly property damage, loss of personal belongings, and potential long-term displacement. Consequently, living in an SFHA in the KPB has the potential for significant economic impact due to actual flood events. Table 40 lists costs associated with potential damages to KPB infrastructure and estimated costs associated potential losses in SFHA coverage areas.

Table 39. Summary of parcel data for SFHA coverage areas in KPB

Description	
Number of parcels in SFHA	24,264.00
Total acreage in SFHA	112,942.00
Total value in SFHA	$4,934,046,989.00
Number improved parcels in SFHA	14,527.00
Total improved acreage in SFHA	39,291.00
Total improved value in SFHA	$3,695,659,800.00
Total Acreage of SFHA per Zone	36,870.50
Total Number of Parcels Having Some Portion in SFHA	6,405.00
Total Improvement Value of Parcels Having Some Portion in the SFHA	$1,196,575,900.00
Total Number of Parcels Having a Structure that within SFHA	2,044.00
Total Improvement Value of Parcels Having a Structure within the SFHA	$532,163,600.00

(KPB Assessing & GIS 2024)

Section 6.7.1 Floodplain Mapping

In January 2023, FEMA provided the KPB with draft copies of the revised FIRMs for the Kenai River below Skilak Lake, Cook Inlet coastal areas around the Anchor River, the Homer area, areas around Juneau Creek, and areas within the City of Seward/SBCFSA. These proposed map changes will become the new regulatory maps for these areas when finalized. The new maps show changes from paper maps and hand-drawn flood maps from which past FIRMs were developed. The 2023 FIRM mapping process includes Geographic Information Systems (GIS) mapping based on scientific modeling and digital data entry. Modeling and data are generated by FEMA looking at preliminary flood hazard mapping changes over time, with input from local resources including the KPB Floodplain Manager, KPB River Center, KPB GIS Department, SBCFSA, City of Seward and State of Alaska.

Floodplain maps developed by FEMA's Flood Map Service Center are used by the KPB River Center and the KPB GIS Department for understanding flood risks and managing development in flood-prone areas. These maps depict areas susceptible to flooding based on historical data, hydrological studies, and topographical analysis. Key features of KPB floodplain maps include SFHA Flood Zones, such as Zone A (areas with a one percent annual chance of flooding). These maps are critical for residents, property owners, developers and policymakers to effectively manage and mitigate the risks associated with flooding in the Borough.

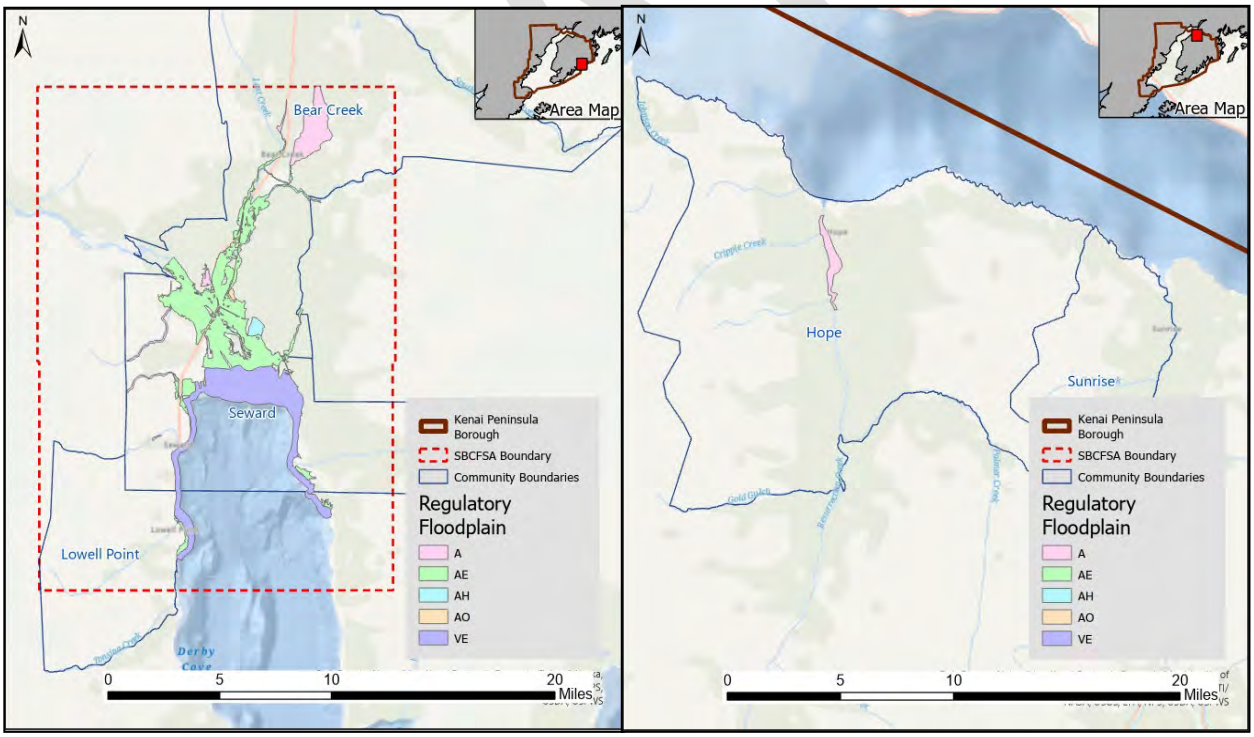


Figure 4. Regulatory Floodplain Map for SBCFSA and Hope Sunrise SFHA Areas (FEMA 2023)

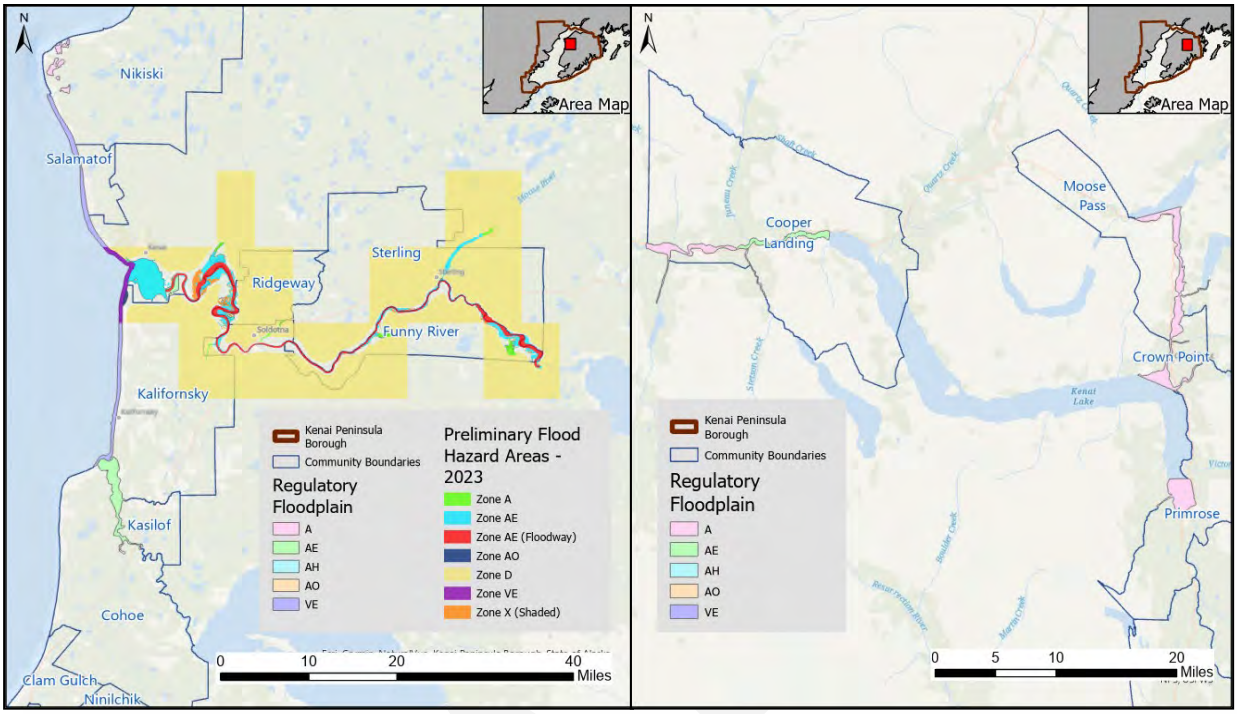


Figure 5. Regulatory Floodplain Map for Kenai/Kasilof and Cooper Landing/Moose Pass SFHA Areas (FEMA 2023)

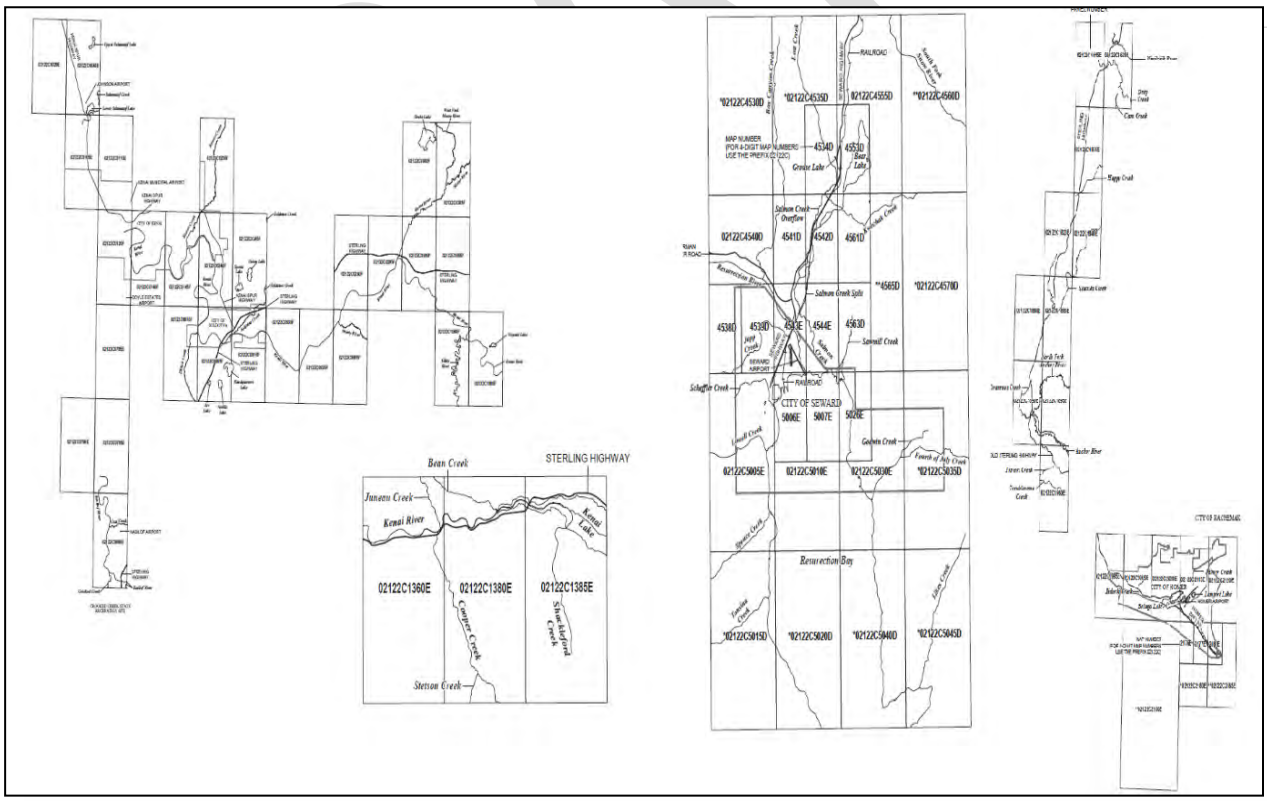


Figure 6. FEMA FIRM coverage areas for 2023-2024 updates

SFHAs are identified across various communities in the KPB, each facing unique flood risks. Additional areas may have flooding concerns but have not had flood mapping conducted; those areas are included in Table 40.

Table 40. Communities with Known and Probable Flood Hazard Risk in KPB

Communities and Areas	Water Body	FEMA SFHA Maps	Type of Flooding
Salamatof, Nikiski	Cook Inlet, Swanson River, Bishop Creek	Nikiski – Limited un-numbered A Zones Cook Inlet – limited Numbered V Zone.	Lake, riverine, coastal storm
West Side – Drift River Terminal Area	Drift River, Rust Slough, Cook Inlet	No Flood Mapping	Riverine, volcanic debris-surge, ice-jam, coastal storm
Beluga, Tyonek	Three Mile Creek, Chuit River, Cook Inlet	No Flood Mapping	Riverine, coastal storm
Kenai (City)	Kenai River, Beaver Creek, Cook Inlet	Numbered A and V Zones –City started participating in NFIP in 2022.	Riverine, ice-jam, jökulhlaup, coastal storm
Clam Gulch	Cook Inlet	None	Coastal storm, riverine
Cohoe	Kasilof River, Crooked Creek, Cook Inlet	Numbered and un-numbered A and V	Coastal storm, riverine
Cooper Landing	Kenai River, Kenai Lake	Un-numbered A	Riverine, jökulhlaup, ice jam
Funny River	Kenai River, Funny River, Killey River	Numbered and Un-numbered A	Riverine, jökulhlaup, ice jam
Kalifornsky	Kenai River, Slikok Creek	Numbered A and V	Coastal storm, riverine
Kasilof	Kasilof River, Crooked Creek, Cook Inlet	Numbered and un-numbered A and V	Coastal storm, riverine
Soldotna City	Kenai River, Soldotna Creek	Numbered and un-numbered A	Riverine, jökulhlaup, ice jam
Sterling	Kenai River, Killey River, Moose River, Funny River	Numbered and un-numbered A	Riverine, jökulhlaup, ice jam
Hope/Sunrise	Resurrection Cr., Six Mile Cr, Cook Inlet	Hope – unnumbered A and V Zones	Riverine, coastal storm
Moose Pass, Crown Point, Primrose	Trail Lake, Trail River, Kenai Lake, Primrose, Grant, Ptarmigan, Falls, Victor Creeks	Limited Unnumbered A Zones	Riverine, lake

Communities and Areas	Water Body	FEMA SFHA Maps	Type of Flooding
Seward and outlying Lowell Point, Bear Creek areas	Resurrection Bay, Resurrection River, Lowell Cr., Spruce Cr., Japanese Cr., Kwechak/Salmon Cr., Clear Cr., Lost Cr., Sawmill Cr., Grouse Cr., Godwin Cr., Fourth of July Cr.	Numbered and unnumbered A and V Zones - Although FIRM flood maps do not accurately predict flood hazards due to rapid, continual changes in the alluvial stream systems.	Riverine, alluvial fan, surge-release/debris slide, ice jam, coastal storm, tsunami
Ninilchik	Ninilchik River, Deep Creek, Cook Inlet	Limited Unnumbered A & V Zones	Riverine, coastal Storm
Anchor Point, Nikolaevsk	Anchor and North Fork Anchor Rivers, Cook Inlet	Anchor River – Limited Unnumbered A & V Zones North Fork Anchor River - no flood mapping.	Riverine, ice jam, coastal storm
Fritz Creek, City of Homer, Diamond Ridge, Kachemak City, Fox River	Numerous streams including Fritz, Beaver, Fox and Bridge Creeks, Bradley River, Kachemak Bay	*Homer* – Numbered A and V zones. *Outlying areas* – no flood mapping	Mud and debris slides, riverine, coastal storm
Nanwalek, Port Graham, Seldovia, Seldovia Village	Port Graham Bay, English Bay, Seldovia Bay, Fish Creek	Limited unnumbered A and V Zones	Coastal storm, tsunami, riverine

(FEMA 2023)

SFHAs of note within the KPB and associated rivers, streams, tributaries and water bodies include:

Homer Area: SFHAs are located along the coastline and near the Beluga Slough, where storm surges pose significant threats.

Seward/SBCFSA: SFHAs are located along the Resurrection River and its' tributaries; and coastal zones, vulnerable to tidal flooding and storm surges.

Kenai to Skilak Lake Area: Includes City of Kenai and Soldotna as well as surrounding communities including Funny River and Sterling and features low-lying SFHAs adjacent to the Kenai River and coastal areas. SFHAs are primarily associated with the Kenai River, with risks from river overflow during heavy rains or rapid snowmelt. Sterling's SFHAs are along the Moose River and the Kenai River, primarily facing river overflow.

Nikiski: SFHAs include regions near Cook Inlet and local streams, at risk from coastal flooding.

Kasilof: SFHAs are located around the Kasilof River, particularly near the river mouth, facing river overflow and coastal storm surges. Clam Gulch has coastal SFHAs vulnerable to storm surges and local stream flooding.

Anchor Point and Ninilchik: have SFHAs along their respective rivers and coastlines, susceptible to river overflow and coastal flooding.

Seldovia: SFHAs are in low-lying coastal areas and near the Seldovia River. Also included are coastal areas in Port Graham and Nanwalek.

Moose Pass: SFHAs are located near Trail Lake and local streams, with risks from snowmelt and heavy rainfall.

Section 6.8 Flood Stage Data

The NWS defines "flood stage" as the level at which a body of water, such as a river or stream, begins to overflow its banks and cause a hazard to life, property, or commerce. It is a critical threshold that, when reached, triggers various alerts and responses to mitigate the impacts of flooding. The height of water required for flood stage varies by location and is based on historical data and local conditions. The USGS publishes data through its Waterwatch Program. Once water levels reach or exceed this stage, flooding is expected to occur, impacting roads, homes, and other infrastructure in the surrounding areas. This information is vital for emergency management and public safety efforts.

The flood gage monitoring shown in Table 41 is provided by USGS in the KPB and the stage measured at each gage is used as an index of water level characteristics upstream and downstream of the gage in addition to the status at the gage.

Table 41. Gage Locations in the KPB

Gage Location	USGS Gage ID	Flood Stage (feet)
Kenai River (Cooper Landing)	15258000	13
Kenai River (City of Soldotna)	15266300	12
Kenai River (City of Kenai)	15268000	11
Kenai River (Skilak Lake)	15266500	15
Kasilof River (Kasilof)	15271000	13.5
Anchor River (Anchor Point)	15239900	14
Ninilchik River (Ninilchik)	15240000	10.5
Deep Creek (Ninilchik)	15239000	12
Resurrection River (Seward)	15249100	12

(USGS 2024)

The definitions of the high-water terms used in Alaska consider the limited number of gages across the state and are broader to reflect characteristics of the gaged waterbody and nearby waterbodies:

- **Bankfull Stage** is an established gage height at a given location along a river or stream above which a rise in water surface will cause the river or stream to overflow the lowest natural stream bank somewhere in the corresponding reach. The bankfull stage on many streams is associated with the two-year recurrence interval flood. It is not necessarily the same as flood stage.

- **Action Stage** is the stage when a rising stream reaches a level where the NWS or partner/user needs to take some type of mitigation action in preparation for possible significant hydrologic activity.
- **Flood Stage** is an established gage height for a given location above which a rise in water level begins to create a hazard to lives, property or commerce. The issuance of flood advisories and warnings is linked to flood stage.

The NWS also notes flood categories are terms defined for each gage location that describe or categorize the observed or expected severity of storm impacts in the corresponding stream segment or nearby stream. The stage for a given flood category is usually associated with the lowest water level corresponding to the most significant flood impacts somewhere in the reach.

- **Minor Flooding** has minimal or no property damage. A "FLOOD ADVISORY" is issued.
- **Moderate Flooding** has some inundation of structures and roads near the stream or water body. A "FLOOD WARNING" is issued.
- **Major Flooding** has extensive inundation of structures and roads, with significant evacuations of people and/or transfer of property to higher elevations necessary. A "FLOOD WARNING" is also issued if major flooding is expected.

In addition to USGS monitoring in the KPB, the River Center and SBCFSA also monitor river and stream gages in the borough. Information collected from these gages is used to determine the potential flood risk and prepare emergency response measures in areas with potential flooding concerns.

Section 6.9 Flood Risk Definition

A 100-year flood is a flood (also known as the base flood) that has a one percent (1/100=1.0 percent or 0.01 probability) chance of occurring in any given year. FEMA uses the 100-year flood as a community's base flood as it relates to the floodplain.

Flood category terminology can be confusing because a "100-year flood" does not mean it happens once every 100 years. Instead, it refers to a flood that has a one percent chance of occurring in any given year. This means:

A 100-year flood could occur multiple times in the same year.

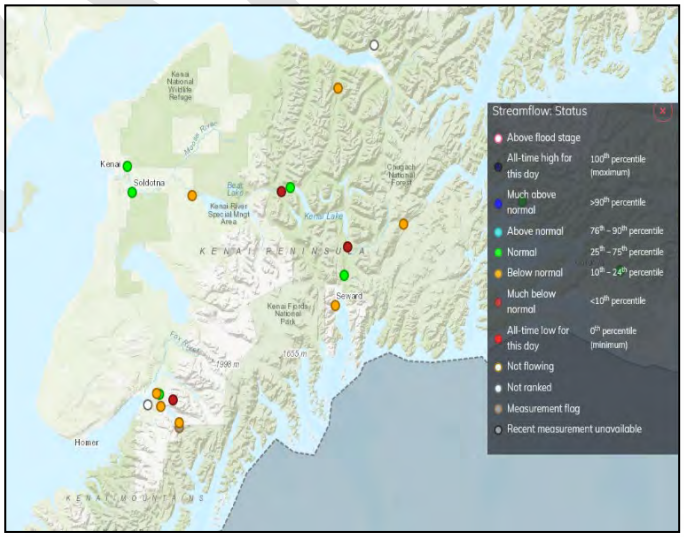


Figure 7. USGS National Water Dashboard for June 4, 2024, streamflow status for gage locations.

The legend uses symbols to show if the gage is above flood stage, above normal, or below normal. (USGS)

It could occur two years in a row or not at all over a span of 200 years or more.

The term "100-year flood" is a statistical probability rather than a specific timeframe guaranteeing occurrence.

Table 42. Annual Flood Chance of Occurring

Category	Definition
1-Year Flood	A 100 percent chance an annual flood will occur (also described as having a 1.0 probability in any year)
2-Year Flood	There is a 50 percent chance a flood event will occur (0.5 Probability)
5-year Flood	There is a 20 percent chance a flood event will occur (or 0.2 probability)
10-Year Flood	There is a 10 percent chance a flood event will occur (or 0.1 probability)
50-Year Flood	There is a 2 percent chance a flood event will occur (or 0.02 probability)
100-year Flood	There is a one percent chance a flood event will occur (or 0.01 probability)

(FEMA)

Agencies such as FEMA, USGS, and USACE use peak flow rates to assess the current conditions of water flow in rivers and streams, particularly during periods of heightened flood risk. These peak flow rates represent the maximum discharge of water over a specified period, often measured in cfs or cubic meters per second (cms). The USGS monitors flow gages in Alaska, allowing a better understanding of stream characteristics. This information is provided publicly at USGS WaterWatch -- Streamflow conditions helping communities and jurisdictions prepare for and mitigate risks. This data is crucial for informing floodplain management, emergency response planning, and infrastructure development in areas prone to flooding.

The USGS receives federal funding to monitor potential flooding sites of "national interest"; however, the list is being increased in 2024 to 300 across Alaska, with current funding for about 10 percent of those sites. About half of the stream gages USGS monitors are for specific funding partners to address specific questions. Recently, KPB partnered with USGS to assess the Kenai River at Cooper Landing and Soldotna. That effort concludes in July 2024 unless the KPB chooses to renew it. Current and previous locations of USGS stream monitoring are available on the NWIS: Mapper.

Table 44 shows previous monitored peak flow rates for streams and creeks in the SBCFSA, developed by USACE using FEMA peak flow rate conditional standards.

Table 43. Peak Flow Rates Using Projections of Historic Flood Conditions for Major Streams in SBCFSA (1950-2021)

Watershed	Hydrology Method	Current Peak Flow (cfs)			
		10-Year	50-Year	100-Year	500-Year
Japanese Creek	Regional Regression Equations (USGS)	897	1,220	1,360	1,700
Resurrection River	FEMA	19,230	26,190	29,160	36,570
Scheffler Creek	Regional Regression Equations (USGS)	418	572	673	799
Spruce Creek	Regional Regression Equations (USGS)	1,050	2,020	2,240	2,790

(FEMA 2023)

Section 6.10 Flood and Erosion Mitigation

Within the KPB, the mix of public and private facilities, infrastructure and land ownership influences flood mitigation activities. Local, state, and federal planning and regulatory authorities structure mitigation efforts. This complexity necessitates a broad management perspective for flood mitigation planning. It also offers a wider array of resources and mitigation opportunities through cooperative partnerships. The SBCFSA is one of only two flood service areas in the State of Alaska and is included in many planned or proposed mitigation action efforts in the Borough. Historical and recent actions the KPB and SBCFSA have taken to help mitigate repeated and ongoing flooding concerns include the following:

Floodplain Management:

Application of KPB Chapter 21.06 Floodplain Management which regulates land subdivision, residential and commercial construction, dredging, filling, mining, excavation and placement of manufactured homes within the FEMA FIRM-mapped Flood Zone A.

- The creation and maintenance of a floodplain permit database including name, tax parcel number, location, project description, permit date, and base flood elevation information.
- Annual social media postings and mail outs to floodplain property owners advising them of their compliance status as well as their responsibility to apply for floodplain development permits.
- Providing a local source of information on proper floodplain building techniques and an ongoing review and revision of the KPB Floodplain Management Code (most recent amendment to KPB 21.06 on 10/24/23 Ord 2023-23), to improve the clarity, implementation and enforceability of the floodplain code.
- Ongoing partnership with USGS for installation and maintenance of real-time stream and precipitation gages.
- Ongoing Light Detection and Rating (LIDAR) data acquisition using state and federal resources to monitor geographic changes in floodplains through GIS mapping.

Floodplain Embankment Protections:

- Implementation of KPB Chapter 21.18 Anadromous Waters Habitat Protection. Although primarily enacted to protect salmon spawning and rearing habitat, the 50-foot habitat protection area also helps maintain stable, well-vegetated banks and minimizes new development within 50 feet along 25 peninsula streams. Section 21.18.050 also establishes permit requirements for fuel storage and logging activities within mapped floodplains.

Flooding Education:

- Use of the KPB OEM website and Ready, Set, Go! Program to provide current weather watch and advisory information as well as links to the National Weather Service, FEMA

educational materials, the Local Emergency Planning Committee, and other web resources.

Flooding Emergency Response:

- Partnership with the National Weather Service to improve weather radio and emergency broadcast capabilities in the central peninsula, including installation of a NOAA weather radio station in Ninilchik.
- Implementation of a Reverse 911 system (aka Rapid Notify System) to telephone property owners with a recorded alert message in the event of flooding or emergency evacuation. This system works with both cell phones and land line phones, if the service provider participates in the program. This system differs from KPB Alerts which is a self-registration system for receiving emergency notifications.

In addition to borough-wide flood mitigation improvements, specific improvements involving mitigation projects have been completed and are subject to ongoing maintenance or upgrade for areas within the SBCFSA.

Table 44. SBCFSA Problem Flood Areas and Past and Present Mitigation Actions

Location	Problem Areas	Past Mitigation Activities	Current Mitigation Activities (2019-2024)
Lost Creek	Old Mill Subdivision area is flood-prone but is not included in area floodplain mapping. Stream channels under bridges are filled with gravel and debris.	Obtain flood maps or otherwise regulate Lost Creek floodplain development; raise bridges or dredge gravel and debris to improve clearance and water conveyance. 6 repetitive loss parcels with 5 homes were purchased by the KPB in 2011. The debris removal project was completed in 4/2013. Bridge conveyance and channel maintenance completed with KPB RSA 2017.	Lost Creek requires periodic maintenance to remove aggraded material from the channel to ensure continued hydraulic function of the Forest Road bridge. The SBCFSA program manager provided design plans to the SBCFSA Board for Directors for Lost Creek in the vicinity of the bridge showing the condition after maintenance occurs. The design condition was not reflected in the 2019 LiDAR, so for the baseline terrain, the design condition was stamped into the 2019 LiDAR using Autodesk Civil 3D software. This was the only channel stamping completed for this mode. SBCFSA mitigation priorities list replacement of the bridge at Lost Creek; and replacement and relocation of the bridge on Que Sera Drive to an area north of flood prone areas. Moving the location of the second bridge will provide for more clearance and better access to the subdivision as recommended mitigation options.
Lowell Creek	Potential for a tunnel blockage and diversion levee failure	Construction of a second tunnel; continued feasibility study began 2016, completion in 2019.	USACE in partnership with the City of Seward is working on construction of the new flood diversion system for Lowell Creek approved in 2021; planned construction will occur at site over the next six years.
Scheffler Creek	Culvert blockage in 1995 caused flooding across the Seward Highway and damage to a fish processing plant and the harbor.	Culvert replaced with a larger oval design after October 2006 floods. Additional culverts were replaced in partnership with City of Seward/SBCFSA and USFWS; these projects were completed in 2019.	RFQ for design on Scheffler Creek and AWR memo being reviewed by City of Seward and SBCFSA with planned mitigation efforts being implemented in 2024-2025. SBCFSA lists revetment, mitigation, and box culvert along Scheffler Creek as future mitigation actions. In 2023 the City of Seward City Council Resolution 2023-084 allocated additional funds to help improve flooding scenarios in the Forest Acres Subdivision along Scheffler Creek.

Location	Problem Areas	Past Mitigation Activities	Current Mitigation Activities (2019-2024)
Resurrection River	ARRC pier-supported bridges (situated downstream of the Seward Highway bridges) catch debris and contribute to back-water flooding above the Seward Highway. The Seward Airport runway has repeated flood problems. Exit Glacier Road- the riverbed is filling and building and may soon overtop the armor reinforcement placed along the road embankment.	Clear span bridges would help. In conjunction with (Alaska Department of Transportation and Public Facilities) ADOT&PF highway bridge upgrades, the ARRC plans to lengthen the span on the center bridge in the near future. ADOT&PF/KPB/City of Seward – ongoing joint effort to annually dredge the mainstream channel and maintain water conveyance away from the airport. ADOT&PF is currently working on plans for relocation and extension of the short runway/removal of long runway. ARRC removed woody debris from pier supports in 2017. Two private contractors remove material from the riverbed each year.	The Seward Airport ADOT&PF reconstruction project is currently in the right-of-way acquisition phase with design at 95 percent complete. Planned construction is scheduled for 2026.
Salmon Creek	ARRC Bridge collects debris and fills with gravel. Nash Road Bridge- channel silting in with gravel and debris, clearance is no longer adequate. Culverts in the vicinity are undersized or partially blocked and contribute to flood problems. Most flood prone private properties are located south of Nash Road.	Elevate, revise to clear span or otherwise upgrade bridge to increase and maintain water conveyance. Acquired 126 acres of floodplain properties north of Nash Road in 2012. SBCFSA is working with USFWS to expand Salmon Creek Conservation Area south of Nash Road. SBCFSA to obtain approval from ADNR for site-specific mitigation plan to manage sediment and partner with ADOT&PF to harvest and haul material from bridge ROW.	New dike and mitigation improvements completed along Salmon Creek in 2019. The ARRC (2021) proposes flood mitigation measures between ARRC Milepost (MP) 4.8 to MP 5.95, along the Salmon Creek drainage near Seward. Includes efforts to raise the mainline track about four feet from MP 5.2 to MP 5.7 (about 3,811 feet of raised track) with the track bed gradually tapering back to the original grade on the north and south ends. Riprap will be placed along the raised track embankment to protect it from flood damage. Upgrade and replace the at-grade crossing at MP 5.2., Instruction to Bidder (ITB) for Salmon Creek Revetment that is ongoing currently. Armoring/revetment is also recommended by the SBCFSA at problem areas along Bruno Road.

Location	Problem Areas	Past Mitigation Activities	Current Mitigation Activities (2019-2024)
Clear Creek	Clear Creek originates in an area that historically floods from both the Resurrection River and Box Canyon Creek. Meeting participants recommended the KPB classify the entire parcel off Old Glacier Road as preservation and keep it undeveloped to prevent future flood damage.	The KPB classified, subdivided and is selling a large parcel of land off of Old Exit Glacier Road. Selling of these parcels will encourage more commercial development in a flood-prone area.	Flood Hazard Analyses for Seward Mapped Flood Data Area in 2021 looked at Clear Creek areas of flooding concerns and hydrology data related to the waterbody. Ongoing mitigation recommendations were provided for the Old Exit Glacier Subdivision within the study.
Box Canyon Creek	Debris slides/surge release flooding; stream makes a 90-degree bend as it comes out of the canyon. Past problems include overland surge flooding and problems at Exit Glacier Road.	During the 2012 flood restoration, 90-degree bend was removed, and channel moved to an historical alignment. Channel and embankment restoration 2017.	Flood Hazard Analyses for Seward Mapped Flood Data Area in 2021 looked at a condition where the Box Canyon Creek levee has failed and is washed away. The existing levee is constructed of highly erodible gravel, and levee failure has occurred in the past. Ongoing mitigation is needed to alleviate issues associated with potential engineering failures.
Kwechak/ Glacier Creek	Single ingress/egress roads to Questa Woods and Camelot-By-The-Sea, both of which are susceptible to flooding with limited evacuation options when flooded.	Identify alternative access routes. Possible alternatives include bridging Salmon Creek at a point north of Camelot- By-The-Sea and constructing a ridge road above the floodplain between Questa Woods and Camelot-By-The-Sea Subdivisions.	Kwechak Creek Bank restoring of Water Diversion Structures to Pre-2012 Flood Conditions. Ongoing maintenance and monitoring of site conducted to ensure bank channel is maintained
Bear Creek	During high water, Bear Creek causes localized flood damage as it tries to merge with Kwechak Creek.	Completion of USACE 205 Project will mitigate surge release flooding of Bear Lake and Bear Creek	USACE 205 Project Management Section 205 cited risk of inundation for Bear Creek and Salmon Creek as the basis for needing mitigation improvements. Mitigation improvements have been made along Salmon Creek; mitigation improvements will be made when funding is available for areas of Bear Creek.
Sawmill Creek	Subject to debris jams and frequently causes localized damage in the vicinity of the Nash Road crossing.	Channel and embankment restoration in 2017. Site specific mitigation plan for sediment management submitted to AK DNR in 2018 from SBCFSA.	In 2020 a preliminary decision for sediment management was made by ADNR along Sawmill Creek Channel. Use of the KPB Sediment Management Plan was authorized enabling ongoing and planned dredging along the creek.

Section 6.11 Impact of Future Climate Conditions

NOAA predicts that sea level rise is expected to continue due to increased glacier and ice sheet melting, which adds water volume to oceans. This increases the potential for flooding in coastal areas and can affect areas at the mouths of rivers and streams near coastal areas.

One of the notable flooding changes in recent years comes from the increased occurrence of glacial outburst flooding in the KPB. More glacial lakes may form due to deglaciation, which has the potential to impact downstream communities on river's edges in addition to those in the vicinity of these lakes. A double glacier lake release in September 2023 caused high water levels and flood risks for areas around Skilak Lake and in the Kenai River. Areas in the low-lying Kenai Keys neighborhood experienced roads and areas near channels reaching potential flood stage levels.

Weather and temperature are two of the primary drivers of coastal erosion in Alaska. Weather (the day-to-day state of the atmosphere) affects erosion in the short term with individual episodes of rainfall, wind, and temperature that initiate or intensify individual episodes of erosion. Shorter periods of ice-free shorelines will result in a shorter period of protection of coastal regions from high energy fall storms. Shorter periods of ice extent will expose more coastal communities to ocean currents, wave action, and storm surge, leading to increased threats from erosion which has the potential to put more infrastructure at risk.

Section 6.12 City of Seward Hazard Overview

The City of Seward faces significant challenges with flooding and erosion due to its coastal location and proximity to the Resurrection River. Heavy rainfall, snowmelt, and glacial activity often contribute to high water levels, overwhelming local drainage systems and leading to frequent flooding events. To address these issues, the City, in collaboration with the SBCFSA, has implemented various flood mitigation measures. Other groups have also worked to alleviate issues related to increased erosion and flooding in coastal areas through grants and other funding opportunities. A grant was recently awarded to the Chugach Regional Resources Commission from the National Coastal Resilience Fund to design a hybrid living reef to build flood resiliency in the Seward area. This is a novel new concept for a nature-based solution to safeguard the Alutiiq Pride Marine Institute, an important Tribal shellfish hatchery and essential salmon habitat. This type of proposal could provide a longer-term solution to protect and enhance coastal areas from erosion and flood events.

Section 6.13 City of Seldovia Hazard Overview

The City of Seldovia's primary flooding and erosion hazard is storm surge flooding. Seldovia is located on the coast, and therefore is susceptible to significant storm surge flooding. Rising sea levels may create issues particularly near the mouth of the Seldovia Slough.

Changing climate conditions are increasing the frequency and intensity of storms in Seldovia, Alaska, which could lead to more severe flooding in future years.

Section 7 Wildfires

I'd rather fight 100 structure fires than a wildfire. With a structure fire you know where your flames are, but in the woods, it can move anywhere; it can come right up behind you.

- Tom Watson

Section 7.1 Hazard Overview

The wildfire section of the HMP was developed using portions of the 2022 Community Wildfire Protection Plan (CWPP). More detailed information for each component of the planning and mitigation efforts related to wildfires in the KPB can be found in the CWPP and by using the CWPP landing page (2022).

Wildfire is the leading hazard in Alaskan boreal forests, and roughly 80 percent of Alaskans reside in areas potentially at risk from wildland fire. Communities within the KPB planning area are familiar with community fire planning, having developed 17 community wildfire protection plans, covering 33 communities, since the early 2000s. Because wildfire does not respect political boundaries, the KPB and other land management entities have been working together collaboratively for more than 15 years to treat fire management as a landscape effort, forming the All Lands/All Hands (ALAH) interagency organization. This is a comprehensive body of land and resource managers across all jurisdictions, who collaborate on landscape-scale planning efforts; they prepared the original ALAH Action Plan and supplemental updates.

In support of this collaborative management approach, the purpose of the 2022 CWPP was to:

- provide a peninsula-wide scale of wildfire risk and protection needs,
- bring together all the responsible wildfire management and suppression entities in the planning area to address the identified needs, and
- provide a framework for future planning and implementation of necessary mitigation measures.

Swan Lake Wildfire - 2019 (USFWS)

The 2022 CWPP update looked at past fires and treatment accomplishments using the knowledge and expertise of the land and resource managers who work for the various agencies and governing entities in the planning area. This update process incorporated a new assessment of wildfire risk and hazard and supplemented local knowledge with relevant science and literature from the region.

Section 7.2 Wildfires Conditions

Conditions such as the growing season temperature, precipitation, lightning strike frequency, elevation, aspect, and forest type and structure, interact to influence fire frequency. Fire research in the Kenai Peninsula indicates that prior to the settlement of Alaska by non-native peoples, the fire regime was characterized by small fires (approximately 50,000 acres or less) and rare larger fires. After settlement, and population increases, the Kenai Peninsula experienced more frequent and larger fires associated with the increased presence of people.

2014 Funny River Wildfire, a suspected human caused fire that burned nearly 200,000 acres (USFWS)

In the U.S. as-a-whole, for the period of 1990 through 2020, the top two causes of fire events were lightning strikes and human activity. Ninety-five percent of fires were human caused; however, it should be noted that human-caused fires are generally smaller than lightning-caused fires. There has been an increasing trend toward fires larger than five acres in recent years; prior to 1990, fire events were typically less than five acres in size.

Abnormally warm temperatures have created conditions conducive to problematic insects as well as increased fire risk on the Kenai Peninsula. In the 1990s, there was an unusually dry and warm trend in Alaska, which was accompanied by a significant increase in Spruce Bark Beetle (SBB) infestation. Specifically, the Kenai Peninsula and the Copper River Valley experienced SBB outbreaks that infested a total of about 2.3 million acres, killing most large-diameter spruce trees.

Recent findings by the US Forest Service suggest that SBB outbreaks are likely to persist. In 2016, another outbreak was recorded. A 2016 aerial detection study mapped 190,000 acres of

SBB damage across the Kenai Peninsula. Since the 2016 outbreak began, more than one million acres in Southcentral Alaska have been impacted, with 145,000 acres of SBB damage recorded in 2020 alone. In a preliminary remote forest inventory from 2022, 21,000 acres of Borough-managed lands were identified for forest management due to varying degrees of spruce bark beetle impact around Cooper Landing, Nikiski, Sterling, Kenai, Soldotna, and Kasilof. See KPB SBB Kill Forest Management Project Website page for more detailed information regarding SBB Kill Forest Management Projects. Beetle-killed trees are a complex fuel type and pose an escalated risk for wildfire. The needles remain on the branches an entire season after the tree dies, leaving the tree more flammable during this period. As the tree dries, branches and crowns are perfect fuel ladders for surface fires. Stem breakage in deceased trees usually starts around five years after mortality and combines with forest surface debris (needles, grasses, and organic layers), resulting in a particularly dangerous fuel complex.

Section 7.3 Historic Events

The KPB has seen many large reportable wildfires both historically and in recent years. These include the following historical notable wildfires:

- 1947 Skilak Lake Fire (310,000 acres)
- 1969 Swanson River Fire (79,000 acres)
- 1991 Pothole Lake Fire (7,900 acres)
- 1996 Crooked Creek Fire (17,500 acres),
- 1996 Hidden Creek Fire (5,200 acres).
- 2004 Glacier Creek Fire (8,600 acres)
- 2005 Fox Creek Fire (25,500 acres)
- 2005 Tracy Avenue Fire (5,400 acres)
- 2005 King County Creek Fire (10,000 acres)
- 2007 Caribou Hills Fire (55,000 acres)
- 2009 Shanta Creek Fire (13,000 acres)
- 2014 Funny River Fire (196,000 acres)
- 2015 Card Street Fire (8,900 acres)
- 2017 East Fork Fire (1,000 acres)
- 2019 Swan Lake Fire (170,000 acres)

The 2019 wildfire season was the second-most destructive in Alaska history and the KPB was particularly hard hit. One of the largest fires of the 2019 fire season was the Swan Lake Fire. This fire was a lightning-caused wildfire and burned approximately 170,000 acres between Sterling and Cooper Landing on the Kenai Peninsula. In 2019, Southcentral Alaska had an extraordinarily hot, dry spring and summer season. June 2019 was the second-warmest month in the state's history, which combined with higher-than-average lightning strikes to create ideal conditions for extreme wildfires. The Swan Lake Fire, burning since June 5, 2019, escaped containment lines in August and crossed portions of the Sterling Highway, threatening the communities of Sterling and Cooper Landing. The fire also closed the Sterling Highway for a period of days when the fire crossed the roadway. Two additional wildland fires near Homer ignited on August 17 and 18, 2019, the North Fork and Caribou Lake Fire, and continued to threaten structures in the vicinity

of Anchor Point and Homer through the end of August. Governor Dunleavy declared a state emergency (AK-19-266) on August 23, 2019, in response to the Swan Lake Fire and additional wildfires across the Southcentral Region.

The Funny River Fire was a significant wildfire in the KBP that began on May 19, 2014. Believed to be caused by human activity, the fire rapidly spread due to dry conditions and high winds, ultimately burning approximately 196,000 acres. It threatened the Funny River community and Funny River Road, and evacuations occurred using the only evacuation route from the community. Despite initial challenges in containing the fire, cooler and wetter weather in early June helped bring the fire under control. Ongoing fire mitigation efforts are occurring in the area and the KPB has initiated [Wildfire Research (WiRē)] outreach in Funny River, as well as Cooper Landing and Nikiski, for summer 2024 with planned follow up activity later in the year. The WiRē Team is a partnership between wildfire practitioners and researchers. The team focuses on innovation and new approaches to integrating local social science into wildfire education and mitigation programs. The WiRē team brings together diverse expertise in economics, sociology, and wildfire risk mitigation.

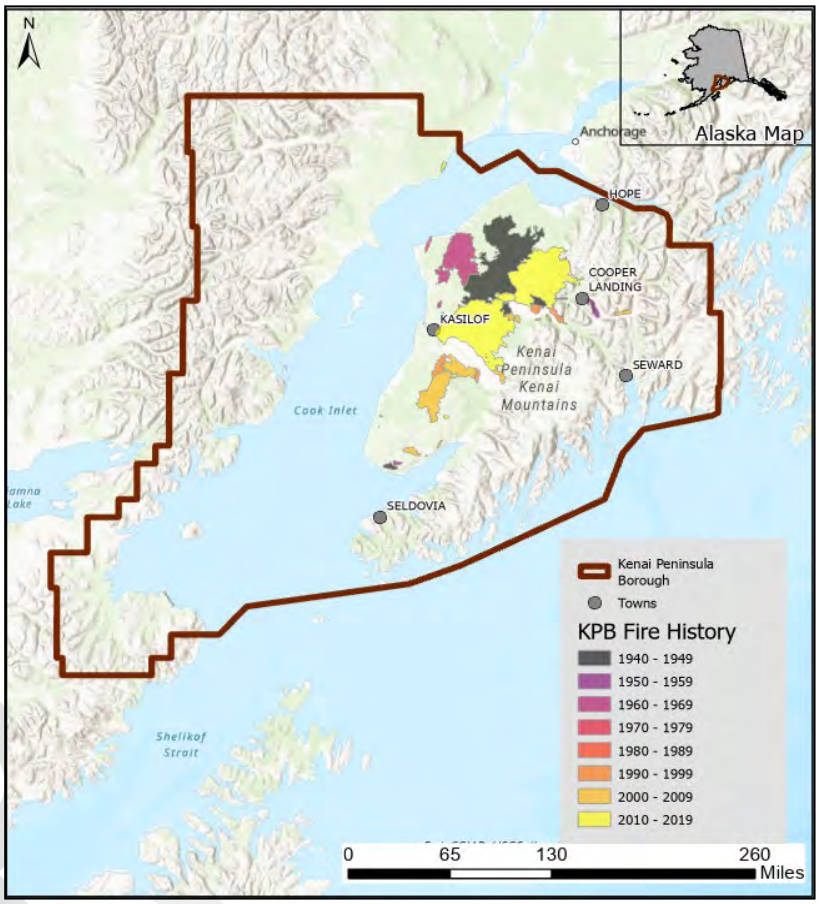


Figure 8. KPB Wildfire History 1940-2019

Section 7.4 Wildfire Risk Analysis

The Wildland–Urban Interface (WUI) hazard and risk assessment for the CWPP is based on the Chugach All-Lands Wildfire Risk Assessment (known as ARRA), developed between 2019 and 2021 by the US Forest Service (USFS). The purpose of the ARRA is to provide foundational information about wildfire hazard and risk to highly valued resources and assets (HVRAs) for the

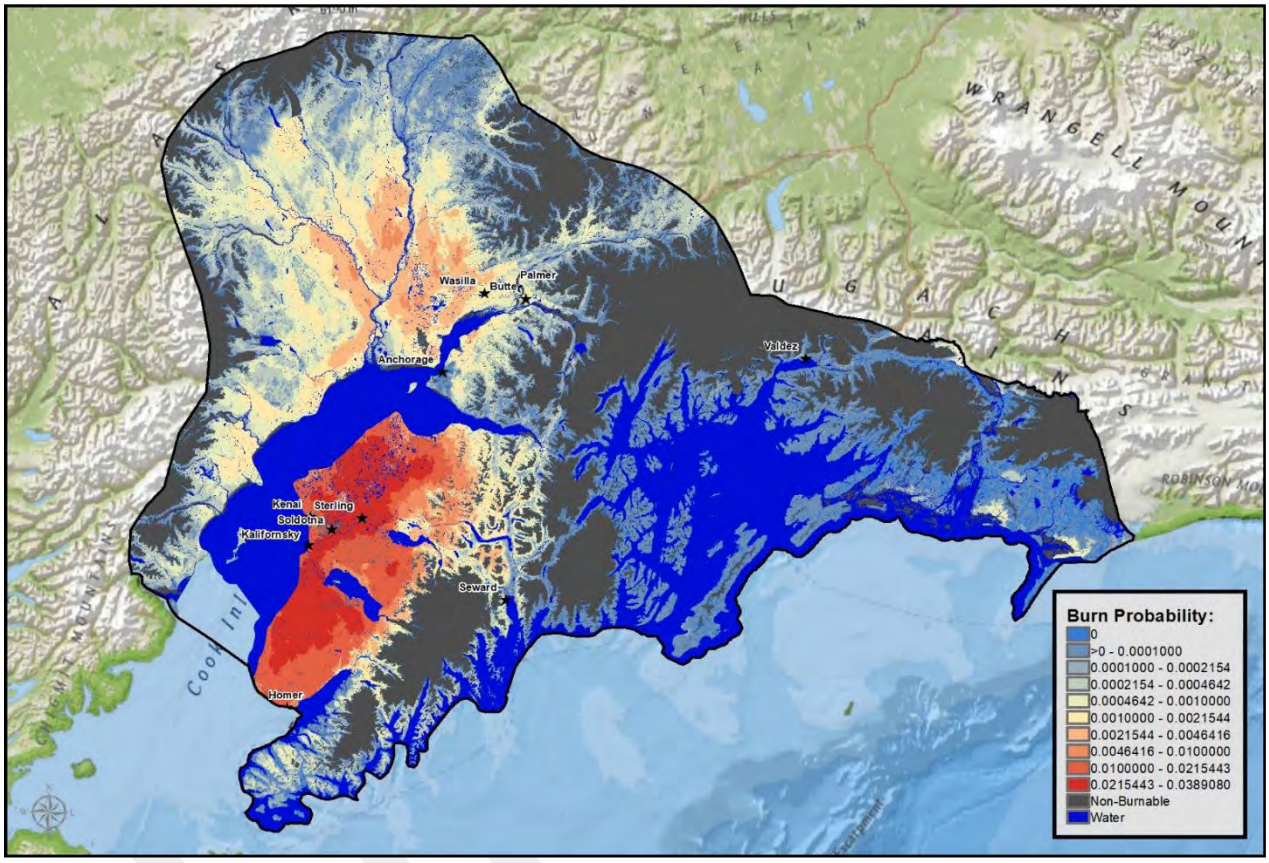


Figure 9. Burn probability results for the ARRA Analysis Area at 120 m resolution.
Areas shown in red have the greatest burn probability, which includes a large portion of the western Kenai Peninsula.
More detailed information on how the analysis was developed can be found in the CWPP.

Chugach National Forest and surrounding areas in Southcentral Alaska. The ARRA provides a quantitative analysis of the assets and resources across the landscape and how they are potentially impacted by fire (Chapter 3 WUI Hazard Risk Assessment, 2022 CWPP). The summary of the analysis includes:

- Likelihood of a fire burning
- Intensity of a fire
- Exposure of assets and resources based on their locations
- Susceptibility of those assets and resources to wildfire

The ARRA analysis highlights the percentage of land classified as WUI, the amount of land impacted by modeled wildfire related loss, dominant fuel types, potential fire behavior, fire

response capacity, current fire and fuel management programs and plans, positive and negative attributes associated with structural hazards in each community polygon, and suggested mitigation focus areas. See the ARRA in the 2022 CWPP for a more detailed analysis of wildfire risk within the KPB.

The 2022 CWPP used the National Fire Protection Association (NFPA) 1144 standard for assessing structure ignitability in the WUI. The WUI is defined as the zone where natural areas, such as forests, grasslands, and shrublands, meet human-developed land, including homes, businesses, and other structures. This WUI is characterized by the presence of both highly flammable vegetation and human development, creating a unique set of challenges for wildfire management, community safety, and environmental preservation. It is noted that for large portions of the borough, this WUI coincides with the Kenai National Wildlife Refuge boundary. Hazard rating scores for each community were rated into whether they had a low, moderate, high or extreme risk for future fire. These scores were developed by using the NFPA Wildland Fire Risk and Hazard Severity Form 1144. The NFPA standard focuses on individual structure hazards and requires a spatial or area-based approach to assessing and mitigating wildfire hazards around existing structures. It also includes ignition-resistant requirements for new construction and is used by planners and developers in areas that are threatened by wildfire.

The risk assessment for communities in the KPB showed many areas as having a high rating score. Some communities of note with a high-risk rating include Moose Pass, Seldovia, and Hope. All community ratings can be found in the 2022 CWPP.

Hazard Rating Scale	<40 Low	>40 Moderate	>70 High	>112 Extreme

2022 Community Fire Risk Assessment Rating Scale; see CWPP plan for more detailed information on Risk Assessment.

Section 7.5 Wildfire Mitigation

The KPB in developing the CWPP had recommendations for wildfire mitigation that were structured around three main goals:

- Restoring and maintaining landscapes.
- Fire-adapted communities.
- Wildfire response.

Hazardous Fuels Reduction. Fuels management of land within the KPB prior to a wildfire event is key to the survival of structures during an event. As wildfire frequency, size, destruction, and restoration costs have been on the rise, the need for wildfire mitigation via fuels treatment is at an all-time high. The importance of fuels management is reflected in forest policy at the federal level, with the Healthy Forests Restoration Act (HFRA) requiring that federal land management agencies spend at least 50 percent of their fuels reduction funds on projects in the WUI. The HFRA was enacted in 2003, when the U.S. Congress recognized widespread declining forest

health and a need to develop and implement hazardous fuels reductions programs on federal lands. A USFWS case study done in 2014 for the Funny River Fire concluded that fuel treatments were imperative in preventing fire spread and containing the fire to unpopulated areas.

Recent mitigation strategies in the KPB have focused on clearing dead trees in concentrated beetle kill areas. In its 2022 Alaska Forest Health Conditions report, the USFS's aerial surveys detected about 115,000 acres of SBB activity in Alaska statewide, of which 108,000 acres were recent mortality; 96 percent of the damage mapped is within southcentral Alaska. In the KPB, 18,330 acres of SBB activity were detected. SBB activity increased substantially in the Cooper Landing area in 2020, with patches of damage observed along the Sterling Highway and the Kenai River from around Quartz Creek Campground to Skilak Lake Road. SBB-caused mortality was also dispersed along the Russian River several miles upstream from its confluence with the Kenai River. SBB activity continued to expand in the Kenai and Soldotna areas, with activity continuing in the Kenai National Wildlife Refuge and in the vicinity of the Kenai Spur Highway from Soldotna to Kenai.

Equally extensive damage was noted in the Soldotna vicinity, particularly along the south side of the Kenai River and continuing to Kasilof.

Mitigation within the KPB Land Management Department has focused on providing slash disposal sites at strategic areas in the KPB. These slash disposal sites are currently located in Cooper Landing, Hope, and at the landfill in Soldotna. These free slash disposal sites allow KPB residents to safely dispose of SBB affected slash resulting from clearing infested trees, along with trees not being used for firewood or building purposes from their property, thus reducing their fuel hazard. Slash disposal sites are a part of the long-term strategies implemented within the 2022 CWPP.

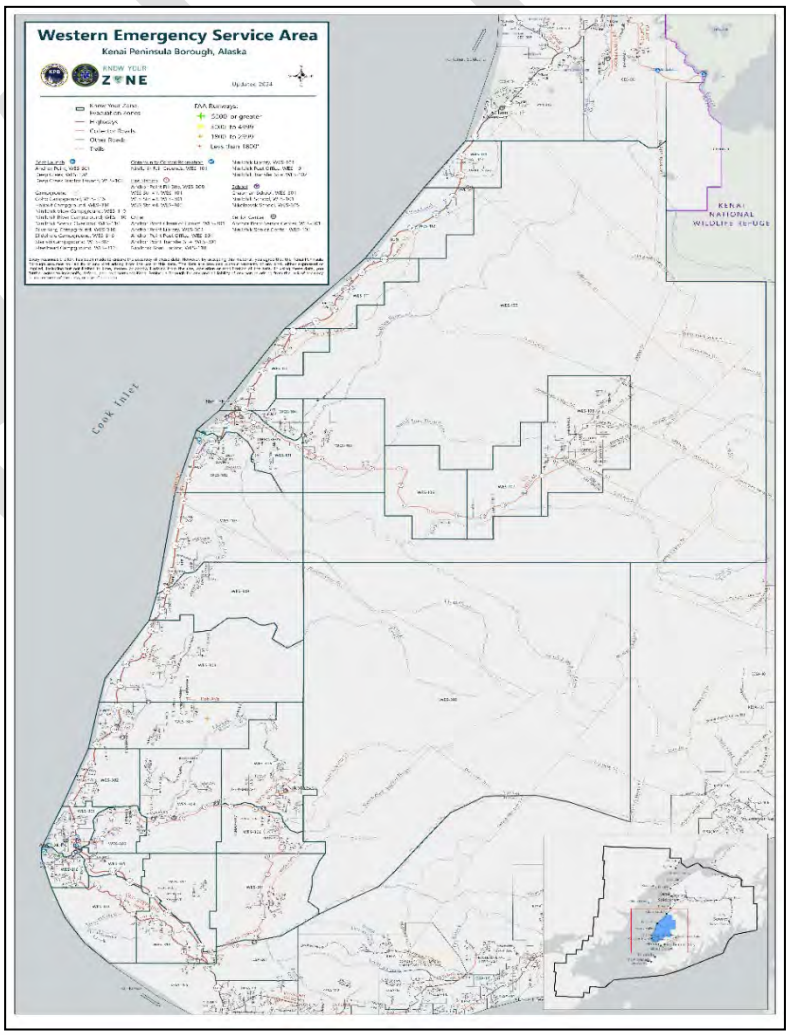


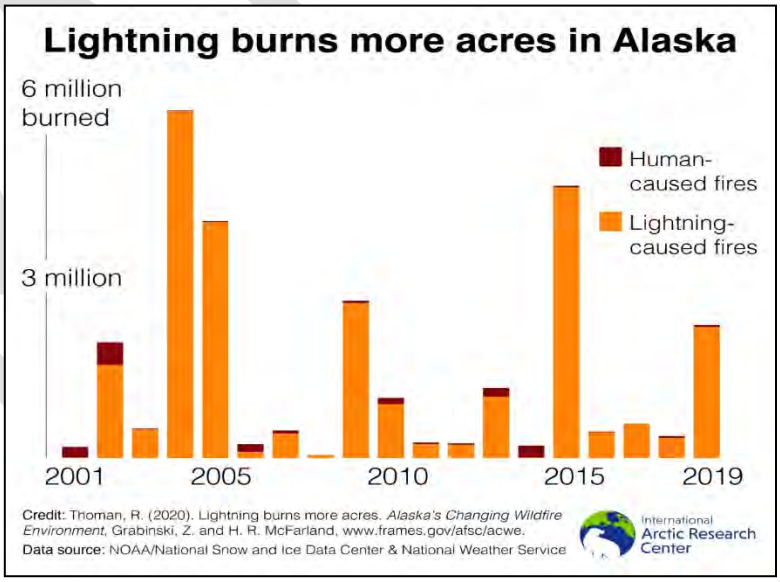
Figure 10. Western Emergency Service Area Know Your Zone Coverage Map

Additional ongoing work for

fire mitigation is updating and expanding fire lines, which is taking place in the summer of 2024. The communities undergoing fire mitigation include Cooper Landing, Seldovia and areas around the Cities of Kenai and Soldotna. The interactive Know Your Zones maps developed by KPB OEM and GIS provide emergency responders and residents with evacuation coverage areas, and in an emergency will provide real-time information on topics such as which populations need to evacuate, and which routes are safe to take. Response is coordinated with support from regional coverage areas and the Emergency Services departments in those regions. As an example, the Western Services Area map provides the zones covered within the areas of Anchor Point and Ninilchik. The KPB Ready, Set, Go!, program can be used to provide residents and property owners with evacuation zone information as well as information on shelter sites, and community infrastructure. Though both programs are used to educate the public on response to wildfire risk, the Know Your Zones program is focused on evacuation efforts in the event of a wildfire. While the KPB Ready, Set, Go! Program is focused more on educating the public on ways to be prepared and ready in the event of a wildfire or hazard event.

Section 7.6 Impact of Future Climate Conditions

The State of Alaska and US Forest Service note that Alaska's wildfire season is getting longer; they are looking at the relation to the effects of a changing climate on seasonal weather as a potential cause. Over the past 40 years, the first large fire of 1,000 acres or more starts earlier in the year, and the last large fire of the season starts later. Fire managers responded by changing the official start date of the fire season in 2006 to an official fire season start-date of April 1. Summer temperatures across Alaska have been increasing since 1970. A typical summer now may be close to what the warmest summers were prior to the 1970s. When comparing the average June to August temperatures over the last 95 years, nine of the ten warmest summers occurred in the past 20 years, whereas the ten coldest summers all occurred before 1975. Since 1990, Alaska has experienced nearly twice the number of wildfires per decade compared to the period of 1950 through 1980.



Lighting Caused Fires: Graph showing the higher incidence of fires being caused by lighting

Changes in environmental factors such as lightning, temperature, and precipitation are contributing to more fires on the landscape in Alaska. Since the 1970s, average summer

temperatures in the KPB have risen more than three degrees Fahrenheit. As the air temperature rises, the air holds more moisture, leading to more convective storms. Lightning ignited fires,

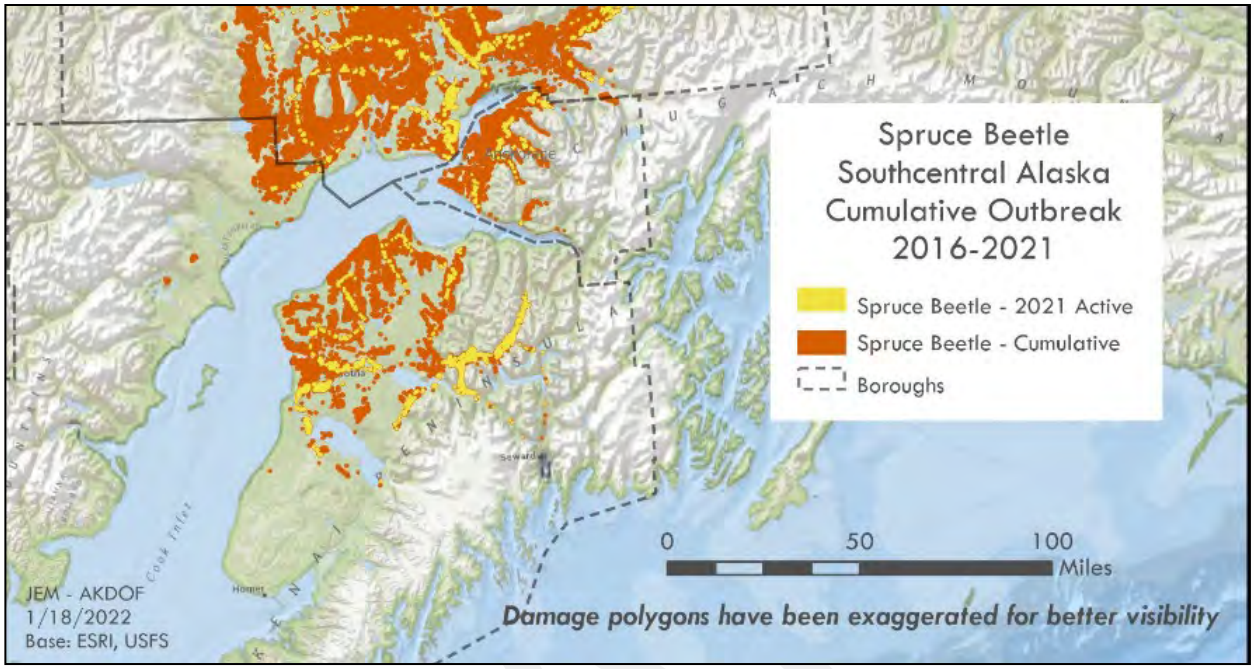


Figure 11. Map of Spruce Bark Beetle (SBB) Outbreak areas in the Southcentral Region.
Noted areas in yellow include areas that are currently in an active outbreak as of 2021 (Alaska Department of Forestry)

including the 2019 Swan Lake Fire, make up the vast majority of burned acres in Alaska and are reaching into places where they have rarely occurred in the past. Average summer lightning strikes have increased statewide by 17 percent over the past three decades, and several regions in the state have more than doubled in that same time. When weather conditions over the state are suitable, the magnitude of storms and lightning ignitions can be overwhelming for fire response. Additional factors including drought conditions and SBB infestation of areas of the KPB both contribute to the intensity of wildfire events in the KPB.

Unusually warm temperatures favor the pattern of SBB induced tree mortality, increased dead fuel, and the persistence and amplification of frequent and large fires. The warmer climate pattern has also triggered the onset of earlier-than-average snow-free events, which brings the premature arrival of the fire season. Under such circumstances, the drying of vegetation occurs more readily and for longer periods of time. Additionally, the shifting climate patterns create conditions that amplify the occurrence of lightning strikes. The combination of increased lightning strikes and ample fuels increases the risk of catastrophic wildfire on the Kenai Peninsula.

Section 7.7 City of Seward Hazard Overview

In the City of Seward, the Forest Acres subdivision and the base of Mt. Marathon are identified as areas of concern due to wildfire risk (2002 CWPP). Mitigation efforts are needed, including establishing a local lumber market and processing facility to support increased fuel treatments.

Additionally, there is a need for fire weather reports tailored specifically to east-side peninsula communities to accurately assess fire danger and implement appropriate burn restrictions. Addressing access issues, particularly weak bridges to private residences in Bear Creek, along with addressing yard maintenance and derelict property concerns, are crucial steps in enhancing fire safety preparedness. Education campaigns on safe campfire use are also essential to mitigate ignition risks on adjacent US Forest Service property.

Section 7.8 City of Seldovia Hazard Overview

The City of Seldovia, according to the 2022 CWPP, has a high rating for wildfire risk. The area is characterized by more humid forest cover and predominantly features metal and composite roofs, which are fire-resistant. Historically, the area has experienced low fire activity. However, there are concerns related to accessibility, with challenging ingress and egress primarily by air and sea. The community's proximity to steep topography poses additional challenges for fire management and evacuation. Furthermore, the minimal separation between adjacent structures, combustible siding, decking, fencing, and aboveground utility placement increase the vulnerability to fire hazards despite the lower density of values at risk.

Section 8 Earthquakes

Wind chimes are also earthquake chimes. *- Demetri Martin*

Section 8.1 Hazard Overview

According to USGS, Alaska is the most earthquake-prone state and one of the most seismically active regions in the world. Caused by a sudden slip on a thin zone of crushed rock separating blocks of the earth's crust, or a fault, the USGS defines the strength and size, or magnitude, of an earthquake as a number based on maximum motion recorded by a seismograph. Several scales are used to define this number; this plan uses local magnitude (ML), commonly referred to as "Richter magnitude" (M). Alaska experiences a M7 earthquake almost every year, and a M8 or greater earthquake on average every 14 years. The Alaska Earthquake Center (AEC) reports that Alaska has experienced three of the 20 largest earthquakes anywhere on the globe since 1904. These were attributed to subduction zone action. Seventy-five percent of all the earthquakes in the United States occur in Alaska. On average, the AEC detects an earthquake in Alaska every 15 minutes. Three out of every four M5+ earthquakes in the United States occur in Alaska.

Section 8.2 Earthquake Types

Most of the earthquakes on the Kenai Peninsula are subduction zone earthquakes. Subduction zones are plate tectonic boundaries where two plates converge, and subduction zone earthquakes occur when one plate is thrust beneath the other. Southcentral Alaska is primarily influenced by the interaction of two major tectonic plates: the Pacific Plate and the North American Plate. The collision and subduction of these two plates are responsible for the geological features and seismic hazards present in Southcentral Alaska.

Damage to the Seward Highway from the 1964 earthquake. (UA Archives)

The release of built-up stress in subduction zones typically leads to very large earthquakes, like the magnitude 9.2, Good Friday Earthquake, also known as The Great Alaska Earthquake (March 27, 1964). These types of earthquakes can be very forceful and typically cause strong shaking that may last several minutes and may cause significant damage. In addition to ground shaking and surface rupture, subduction zone earthquakes also commonly result in tsunamis, landslides,

seiches, and repeated and ongoing aftershocks (earthquakes, usually smaller, at main earthquake point).

The movement of active faults will also cause earthquakes in the KPB. These intraplate earthquakes may occur at a great distance from the plate boundaries. Intraplate earthquakes happen less frequently and with less predictability compared to those at plate boundaries. The borough is traversed by many fault lines, including the Lake Clark Fault, Bruin Bay Fault, Sterling Fault, Border Ranges Fault, and Eagle River Fault.

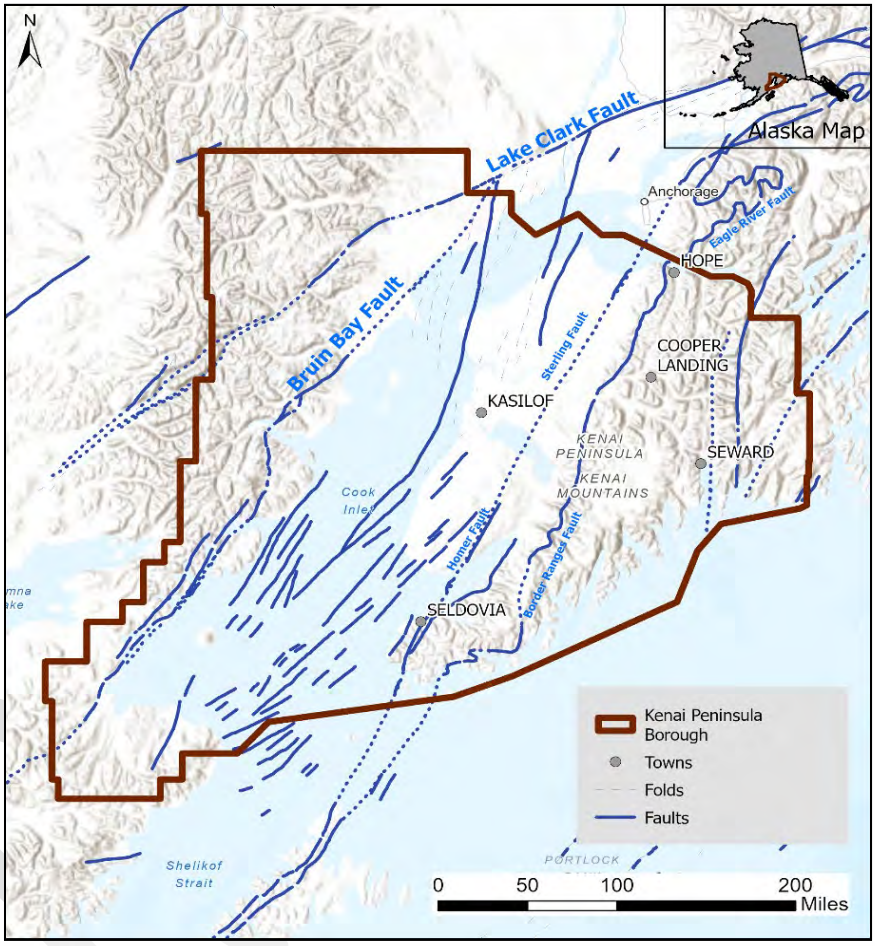


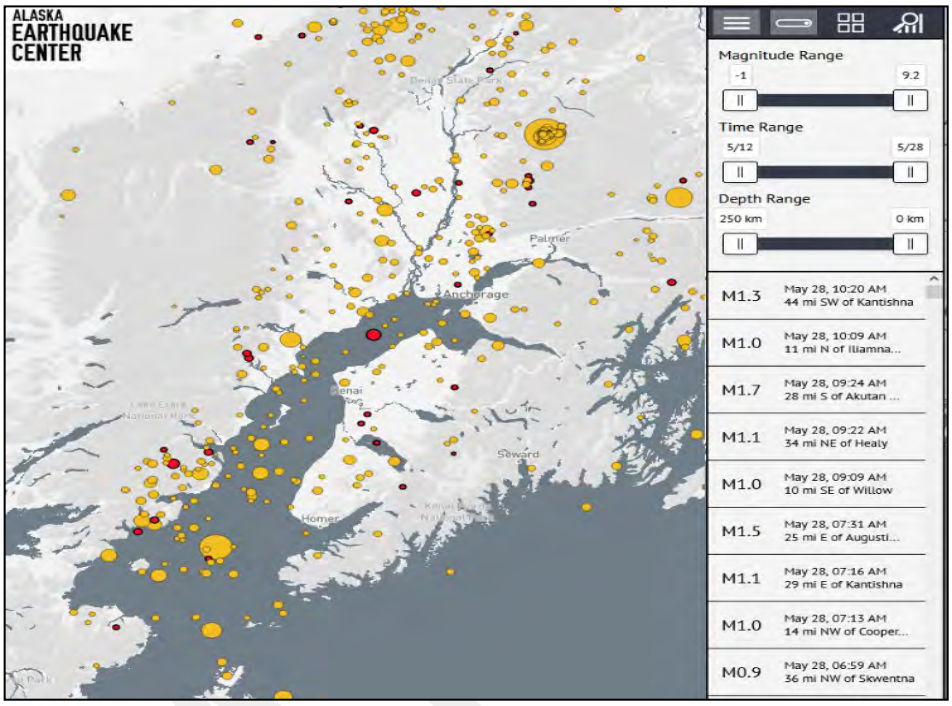
Figure 12. Map of tectonic faults and folds in the KPB (DGGS)

Faults and folds are closely related to the occurrence of earthquakes. Faults are fractures in the earth's crust where rocks have slipped past each other, releasing accumulated stress as seismic energy, which causes earthquakes. Folds are bends in rock layers formed by compressional forces. Folds do not directly cause earthquakes but can influence the stress distribution in the crust, potentially triggering movement along nearby faults or reactivating old ones. The KPB region has significant folding and is known to harbor hidden faults that can generate earthquakes.

Section 8.3 Earthquake Monitoring

The point at the Earth's surface directly above where an earthquake rupture begins is known as its "epicenter." Although the epicenter usually experiences the most intense earthquake effects (e.g., shaking), the total area affected can cover hundreds or thousands of square miles, depending on the earthquake's magnitude. Scientists and seismologists cannot predict earthquakes and because damage can occur only seconds after rupture initiation, it is important for every Alaskan to know what to do to minimize the risk posed by earthquakes.

The Earthquake Early Warning (EEW) systems, developed by USGS for California, provide alerts seconds to minutes before the shaking from an earthquake reaches a location. These systems detect the initial, less destructive seismic waves (P-waves) and issue warnings before the more damaging waves (S-waves or surface waves) arrive. The AEC, in collaboration with the USGS and other agencies, is implementing and refining EEW systems for the state of Alaska. Alaska's vast and remote terrain presents challenges in sensor coverage and data transmission. The harsh weather and logistical difficulties in maintaining equipment in remote areas also complicate EEW systems implementation. Efforts are continually ongoing to educate Alaskans about the EEW and how to respond to alerts.



Reportable earthquakes over a two-week period showing location, magnitude, depth range, and date. (AEC)

Earthquakes are also classified by their felt effects (e.g., the perceived shaking intensity). In general, the closer one is to an earthquake's epicenter, the more severe the felt effects and damage will be. An earthquake's intensity is described by the Modified Mercalli Intensity (MMI) Scale. As shown in the previous figure, the MMI Scale consists of ten subjective intensity levels ranging from "not felt" to "extreme," with varying amounts of damage associated with each. The

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
MMI scale	I	II–III	IV	V	VI	VII	VIII	IX	X+

Modified Mercalli Intensity (MMI) Scale (USGS)

figure also depicts the relation of Modified Mercalli Intensity and ground acceleration (percent g), which is a measure of shaking strength.

In addition to monitoring conducted through AEC and USGS, alerts related to secondary hazards such as tsunamis are important for coastal areas of Alaska. Notable systems in place in the KPB include the All-Hazard Alert Broadcast System (AHAB) and Emergency Alert Systems (EAS). More detailed analysis of tsunami related monitoring and alert systems can be found in the Tsunami/Seiches Section of this Plan.

Section 8.4 Historic Earthquake Activity

The KPB frequently experiences small earthquakes (below M4), which usually go unnoticed by area residents - only information collected at seismic stations detects the activity. Earthquakes are commonly noticed when they reach the M4 to M4.5 range, though property damage or injury is minimal at this level. However, once earthquakes exceed M4.5, the possibility of damage and injury increases significantly.

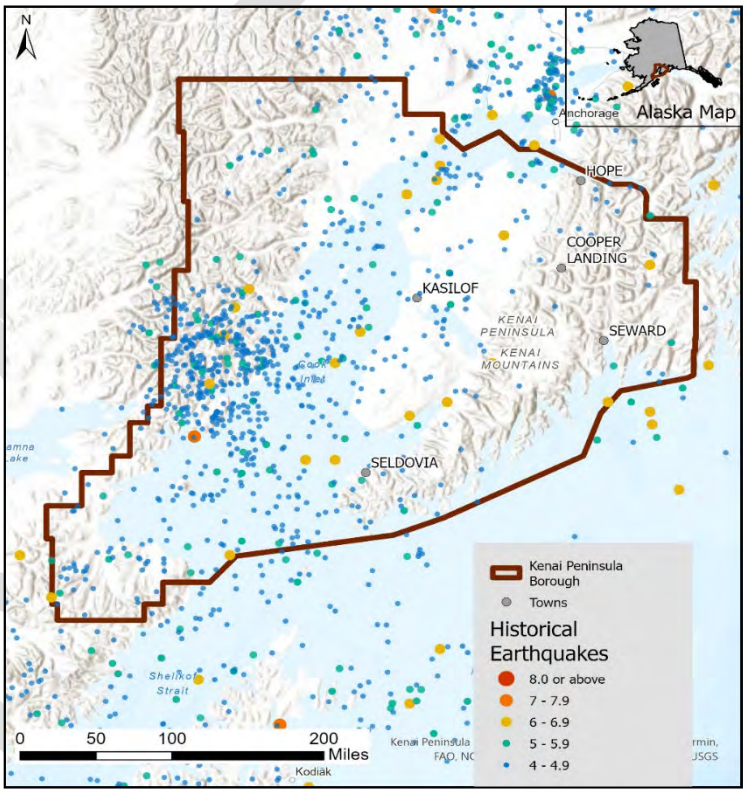


Figure 13. Map of historical reportable earthquakes M4 or greater,1900-2023 (USGS)

The M7.1 earthquake in November 2018 near Anchorage caused minimal noticeable damage to KPB facilities but did cause some damage to state roads near Nikiski. Most noticeable damage was on Mile 19 of the Kenai Spur Highway where a 500-foot crack appeared. The road remained open at a reduced speed after the earthquake occurred with traffic diversions until repairs had been made. In January 2016, a M7.1 earthquake (the Old Iliamna quake), centered about 50 miles west of Anchor Point in Cook Inlet (near Pedro Bay) caused damage to K-Beach Road at Mile Post 1 where the northbound lane dropped about 1.5 feet for about 150 feet. This was the largest recent earthquake to occur within the boundaries of the KPB.

Table 45. Historical Earthquakes with Magnitude Greater than 6.0 in the KPB Region 1900-2024

Date	Latitude	Longitude	Depth (feet)	Richter Magnitude	Location
9/22/1911	60.888	-148.246	25	6.28	27 km ENE of Whittier, Alaska
2/23/1925	61.028	-147.764	25	6.63	57 km ENE of Whittier, Alaska
12/24/1931	60	-152	100	6.25	16 km WNW of Happy Valley, Alaska
12/24/1931	60	-152	100	6.25	16 km WNW of Happy Valley, Alaska
1/4/1933	60.857	-148.304	20	6.4	22 km ENE of Whittier, Alaska
4/27/1933	61.094	-151.113	15	6.85	Southern Alaska
5/4/1934	61.529	-147.79	25	6.79	31 km SSW of Glacier View, Alaska
6/18/1934	60.716	-151.395	60	6.72	6 km WNW of Nikiski, Alaska
10/23/1936	61.171	-151.015	15	6.82	4 km NE of Beluga, Alaska
7/30/1941	60.896	-151.051	35	6.4	19 km SSE of Tyonek, Alaska
11/3/1945	59.393	-150.577	39.1	6.24	43 km ESE of Halibut Cove, Alaska
1/12/1946	59.322	-148.75	20	6.45	92 km SSE of Lowell Point, Alaska
9/27/1949	60.146	-149.438	15	6.63	3 km SW of Bear Creek, Alaska
10/3/1954	60.651	-150.392	61.5	6.77	24 km ENE of Sterling, Alaska
6/24/1963	59.499	-152.28	45	6.4	25 km NW of Nanwalek, Alaska
6/24/1963	59.499	-152.28	45	6.4	25 km NW of Nanwalek, Alaska
3/28/1964	59.751	-149.222	29.3	6.33	37 km SSE of Lowell Point, Alaska
12/17/1968	60.146	-153.058	109.6	6.25	70 km E of Port Alsworth, Alaska
9/7/1983	60.976	-147.5	45	6.4	46 km WNW of Tatitlek, Alaska
7/29/2015	59.8935	-153.1962	119.3	6.4	52 km ENE of Pedro Bay, Alaska
1/24/2016	59.6204	-153.3392	125.6	7.1	47 km ESE of Pedro Bay, Alaska
11/30/2018	61.3464	-149.9552	46.7	7.1	1 km SE of Point MacKenzie, Alaska

(USGS)

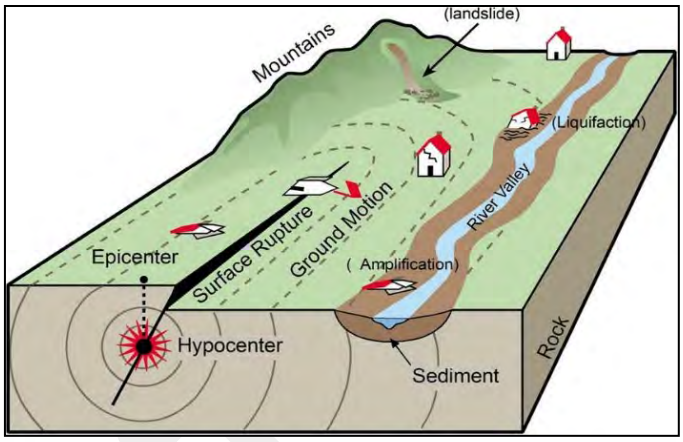
Section 8.5 Earthquake Risk Analysis

The entire KPB is vulnerable to earthquakes. It is critical that high-risk facilities and populations are identified and prioritized to ensure that appropriate mitigation strategies can be developed and implemented. Factors to consider when assessing earthquake risk include:

- Population
- Property distribution (proximity between buildings and structures)
- Housing and facilities location relative to potential secondary hazards, such as gas lines
- Building design and construction
- Disaster readiness for the region

Major damage can be caused by secondary earthquake hazards, including landslides, flooding, avalanches, and tsunamis or seiches. Additional risk factors resulting from earthquakes include uplift, subsidence, infrastructure structural failures, and soil liquefaction. The resulting severity of the damage from earthquakes is a result of several factors including:

- soil and slope conditions,
- proximity to the epicenter,
- earthquake magnitude,
- the type of earthquake



Earthquake and Secondary Hazard Diagram (USGS)

A FEMA Risk Report developed in December 2017 for the KPB provided an in-depth analysis of the potential earthquake damage that could occur in the event of a major earthquake. The report contains an essential facility damage scenario, summarized by potential damage caused by an earthquake event like the 1964, M9.2, Good Friday earthquake or an event like the January 2016, M7.1, Old Iliamna earthquake. The total facilities value is provided in Table 47 and includes 2023 KPB Assessing data by structure value for each community. The existing loss ratios were maintained and adjusted to account for the change in structure value. The table uses the Hazus modelling program to determine the loss ratios and coverage areas based on geography, location and impact areas from each earthquake event.

Table 46. FEMA Hazus Earthquake Results for M7.1 and M9.2 Earthquakes in the KPB

Community Name	Total Structure Values (2023)	Total Number Improved Parcels	M7.1 Event Total Dollar Loss	Loss Ratio ($ losses / total value)	M9.2 Event Total Dollar Loss	Loss Ratio ($ losses / total value)
Anchor Point	$142,077,700	2,296	$340,986	0.24%	$5,782,562	4.07%
Bear Creek	$150,050,500	1,742	$15,005	0.01%	$7,487,520	4.99%
Beluga	$3,277,400	146	$328	0.01%	$63,254	1.93%
Clam Gulch	$13,430,800	253	$29,548	0.22%	$475,450	3.54%
Cohoe	$109,354,500	1,667	$240,580	0.22%	$4,286,696	3.92%
Cooper Landing	$73,855,500	889	$29,542	0.04%	$2,599,714	3.52%
Crown Point	$10,212,100	101	$0	0.00%	$432,993	4.24%
Diamond Ridge	$106,407,300	1,027	$255,378	0.24%	$4,649,999	4.37%
Fox River	$25,458,400	547	$20,367	0.08%	$1,130,353	4.44%

Community Name	Total Structure Values (2023)	Total Number Improved Parcels	M7.1 Event Total Dollar Loss	Loss Ratio ($ losses / total value)	M9.2 Event Total Dollar Loss	Loss Ratio ($ losses / total value)
Fritz Creek	$159,443,900	1,776	$159,444	0.10%	$6,680,699	4.19%
Funny River	$138,418,500	1,670	$179,944	0.13%	$5,633,633	4.07%
Halibut Cove	$14,106,300	347	$15,517	0.11%	$696,851	4.94%
Happy Valley	$52,329,800	1,028	$177,921	0.34%	$1,847,242	3.53%
Homer (City)	$637,516,200	3,683	$1,721,294	0.27%	$29,325,745	4.60%
Hope	$16,897,200	429	$5,069	0.03%	$664,060	3.93%
Kachemak City	$58,928,200	476	$94,285	0.16%	$2,533,913	4.30%
Kalifornsky	$814,503,400	6,100	$1,547,556	0.19%	$29,322,122	3.60%
Kasilof	$40,223,900	521	$92,515	0.23%	$1,536,553	3.82%
Kenai (City)	$686,095,100	3,652	$1,097,752	0.16%	$23,670,281	3.45%
Lowell Point	$5,801,400	150	$580	0.01%	$182,164	3.14%
Moose Pass	$23,374,600	273	$0	0.00%	$680,201	2.91%
Nanwalek	$9,615,200	75	$28,846	0.30%	$385,570	4.01%
Nikiski	$411,901,700	3,893	$370,712	0.09%	$11,821,579	2.87%
Nikolaevsk	$22,248,900	301	$46,723	0.21%	$883,281	3.97%
Ninilchik	$30,976,600	1,812	$92,930	0.30%	$1,130,646	3.65%
Port Graham	$22,841,728	126	$57,104	0.25%	$584,748	2.56%
Primrose	$9,157,813	104	$0	0.00%	$462,470	5.05%
Pt. Possession	$3,176,863	215	$635	0.02%	$92,447	2.91%
Ridgeway	$303,552,858	2,327	$637,461	0.21%	$11,261,811	3.71%
Salamatof	$130,977,126	779	$144,075	0.11%	$3,772,141	2.88%
Seldovia (City)	$89,984,700	335	$305,948	0.34%	$4,634,212	5.15%
Seldovia Village	$30,861,603	361	$70,982	0.23%	$1,327,049	4.30%
Seward (City)	$331,484,500	1,205	$33,148	0.01%	$10,077,129	3.04%
Soldotna (City)	$541,664,300	2,243	$866,663	0.16%	$19,120,750	3.53%
Sterling	$600,746,500	5,954	$901,120	0.15%	$24,570,532	4.09%
Sunrise	$2,258,800	55	$226	0.01%	$83,124	3.68%
Totals	$5,607,848,700	48,503	$8,972,558	0.16%	$206,929,617	3.69%

(FEMA & KPB Assessing 2023) 2017 FEMA Risk Report Hazus Earthquake Modeling & KPB 2023 Assessing Department Values

Transportation: As was clearly demonstrated in 1964, large earthquakes have the potential to disrupt critical transportation infrastructure. Of the three main types of transportation infrastructure on the Peninsula (land, water, and air), land-based transportation is likely to be the most seriously affected by a large earthquake. Runways, docks, and harbors are also at risk from an earthquake and resulting subsidence, tsunamis, and flood inundation. ARRC railways and associated infrastructure are also a vital connection for tourists and residents in the KPB to the rest of the state.

Table 47. Vulnerable Transportation Facilities by Community

Community	Major Dock/Harbor	Medium/Small Dock/Harbor	Airport: Commercial and Charter	Water/Air Access Dependent (No road access)
Halibut Cove		✓		☑
Homer	✓		✓	
Seldovia	✓		✓	☑
Seward	✓		✓	
Tyonek		✓	✓	☑
Kenai		✓	✓	
Nikiski	✓	✓		
Ninilchik		✓		

The ADOT&PF Central Region is responsible for the maintenance, construction, and improvement of the Seward Highway from Anchorage to Seward, and Sterling Highway from the Seward "Y" to Homer. The earthquake readiness of state-owned bridges is a high priority for ADOT&PF. All the Kenai River bridges have been seismically retrofitted and undergo routine inspections. Recent replacements to improve ADOT&PF bridges include the Anchor River bridge, completed in 2022. Other recent bridge projects include the replacement of the Quartz Creek Road Bridge and improvements to the Snow River bridges, with construction scheduled for completion in 2024. The KPB Assembly has asked through legislation that the ADOT&PF study the Kasilof Bridge and determine if the bridge needs to be replaced or upgraded.

Outside of the KPB, damage to bridges on the Seward Highway along Turnagain Arm at Ingram Creek, Portage Creek, Placer River, and Twenty-Mile River would disrupt access to the Peninsula. Although those bridges are located outside of the KPB's boundary, the Seward Highway provides the only road access to the KPB. The KPB owns ten bridges on the road system, and the City of Seward owns one, the Lowell Creek bridge. The Lowell Creek bridge is a part of the Lowell Creek Diversion Tunnel project, and improvements are scheduled through that area in coordination with the USACE as previously described.

Utilities: Utility systems were the hardest hit piece of infrastructure from the M7.1 January 2016, Old Iliamna earthquake. Natural gas service leakage caused the destruction of four houses in the

City of Kenai and utility companies spent weeks completing infrastructure inspections for gas leaks after the earthquake. The 2016 earthquake, which was felt strongly throughout the Borough, caused a region-wide power outage and many residents were without power for many days. The City of Kenai also sustained damage to one of their large water storage tanks.

Building Codes: According to the International Building Code (IBC), earthquake building codes are regulations that ensure buildings and structures are designed and constructed to withstand seismic forces. These codes specify the necessary requirements for materials, design, and construction techniques to enhance the structural integrity and safety of buildings in the event of an earthquake. By adhering to these standards, the aim is to protect human life, minimize property damage, and maintain the functionality of essential infrastructure during and after seismic events The 2017 FEMA Risk Report contains a Hazus based Building Code Analysis related to the KPB. This information has not been updated since the KPB does not generally have building codes, and no updates to KPB building codes have taken place since the last plan update. Hazus identifies key changes in earthquake building codes, based on year as found in the table below:

- **Homes built prior to 1941** 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 1941** or built prior to 1941 but with a wood frame are considered moderate code and may include some earthquake building components.
- **Buildings built after 1975** are considered high code. Without zoning or building code requirements in the unincorporated areas of the Borough, the buildings shown as high code frequently do not all comply with building codes, even if constructed after 1975.

Table 48. Moderate and High Code Buildings in the KPB

Community Name	Total Moderate Code Buildings	Percent Moderate Code Buildings	Total High Code Buildings	Percent High Code Buildings	Total Number of Buildings
Homer (City)	688	18.69%	2,993	81.31%	3,681
Kachemak City	72	15.13%	404	84.87%	476
Kenai (City)	1,077	29.49%	2,575	70.51%	3,652
Seldovia (City)	129	39.33%	199	60.67%	328
Seward (City)	555	46.06%	650	53.94%	1,205
Soldotna (City)	438	19.53%	1,805	80.47%	2,243
Incorporated Total	2,959	25.54%	8,626	74.46%	11,585
UNINCORPORATED COMMUNITIES					
Anchor Point	284	12.38%	2,012	87.71%	2,294

Community Name	Total Moderate Code Buildings	Percent Moderate Code Buildings	Total High Code Buildings	Percent High Code Buildings	Total Number of Buildings
Bear Creek	259	14.87%	1,483	85.13%	1,742
Beluga	37	25.34%	109	74.66%	146
Clam Gulch	39	15.42%	214	84.58%	253
Cohoe	203	12.18%	1,464	87.82%	1,667
Cooper Landing	227	25.53%	662	74.47%	889
Crown Point	29	28.71%	72	71.29%	101
Diamond Ridge	104	10.13%	923	89.87%	1,027
Fox River	41	7.50%	506	92.50%	547
Fritz Creek	188	10.59%	1,588	89.41%	1,776
Funny River	164	9.82%	1,506	90.18%	1,670
Halibut Cove	56	16.14%	291	83.86%	347
Happy Valley	112	10.89%	916	89.11%	1,028
Hope	105	24.48%	324	75.52%	429
Kalifornsky	700	11.48%	5,400	88.52%	6,100
Kasilof	92	17.66%	439	82.34%	521
Lowell Point	15	10.00%	135	90.00%	150
Moose Pass	67	24.54%	6-Feb	75.46%	273
Nanwalek	10	13.33%	65	86.67%	75
Nikiski	823	21.15%	3,070	78.90%	3,891
Nikolaevsk	65	21.59%	236	78.41%	301
Ninilchik	250	13.80%	1,562	86.20%	1,812
Pt. Possession	8	3.85%	200	96.15%	208
Port Graham	44	34.92%	82	65.08%	126
Primrose	42	40.38%	62	59.62%	104
Ridgeway	396	17.02%	1,931	82.98%	2,327
Salamatof	199	25.55%	580	74.45%	779
Seldovia Village	46	12.74%	315	87.26%	361
Sterling	780	13.10%	5,174	86.90%	5,954
Sunrise	18	32.73%	37	67.27%	55
Tyonek	25	21.19%	93	78.81%	118

Community Name	Total Moderate Code Buildings	Percent Moderate Code Buildings	Total High Code Buildings	Percent High Code Buildings	Total Number of Buildings
Other Areas	216	17.55%	1,015	82.45%	1,231
Unincorporated Total	5,644	14.73%	32,662	85.27%	38,302
TOTAL	**8,603**	**17.24%**	**41,288**	**82.76%**	**49,891**

(2017 FEMA Risk Report)

The State of Alaska currently uses the International Building Code (IBC 2021) developed and updated by the International Code Council (ICC). The IBC uses Seismic Design Categories (SDC) to determine the level of seismic resistance for new buildings. The Alaska State Fire Marshal, as part of the Alaska Department of Public Safety, Fire, and Life Safety Division, has the authority to adopt and enforce building and fire codes throughout the state. According to the 2023 State Hazard Mitigation Plan (SHMP):

- *The IBC and International Fire Code (IFC) are adopted under the authority of the Alaska State Fire Marshal. The Fire Marshal has the discretion to initiate code adoption of the IBC and IFC when new editions are available (SHMP 2023).*

Seismic Design Category (SDC)	Description[1]
A	Structures in regions where anticipated ground motions are minor, even for very long return periods.
B	Seismic Use Group I and II structures in regions of seismicity where only moderately destructive ground shaking is anticipated.
C	Seismic Use Group III structures in regions where moderately destructive ground shaking may occur as well as Seismic Use Group I and II structures in regions with somewhat more severe ground shaking potential.
D	Seismic Use Group I, II, and III structures in regions expected to experience destructive ground shaking but not located very near major active faults.
E	Seismic Use Group I and II structures in regions located very close to major active faults.
F	Seismic Use Group III structures in regions located very close to major active faults.

IBC Seismic Design Category Description (ICC) Table, FEMA does not include SDC rating for F Category due to limited data for category in National Seismic Hazard Models (NSHMs)

The entire KPB is rated SDC category D2, the second highest rating possible: see FEMA Hazard Level Rating Categories Document for reference. The potential effects of a D2 Rating are:

- *Very strong shaking described as slight damage in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse; and great damage in poorly built structures (FEMA).*

Public buildings that are under new construction are required to follow the 2022 IBC which includes appropriate measures to minimize damage based on the D2 risk classification for the borough. There are no enforced building codes for residential structures smaller than a four-plex in the unincorporated areas of the borough. Therefore, it is reasonable to expect that a strong earthquake of M7.0 or more could cause severe structural damage to many of the structures in the KPB. Many non-residential structures are old enough (1980s or older) to pre-date current earthquake standards and are even more vulnerable to earthquake damage. Non-residential

privately owned buildings do not require enforced building standards due to limited government staffing, budget constraints, and community concerns over potential construction cost impacts.

Schools: Using a FEMA rapid evaluation procedure (see FEMA publication P-154), BBFM Engineers, a contractor for the KPBSD, prepared a Vulnerability Study of some schools in the district. The 2015 study was funded by FEMA and administered by the Earthquake Engineering Research Institute (EERI), for the KPB School District (KPBSD) and the Alaska Seismic Hazards Safety Commission (ASHSC). The KPBSD also has an Emergency Action Plan (EAP) that has an Earthquake Assessment checklist of school district facilities for use following notable earthquake events, or M6.0 or more. The study provided a rapid visual screening of fifteen aging schools and forty-seven accompanying structures in the KPBSD. The results were used to determine which schools needed an in-depth seismic follow-up review and possible building improvements. Nineteen of the structures evaluated were found to warrant a more detailed future evaluation.

An explanation of the scoring rubric is as follows: The FEMA based scoring of buildings (S score) is an estimate of the probability that a building will collapse if ground motions occur that equal or exceed the maximum considered earthquake (MCE) ground motions (the current FEMA 310 Handbook ground motion specification for detailed seismic evaluation of buildings). These estimates of the score are based on limited observed and analytical data, and the probability of collapse is therefore approximate. For example, a final score of S=3 implies there is a chance of 1 in 1000, that the building will collapse if such ground motion occurs (2015 KPBSD Study).

Table 49. 2015 FEMA KPB School Rapid Visual Screening for Earthquake Risk

School	Location	Date Constructed	S Score	FEMA Estimate of Collapse Risk
Chapman School	Anchor Point	1958	0.7	20%*
		1982 Addition	2.5	0.30%
Cooper Landing School	Cooper Landing	1973	4.1	0.01%
		1983 Addition	2.7	0.20%
Homer Middle School	Homer	1970	1.4	4%*
Kenai Central High School	Kenai	1960	3.9	0.01%
		1964 Addition	1.5	3%*
		1967 Shop Addition	2.1	0.80%
		1968 Addition	1.2	6%*
		1970 Voc Ed Addition	1.7	2%*
		1975 Addition	1.5	3%*
		1983 Addition	1.5	3%*
Moose Pass School	Moose Pass	1935	1.6	3%*
		1953 Addition	1.1	8%*
		1960 Addition	1.1	8%*
		1974 Addition	1.6	3%*
		1993 Addition	3.6	0.03%

School	Location	Date Constructed	S Score	FEMA Estimate of Collapse Risk
Nikolaevsk School	Nikolaevsk	1975	3	0.1%*
		1982 Addition	5.4	0.00%
Ninilchik School	Ninilchik	1950	2.2	0.60%
		1962 Addition	3	0.10%
		1979 Addition	3.1	0.08%
		1981 Addition	3.4	0.04%
Paul Banks Elementary	Homer	1964	2.3	0.50%
		1975 Addition	2.3	0.50%
		1984 Addition	3.2	0.06%
Sears-Kaleidoscope Elem.	Kenai	1968	2	1%
Seward High School	Seward	1977	3.2	0.06%
Soldotna Elementary School	Soldotna	1960	2.9	0.10%
		1962 Addition	2.9	0.10%
		1968 Addition	2.9	0.10%
		1975	1.6	3%*
Soldotna Middle School	Soldotna	1970	2.1	0.80%
		1986 Addition	0.8	16%*
Sterling Elementary School	Sterling	1958	4.3	0.01%
		1963 Addition	3.8	0.02%
		1968 Addition	2.1	0.80%
		1978 Addition	5.3	0.00%
		1983 Addition	2.8	0.2%*
Susan B English School	Seldovia	1957	2.1	0.80%
		1972 Addition	1.4	4%*
		1983 Addition	1.1	8%*
Tustumena Elementary School	Kasilof	1958	3	0.10%
		1969 Addition	1.7	2%*
		1978 Addition	4.9	0.00%
		1983 Addition	1.7	2%*
		1995 Addition	2.9	0.10%

(KPBSD 2015) * Indicates detailed investigation warranted; concerns may be structural or attachments such as canopies.

Probability: Because earthquakes are impossible to predict, scientists must use a unique approach to describe the hazards posed by earthquakes. Probabilistic Seismic Hazard Analyses (PSHAs) describe earthquake shaking levels and the likelihood that they will occur in Alaska. PSHA estimates the likelihood of earthquake effects, such as ground shaking, occurring at a site over a specified period. It involves identifying seismic sources, developing recurrence models, and using Ground Motion Prediction Equations (GMPEs) to predict ground motions, resulting in hazard curves that show the probability of exceeding different ground motion levels. PSHA is crucial for informing building codes, risk assessments, insurance, and urban planning, providing a comprehensive and quantitative approach to mitigating seismic risks. In addition to analysis by

USGS, more in depth analysis on probability risk mapping for earthquakes can be found in research conducted through the National Earthquakes Hazards Reduction Program (NEHRP). This program develops tools, techniques, and other measures that can reduce the adverse effects of earthquakes and facilitates and promotes the implementation of these measures, thereby strengthening earthquake resilience among at-risk communities.

Section 8.6 Impact of Future Climate Conditions

The characteristics and nature of earthquakes are not affected by future climate conditions. In addition, earthquake intensity is not affected by future climate conditions and is not expected to change in the future.

Section 8.7 City of Seward Hazard Overview

The City of Seward faces a high earthquake hazard risk due to its location within a seismically active area of Southcentral Alaska. Earthquakes in this region can trigger secondary hazards such as tsunamis, landslides, and soil liquefaction, which pose significant threats to infrastructure and public safety. The 1964 Good Friday Earthquake caused significant damage to the City of Seward and its infrastructure.

Section 8.8 City of Seldovia Hazard Overview

The City of Seldovia is highly susceptible to earthquake hazards due to its proximity to the active Alaska-Aleutian subduction zone, which frequently generates significant seismic activity. The city is at risk of strong ground shaking, liquefaction of coastal sediments, and tsunamis, as demonstrated by the 1964 Good Friday Earthquake's impact. These factors collectively heighten the potential for substantial damage to infrastructure and increased risk to human safety in Seldovia.

Section 9 Severe Weather

Weather can kill you so fast. The first priority of survival is getting protection from the extreme weather.
- Bear Grylls

Section 9.1 Hazard Overview

Severe weather events often impact large geographic areas of the Borough and pose a significant threat to life and property. They disrupt utilities, transportation and telecommunication systems, often leaving remote communities without services for days or weeks. It is critical that communities have appropriate warning of severe weather events and undertake realistic mitigation planning.

Snow Removal on KPB road during winter snowstorm (ADOT 2022)

The KPB regularly experiences winter storms, high winds, seasonal heavy rainfall, coastal storms, and tidal storm surge events. Severe winter weather is often accompanied by high wind, freezing rain, icing conditions, heavy snowfall, and extended periods of cold temperatures.

Section 9.2 Types of Severe Weather Hazards

Several weather-related hazards may result from weather events in the KPB, including:

- **Winter Storm** - The NWS defines this as heavy sleet, heavy snow, ice storm, blowing snow, or a combination of these. They originate as mid-latitude depressions or cyclonic weather systems.
- **Heavy Snow** - Heavy snow is generally defined by NWS as 12 inches of accumulation in less than 24 hours. It can immobilize communities, closing airports and major roadways, delaying or closing schools, collapsing building roofs, and causing accidents resulting in death or injury.
- **Extreme Cold** – NWS defines extreme cold in Alaska as temperatures that pose a significant risk to human health, safety, and property. Extended periods of temperatures between minus 20 and minus 40 degrees (F) can freeze pipes, disrupt utilities, cause the Cook Inlet to ice up, and result in riverine ice jams with associated flooding.
- **Ice Storms** – The NWS defines an ice storm as a weather event which results in the accumulation of at least 0.25 inch (6.4 mm) of ice on exposed surfaces. Freezing rain occurs when rain falls onto surfaces with temperatures below freezing, causing it to

freeze upon contact. This can result in a layer of ice forming on roads, trees, power lines, and other surfaces.

- **High Winds** –NOAA defines high wind as wind speeds of 40 miles per hour (mph) or greater lasting one hour or longer, or winds of 58 mph or greater for any duration. Winds greater than 60 mph occur frequently over coastal areas of the KPB.
- **Thunderstorms and Lightning** – A thunderstorm is considered severe if winds reach or exceed 58 mph, a tornado develops, or hail drops exceed one inch in diameter. Lightning is caused by a buildup of charged ions in a thundercloud. The 2019 Swan Lake Fire was a large lightning-caused fire that burned roughly 170,000 acres.
- **Coastal Storms** – From fall through spring, low pressure cyclones develop in the Bering Sea and Gulf of Alaska. When coastal storms impact the shoreline, they can bring high winds, causing coastal flooding and erosion. Coastal areas that are most affected by these types of storms include Kachemak Bay, Cook Inlet, Resurrection Bay and Turnagain Arm.
- **Tidal Storm Surge** – NOAA defines tidal storm surge as the abnormal rise in seawater level during a storm event, typically caused by a combination of factors such as low atmospheric pressure, strong winds, and the astronomical tide. This surge in water levels can lead to coastal flooding, inundating low-lying areas and causing significant damage to property and infrastructure. If the storm surge accompanies 20+ foot high tides in Cook Inlet, the damage and erosion can be considerable. Coastal bluffs are vulnerable to the effects of tidal storm surges, which can lead to erosion, undercutting of the bluff face, and potentially causing collapse.

Section 9.3 Historic Severe Weather Events

Severe Weather events in the KPB produced significant threat and damage to life and property over the years. As a direct result of severe weather events within the Borough, highway closures, power outages, structural damage and loss of life have occurred. It is important to mitigate the potential negative effects of severe weather – the weather cannot be prevented, but the effects can be lessened by actions taken before, during and after the events.

Severe Weather can contribute directly and indirectly to other hazards including the severity and probability of their occurrence. Severe weather, such as heavy rainfall and storms, significantly increases the risk of flooding and erosion by overwhelming drainage systems and destabilizing soil. Additionally, the accumulation of snow during intense winter storms can trigger avalanches, while the saturation of ground from prolonged precipitation can lead to landslides. Table 51 lists historic weather events that have received either a federal, state, or local natural disaster declaration in the past twenty years.

Table 50. History of Severe Weather-Related Events in the KPB 2004-2024

Year	Type	Description	Description	Disaster Declaration #
2006	Seward Area	Flooding	On October 8, 2006, heavy rains and wind resulted in flooding and mudslides, closing the Seward Highway at Mile 4 and Lowell Point Road at the bridge, leaving both communities inaccessible by road. Damage to other area infrastructure resulted in a federal disaster declaration.	DR 1669
2007	Seward Area	Flooding	Heavy deposits of gravel and silt from the headwaters of Lost Creek resulted in the May 17 flooding of Old Mill Subdivision. Removal of approximately 100,000 CY of gravel by dredging provided a temporary resolution. A local disaster was declared.	Local Disaster Declaration June 7, 2007 Extended by Reso 2007-049 June 14, 2007
2007	Kenai River	Ice jam flooding	The Skilak Glacier-Dammed Lake began releasing January 16 and by January 27 the Kenai River was 20 feet above flood stage at the Soldotna Bridge, causing ice jams and localized flooding. Significant property damage resulted. A local disaster was declared.	
2009	Seward Area	Sea storm and tidal surge	On December 1, an extreme high tide combined with a windstorm caused severe damage to areas around Resurrection Bay. A local and state disaster were declared.	City of Seward Local Disaster Declaration, December 4, 2009 KPB local Disaster Declaration, December 7, 2009 State Disaster Declaration, December 31, 2009
2011	KPB Areawide	Windstorm	Three windstorms in November caused widespread power outages; HEA and CEA estimated up to $1.8 million in damages. A federal disaster was declared.	DR 4054
2012	KPB Areawide	Severe storm, winds, flooding	Heavy rainfall in September caused damage to infrastructure in the Seward area, including Box Canyon water diversion structure, Old Exit Glacier Road, 3 bridges in Old Mill Subdivision, and Bear Creek Fire Station. Landslides, flooding, and erosion closed numerous roads in the area. The central peninsula had numerous roads closed by flooding; a portion of Kalifornsky Beach Road at Mile 11 completely washed out, closing that road for weeks until a detour could be constructed, followed by reconstruction of the road the following year. Tyonek and Beluga on the west side of Cook Inlet were flooded and without power. A federal disaster was declared.	DR 4094

Year	Type	Description	Description	Disaster Declaration #
2013	KPB Areawide	Flooding	Heavy rain fell in a flat area with high groundwater and limited drainage off Kalifornsky Beach Road, causing flooding to crawl spaces, basements, septic systems, wells, and roads. Roads and bridges in the southern peninsula area of Anchor Point flooded. The road connecting Tyonek and Beluga on the west side of Cook Inlet was washed out. The Seward Airport was closed, Lowell Creek Bridge was flooded, and Box Canyon water diversion structure was compromised. A federal disaster was declared.	DR 4161
2018	Seward Area	Tidal storm surge	A December storm coupled with a high tide severely damaged Lowell Point Road along Resurrection Bay. A federal Disaster declaration was approved in June 2018.	DR 4369
2019	KPB Areawide, City of Seldovia, Nanwalek IRA	Drought	Much of the KPB experienced record high temperatures with little rainfall in summer 2019. City of Seldovia and Native Village of Nanwalek had limited water supplies that had been depleted to the point of water needing to be brought in by the end of August. A local, City of Seldovia and Nanwalek IRA emergency declaration was declared to help support renewable water resources being brought into both communities. Water supplies were shipped in and flown in until the water reserves were able to be replenished in the fall.	KPB Local Disaster Declaration August 29, 2019 City of Seldovia Disaster Declaration August 28, 2019 Nanwalek IRA Disaster Declaration August 27, 2019
2019	KPB Areawide, City of Seldovia	Severe Storm, High Winds	November 27, 2019, numerous unincorporated areas of the KPB and the City of Seldovia sustained severe damage from high winds reaching up to 60 mph. High winds along with ice storms and heavy snow led to loss of power for a number of days and significant damage to Seldovia small boat harbor and Jakolof Bay Dock. A local and City of Seldovia emergency was declared.	KPB Local Disaster Declaration, December 6, 2019 City of Seldovia Disaster Declaration November 27, 2019
2020	Seward Area	Severe Storm	Severe storms brought significant rains into the Seward and Bear Creek areas that were forecast to bring flood levels similar to 2012 and 2018 declared flood events. Areas with high water issues were Kwechak Creek, Lost Creek, Salmon Creek, Sawmill Creek, and Clear Creek. A local disaster was declared.	KPB Local Disaster Declaration October 2, 2020
2022	KPB Areawide	Severe Storm	Severe storms, straight-line winds, flooding, landslides, and mudslides occurred in the KPB October 29–November 1, 2021. A federal Disaster declaration was approved in 2022.	DR 4638
2023	Kenai River	Flooding	High water on the Kenai River caused by glacier dam lake releases beginning September 7, 2023, resulted in flooding impacts along the low-lying areas of the river that impacted residential structures and infrastructure. Precipitation levels not seen since 1989 combined with ground saturation, particularly in the mile 16 area of K-Beach Road resulted in a local disaster declaration.	KPB Local Disaster Declaration September 14, 2023

(FEMA & KPB)

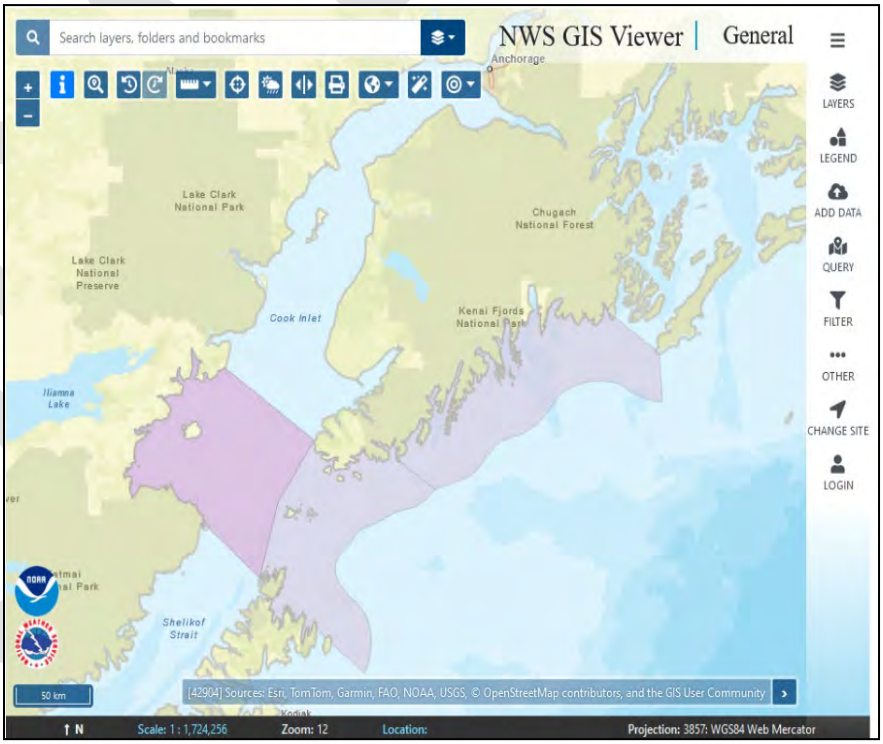
Section 9.4 Severe Weather Hazard Risk

The extent of damage caused by severe weather depends on various factors including temperature, type and amount of precipitation, wind speed, and event duration.

Severe weather events have the potential to damage or disrupt water, sewer, power, gas, and transportation services; communication infrastructure, as well as emergency response facilities and systems can also suffer damage or outages. Heavy rains, high wind, extreme cold, and winter storms have all directly affected the KPB in recent years. Storm events that closely follow each other, or occur in combination with other hazards, have the potential to affect all Borough residents directly or indirectly. Depending on the severe weather event, damage to critical infrastructure up to and including the complete abandonment of key facilities may result. Indirect effects may include road closures that isolate residents, impact public safety, and limit availability of perishable commodities. All communities in the KPB are susceptible to severe weather risks.

Section 9.5 Severe Weather Monitoring

The Alaska Department of Transportation and Public Facilities (ADOT&PF) provides updates to weather related road conditions on its maintained roadways. The ADOT&PF Alaska 511 Traveler website has up-to-the-minute information on road conditions using road cameras and daily updates from ADOT&PF Maintenance. These road conditions can vary from good to hazardous and will include road closures or travel advisory information.



NWS Weather Map shows weather warnings, watches, advisories for the state and the KPB (NWS/NOAA)

Severe weather information for the Borough, through information collected by NOAA, and NWS, provides real-time weather event notifications. This information is meant to be used as a means of determining the most recent weather watches and warnings being administered by the NWS.

This information is readily available to the public on the KPB Ready Set Go! Page as well as through the NWS Alaska Region website. KPB Alerts is also a means for OEM to notify residents through social media or cell phone notifications. It requires voluntary registration of cell phones with OEM.

StormReady, is part of the NWS nationwide community preparedness program that uses a grassroots approach to help communities develop plans to handle all types of severe weather. The program encourages communities to improve local hazardous weather operations by providing emergency managers with explicit guidelines for improving their hazardous weather operations. In the KPB, the Cities of Seward, Seldovia, and Homer are actively involved in this program, along with Seldovia Village. In Seward, the Alaska Sealife Center provides outreach and informational material as well as support for the program to visitors and residents alike.

Section 9.6 Severe Weather Hazard Extent

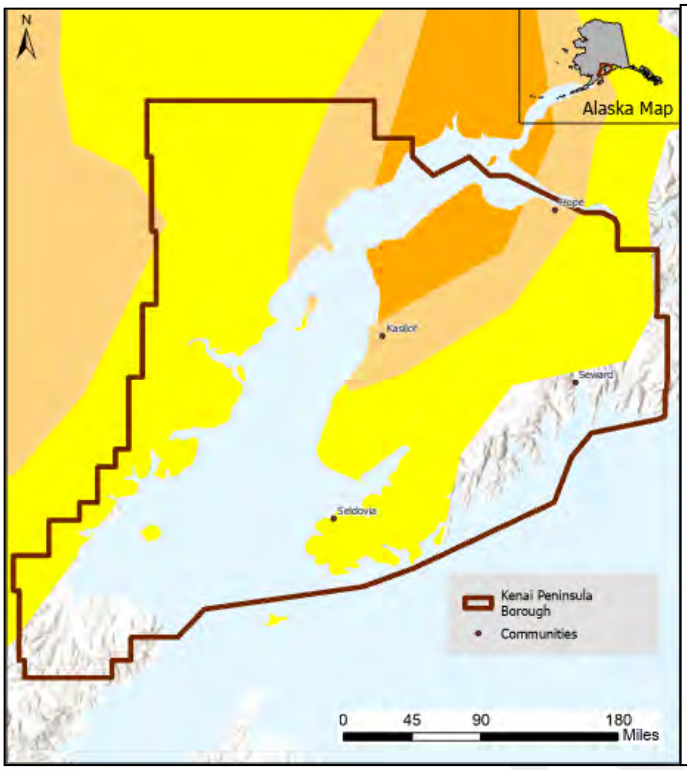
Based on past severe weather events and the criteria identified in the hazard assessment, the extent of severe weather is considered "Limited", where complete shutdown of critical facilities occurs for more than one week, and more than 10 percent of property is severely damaged. Severe Weather events in the KPB can occur throughout the year and residents should be aware of warnings, watches, and advisory notices to understand and be aware of potential events.

Section 9.7 Severe Weather Probability

Based on the number of severe weather events that occur using the hazard assessment criteria in the plan, the probability of an event occurring in the next year is Highly Likely. Areas of particular concern are coastal areas and areas that have a high risk of flooding. The City of Seldovia and City of Seward/SBCFSA are particularly susceptible to coastal storms, and the SBCFSA monitors local streams in the Seward, Lowell Point and Bear Creek areas for weather affects to flood levels.

Section 9.8 Impact of Future Climate Conditions

Due to changes in climate conditions from a warmer atmosphere, a warmer and more acidic ocean, higher sea levels, and larger changes in precipitation patterns, weather in the KPB is more susceptible to extreme conditions. Temperatures in Alaska have been consistently warmer than at any time in the past century, resulting in increased glacial melt. Recent years have brought temperature extremes to Alaska, including the warmest year (2016), and the warmest month (July 2019) on record. The U.S. Drought Monitor from NOAA has shown much of the KPB as having been under drought conditions over the past 10 years. The last year where drought conditions were determined to be listed as "Severe Drought" and "Moderate Drought" by percent area included areas from Kasilof to Hope in 2022. In August 2019, the KPB signed a disaster declaration for drought affecting the communities of Seldovia and Nanwalek. 2022 was the last summer when drought conditions were documented in the KPB. Figure 14 maps the drought conditions from July 5, 2022, with a table showing drought conditions as a percentage



Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	54.78	45.22	17.90	1.27	0.00	0.00
Last Week 06-28-2022	53.84	46.16	15.60	0.67	0.00	0.00
3 Months Ago 04-05-2022	100.00	0.00	0.00	0.00	0.00	0.00
Start of Calendar Year 01-04-2022	100.00	0.00	0.00	0.00	0.00	0.00
Start of Water Year 09-28-2021	100.00	0.00	0.00	0.00	0.00	0.00
One Year Ago 07-06-2021	74.35	25.65	0.00	0.00	0.00	0.00

Intensity:

- None
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

Figure 14. Map and table of drought conditions from July 2022 (USDA)

of area for the State of Alaska. Areas through Hope and Kasilof show Moderate Drought with the northern reaches of the Borough under Severe Drought conditions.

The University of Alaska Fairbanks Scenarios Network for Alaska and Arctic Planning (SNAP), a part of International Arctic Research Center, provides data showing how weather will be impacted by future climate conditions in the coming years. Their modeling includes assessing a variety of metrics including temperature and precipitation projections through 2099. Modeling for the KPB predicts precipitation and temperature as remaining fairly consistent throughout the various seasons, see Home — SNAP (uaf-snap.org) for detailed information.

As an example, Seldovia and Seward are shown within SNAP projected precipitation and temperature models that there will be future changes to climate and weather in the upcoming years, see Figure 16 and 17 for reference. The modeling capability is available for many of the communities in the KPB and uses Representative Concentration Pathways (RCP) to display climate scenarios. The scenarios shown use the medium scenario model example, low and high scenarios can also be used to determine variation based on projective changes to the amount of greenhouse emissions over time.

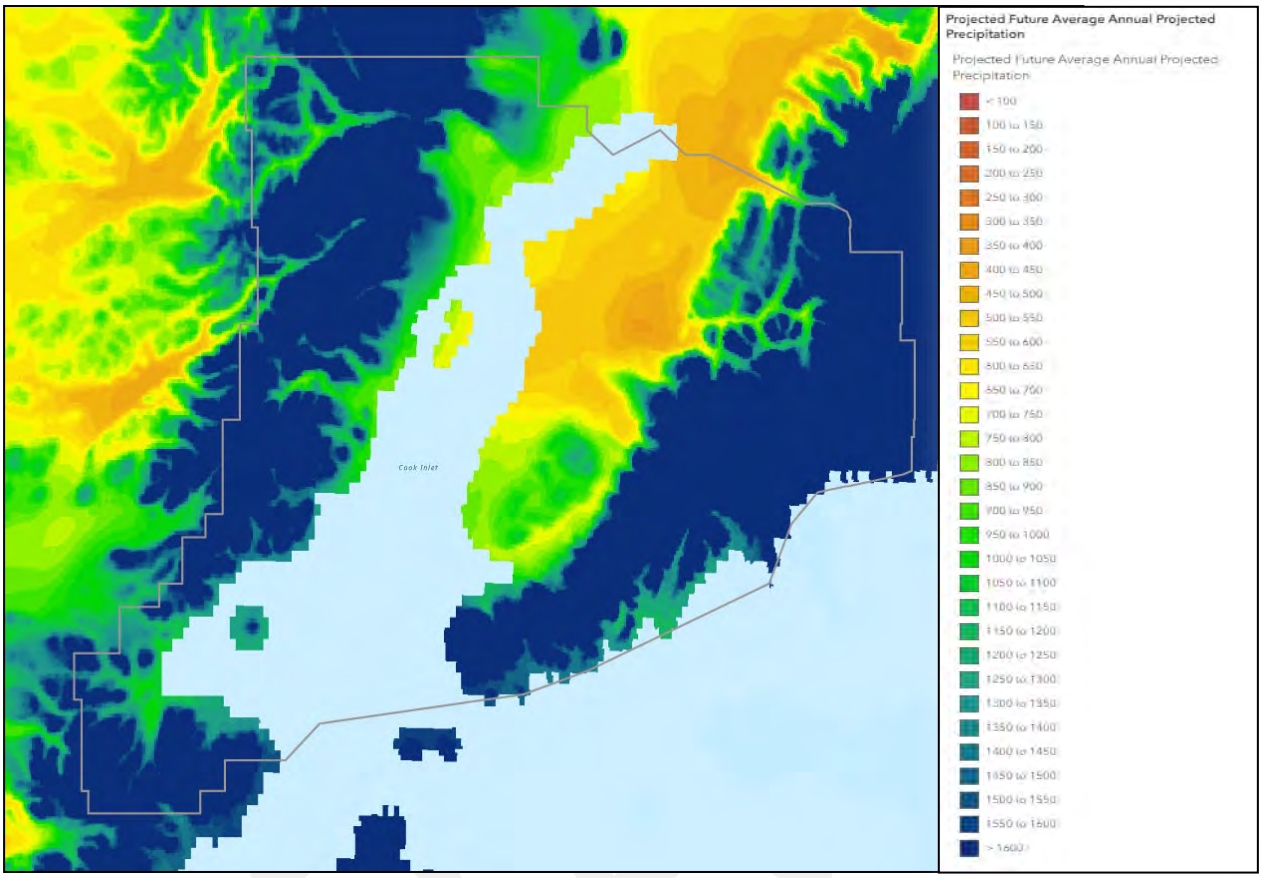


Figure 15. Climate Change Map

The Rocky Mountain Research Station (RMRS) developed this map with data support from UAF (SNAP). Projected average annual precipitation is in millimeters (mm) and was developed using historical (1975-2005) and future (2071-2090) precipitation and temperature data. (NWS/NOAA)

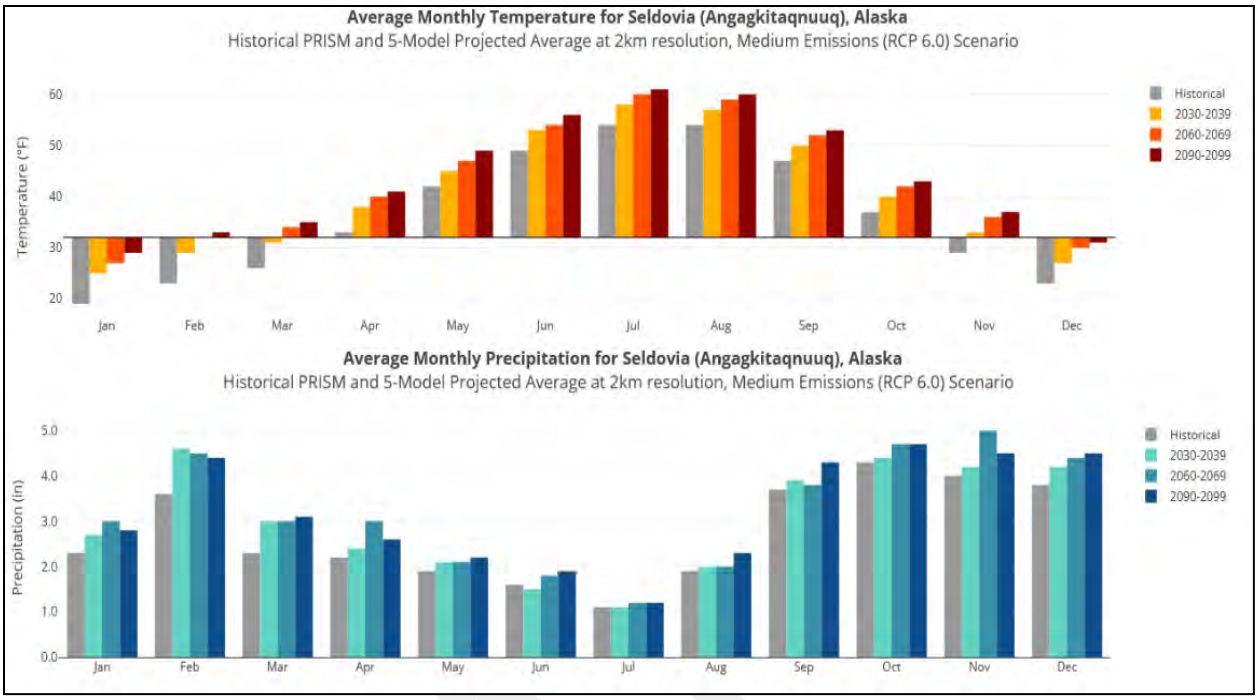


Figure 16. Historic and Predicted Precipitation & Temperature Ranges for Seldovia (SNAP 2024)

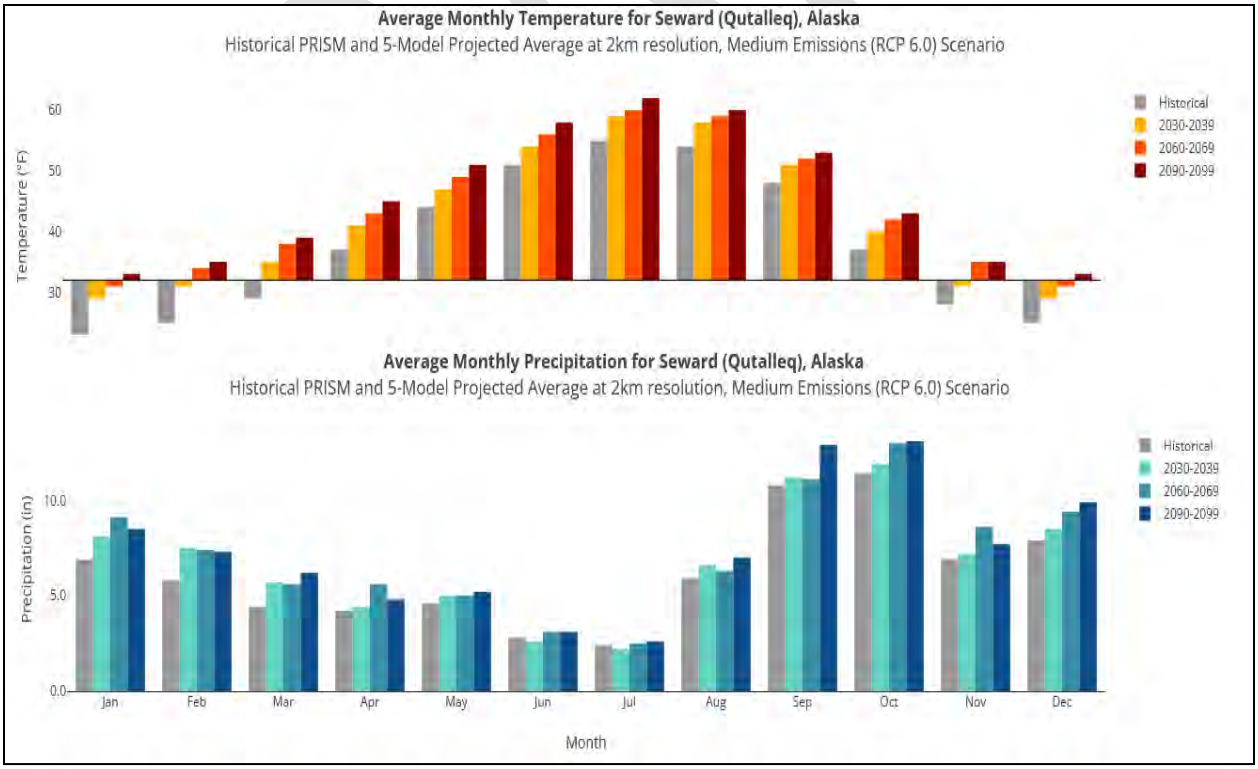


Figure 17. Historic and Predicted Precipitation & Temperature Ranges for Seward (SNAP 2024)

Section 9.9 City of Seward Hazard Overview

The City of Seward experiences severe weather characterized by intense winter storms bringing heavy snowfall and gale-force winds. Additionally, the area is prone to significant rainfall and coastal flooding, especially during late summer and early fall.

Section 9.10 City of Seldovia Hazard Overview

The City of Seldovia often faces severe weather due to its exposed location, including powerful winter storms that bring heavy snow and strong winds, creating hazardous conditions and potential disruptions. The City is also susceptible to significant rainfall and flooding, particularly during the fall and early winter months.

Section 10 Tsunamis and Seiches

The criteria for architecture after the tsunami is humbleness.

- Kengo Kunma

Section 10.1 Hazard Overview

The National Oceanic and Atmospheric Administration (NOAA) defines a tsunami as a series of ocean waves with very long wavelengths (typically hundreds of kilometers) caused by large-scale disturbances of the ocean, such as earthquakes, volcanic eruptions, or underwater landslides. Tsunamis can travel across entire ocean basins at high speeds and can cause significant destruction and loss of life when they reach coastal areas. Unlike regular ocean waves, which are caused by the wind, tsunamis are generated by the displacement of water, often resulting in massive inundation and flooding of coastal regions. A tsunami in the KPB could also be generated by volcanic flow or landslides coming from coastal volcanoes that line Cook Inlet.

Tsunami damage in Seward after 1964 Great Alaska Earthquake (USGS)

A seiche is a wave that moves back and forth in partially or totally enclosed bodies of water. Seiches can last from a few minutes to a few hours as a result of an earthquake, surface or submarine landslide, or atmospheric disturbance. In Alaska, seiches are commonly generated by the collapse of deltas into deep glacial lakes. Seiches can also contribute to the formation of deltas over time near alluvial streams and water bodies. A seiche delta is created where sediment carried by seiche currents settles and builds up over time. Seiches in the Cook Inlet can occur due to various factors, including tidal forces, wind, and underwater topography.

Section 10.2 Tsunami Types

Within the KPB, tsunamis can be classified into four distinct types based on their origins and mechanisms. The region's geological and tectonic settings contribute to the types of tsunamis that may occur. The primary types of tsunamis that can affect the KPB include:

- **Teletsunami:** Also referred to as a Distant Tsunami, the term is used when a tsunami travels more than 1,000 kilometers (approximately 620 miles) or three hours' travel from its source. In many cases, teletsunamis allow for sufficient warning time and evacuation. Most teletsunamis reaching Alaska are not severely damaging, but waves of just a few feet can cause currents that make maritime navigation difficult to impossible and

damage harbors and other infrastructure. To date, no damage from teletsunamis has been recorded within the KPB.

- **Volcanic Tsunamis:** Volcanoes that are situated in the sea or near the coast can initiate tsunamis by generating earthquakes, pyroclastic flows, submarine explosions, debris avalanches, caldera collapse, pyroclastic surges, lahars and airwaves from explosions, and lava avalanches into the sea. The five active volcanoes in the KPB are all potential contributing causes to these types of tsunamis.
- **Seismically Generated Local Tsunamis:** Although most of the seismically generated local tsunamis occur along the Aleutian Arc, seismic activity is common in the KPB and is often associated with its active volcanoes. Of note is Augustine volcano which has a high probability of generating tsunami waves that could impact communities in lower Cook Inlet. The 1964 Good Friday Earthquake and Tsunami is an example of a major tectonic or seismically generated tsunami.
- **Landslide-Generated Tsunamis**: Submarine and surface landslides can generate large waves. Surface landslides have greater associated kinetic energy than submarine landslides, so they typically trigger larger tsunamis. Earthquakes often trigger multiple landslides and landslide-generated tsunamis. Submarine landslides occur more readily at low tide when water-saturated sediments are exposed and lack the support of the water. Additional loading from human activities, such as warehouses, canneries and freight yards can increase a delta's instability. In Alaska, landslide events usually occur in heavily glaciated areas such as Resurrection Bay, Kachemak Bay, and Prince William Sound. Landslide-generated tsunamis are often the deadliest because they quickly follow the triggering event with little to no warning.

Seiches, though not as commonly known or understood as tsunamis, are a hazard risk worth noting in the KPB. Given the KPB's susceptibility to earthquakes, seiches are often associated with the seismic disturbances that periodically affect the region. For instance, the 1964 Alaskan earthquake generated significant seiche activity in several fjords and bays along the Peninsula. Additionally, the complex interplay of tides, wind, and topographical features such as narrow inlets and steep coastal slopes can amplify these oscillations, potentially causing localized flooding and impacting marine navigation. Within the KPB, slide-induced waves have occurred in the borough's major inland water bodies including Kenai, Tustumena, and Skilak Lakes.

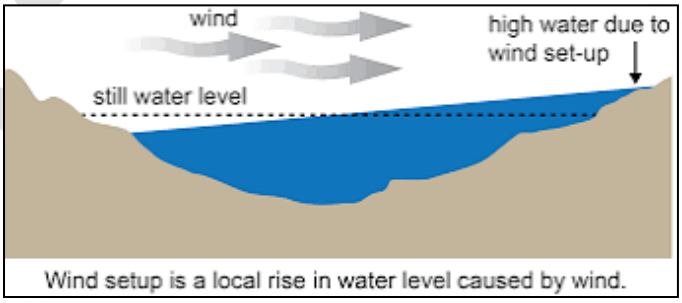


Diagram of a Seiche. (NOAA)

Section 10.3 Tsunami Warning Systems

The KPB has implemented several tsunami warning systems including cell phone alerts, social media alerts and warning sirens to protect its coastal communities from the devastating effects of tsunamis. These systems are designed to provide timely alerts and ensure effective evacuation procedures. An example of the use of these warning systems alerting the public most recently occurred in July 2023. This alert was issued as a tsunami warning for the Homer Spit, which was later downgraded and cancelled. The tsunami alert was generated when an earthquake hit about 60 miles south of Sand Point. Evacuations of Homer Spit occurred after sirens were activated, and once the alert was downgraded, people were allowed to move back into the Spit. The Wireless Emergency Alert (WEA) System generated alerts to cell phone users across the KPB and Southcentral Alaska Region. The KPB currently alerts all areas of the borough in the case of siren-initiated systems but is working with the NWS and other entities to have a more targeted area approach in the future. Key components of the tsunami warning systems currently in place for the KPB include:

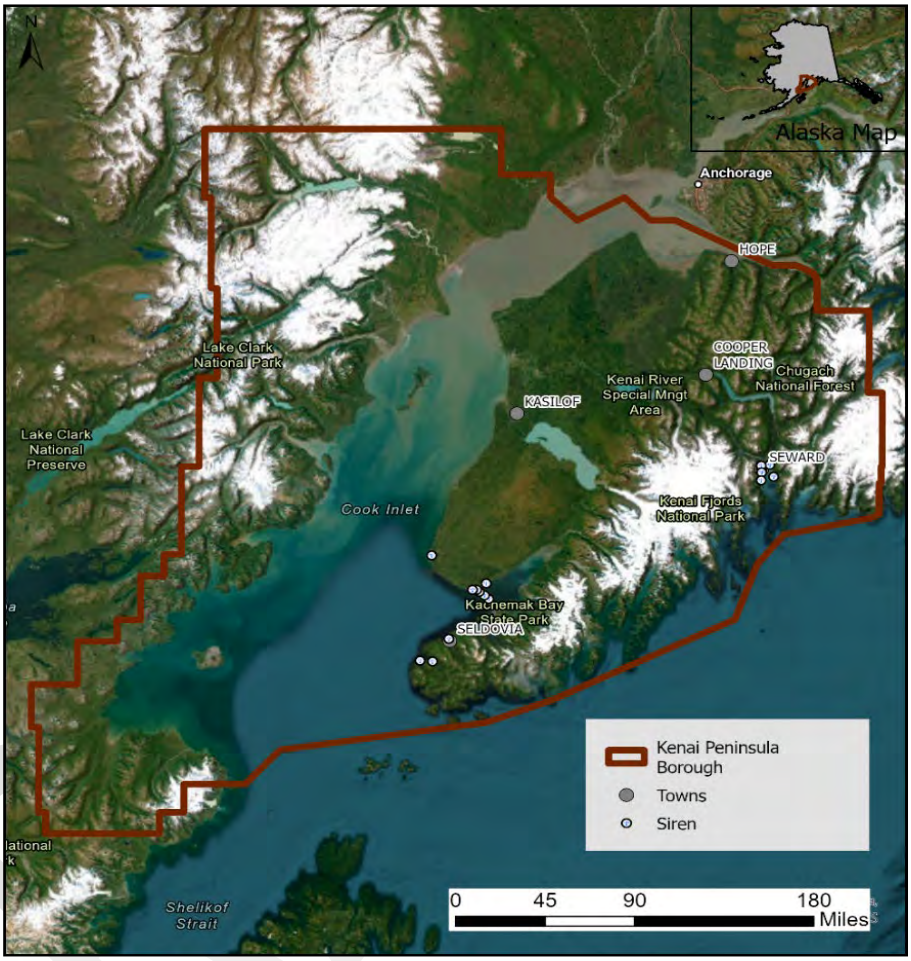


Figure 18. Map of KPB Siren Locations (OEM)

- **Deep-Ocean Assessment and Reporting of Tsunamis (DART):** A US National Tsunami Hazard Mitigation Program (NTHMP) supported by NOAA. DART utilizes an array of stations in the Pacific Ocean to transmit tsunami information to the National Tsunami Warning Center (NTWC) in Palmer, Alaska. These stations report sea level information from tsunami waves that is processed to give estimates of the tsunami source to forecast watches, warnings, and potential evacuations.

- **TsunamiReady Program:** National Weather Service (NWS) initiative that combines the efforts of federal, state, and local emergency management agencies, the public, and the NWS tsunami warning system. The program currently has 14 Alaskan communities that participate, with Homer and Seward being the first in the State to join in 2002.
- **All Hazard Alert Broadcast System (AHAB):** Present in coastal communities in the borough that have an identified risk for tsunami inundation. This system is made up of warning sirens located in Homer, Seldovia, Port Graham, Nanwalek, Seward, and Lowell Point. These sirens operate on utility power, with batteries and solar panels as backup in case of failure of commercial power infrastructure. The system can operate over data links controlled from the OEM office or Dispatch centers, as well as independently using radio links, activating the system simultaneously with tsunami warnings through the EAS. DGGS tsunami inundation area maps have also shown a risk to areas of Hope and Anchor Point, these need further study to identify if additional siren systems should be installed in their communities.
- **National Tsunami Warning Center (NTWC):** Based of out of Palmer, Alaska, the NTWC provides warning services to the Pacific Ocean areas not served by the Pacific Tsunami Warning Center (PTWC) in Hawaii (the Indian Ocean, South China Sea, Caribbean Sea). The PTWC area was expanded in 2004 to include the US Atlantic and Gulf of Mexico coasts, Puerto Rico, the Virgin Islands, and the Atlantic Coast of Canada. The program works closely with the PTWC in Hawaii on monitoring potential tsunamis that could affect both regions.
- **Pacific Disaster Center (PDC):** Headquartered at the University of Hawaii, PDC leverages cutting-edge research, real-time data, and innovative tools to support decision-makers, emergency responders, and communities worldwide including Alaska. The center offers a suite of services including early warning systems, hazard monitoring, risk assessments, and disaster modeling. One of PDC's flagship platforms, DisasterAWARE, integrates comprehensive information on natural hazards, enabling users to visualize potential impacts and coordinate effective response strategies.
- **Wireless Emergency Alerts (WEA):** A Federal Communications Commission (FCC) public safety system that allows customers who own compatible mobile devices to receive geographically targeted, text-like messages alerting them of imminent threats and hazard to safety in their area. This system is tied to emergency alert systems, such as those operated by the NTWC, and works to provide targeted alerts to those within evacuation areas or regions.

Section 10.4 Historic Tsunami Events

The KPB has experienced three notable historic tsunami events, primarily triggered by significant seismic activity in the region. These events had profound impacts on the coastal communities including Seward, Seldovia, and Homer. These historic tsunami events include:

- **1983 Augustine Eruption Generated Tsunami:** The eruption of Mount Augustine generated a tsunami that struck the coastal villages of Nanwalek and Port Graham. The volcanic eruption caused a series of pyroclastic flows and landslides that entered the

water, displacing large volumes of water and generating tsunami waves. The villages received no warning as waves reached the shores of Nanwalek and Port Graham, causing significant flooding and damage to infrastructure and homes. The event underscored the potential for volcanic activity in the KPB to create tsunamis, impacting areas well beyond the immediate vicinity of the eruption.

- **1964 Good Friday Earthquake and Tsunami**: The most devastating tsunami to affect the Kenai Peninsula was generated by the M9.2 earthquake on March 27, 1964. This earthquake, the second most powerful ever recorded, caused massive ground shaking and subsequent underwater landslides, leading to a series of tsunamis. The resulting waves inundated coastal areas, including some in the KPB. Among those was Seward, where waves reaching up to 30 feet destroyed infrastructure and homes and resulted in significant loss of life. The initial earthquake caused regional subsidence (approximately four feet) near College Fjord in Prince William Sound, which exacerbated a local tsunami event. The tsunami that hit the City of Seward destroyed most of the facilities near the former shore, including a fuel tank farm, which started the first of many fires. Additionally, the local tsunami spread floating, burning oil, which engulfed another large fuel tank farm further inland. The main dock collapsed with the waterfront and sank 30 fishing boats and 40 pleasure craft in the small boat harbor. The local tsunami also heavily damaged the railroad yards, moving 120-ton locomotive 100 feet, and 75-ton locomotive 300 feet. About 25 minutes after the earthquake and local tsunami event, the tectonic tsunami event arrived in Seward. The waves carried flaming oil and debris into Seward and set fire to a large section of the town. Overall, Seward lost about 95 percent of its industrial base and 15 percent of its residential properties. There were 12 fatalities, 200 injuries, and approximately $14 million in damages. Other communities like Homer and Seldovia also experienced severe damage from the tsunami waves. In Seldovia, tsunami waves destroyed much of the town's waterfront infrastructure, including docks, businesses, and homes. The powerful tsunami significantly altered the coastline, leading to widespread damage and necessitating extensive rebuilding efforts in the aftermath. The Homer Spit was inundated with flood waters causing extensive damage to industrial infrastructure and properties. The sea level rise after the flood inundation resulted in cleanup efforts that required buildup of the spit to try to reduce future impacts from tsunami affects. After the event, buildings and structures on the spit flooded during high tides.

Tsunami damage to Seward Infrastructure after 1964 Earthquake (USGS)

- **1957 Andreanof Islands Earthquake and Tsunami:** The M8.6 earthquake on March 9, 1957, in the Andreanof Islands of the Aleutian chain generated a significant tsunami. The waves reached the shores of the Kenai Peninsula, including Cook Inlet coastal communities causing notable changes in sea level and prompting concerns about tsunami preparedness in the region. Although the impact was less severe than the 1964 event, it reinforced the importance of monitoring and early warning systems.
- **1946 Aleutian Islands Earthquake and Tsunami:** On April 1, 1946, an M8.6 earthquake near the Aleutian Islands generated a powerful tsunami that traveled across the Pacific Ocean. While the tsunami caused widespread damage in Hawaii, it also impacted parts of the Kenai Peninsula, including Seldovia, Port Graham, Nanwalek and Homer. Communities experienced unusual wave activity and minor flooding, highlighting the far-reaching effects of distant seismic events.

Section 10.5 Tsunami Risk Assessment and Response

Tsunami vulnerability is greater when coastal communities have beaches that open to the ocean or are located near bay entrances, tidal flats, and shores of coastal rivers. Within the KPB, the most significant threat is from local tsunamis generated in Resurrection Bay, Alaska Pacific waters, and Cook Inlet. The State of Alaska, DGGS, and the NOAA's Pacific Marine Environmental Laboratory indicate that Seward, Homer, Seldovia, Port Graham, and Nanwalek have a "severe" tsunami impact threat. Hope and Anchor Point do not have a high threat level due to lack of past damage and impact from tsunami events. Emergency Response Plans are in place for the Borough and these communities to provide response measures that are to be utilized when a tsunami occurs. Residents of other coastal communities in the north Cook Inlet and Turnagain Arm are moderately vulnerable to tsunamis, although the probability of occurrence is lower due to the shallow depth of upper Cook Inlet and the lack of substantial submarine structures. Under certain circumstances there is the potential for high tsunami inundation due to tide levels and timing of wave arrival, see DGGS report on Cook Inlet for more information.

Section 10.5.1 Tsunami Inundation Mapping'

Over the past 10 years, the State of Alaska has been mapping potential tsunami inundation using numerical modeling of tsunami wave dynamics with the following partner agencies: Alaska Earthquake Center, Alaska Division of Homeland Security and Emergency Management (DHSEM) and Alaska Division of Geological & Geophysical Surveys (DGGS). The Tsunami Inundation Mapping Program over the past 10 years has made coastal communities safer by providing state and local officials with the best possible information for addressing the tsunami hazards faced by their communities. Communities were selected for the study with consideration of their tsunami hazard exposure, location, infrastructure, availability of data, and willingness to incorporate the results in a comprehensive mitigation plan. The maps incorporated the best tsunami science available at the time of publication. Because of historical instances, population size and abundance of coastal low-lying areas, most coastal communities in KPB are part of the Tsunami Inundation Mapping Program study.

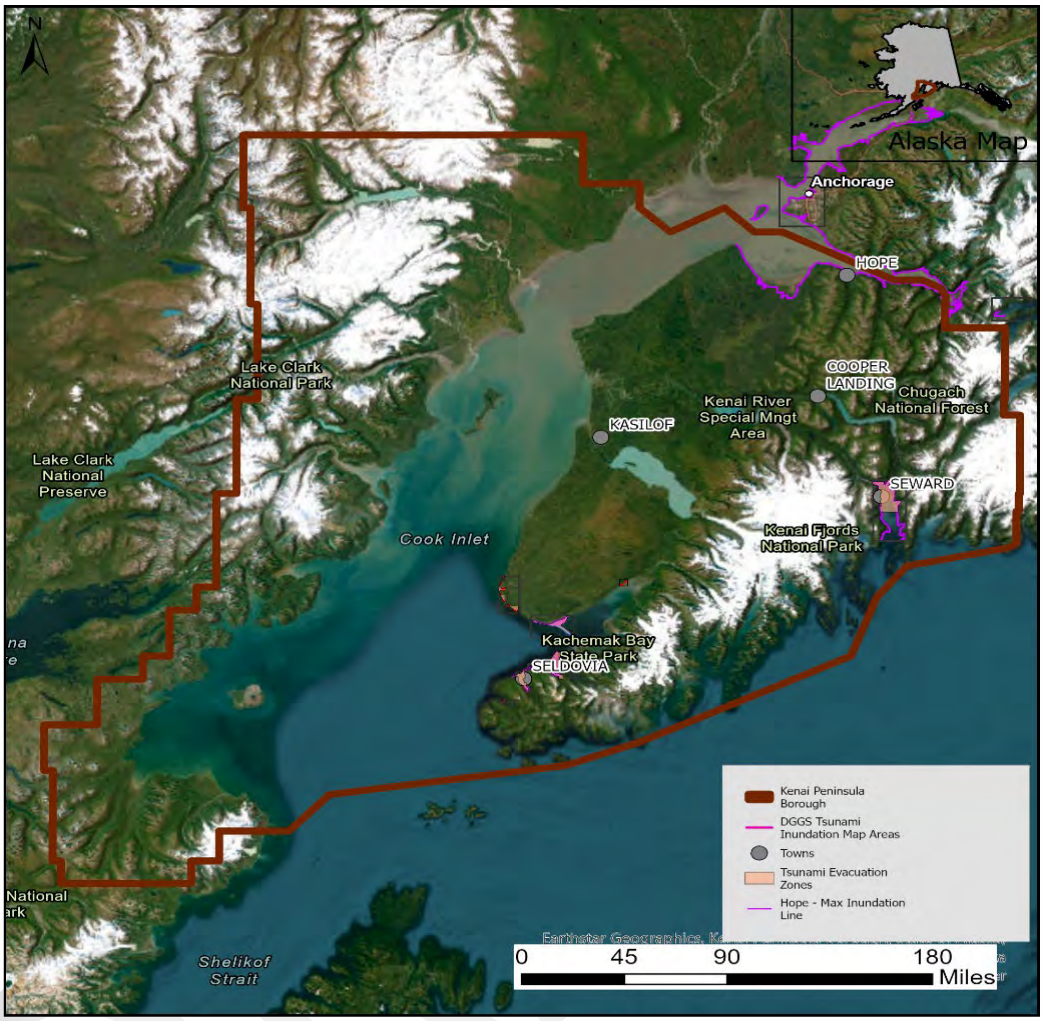


Figure 19. Coastal areas covered by Tsunami inundation mapping program (DGGS)

- **Tides and water depth:** The ability to forecast tsunami inundation at different coastal locations was not available until the 1990s, when researchers started using numerical modeling to integrate the complex movements of tsunamis with real ocean bathymetry.
- **Previous large earthquakes in Alaska:** Geologic research in the past two decades around Southcentral Alaska shows that the region has experienced earthquakes as large or larger than the 1964 Good Friday Earthquake in the past 1,500 years.
- **Location:** The 2011 M9.1 earthquake off Tohoku, Japan, gave new insight into how and where large subduction-zone earthquakes can generate tsunamis. Southcentral Alaska sits on a similar subduction zone.

Since 2019 six communities have been a part of this ongoing mapping project. The modeling for these tsunami inundation maps is continuing and can be routinely updated or improved based on newly developed information from worldwide tsunami events and local experts. Table 52 lists updated DGGS maps for tsunami inundation areas:

Table 51. Tsunami Inundation Mapping-KPB Communities at date mapped

Community	Date Mapped
Anchor Point	2019
Homer	2019
Hope	2023
Kachemak Selo	2019
Nanwalek	2019
Port Graham	2019
Seldovia	2019
Seward	2022

(DGGS)

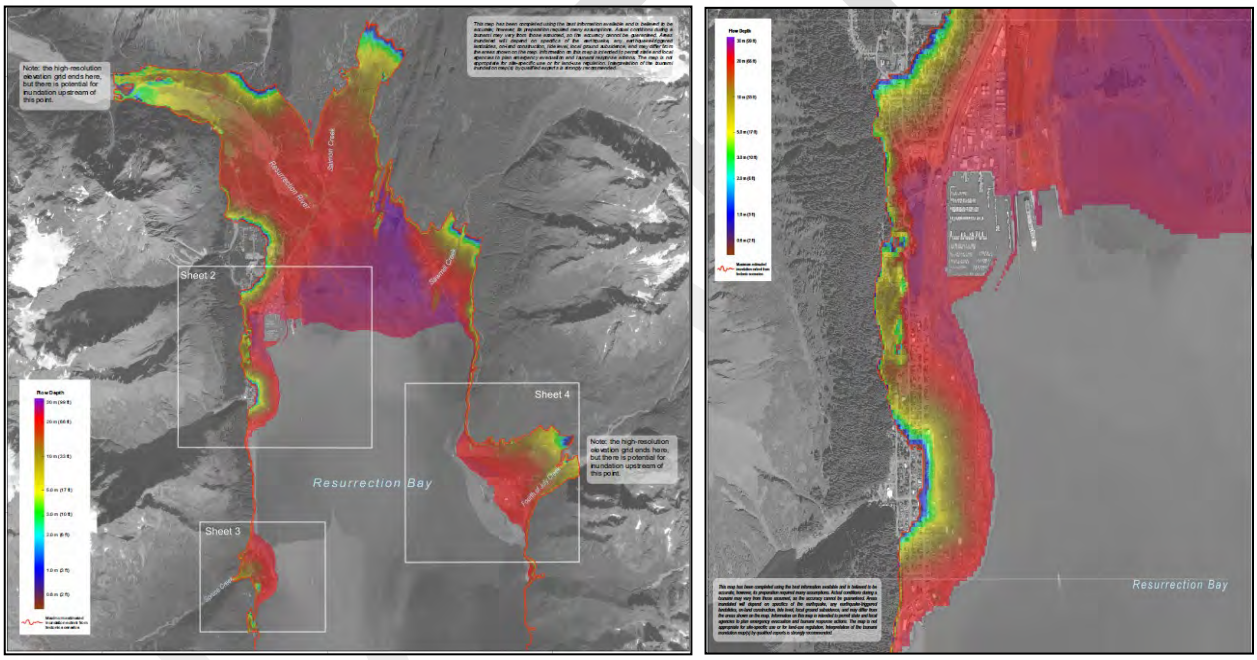


Figure 20. Maximum Tsunami Inundation for the Seward Area and City of Seward (DGGS)

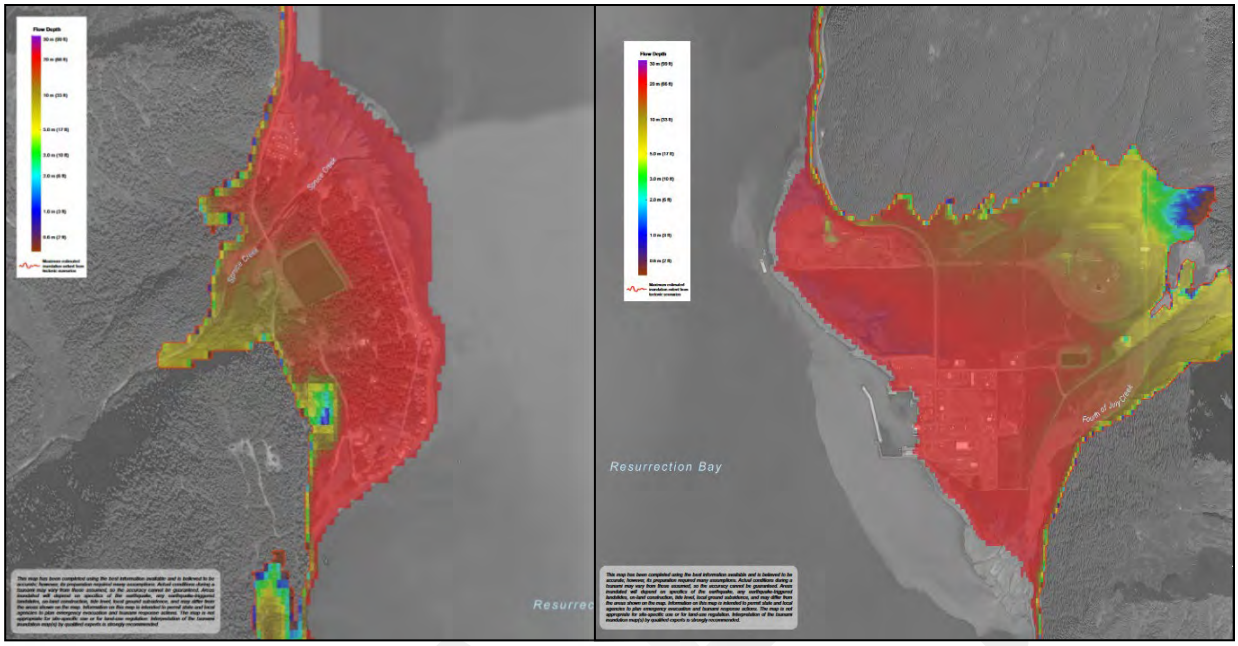


Figure 21. Maximum Tsunami Inundation for Lowell Point and Fourth of July Creek, Seward (DGGS)

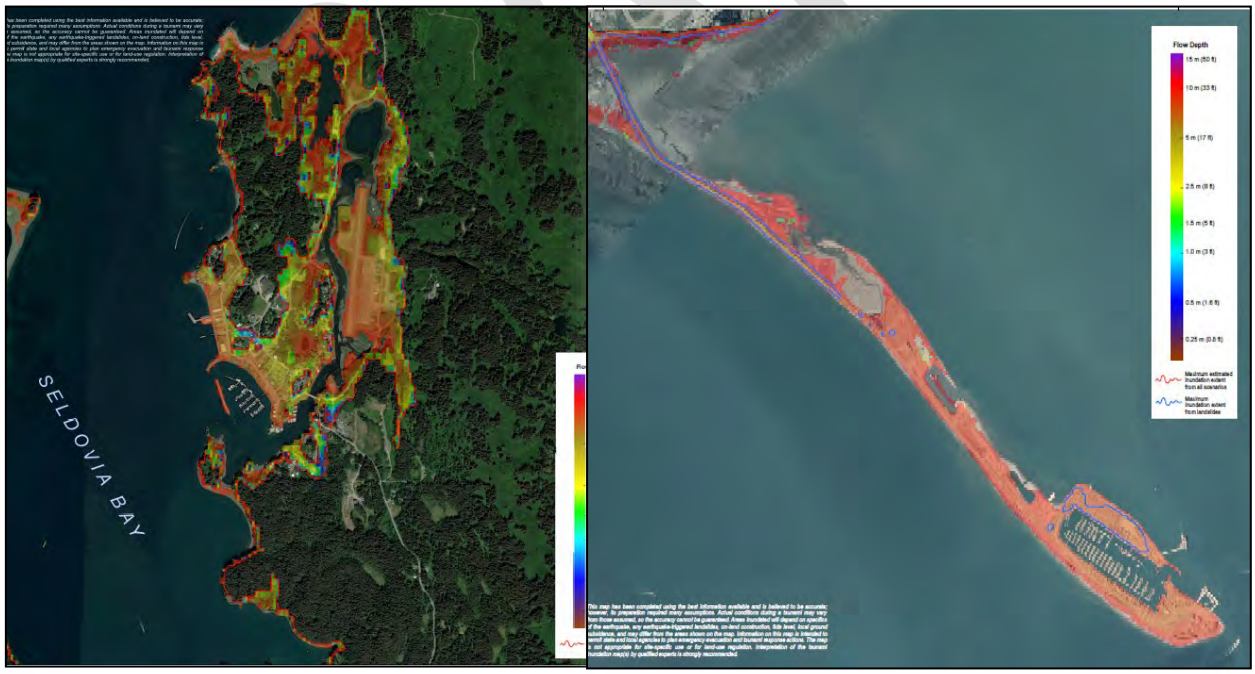


Figure 22. Maximum Tsunami Inundation for the City of Seldovia and Homer Spit (DGGS)

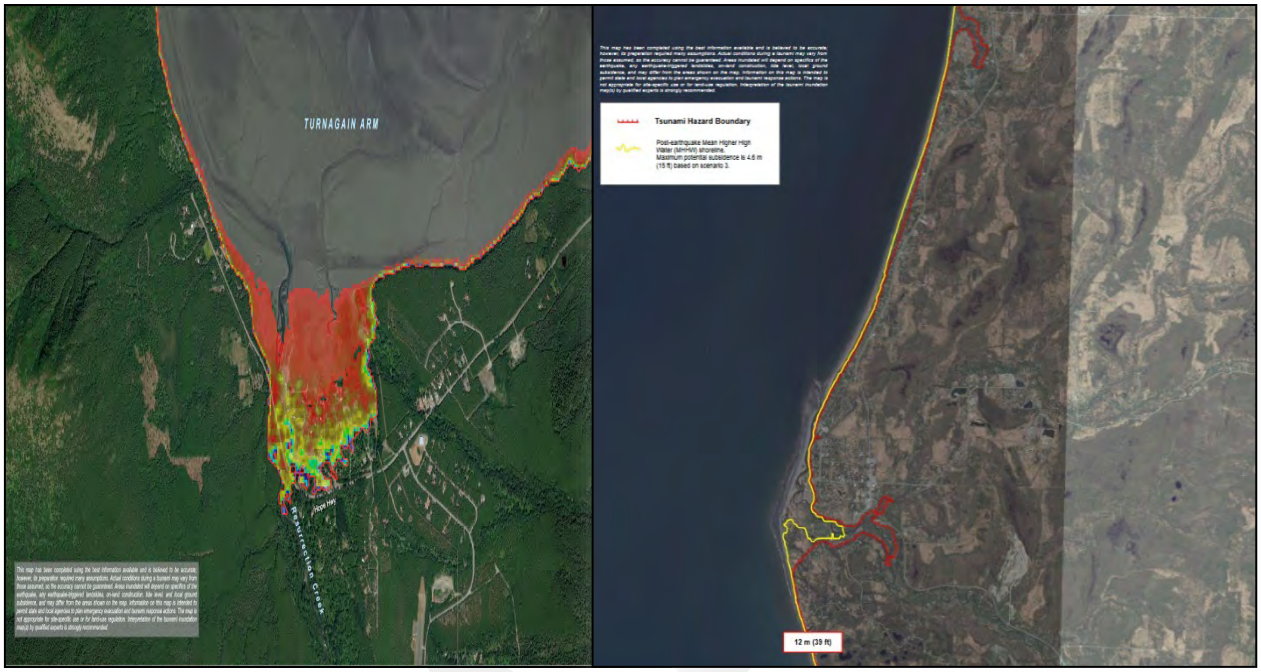


Figure 23. Maximum Tsunami Inundation for Hope and Anchor Point (DGGS)

Figure 24. Maximum Tsunami Inundation for the Nanwalek and Port Graham (DGGS)

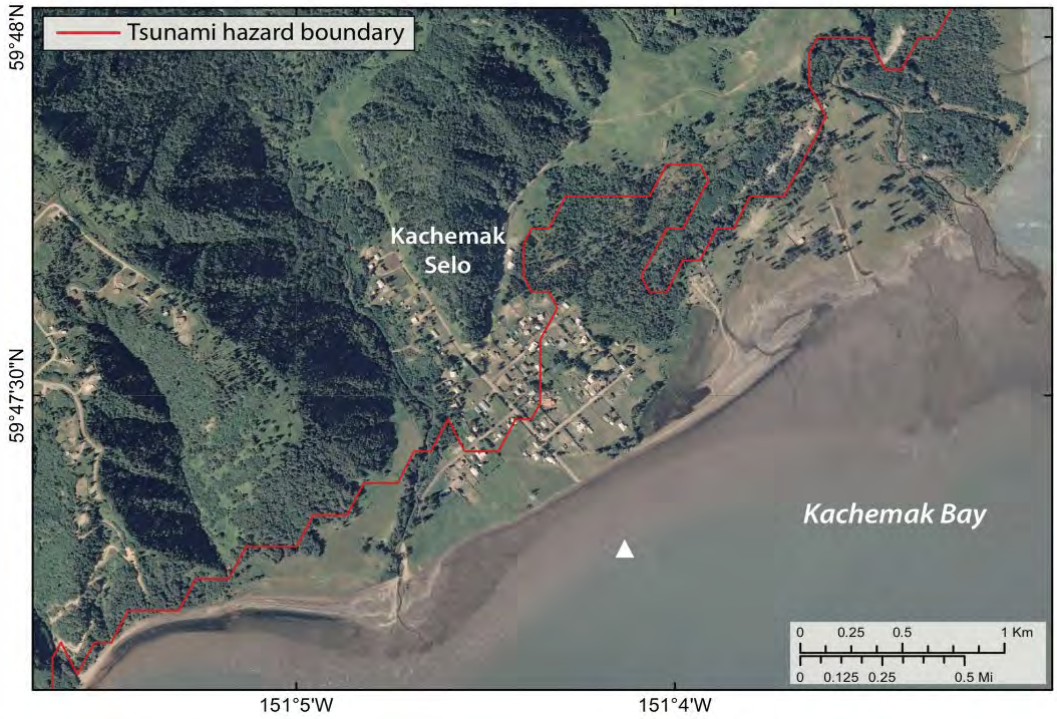


Figure 25. Maximum Tsunami Inundation for Kachemak Selo (DGGS)

The 2017 FEMA Risk Report provided tsunami scenarios based upon structures at risk. These scenarios focused on the value lost in the event of a tsunami event. Modeling did not account for loss of life or the substantial number of people who could be at risk seasonally in Homer, Seward, and Seldovia. These communities have populations that swell in the summer months due to tourism and commercial fishing. These activities put these seasonal populations primarily in areas most vulnerable to tsunami inundation.

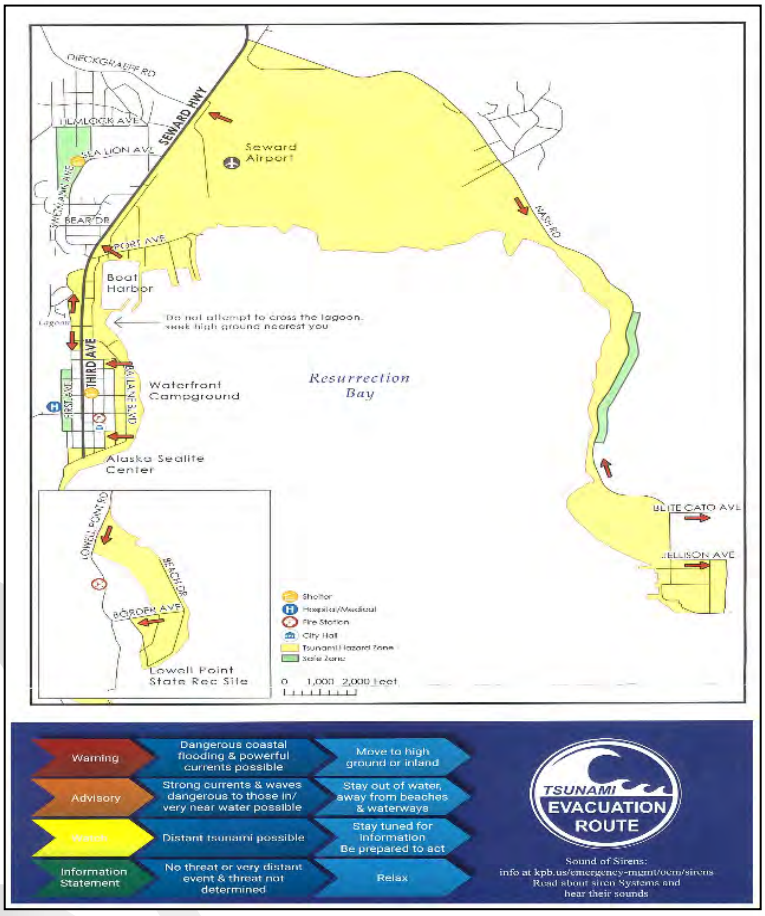
Table 52. Risk Report Parcel Improvement Exposure – Maximum Credible Scenario Tsunamis in KPB

Community	Total Structure Value (2023)	Total Structure Value in Tsunami Zone (2023)	Total number Improved Parcels	Total number Improved Parcels in Tsunami Zone	Percentage of Improved Parcels in Tsunami Zone
Homer, City of	$637,516,200	$4,016,352	2,396	15	0.63%
Seldovia, City of	$89,984,700	$12,408,890	319	44	13.79%
Seward, City of	$331,484,500	$43,557,063	1,835	162	13.14%
TOTAL	$1,058,985,400	$51,466,690	4,550	221	4.86%

(FEMA & KPB Assessing 2023)

Section 10.4.2 Tsunami Evacuation Plans

The KPB, along with the City of Seward and City of Seldovia, has developed comprehensive tsunami evacuation plans and maps to ensure the safety of its residents and visitors. These resources are designed to provide clear guidance on how to respond during a tsunami warning and to facilitate efficient and orderly evacuations. Key components of the KPB tsunami evacuation plan include:



City of Seward Tsunami Evacuation Map

Evacuation Plan Maps:

- **High-Risk Areas:** The maps highlight areas that are most at risk of tsunami inundation, such as low-lying coastal regions, waterfront properties, and harbors.
- **Evacuation Routes:** Clearly marked routes indicate the safest and most efficient paths to higher ground and designated evacuation centers. These routes are designed to avoid traffic congestion and other obstacles.
- **Assembly Points:** Maps show designated assembly points and shelters where people can gather and receive further instructions and assistance.

Public Information, Education and Coordination with Emergency Services:

- **Community Outreach:** The OEM office conducts regular outreach programs, including workshops, drills, and distribution of informational materials to educate the public about tsunami alerts, risks and evacuation procedures.
- **Educational Materials**: Brochures, posters, and online resources provide detailed instructions on how to prepare for a tsunami, including creating a family emergency plan and assembling a disaster supply kit. Education is also included for the Ready, Set, Go! (RSG) Program.
- **Local Emergency Planning Committees (LEPCs):** The KPB LEPC coordinates between various agencies, including fire departments, police, and emergency medical services, to

ensure a coordinated response during a tsunami event. There are 21 LEPCs in the State of Alaska. The boundaries of each LEPC are called a Local Emergency Planning District (LEPD). The LEPD boundaries are determined by the State Emergency Response Commission (SERC). Alaska Statute 26.23.071 establishes the Alaska SERC and LEPCs and specifies their duties.

- **Emergency Operations Center (EOC):** The EOC may be activated during emergencies to manage the response efforts and provide support and resources to affected communities.

Residents and visitors in the Kenai Peninsula Borough can access detailed evacuation maps and plans through the OEM website, City of Seward website, City of Seldovia clerk's office, and local government offices across the borough. Efforts have been made to make those who are within these evacuation zones knowledgeable of the hazard risks. There has been an increased interest in more signage, developing alternative evacuation routes, and more designated shelter-in-place sites as part of ongoing mitigation efforts in the borough. A designated shelter in a plan is a specific, pre-identified location equipped to provide safety, basic necessities, and support to individuals during emergencies or disasters. Tsunami Vertical Evacuation Structures or Refuges should be considered for some areas, such as the Homer Spit or Lowell Point.

Section 10.6 Impact of Future Climate Conditions

Local tsunamis and seiches due to slope failures could become more common as future climate changes occur. Retreating glaciers, and increased rainfall contribute to unstable slopes that may cause a tsunami if landslides or rockfalls enter a body of water. Impacts are currently limited in scope for the KPB and tsunami and seiche intensities are not expected to change due to future climate changes.

Section 10.7 City of Seward Hazard Overview

The City of Seward faces significant tsunami risk due to its proximity to major fault lines and its location in Resurrection Bay. Historical events, such as the 1964 Good Friday Earthquake, have demonstrated the city's vulnerability, with massive waves causing extensive damage and loss of life.

Section 10.8 City of Seldovia Hazard Overview

The City of Seldovia faces significant tsunami risk due to its proximity to major fault lines and its location in Kachemak Bay. The threat of tsunamis in Seldovia is underscored by its location and past events, such as the 1964 Good Friday Earthquake, which generated significant tsunami events that affected Seldovia and nearby communities.

Section 11 Volcanoes

He looked around when he heard a window-rattling roar. "Earthquake? Volcano? Nuclear war?" "Beaver," Peter told him. "I don't care if it is Alaska, you don't have beavers big enough to sound like that."

- Nora Roberts

Section 11.1 Hazard Overview

The Alaska Volcano Observatory (AVO) describes the Alaska landscape as having been profoundly shaped by volcanic processes. These processes are particularly evident in areas in and around the KPB shown in the figure below. An average of one to two eruptions per year occurs in Alaska according to AVO monitoring. During the last 2 million years, more than 130 volcanoes or volcanic fields have been active within the state. Of these volcanoes, about 90 have been active within the last 10,000 years, and more than 50 have been active within the record of historical time started in the 1700s. The 2024 HMP Update aims to build on information collected during the 2019 update and add new information from AVO, NWS, State of Alaska and USGS as available.

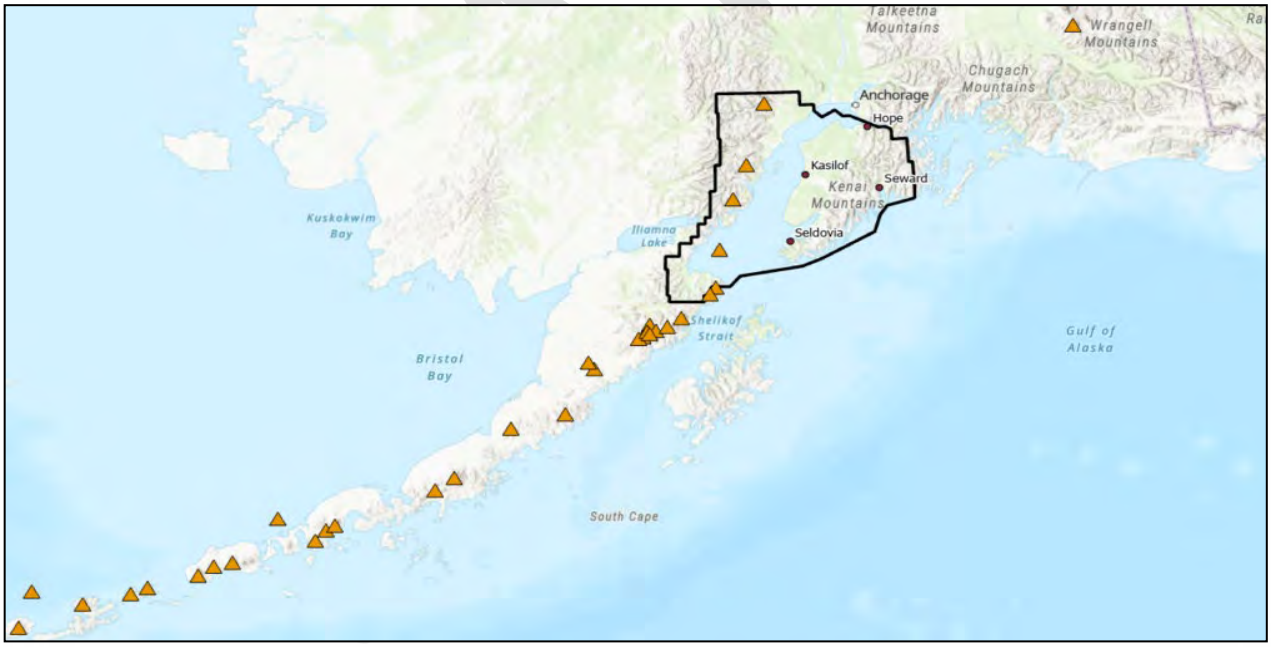


Figure 26. Map of Historically Active Volcanoes in relation to the KPB (AVO)

Alaska is home to more than 50 historically active volcanoes stretching across the entire southern portion of the state from the Wrangell Mountains to the far western Aleutians. Recent volcanic activity in the state, including the July 12 through October 3, 2023, eruption of Shishaldin, illustrate the ongoing potential for eruptions. This eruption, which affected air travel in the Aleutian Island Region, occurred roughly 600 miles southwest of the KPB.

Volcanoes are also categorized according to the age of their eruptive activity.

- **Active volcanoes** are those that are currently erupting or showing signs of unrest, such as unusual earthquake activity or significant new gas emissions. There are five active volcanoes within the KPB on the west side of Cook Inlet: Fourpeaked, Augustine, Iliamna, Redoubt and Mount Spurr.
- **Dormant volcanoes** are those that are not currently active but could become restless or erupt again.
- **Extinct volcanoes** are those considered unlikely to erupt again. There are over eighty volcanic centers in Alaska but only 52 are considered active.

Eruption column from the Crater Peak vent of Mount Spurr volcano in 1992. A light-tan cloud ascending from pyroclastic flows is visible at right. (USGS)

Section 11.2 Volcano Types

The AVO defines the four general types of volcanoes represented in Alaska as:

- **Cinder Cone** are volcanoes built from loose fragmented material that can solidify into volcanic ash, lapilli, and bombs that fall back and accumulate around the vent. Cinder cones are rarely more than a thousand feet tall. Most cinder cones form during eruptions that last for days or weeks, although some cinder cone eruptions can last for months or even years.
- **Composite volcanoes,** sometimes called stratovolcanoes, are steep-sided, conical shapes, built of lava flows and fragmental deposits from explosive eruptions. Most Alaskan volcanoes are stratovolcanoes, including Augustine, Fourpeaked, Redoubt, Spurr and Iliamna in the Cook Inlet Region.
- **Shield volcanoes** are gently sloping in the shape of a flattened dome and built almost exclusively of lava flows. Mount Wrangell, Yunaska Volcano, and Westdahl Volcano are examples of shield volcanoes in Alaska.
- **Lava domes** are formed when lava erupts and accumulates near the vent. The 2009 eruption of Redoubt produced many lava domes, the largest one measuring 3,300 feet (1,000 meters) in length, 1,640 feet (500 meters) in maximum width, and at least 650 feet (200 meters) thick. The total volume of this 2009 Redoubt lava dome would fill more than 500 Conoco-Phillips buildings—at 300 feet (90 meters), the tallest structure in

Alaska. Augustine Volcano is an aggregate of multiple lava domes that emplaced and repeatedly collapsed over the past 2,000 years.

- **Calderas** are volcanic depressions that form when the ground surface that overlies a magma reservoir subsides during a volcanic eruption. The caldera at the summit of Mount Katmai is Alaska's youngest caldera owing to its formation to the 1912 Novarupta-Katmai eruption.

Section 11.3 Volcano Hazards

The following volcano hazard descriptions are summarized based on information from AVO and USGS:

Far Field Hazards are hazards that may affect human activities near and far from the volcano:

- **Volcanic Ash Clouds** are created when volcanic ash is explosively blasted into the atmosphere during an eruption and then drifts away from the volcano with the wind. This is Alaska's principal volcanic hazard associated with explosive eruptions. Ash-rich clouds produced during large eruptions can reach heights of 30,000 to 65,000 feet or more above the volcano, although most Alaska eruptions are smaller (a few thousand feet to 20,000 feet). Encounters between aircraft and volcanic ash are serious because the ash can cause severe damage to the engines as well as other parts of the airplane. Recent eruptions of Alaska volcanoes, including eruptions of Augustine in 2005, and Redoubt in 2009, have resulted in numerous flight delays and cancellations for regional and international flights.

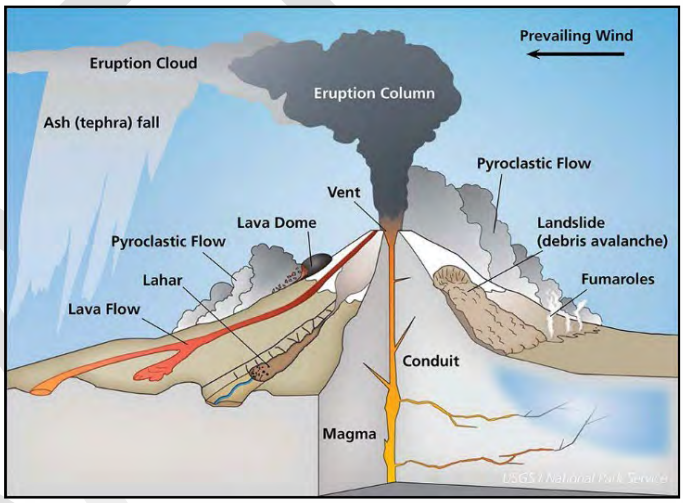


Diagram of a Stratocone and Associated Eruption Hazards (USGS)

- **Volcanic Ashfall** is ash that falls to earth from an eruption cloud. The fragments in the ash cloud vary in size, and the heavier particles fall near the source while finer particles travel farther downwind. Transported ash will fall out of the cloud and accumulate on surfaces and structures, contaminate water sources, and infiltrate electronics and motors. Even small amounts of volcanic ash can have a significant impact. During the recent eruptions of Augustine, Spurr, and Redoubt volcanoes in Cook Inlet, ash fall severely impacted Southcentral Alaska, especially the Kenai Peninsula, resulting in transportation delays; airport, school, and business closures; ash cleanup costs; degradation of power and water systems; and stockpiling of emergency supplies. Ash fallout can come from eruptions a great distance away, so the hazard to Borough residents is not limited to eruptions within the Cook Inlet region. The largest eruption of the twentieth century was

the 1912 Novarupta-Katmai eruption on the Alaska Peninsula which produced ashfall as far away as Puget Sound in Washington.

- **Volcanic Tsunamis** can be created by underwater eruptions, volcanic flank collapses that send large amounts of debris into a water body, or pyroclastic density currents entering a body of water. Communities surrounding Cook Inlet may be at an increased risk for volcanic tsunamis generated by activity from volcanoes near shore. Prehistoric debris avalanche activity from Augustine volcano in Cook Inlet generated at least one tsunami with deposits found near Homer.

Near Field Hazards occur within a few miles of the volcano:

- **Lahars and Floods** are fast moving slurries of water, mud, rocks, and sand. Lahars may form when hot volcanic debris melts the snow and ice around a volcano. These flows follow streams and drainages, a threat to infrastructure or communities in those locations. The Drift River Oil Terminal on the west side of Cook Inlet was damaged in the 1989-1990 and 2009 eruptions of Mount Redoubt.
- **Volcanic gases** include hydrogen sulfide, carbon dioxide and sulfur dioxide. These gases, vented from volcanoes, can be harmful to humans. Windy conditions surrounding the Cook Inlet volcanoes dissipate the gases, unless they are in craters, caves or fissures occupied by fumaroles.

A gas plume rising from Augustine Volcano during 2005-2006 eruption. (USGS)

- **Pyroclastic Flows** are incandescent flows of ash, gas and volcanic rock; surges are hurricane-force blasts of turbulent hot gas and ash clouds that can travel down slopes at speeds of 30 to 90 miles per hour for distances up to 18 miles from the vent. If large enough, a pyroclastic flow has the potential to trigger a volcanic tsunami.
- **Ballistics** are pebble to boulder sized fragments of rock, ice or pumice blasted into the air by explosive eruptions, these projectiles travel away from the vent, generally falling within a few miles. They can be harmful to people or structures.
- **Lava Flows and Lava Domes** are flows of molten rock that may result from an eruption. Generally slow moving, they do not pose much hazard to humans. They may form steep blocky fronts that can collapse, with potential for hazard to anyone in the vicinity.
- **Rockfalls and Landslides** are volcanic hazards because many volcanoes, and especially caldera walls, are steep-sided and constructed of accumulated products from previous

eruptions. Earthquakes near or associated with volcanoes can lead to increased rockfall, as well as increased landslide frequency and size.

- **Debris Avalanches** are rapidly moving masses of rock debris produced by a large landslide from the summit area of a volcano; this type of hazard is frequently associated with the steep slopes of stratovolcanoes. Large debris avalanche deposits are seen in the geologic record at several Alaska volcanoes, including Augustine, Mount Spurr, and Iliamna volcanoes.
- **Directed Blasts** are laterally directed explosions caused by rapid release of internal pressure. Most directed blasts are caused by a slope failure, newly erupted lava domes or sector collapse of the summit edifice into a debris avalanche. Structures can be destroyed in a radial zone extending up to 15 miles.

Section 11.4 Historic Volcanic Activity

The AVO describes Alaska as having over 130 volcanoes which have been active in the last two million years; about 90 having been active in the last 10,000 years; and 50 having been active since about 1760. Over three-quarters of the volcanoes that have erupted in the US in the last 200 years are in Alaska.

The largest volcanic eruption of the 20th century occurred at Novarupta on Mount Katmai in June 1912. The three-day event generated an ash cloud extending thousands of miles reaching most of Alaska and areas as far away as Seattle, Washington. Recent notable eruptions of Redoubt, Spurr, and Augustine volcanoes have also occurred in the past 100 years. Historic volcanic activity in or near the KPB is listed in Table 54:

Table 53. Historic Volcanic Activity in or near the KPB

Volcano	Year	Description
Novarupta	June 1912	Largest eruption of 20th century; damaged Kodiak with ash fallout and sulfur dioxide gas. Some villages abandoned, including Katmai and Savonoski. polluted water, blinded large animals. 14 associated earthquakes.
Redoubt	1989-1990	At least 23 major explosive events from December 1989 through April 1990 greatly impacted the surrounding areas of Cook Inlet. A KLM 747 passenger plane temporarily lost power in all four engines, regaining power just in time to avert a disaster. Air traffic was affected, heavy ash fallout was seen throughout the region with associated health and machinery concerns. Drift River oil terminal was flooded. Total estimated cost was $160 million, the second most costly eruption after Mt. St. Helens in 1980.
	2009	Eruptions that began in March and continued through April closed Ted Stevens Anchorage International Airport for 20 consecutive hours; Alaska Air canceled approximately 200 flights, cargo airlines rerouted shipments to Seattle. Lahars partially inundated Drift River oil terminal and oil storage at the facility was discontinued.

Volcano	Year	Description
Augustine	1976	Following an eruption, an ash cloud was launched over 8 miles into the sky. A violent pyroclastic flow spread across the small island. The local research station was damaged but was unmanned at the time, and no deaths occurred. Air traffic was impacted.
	1986	Lasting nearly 6 months, eruptions dropped ash on the Kenai Peninsula and volcanologists feared that the volcano would reach a breaking point and erupt like Mt. St. Helens. The huge eruptions never materialized, and fears of a triggered tsunami were not realized.
	2006	Ash plume disrupted air traffic; ash fell in Homer, Nanwalek, Port Graham, Seldovia, Iliamna, and Kodiak.
Spurr	1992	Produced ash clouds that were detected as far as the North Atlantic within a few days. Ash clouds threatened air traffic.
Iliamna	2016	A plume of steam and gas was observed from the glaciated north flank of the volcano. The most recent definitive eruption was over 300 years ago, although there is some indication of eruptions 90-100 years ago. Future eruptions could involve significant amounts of ice and snow, producing large lahars and downstream flooding. Ash clouds could severely impact air traffic.
Fourpeaked	2013	Many earthquakes and aftershocks were observed in the vicinity of the volcano, but no eruption followed.

(AVO)

Section 11.5 Volcano Hazard Location

Alaska's Cook Inlet volcanoes are part of the Pacific 'Ring of Fire' and offer a scenic backdrop for residents of the KPB. Scientists are particularly concerned about the volcanoes whose eruptions can affect the Cook Inlet region, where 60 percent of Alaska's population lives. Because eruptions in the Cook Inlet region are frequent - Redoubt, Spurr and Augustine volcanoes have all erupted during the past decade - it is important that residents are aware and ready for potential volcanic activity.

Section 11.5.1 Mount Redoubt Volcano

Mt. Redoubt is one of the most visible of the volcanoes on Cook Inlet. Many public facilities in the Borough carry the name, including schools and streets. Steam can frequently be seen coming from the volcano. Because of its location and easy visibility, eruptions have been well documented in recent years, including most recently in 2019.

Mount Redoubt erupting on December 18, 1989. (AVO)

The 2009 eruption of Mount Redoubt began on March 22, and continued intermittently for several months. The eruption produced multiple ash clouds

that reached high altitudes and spread over a wide area. The ash clouds led to the closure of airspace in Southcentral Alaska and the cancellation of all flights in the vicinity of Mount Redoubt for over a week. This affected not only local airports but also had ripple effects on air travel across the region.

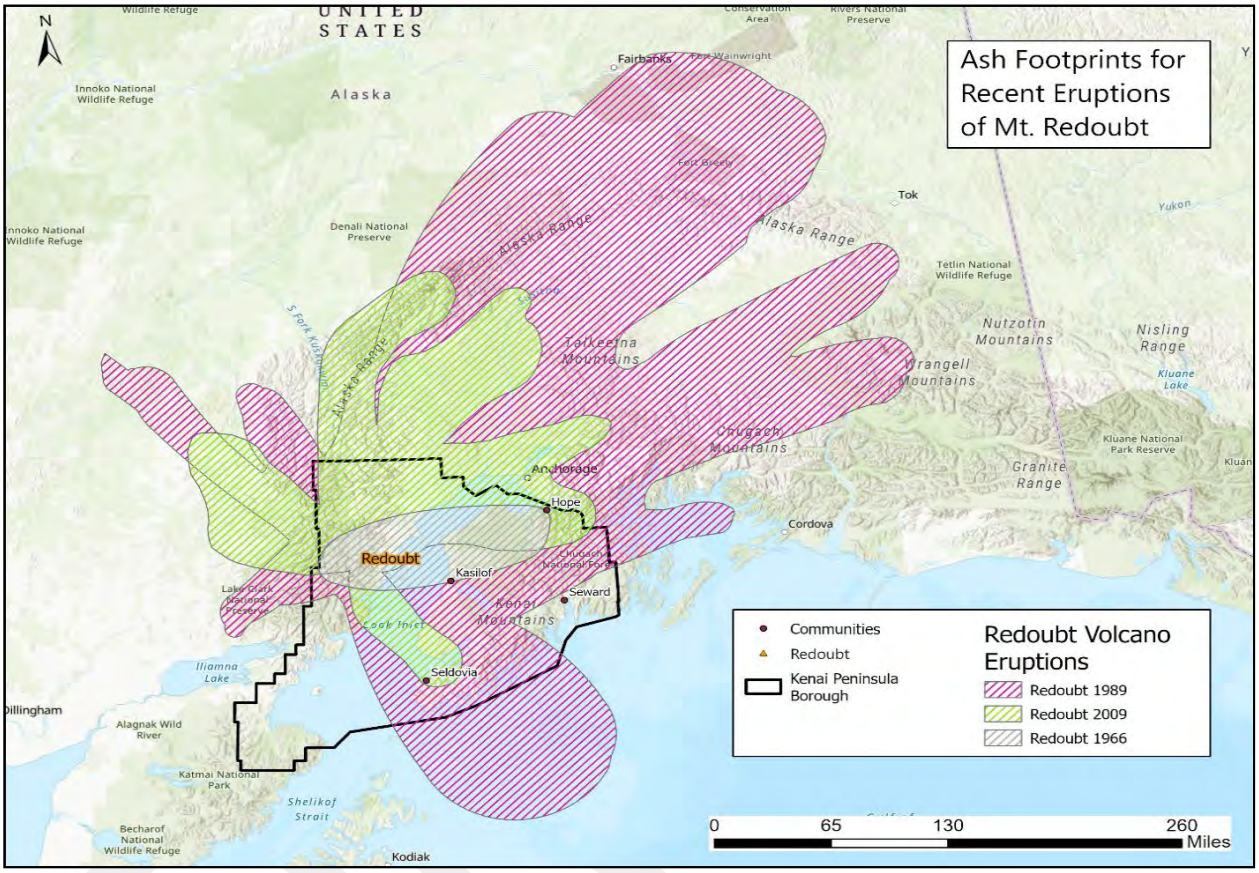


Figure 27. Ash fallout footprint for 1966, 1989-1990 and 2009 Mt. Redoubt Eruptions (DGGS)

The AVO and USGS in their assessment report from 1997 provided several hazards specific to Mount Redoubt volcano:

- **Volcanic ash clouds** – Can be dangerous for aircraft. Many flights pass through the potential ash cloud area.
- **Volcanic ash fallout** - Can close schools, businesses, and airports. Inhalation of ash can lead to respiratory problems.
- **Lahar flows** - Can disrupt down slope development. Fortunately, there is little development in that area and the Drift River oil terminal, which sustained considerable damage during past eruptions, is currently being decommissioned. Hilcorp's subsidiary, Harvest Alaska, is involved in those ongoing decommissioning efforts. Decommissioning the terminal involves removing its infrastructure and transitioning to a pipeline system for transporting oil.

- **Pyroclastic flows and surges** - Are a serious hazard within about ten miles of the volcano.
- **Debris avalanche** – Although less likely to occur on this volcano, a debris avalanche would obliterate everything in its path, introducing a large sediment volume to its drainage basin.
- **Directed blast** – No evidence of this type of lateral explosion has been found on Redoubt, but such blasts have occurred in other volcanoes like Redoubt.
- **Volcanic tsunamis** – The distance from Redoubt Volcano to the coast of Cook Inlet, approximately 22 miles, makes this type of hazard unlikely.
- **Volcanic gases** – Frequent windy conditions at Redoubt preclude the buildup of volcanic gases.

Section 11.5.2 Mount Spurr Volcano

Mt. Spurr is the northernmost of the volcanoes along the Alaska Peninsula up through the Cook Inlet. The three eruptions that took place in 1992 resulted in ash falling in Hope and Anchorage,

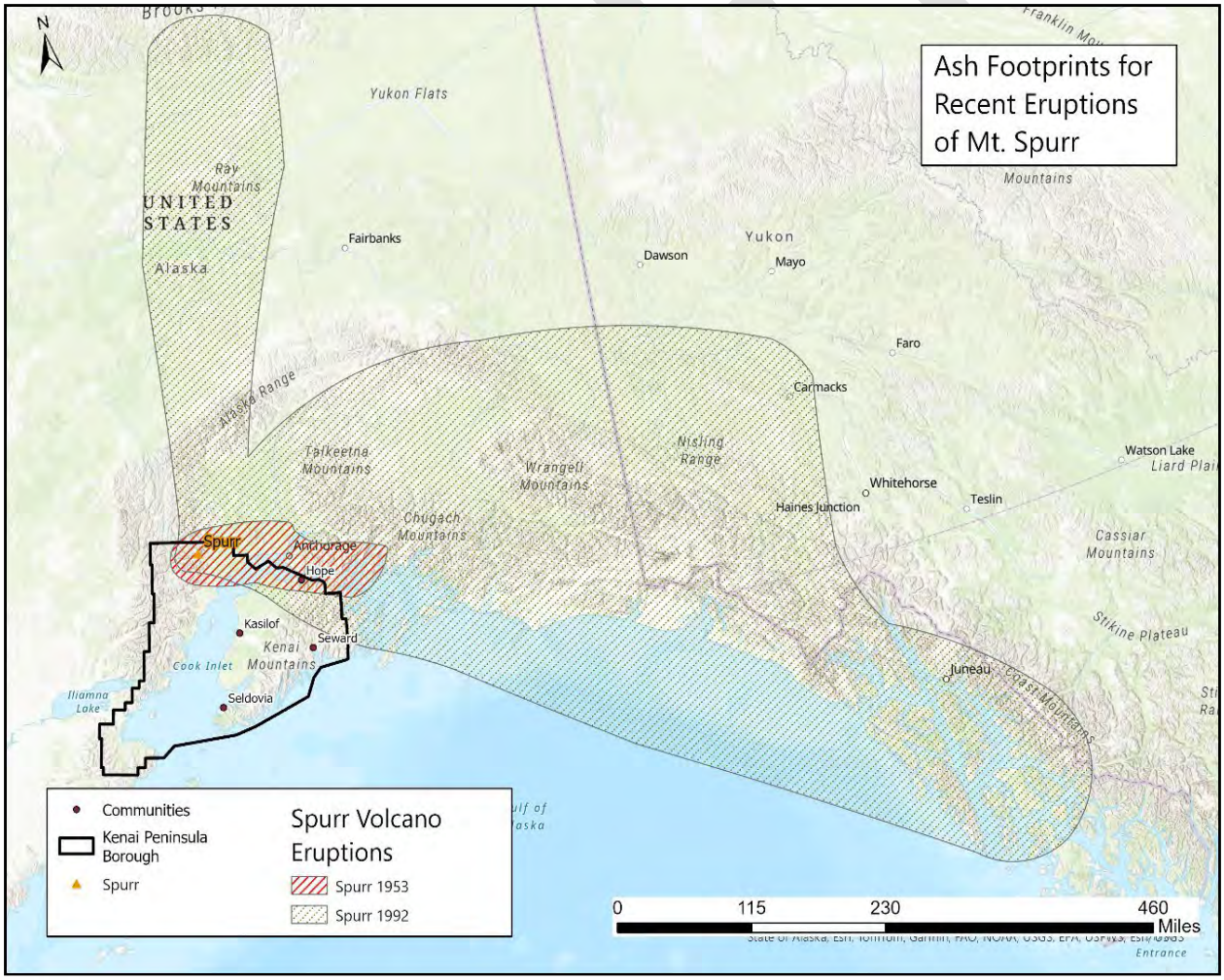


Figure 28. Ash fallout footprint for 1953 and 1992 Mt. Spurr Eruptions. (DGGS)

closing airports and making ground transportation difficult. Air traffic was disrupted; connecting flights from the Lower 48 and inbound flights were diverted until the eruption subsided. The northerly location of Mount Spurr combined with the prevailing wind direction minimized the effects of this volcano's eruptions on the KPB. In August 2004, the AVO reported the presence of a collapse pit, filled with water forming a new crater lake, in the ice and snow cover on the summit. This lake was potentially caused by an increase in heat flow through the summit lava dome. A year later in 2005, AVO webcam images showed a debris flow. A pilot flying over the volcano also reported the debris flow. A subsequent overflight revealed that much of the sitting pond, or crater lake within the melt hole had drained away, a notable depth documenting volcanic activity.

The AVO and USGS in their assessment report from 2002 provided several hazards specific to Mount Spurr Volcano:

- **Volcanic ash clouds** – Dangerous for aircraft, these ash clouds can drift thousands of kilometers from the source.
- **Volcanic ash fallout** – Historic and prehistoric evidence shows heavy ash accumulation in parts of southcentral Alaska. Damaging human health and activities, the ash fallout can also interfere with power generation, damage electrical components and equipment and obscure visibility. Resuspension of fallout ash by wind can extend the effects.
- **Lahar and flood** – Lahar flows from eruptions of Crater Peak on Mount Spurr could follow streams and drainages down the Chakachatna River valley, posing hazards to any oil and gas facilities or communities such as Tyonek and Beluga in the valley.
- **Pyroclastic flow and surge** – These would travel along valleys and low-lying areas but are not expected to reach the coastline. They would pose a risk only to people on or near the volcano.
- **Debris avalanche** – Future debris avalanches are not expected to be voluminous and pose little threat.
- **Directed blasts** – No evidence of any such lateral explosion has been found on Spurr.
- **Volcanic gases** – The windy conditions around Crater Peak prevent the buildup of gases, making the hazard minimal.
- **Lava flow** - Slow moving lava flows extend only a few kilometers from the active Crater Peak vent.

Section 11.5.3 Mount Augustine Volcano

The location of Mount Augustine, a volcanic island in the southern portion of Cook Inlet, could allow for ash fallout to extend to southeast Alaska due to the close and open proximity to the Gulf of Alaska. The entire Cook Inlet region could be affected if the prevailing southwest winds are present. Numerous on- and off-shore oil production and storage facilities, KPB airports and Anchorage International Airport as well as the Port in Anchorage could experience severe damage from heavy ash fallout. Depending on the time of year, commercial fishing activities could be severely impacted as well as subsistence fishing activities in the KPB.

Mount Augustine experienced significant eruptions starting in late 2005 and continuing into early 2006. In late 2005, the volcano showed increased seismic activity and ground deformation, indicating magma movement beneath the surface. This led to a series of explosive eruptions beginning on January 11, 2006, when the first major explosion sent an ash plume up to 9 kilometers (30,000 feet) into the atmosphere. Over the following weeks, multiple explosive events occurred, with a particularly large explosion on January 27 that produced an ash cloud reaching an altitude of about 14 kilometers (46,000 feet). The volcanic activity continued into February with ongoing explosions and the formation of a lava dome at the summit. These eruptions disrupted air traffic due to ash clouds and affected local communities with ashfall, while providing valuable data for scientists monitoring volcanic activity.

The AVO and USGS in their assessment report from 1998 provided several hazards specific to Mount Augustine Volcano:

- **Volcanic ash clouds** – Can be hazardous to aircraft downwind. Airborne ash can drift thousands of miles. Ash from the 1986 Augustine eruption was found in the air as far away as the Great Lakes, Virginia, Colorado and Arizona.
- **Volcanic ash fallout** – Ash from historical eruptions has been found in several parts of mainland Alaska, with evidence of heavy accumulations. Resuspension of ash by wind can extend the ash related side effects of an eruption.
- **Pyroclastic flow and surge** –Hot material debris may flow down the flanks of the volcano. These flows do not usually reach the Cook Inlet coast and pose little hazard except to people or boats on or near the island.
- **Debris avalanche** – If large enough, such an avalanche could cause a tsunami; in this case the hazard is limited to Augustine Island and its nearshore zone.
- **Lahar and flood** – On Augustine Island, this potential hazard causes a threat only if people are on the island at the time of an eruption.
- **Volcanic tsunamis** – A very large debris avalanche would be needed to trigger a tsunami in Cook Inlet, an unlikely occurrence.
- **Directed blasts** – Rare for Augustine volcano, history of such a lateral explosion has only been found for one occurrence in the last 2,500 years.
- **Pumice rafts** – An unlikely occurrence, this would require a large pyroclastic flow and coarse proximal fallout into the sea to create a floating raft of pumice that could be a risk to marine traffic in Cook Inlet.
- **Volcanic gases** – A minimal hazard at Augustine volcano due to the windy conditions and lack of closed depressions; would be harmful only in or near active vents, lava domes or fumaroles.
- **Lava flow** – Flows from Augustine volcano are slow and pose little hazard to humans.

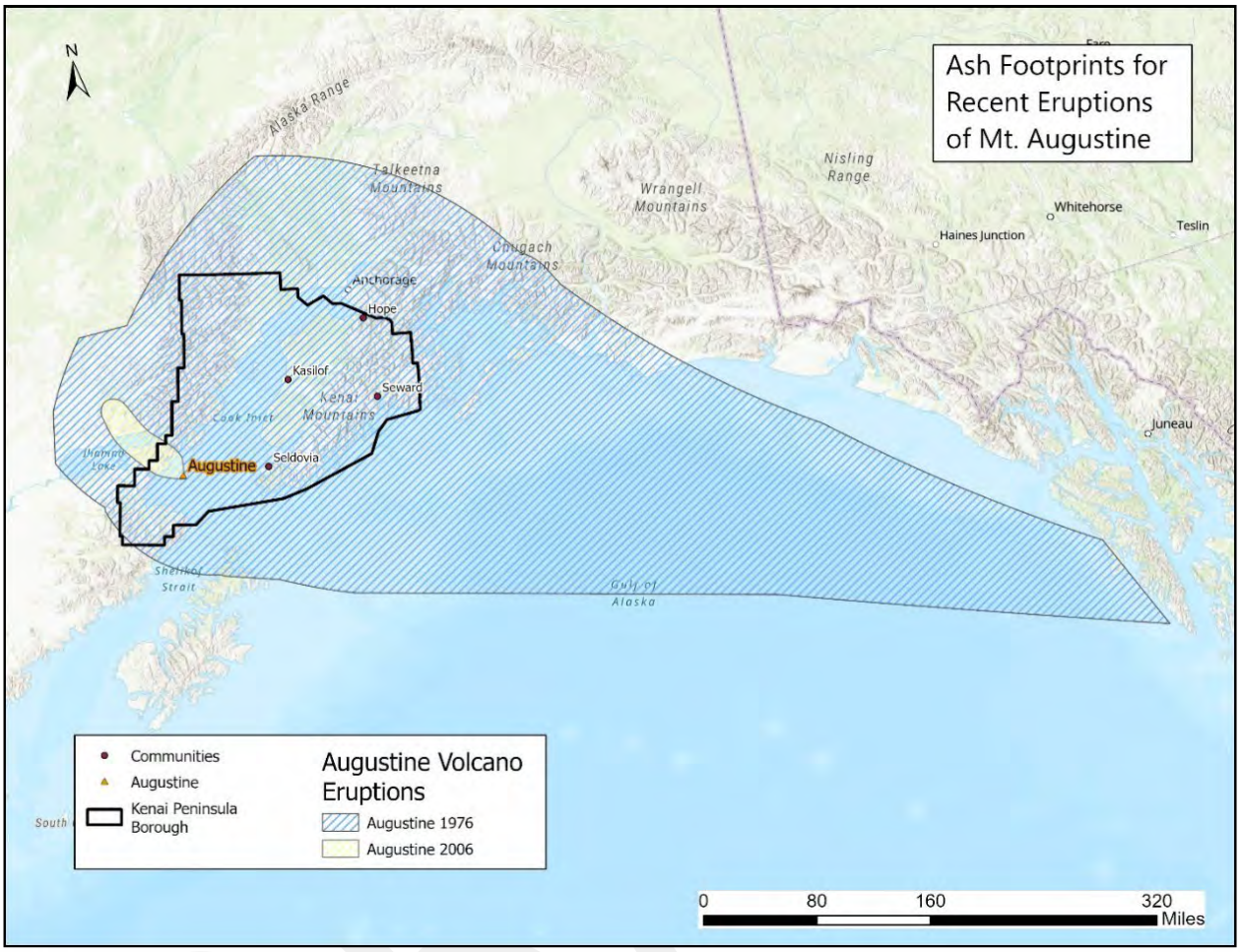


Figure 29. Ash fallout footprint for 1976 and 2006 Mt. Augustine Eruptions (DGGS)

Section 11.5.4 Mount Iliamna Volcano

A plume of steam and gas rising from Mount Iliamna (AVO)

Iliamna volcano is more well known for its persistent fumarolic activity rather than explosive eruptions. Iliamna has not had any major eruptions in historical times but remains geothermally active. The volcano frequently emits steam and gas from its summit area, contributing to a constant plume visible from a distance. Occasional seismic activity is monitored closely by the AVO, which watches for signs of potential eruptions. Although Iliamna's last significant eruptive activity likely occurred

several centuries ago, its continuous fumarolic activity and periodic earthquakes suggest an active magmatic system.

The AVO and USGS in their assessment report from 1999 provided hazards specific to Mount Iliamna volcano:

- **Volcanic ash clouds** – Ash clouds are a hazard to all downwind air traffic.
- **Volcanic ash fallout** - Prehistoric eruptions left heavy ash layers in parts of southcentral Alaska. Ash fallout can be very disruptive to human activities and power generation, as well as being a health hazard.
- **Lahars and floods** – Lahars are expected to form during future eruptions of Iliamna volcano. They tend to flow down streams and drainages and are expected to reach the coastline of Cook Inlet. People or facilities in major valleys could be in danger during an eruption.
- **Debris avalanches** – Caused by a large-scale failure of a volcanic flank, there is historic and prehistoric evidence of this type of activity on Iliamna. These past events did not extend very far beyond the base of the volcano, but a major flank collapse could transform to a lahar, filling streams and drainages on the distal slopes of the volcano.
- **Pyroclastic flow and surge** – These flows usually follow major valleys and would pose a risk to people or facilities in those valleys.
- **Volcanic gases** – A minimal hazard at the Iliamna location due to windy conditions, lack of closed depressions and steep terrain.
- **Lava flow** – Slow moving lava flows extend only a few kilometers from the active vent on Iliamna.

Section 11.5.5 Fourpeaked Volcano

This is a small, isolated volcano surrounded by Fourpeaked Glacier near Cape Douglas in southern Cook Inlet. A small eruption in September 2006 caused the AVO to reconsider activity in this volcano, previously thought to be inactive in the present epoch/era (Halocene). Temporary monitoring of the volcano followed, and a Concern Code Yellow was issued by AVO. Flooding of the Douglas River was noted by the field crew onsite. Three new seismic monitors were installed and reported elevated activity, which gradually declined. In November 2009, the instruments quit recording data as the batteries drained and Fourpeaked was downgraded to USGS Aviation Color Code Green with the volcano removed from the list of those that are seismically monitored. Visual monitoring is conducted when USGS staff are in the region to monitor for potential changes in volcanic activity.

Fumaroles escape from Fourpeaked volcano through a fissure in Fourpeaked Glacier in 2006 (AVO)

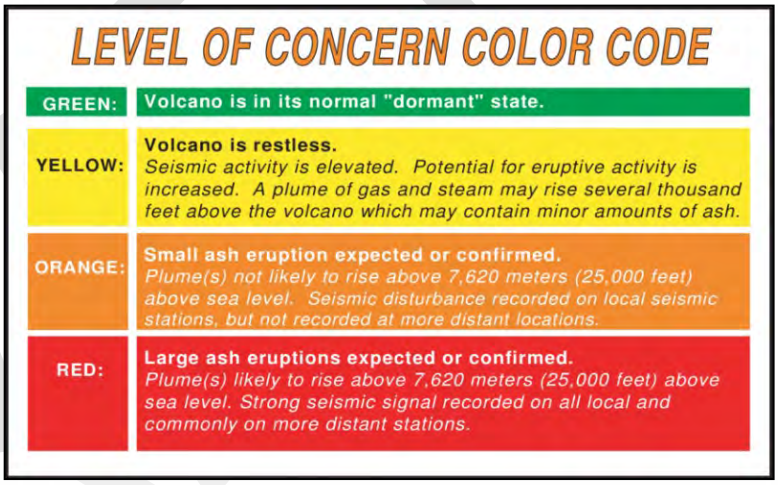
Section 11.6 Volcano Hazard Risk

Although it is difficult to determine when a volcanic eruption will take place, the AVO office in Alaska works to forecast and record eruptive activity, and to mitigate volcanic hazards to life and property. The AVO office in Anchorage is responsible for forecasting and recording eruptive activity. The University of Alaska Fairbanks Geophysical Institute (UAFGI) is located in Fairbanks, and its involvement in the AVO primarily pertains to research, monitoring, and analysis. The primary objectives of the AVO are to:

- Provide timely and accurate warning of volcanic activity in Alaska to local, state, and federal officials and the public.
- Assess volcanic hazards associated with anticipated activity, including kinds of events, their effects, and areas at risk.

Section 11.7 Volcano Monitoring

Volcano monitoring helps AVO provide timely warnings of volcanic activity and better characterize volcanic hazards. Prompt warnings of specific volcanic activity and hazards can help mitigate impacts associated with volcanic eruptions.

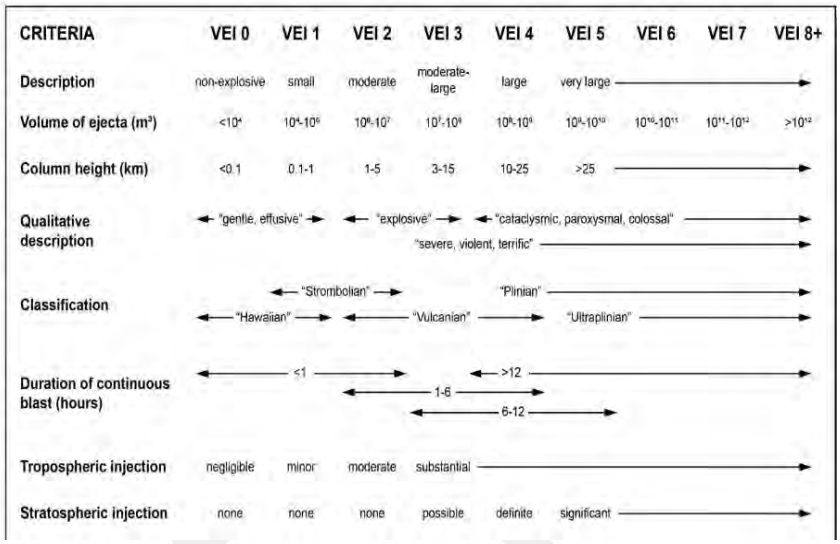


Level of Concern Color Code (AVO)

AVO has published individual hazard assessments for 18 active volcanoes in the State. Each report contains a description of the eruptive history of the volcano, the hazards they pose and the likely effects of future eruptions on populations, facilities, and ecosystems. AVO uses a four-color Level of Concern Color Code to portray activity and likely course of unrest at a given volcano (see figure above).

The National Weather Service and AVO work jointly to produce models that can assist in predicting ash travel and possible ashfall at various elevations. Two separate models with different capabilities are used to predict the effect of volcanic ash and are provided to public safety officials and the public as warning information.

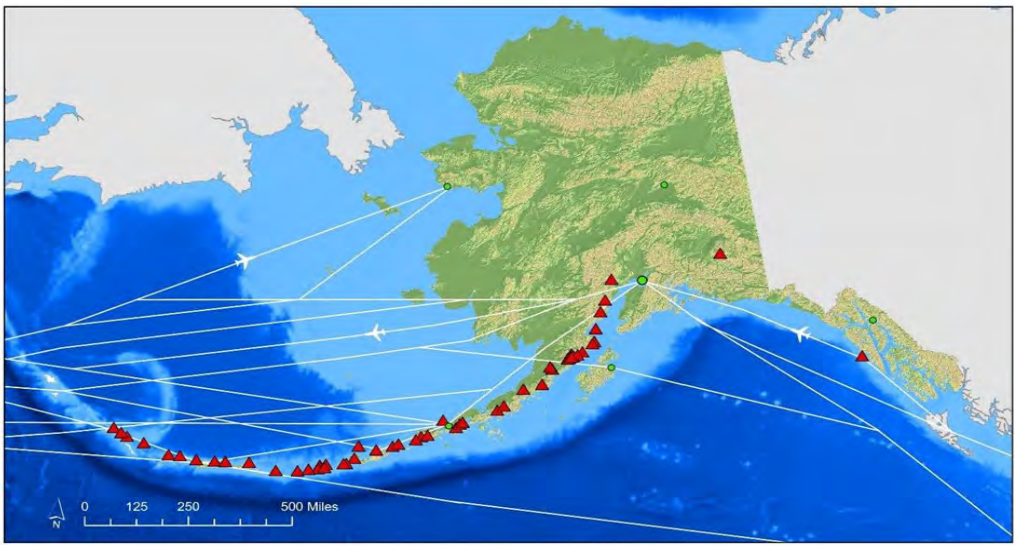
The Volcanic Explosivity Index (VEI) is a scale that measures the explosiveness of volcanic eruptions. It quantifies the volume of erupted materials, such as tephra (ash, rock fragments), lava, and gases, as well as the height and duration of eruption columns. Augustine (1976) registered a VEI of 4, Redoubt (1989-1990) registered a VEI of 3-4 and Spurr (1992) registered a VEI of 4.



Volcanic Explosivity Intensity (VEI) scale (USGS)

Section 11.8 Volcano Hazard Extent

During a volcanic eruption one of the more vulnerable sectors is the aviation industry, which is at risk from the effects of airborne volcanic ash. The significant trans-Pacific and intrastate air traffic in Alaska, directly over or near 52 potentially active volcanoes, has necessitated development of a strong communication and warning link between AVO, other government agencies with responsibility in aviation management, and the airline and air cargo industry. This has become an increasing issue as air traffic has significantly increased in recent years throughout the Cook Inlet region.



International and national flight paths into and out of Alaska in relation to active volcanoes.

Section 11.9 Volcano Hazard Probability

Based on the number and location of active volcanoes in the KPB combined with the history of volcanic activity, it is likely that volcanic eruptions will continue to occur, with probability of occurrence every three years. The characteristics and nature of Alaska volcanoes and their eruptions are not expected to change over time. This activity could consist of eruptive activity that lasts only minutes, although an eruptive period may last for many months or years, consisting of intermittent explosions, gas emissions, and seismic activity.

Section 11.10 Impact of Future Climate Conditions

The characteristics and nature of Alaska volcanoes and their eruptions are not expected to change due to cryosphere or climate change. Volcanoes are primarily formed through the movement of tectonic plates and geologic activity unrelated to cryosphere or climate change.

Section 11.11 City of Seward Hazard Overview

The City of Seward is at risk from volcanic ash hazards due to its proximity to active volcanoes in the Cook Inlet region, which can lead to ashfall that disrupts air quality and daily activities. Volcanic ash can damage City of Seward infrastructure, contaminate water supplies, and pose serious health risks to residents, especially during eruptions. It could also potentially disrupt Seward's railroad operations, halting transportation of goods and affecting supply chains. The port and harbor could suffer damage from ash accumulation, impacting vessels and infrastructure, and hindering fishing activities. Tourism, a key economic driver in Seward, would be affected due to limited transportation into and out of the state.

Section 11.12 City of Seldovia Hazard Overview

The City of Seldovia faces volcanic ash hazards from nearby active volcanoes, primarily those in the Cook Inlet region. This ash can damage City of Seldovia infrastructure, contaminate water supplies, and pose significant health risks to the community. It would also affect ferry service and air travel into the community which would limit the amounts of goods and services that could come into Seldovia. Commercial fishing and tourist activities in the area and around the Seldovia harbor, and tourist accommodations and activities would be impacted as well.

Section 12 Avalanches and Landslides

Even the largest avalanche is triggered by small things.

- Vernor Vinge

Section 12.1 Avalanche Overview

The KPB is susceptible to avalanches, particularly in the Chugach and Kenai Mountains. Avalanches can be triggered by various factors including heavy snowfall, rapid temperature changes, wind-loading, and human activities like backcountry skiing and snowmobiling.

Avalanche control along Seward Highway near Tern Lake (ADOT)

An undetermined number of avalanches occur in Alaska every year, with most occurring in isolated areas. Unless there are near misses, injuries or deaths, many of the avalanches are not reported. Avalanches tend to occur repeatedly in localized areas, and can shear off trees, cover communities and transportation routes, destroy buildings, and cause death. Alaska leads the nation in avalanche accidents per capita.

In Alaska, avalanches cause two primary hazards: roadblocks and death or significant injury. Deaths provide the most accurate and available statistics for estimating the hazard risk. Roadblocks are a major concern where roads intersect an avalanche path. The major costs associated with roadblocks are snow removal and traffic diversion, which both necessitate personnel and equipment. Because the Kenai Peninsula is connected to Anchorage and the rest of the state by a single highway and rail line, avalanches blocking either can effectively isolate the Peninsula.

The popularity of back country sports, including skiing, snowshoeing, snowboarding, and snowmachining, has grown rapidly in recent years. These means of transportation and recreation, most notably snowmachines, enable people to reach areas that may be unfamiliar and unmonitored. Deaths and significant injuries resulting from avalanches can be mitigated with education and preparation. For locations within the Chugach National Forest, Chugach National Forest Avalanche Information Center (CNFAIC) plays a crucial role in monitoring and forecasting avalanche conditions, providing daily updates, and educational resources to the public. To mitigate risks, residents and visitors are encouraged to undertake avalanche safety training and carry essential safety gear when venturing into high-risk areas. This resource is included in the following discussion in Section 12.2.3 Avalanche Monitoring Programs.

Section 12.1.1 Avalanche Types

The KPB experiences five types of avalanches that occur based on a variety of different contributing factors including weather, slope, terrain, and snow load. Damage extent is related to avalanche type, composition, and consistency of the material in the avalanche, the volume of snow and debris involved, force and velocity of the flow, and the avalanche path. Brief descriptions of these avalanche types are provided below:

Diagram of the most common Avalanche Types (National Avalanche Center)

- **Loose Snow Avalanches:** Loose snow avalanches occur when a small amount of non-cohesive snow slips, initiating a downhill movement that can escalate with additional loose snow. They range from small local cold dry 'sloughs' removing excess upper snow layers to large, destructive events. These avalanches can also trigger slab avalanches. Typically, on slopes greater than 35 degrees, they leave an inverted V-shaped scar, often caused by snow overloading (common during or just after snowstorms), vibration, or warming from rain, rising temperatures, or solar radiation.
- **Slab Avalanches:** Slab avalanches, the most dangerous type, occur when a mass of snow breaks away and descends down a mountain, breaking into cohesive blocks as it moves. These slabs vary greatly in thickness and depth, from less than an inch to more than 35 feet. They typically result from structural weaknesses in the snowpack where a strong, cohesive layer sits atop weaker or poorly bonded snow layers. These weaknesses stem from variations in snow thickness and type due to temperature changes or multiple snowfalls. Slab avalanches can be triggered naturally by earthquakes, blizzards, temperature shifts, or human activities. Once released, they accelerate downhill, increasing in speed and mass.

A large avalanche blocked part of the Seward Highway near Tern Lake in 2023 (ADOT)

- **Cornice Collapse:** A cornice forms when wind blows snow over a ridge crest or into the sides of a gulley, creating an overhanging mass of snow. When a cornice breaks off, it can trigger larger snow avalanches if it impacts wind-loaded snow below.

- **Ice Fall Avalanche:** Ice fall avalanches occur when broken glacier ice suddenly falls down a steep slope. They are unpredictable and can occur independently of factors like temperature or time of day that typically influence other types of avalanches.
- **Slush Avalanches:** Slush avalanches predominantly occur in high latitudes like the Brooks Range of Alaska, and occasionally in the Seward Peninsula and Talkeetna Mountains near Anchorage. They are more prevalent in these regions due to rapid spring snowmelt. These avalanches typically initiate on slopes ranging from 5 to 40 degrees but are uncommon on slopes steeper than 25 to 30 degrees. The snowpack is fully or partially saturated with water, and the release bed surface is nearly impermeable. Slush avalanches often coincide with heavy rainfall or sudden intense snowmelt and are characterized by the presence of depth hoar at the base of the snow cover. They can move slowly or reach speeds exceeding 40 miles per hour, with variable depths ranging from one foot to over 50 feet. Slush avalanches are not prevalent in the KPB.

Section 12.1.2 Avalanche Terrain Factors

Avalanche terrain is influenced by several key factors that determine the likelihood and behavior of avalanches. These factors include:

- **Slope Angle:** The steepness of a slope is a critical factor in avalanche formation. Avalanches are most common on slopes between 30 and 45 degrees. Slopes less than 30 degrees are generally too flat for avalanches to start, while slopes steeper than 45 degrees tend to shed snow continuously, preventing large accumulations.
- **Aspect:** The direction a slope faces (its aspect) affects snow stability. South-facing slopes receive more sunlight, which can lead to warming and increased melt-freeze cycles, potentially leading to wet avalanches. North-facing slopes tend to be colder, preserving snow layers longer and potentially creating persistent weak layers.
- **Terrain Roughness:** Features like rocks, trees, and cliffs can influence avalanche potential. Smooth, open slopes are more prone to avalanches, while rough terrain with many obstacles can help anchor the snowpack and reduce avalanche risk.
- **Slope Shape:** Convex slopes, which bulge outward, are more likely to produce avalanches because the snowpack is under greater tension. Conversely, concave slopes, which curve inward, can be more stable because the snowpack is compressed.
- **Elevation:** Higher elevations typically receive more snow and colder temperatures, which can lead to deeper snowpacks and different snow conditions. Elevation also affects the type of snow (e.g., dry or wet) and the timing of snowmelt. Being above the tree line can also affect potential for avalanches as there are fewer tree snow anchors to reduce impact area.
- **Terrain Traps:** Features such as gullies, depressions, and cliffs can increase the danger of avalanches by concentrating debris and snow, increasing burial depth, and limiting escape routes. These traps can significantly increase the consequences for anyone caught in an avalanche.

- **Wind Exposure**: Wind can transport snow from one area to another, creating wind slabs on leeward slopes, which are prone to avalanche. Wind can also scour snow from windward slopes, reducing the avalanche risk in those locations.
- **Anchors and Vegetation:** Vegetation like dense forests can help stabilize the snowpack, while isolated trees or shrubs can act as triggers or obstacles during an avalanche. Large boulders and other natural anchors can also provide some stability to the snowpack. Elevation in relation to the tree line can also increase avalanche impact area.

Section 12.2.3 Avalanche Monitoring Programs

Avalanche monitoring programs in the KPB are crucial for ensuring the safety of residents and visitors in this avalanche-prone region. These programs involve monitoring snowpack conditions, providing forecasts, and educating the public about avalanche safety. Key programs and organizations involved in avalanche monitoring in the KPB include:

In February 2024, a fatal avalanche occurred on John Mountain. (CNFAIC)

- Chugach National Forest Avalanche Information Center (CNFAIC): The CNFAIC is the primary source of avalanche information for the Kenai Peninsula, particularly the Turnagain Pass area. The center provides daily avalanche forecasts, snowpack analyses, and weather updates during the winter season. They also offer educational resources and conduct avalanche safety courses to promote safe backcountry practices.
- **Alaska Avalanche Information Center (AAIC):** The AAIC supports avalanche monitoring and safety efforts across Alaska, including the Kenai Peninsula. They offer statewide avalanche forecasts, educational programs, and resources to enhance public awareness and safety. The AAIC collaborates with local organizations and volunteers to gather and disseminate avalanche information.
- **Alaska Mountain Safety Center (AMSC):** The AMSC is a non-profit organization specializing in avalanche hazard evaluation, mitigation, forecasting, and education. The AMSC also operates the Alaska Avalanche School, which offers field-oriented classes on mountain safety training and avalanche hazard evaluation.

- **Local Search and Rescue (SAR) Teams:** Local SAR teams in the KPB are trained in avalanche rescue operations. These teams work closely with avalanche centers and local authorities to respond to avalanche incidents and conduct rescue or recovery missions.
- **Alaska Department of Transportation & Public Facilities (ADOT&PF):** The ADOT&PF monitors avalanche conditions along major transportation routes in the Kenai Peninsula, such as the Seward Highway. They employ remote weather stations, field observations, and avalanche control techniques (e.g., explosives) to mitigate avalanche risks and maintain road safety.
- **Avalanche Awareness Month:** November is Avalanche Awareness Education month in Alaska and is recognized as such by the State of Alaska and US Forest Service. The state and federal government use educational material available from the CNFAIC, the Alaska Avalanche Information Center, the National Weather Service and the National Avalanche Center to reach out to Alaska residents and visitors.

Section 12.2.4 Historic Avalanche Events

Avalanche events in the KPB typically occur in remote locations and do not result in death or injury. However, avalanches are the leading cause of hazard-related deaths in Alaska and most of those deaths are due to human triggered events. The AAIC indicates that over half of deaths in Alaska occur while snowmachining and backcountry skiing. Additional deaths have occurred related to hiking/climbing, hunting, and other recreational outdoor activities in backcountry areas. Additionally, the risk of rooftop avalanches increases significantly during heavy snowfall, as accumulated snow and ice can suddenly slide off, posing a danger to people and property below. Table 54 lists recent fatal avalanche events in the KPB:

Table 54. Recent Fatal Avalanche Events in the KPB 2014-2024

Date	Location	Description
February 2024	John Mountain	An avalanche was triggered by a group of three backcountry skiers on John Mountain in the Kenai Mountains. The party was ascending the slope when they triggered an avalanche that started 100-200 feet above them. All three were caught and carried in the avalanche. Two of the three people involved sustained injuries and the third did not survive. The avalanche was roughly 150 feet wide and ran for 700 vertical feet, falling on a layer of weak faceted snow roughly two feet deep at the crown. The recent sustained strong easterly winds had likely loaded the start zone, adding stress to that weak layer causing the avalanche to initiate. Group members carried avalanche rescue gear, but some issues were noted with the probe equipment.
February 2020	Boulder Creek	A snowmachine driver was riding on west facing terrain above Boulder Creek. The rider triggered a slab avalanche 150 feet wide, 3 feet thick, and running around 250 feet down the slope. The rider was caught, carried, and fully buried. Riders nearby saw the avalanche and began rescue efforts immediately. The rider was recovered but did not survive.

Date	Location	Description
March 2019	Crescent Lake	Two skiers and a snowboarder on a two-night ski/cabin trip skied 7 miles up from the Carter Lake trailhead to the Crescent Saddle Cabin. While on a run on Madson Mountain, the group got caught in an avalanche that resulted in one skier and the snowboarder holding onto a tree to avoid being caught in the debris. The other member of the group got caught in the avalanche debris and was later found unresponsive via beacon signal.
January 2017	Cooper Landing	Two snowmachine drivers were riding when one was buried in an avalanche. Both had beacons, and the uninjured rider was able to dig the other out, but he did not survive.

(CNFAIC)

Historically, between March 1999 and February 2024, 18 people died in avalanches on the Kenai Peninsula, most in the area through the Chugach Mountains along the Seward Highway. Most fatal accidents occur during off-road recreation, but in February 2000, a railroad employee was killed while clearing the Seward Highway from an earlier avalanche. He was operating a D6 Caterpillar when a second avalanche swept him and the vehicle 400 feet off the road.

A prolonged winter storm in late January and early February 2000 resulted in a series of avalanches that cut off the Kenai Peninsula for five days. On February 1, an avalanche killed a highway worker and the state closed mountainous areas of the Seward and Sterling Highways. Significant avalanches blocked the Seward Highway at Mile 23 and Mile 44. Power lines were damaged, resulting in the communities of Hope and Sunrise being without power and the City of Seward operating on generator power for several days. Hope, Sunrise, Moose Pass, Crown Point, and Seward were cut off from road, rail, and air access, and faced shortages of groceries and other supplies.

On February 9, 2006, three avalanches closed the Seward Highway at Mile 21, Mile 33 and Mile 84. The road was reopened the next day. The avalanche at Mile 21 trapped a car with two occupants (both were rescued) and buried the road under 18 feet of snow. On the same day, an avalanche near Hope cut off the town's power supply. The City of Seward was also cut off from its regular power supply and forced to operate on generator power. On February 11, another avalanche destroyed 2,000 feet of power transmission and distribution line serving Seward and surrounding areas. The City of Seward local disaster declaration estimated costs from the event at $1.06 million.

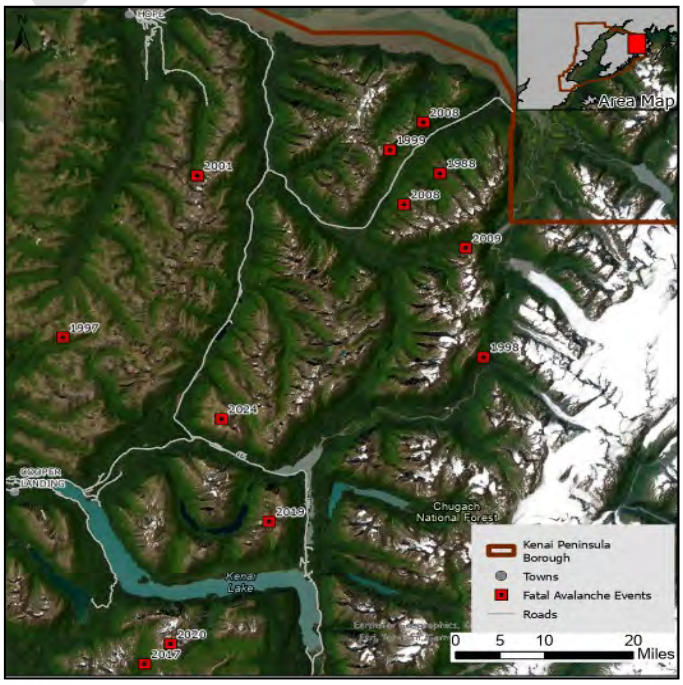


Figure 30. Historic Avalanche events in the KPB resulting in a fatality (AAC)

Section 12.2 Landslide Overview

Landslides or ground failure can be caused by severe storms/heavy rains, construction, or other human activities. The following events are the causes of recent landslides in the KPB USGS Landslide Inventory:

- Increased runoff.
- Excavation of hillsides.
- Shocks and vibrations from construction activities.
- Non-engineered fill placing excess load on the top of slopes.

The combination of these factors necessitates ongoing monitoring and mitigation efforts to protect communities, infrastructure, and natural resources from the impacts of landslides. Areas that have seen notable landslide activity include Lowell Point Road, Jakolof Bay Road and the Seward Highway through Cooper Landing. Leadership and members of the community in these areas have cited an ongoing need for mitigation initiatives that would help monitor and potentially prevent future large landslide events.

Landslide near Cooper Landing covering highway in 2021 (ADOT)

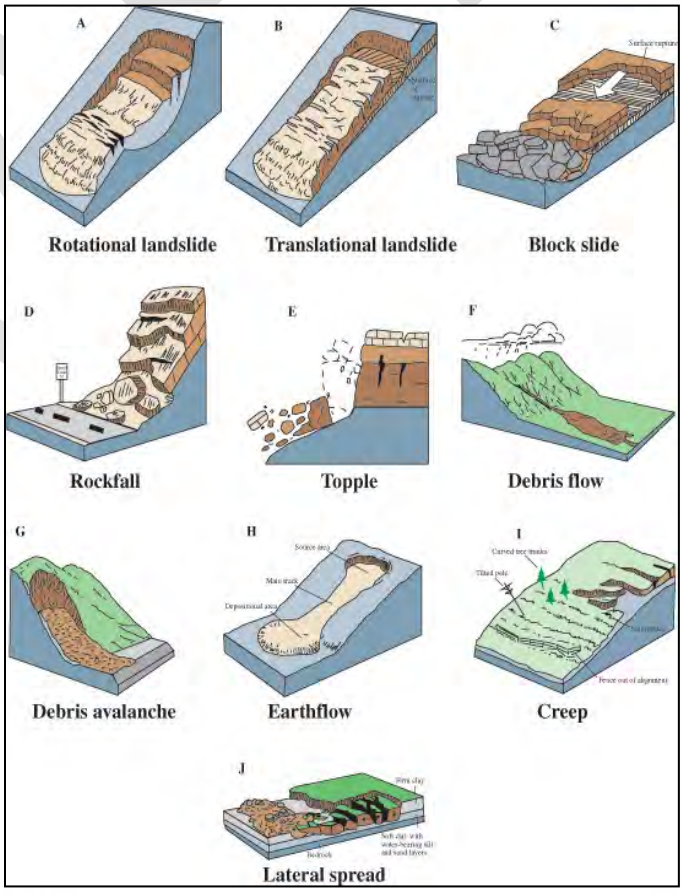


Diagram of Landslide Types (USGS)

Section 12.2.1 Landslide Types

The USGS identifies several landslide types, distinguished by material type, movement, and mechanism. In Alaska and the KPB the two most common landslide types are:

1. **Debris Flows:** Given the State's glaciated terrain and seasonal thawing, debris flows are particularly prevalent. These

rapid-moving mixtures of water, sediment, rock, and organic material occur frequently in areas where glacial meltwater and precipitation combine, such as mountainous regions and river valleys.

2. **Rockfalls and Rockslides:** Alaska's rugged mountain ranges are prone to rockfalls and rockslides, especially along steep slopes and cliffs. Freeze-thaw cycles, seismic activity, and erosion contribute to the instability of rock formations, leading to frequent instances of these types of landslides.

Additional landslide types that are less common but have the potential to affect the KPB include:

- **Slumps:** Slumps are rotational slides that occur when a mass of earth moves down a slope along a curved surface. This type of landslide typically involves cohesive materials like clay or silt and results in a characteristic "slump block" with a steep scarp at the top and a bulging toe at the bottom. Slumps can be triggered by undercutting at the base of a slope, heavy rainfall, or seismic activity.
- **Earthflows:** These are slower-moving landslides composed of fine-grained materials such as clay, silt, or sand. Earthflows can occur on gentle to moderate slopes and often have a characteristic "hourglass" shape, with a narrow source area and a wider deposition area. Prolonged rainfall or irrigation can saturate the soil, reducing its strength, and triggering earthflows.
- **Translational Slides:** Translational slides occur when a mass of soil, rock, or debris moves down a slope along a relatively flat or planar surface, such as a bedding plane or fault line. These slides can be rapid and cover large areas, posing significant risks to infrastructure and communities. They can be triggered by a variety of factors, including heavy rainfall, seismic activity, or human activities like excavation and deforestation.

Section 12.2.2 Landslide Monitoring Programs

Recent landslide events in the KPB, including the event that closed Lowell Point Road in 2022, have highlighted the need for ongoing and sustained landslide monitoring. Current landslide monitoring in Alaska is primarily driven by USGS and DGGS. Listed below are some of the monitoring programs and organizations involved in landslide monitoring in the KPB:

- **Alaska Division of Geological & Geophysical Surveys (DGGS):** The DGGS Landslide Hazards Program conducts geological studies and hazard assessments across Alaska, including the Kenai Peninsula. They monitor landslide-prone areas, analyze geological data, and provide maps and reports that highlight landslide risks. Their research helps inform local planning and mitigation efforts.
- **Alaska Department of Transportation & Public Facilities (ADOT&PF):** The AODT&PF monitors landslide risks along major transportation routes on the Kenai Peninsula, such as the Seward Highway. They use a combination of field inspections, remote sensing, and geotechnical analysis to identify potential landslide sites and implement mitigation measures, such as slope stabilization and drainage improvements.

- **USGS:** USGS conducts nationwide landslide hazard research, including in the Kenai Peninsula. They provide technical expertise, conduct field studies, and develop landslide hazard maps that are used by local agencies for planning and risk reduction. The City of Seward is investigating ways to monitor Lowell Point Road for the potential of future landslides. Currently the only community regularly monitored by USGS in the state of Alaska is Sitka. Seward and the Lowell Point community are interested in a similar monitoring program to potentially mitigate future landslides along that road. Such monitoring could also be beneficial in the area of Cooper landing near the highway.
- **University of Alaska Fairbanks (UAF) – Alaska Earthquake Center (AEC):** UAF AEC monitors seismic activity that can trigger landslides in the Kenai Peninsula. The AEC operates a network of seismometers and other instruments to detect and analyze earthquakes, providing valuable data for assessing landslide risks associated with seismic events.
- **National Weather Service (NWS):** The NWS provides weather forecasts and warnings that are crucial for landslide prediction. They monitor precipitation levels, soil moisture content, and other meteorological factors that contribute to slope instability. By analyzing this data, the NWS can issue timely warnings to help mitigate the impact of potential landslides.

Section 12.2.3 Historic Landslide Events

According to data provided by USGS with support from the DOT&PF Geo Event Tracker, there have been 132 reportable landslide events in the KPB since 2000. These range in size from major rockfalls, moderate landslides and embankment failures, to routine minor rockfall events. ADOT&PF is typically capable of responding and mitigating road cleanup efforts related to landslide events on state roads. However, larger events such as the Lowell Point Road landslide in 2022 and landslides caused by the 1964 earthquake required federal support for cleanup efforts.

Landslides in the KPB have been the source of a large amount of damage. The Good Friday Earthquake of March 27, 1964, caused numerous landslide events across the KPB. The village of Port Graham experienced significant damage from a landslide caused by the earthquake, leading to the relocation of the village to higher ground. A notable landslide occurred near Cooper Landing in 1984, blocking a portion of the Kenai River and forming a temporarily dammed area where the Kenai Lake flows into the Kenai River. In September 2002, a landslide occurred near the town of Hope, blocking access to a popular hiking trail and causing damage to nearby infrastructure. The landslide was triggered by heavy rainfall and resulted in temporary closures of the affected area.

The City of Seldovia along with Seldovia Village Tribe would like to improve Jakolof Road to make it less vulnerable to landslides triggered by weather or earthquake. The road has experienced twelve reportable landslide events since 2010, with the ongoing potential for events in the future. Mitigation efforts are important as the road is an evacuation route for residents and visitors to the areas of Kasitsna, Tutka Bay, and Seldovia in the event of a natural disaster.

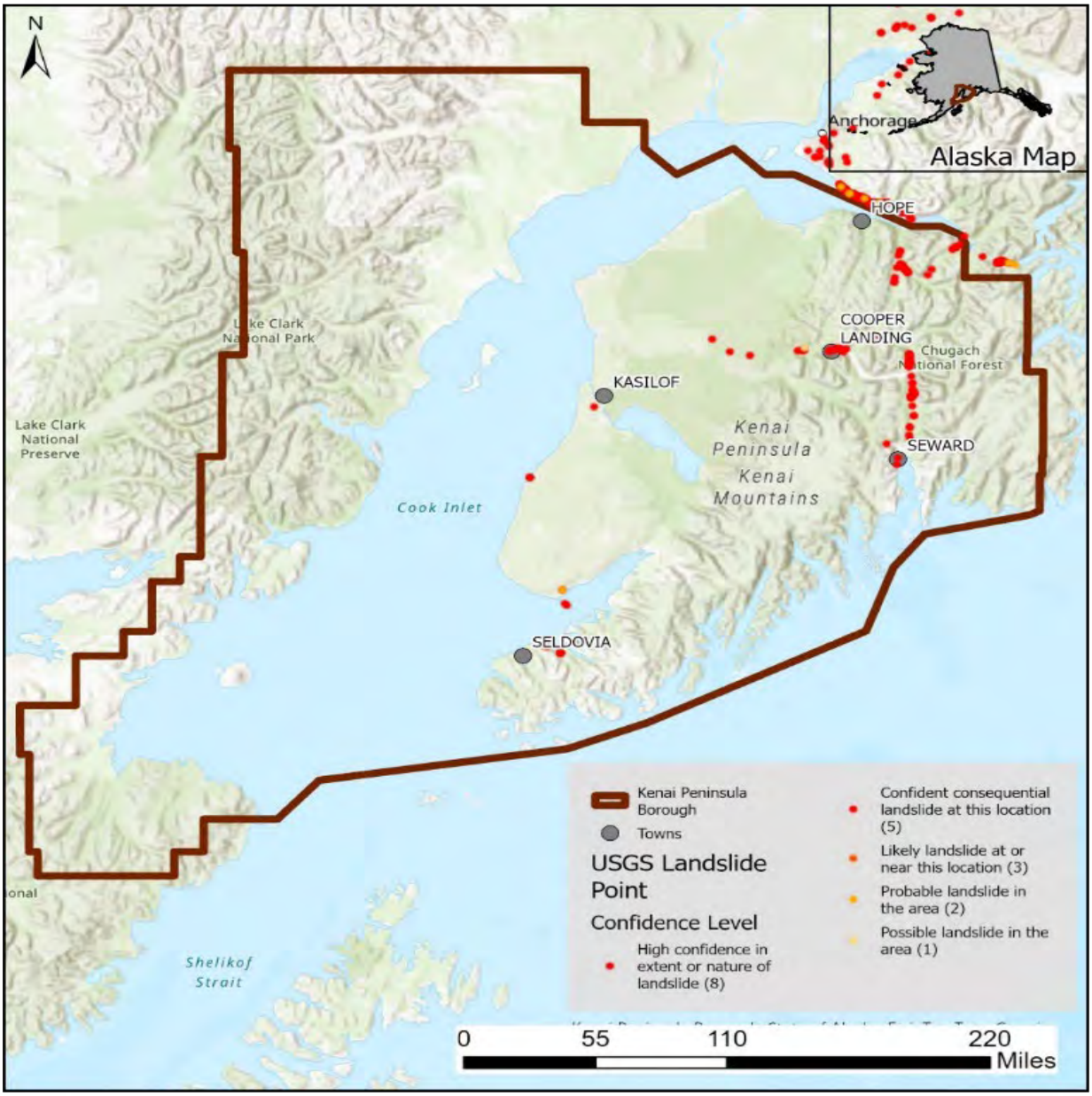


Figure 31. Reported Landslide Events based on confidence level of occurrence (USGS)

Section 12.2.3.1 Lowell Point Road Landslide

On May 7, 2022, Seward experienced a major landslide across Lowell Point Road that cut off road access to the Lowell Point community and interrupted its water/sewer service. A smaller

rockslide had caused the City to shut down the road for clearing prior to the major landslide, so no residents or visitors were on the road at the time of the incident.

Lowell Point Road Landslide (2022)

The landslide was estimated to be 200 feet high and 300 feet wide, containing over 40,000 cubic feet of debris. The most severe impacts from the landslide included substantial cleanup and debris management to restore access, road surface and embankment damage, and disruption or damage to the water/sewer infrastructure through the slide area. The landslide stranded residents and disrupted normal travel to and from the Lowell Point community, requiring the use of commercial and contracted water taxi and barge service on Resurrection Bay around the slide. The City of Seward, KPB, and multiple state agencies engaged in a months-long response to this event. State agencies supported the community with response operations that included water taxi and barge transport around the slide and road clearing. A federal disaster declaration (Lowell Point Landslide DR-4661 AK) was declared on July 26, 2022. Over 1.1 million dollars was allocated through this federal disaster declaration for the initial cleanup work and on-going mitigation for the landslide area.

Lowell Point Road Landslide (2012)

The 2022 landslide event took place adjacent to a similar landslide that occurred on September 29, 2020. The 2020 landslide was triggered by a rainfall event, and it closed the road for several days. People used water taxis to shuttle around it.

Another significant landslide event occurred on Lowell Point Road, September 23, 2012. The landslide, involving a substantial amount of rock, soil, and debris, blocked the road for a week. The ADOT&PF, with support from the City of Seward, responded swiftly, assessing the damage and deploying heavy machinery to clear the debris. To prevent future incidents, ADOT&PF implemented long-term slope stabilization measures, including retaining walls and improved drainage systems. These systems did not help in reducing the impacts associated with the 2022 landslide.

Geotechnical and slope stability assessments have been ongoing for the landslide area since 2022. The landslide area and adjacent mountainside remain unstable, and further movement is a risk. The City of Seward is interested in monitoring programs through USGS and the DGGS that may work to predict or alert those using the road of the potential for a landslide.

The Lowell Creek flood diversion project that is currently in development will include a canopy to protect the tunnel inlet from landslides. Additional improvements related to the project will include landslide mitigation efforts that will work to eliminate potential damage to the road and outflow area. This project will be in design/construction phase over the next five to seven years and public input on the design related to keeping Lowell Point Road open during hazard events influenced final development plans. The USACE is a partner in this project with the City of Seward and has received funding as part of broader federal infrastructure initiatives, including the Infrastructure Investment and Jobs Act and the Disaster Relief Supplemental Appropriations Act.

Section 12.3 Avalanche and Landslide Risk

Hazard risk areas in the KPB primarily occur where avalanches and landslides have previously occurred. Avalanches often clear trees and vegetation, increasing susceptibility to subsequent landslides. Winter avalanche-prone zones commonly transition to summer landslide-prone areas, necessitating integrated risk assessments. While most avalanche and landslide risk areas are located away from populated regions, hazards along the Seward, Sterling, and Hope Highways are notable. Specific concerns include:

- Mile 18 – 23, Seward Highway (Crown Point)
- Mile 61 – 67 Seward Highway (Turnagain Pass)
- Mile 28 – 39 Seward Highway (Moose Pass to just north of Tern Lake)
- Mile 38 – 39 Sterling Highway (just west of Tern Lake)
- Mile 1 – 4 Hope Highway
- Mile 9 – 15 Hope Highway

The following risk maps show the areas mentioned above, as well as areas including Cooper Landing, Seward/Lowell Point, and Seldovia that are at a heightened risk due to their history of landslide events. They also illustrate the land ownership of developed parcels in these regions. It is noteworthy that the majority of land within avalanche-prone zones consists of undeveloped state or federally owned parkland.

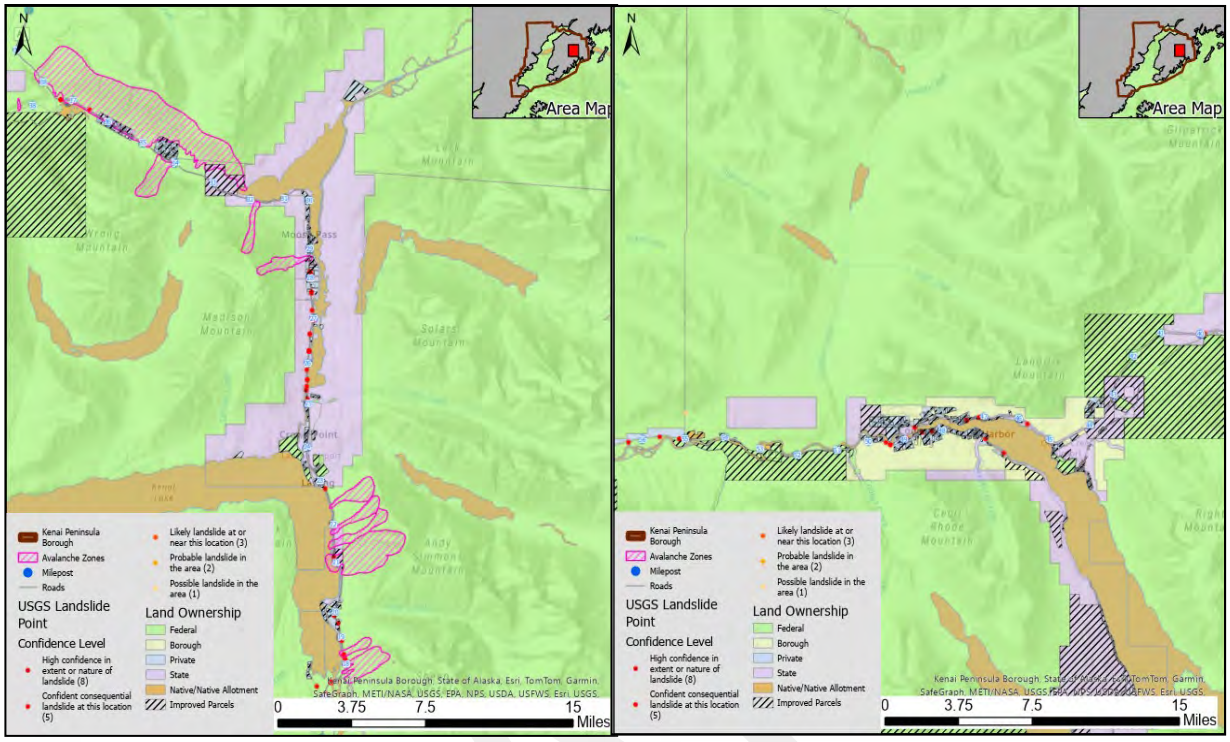


Figure 32. Landslide and Avalanche Risk Areas for the Moose Pass/Crown Point and Cooper Landing Area (USGS 2024)

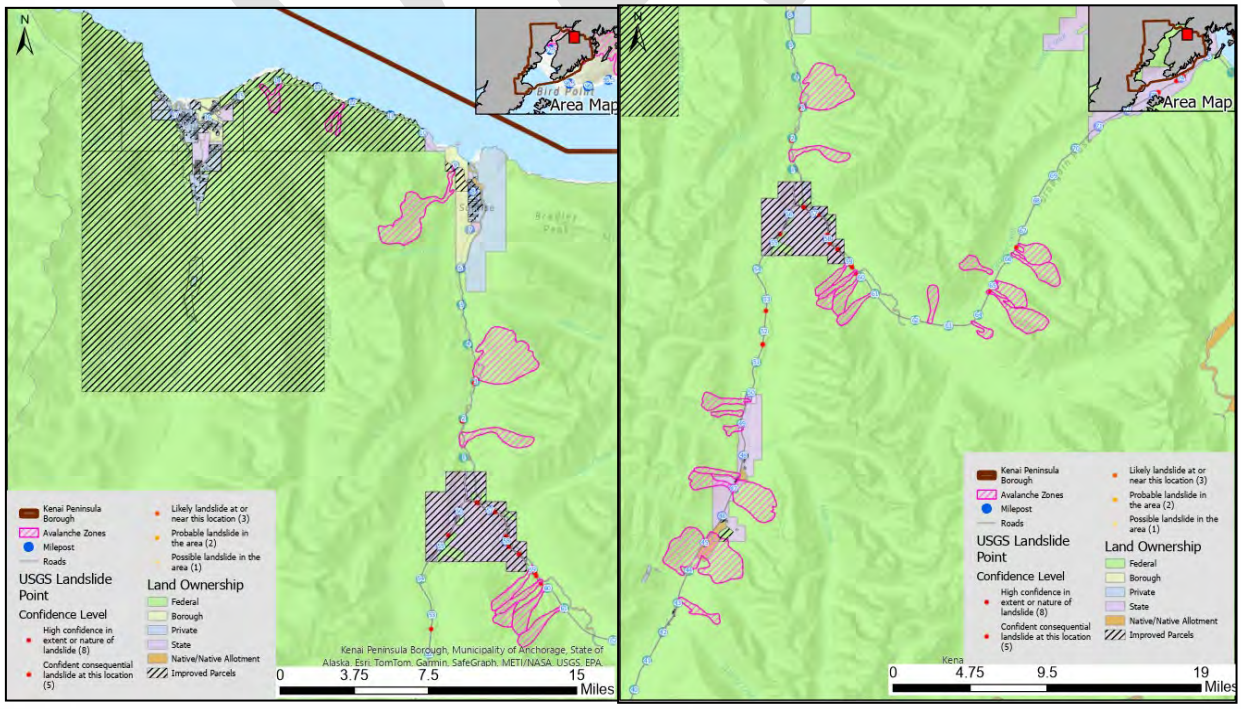


Figure 33. Landslide and Avalanche Risk Areas for the Hope/Sunrise and Turnagain Pass/Johnson Pass Area (USGS 2024)

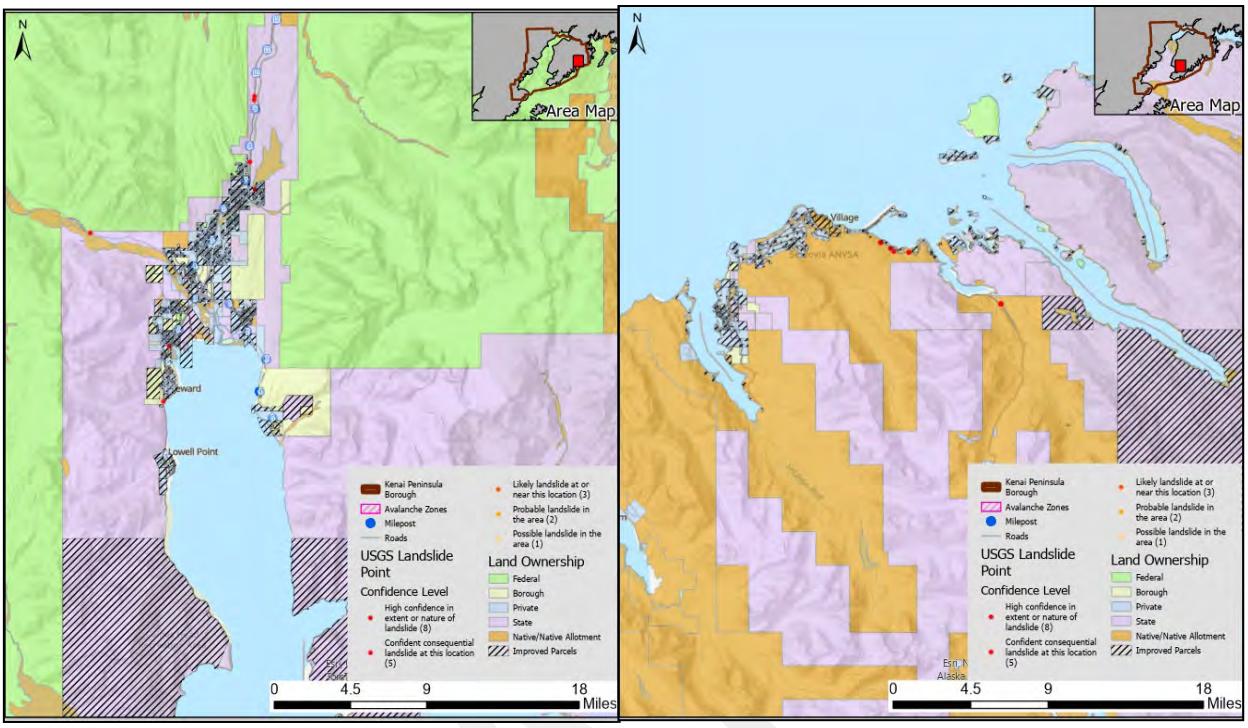


Figure 34. Landslide and Avalanche Risk Areas for the Seward Area and Seldovia Area (USGS 2024)

The areas shown as Avalanche Zones are digitized from the DGGS Snow Avalanche Atlas. Primary populated hazard areas are concentrated along the Seward Highway, including Moose Pass and Primrose. Moose Pass represents the most populated area in the region most at risk from avalanche hazards. In that area, all the lots in Goat Haven Estates and Tern Lake Estates are in the hazard zone. Although the community of Crown Point has no lots located within the mapped avalanche hazard zone, it is located between Moose Pass and Primrose, both of which are partially located within the avalanche hazard zones.

Improved lots shown in each of the maps as developed do not necessarily mean they have a residential structure or occupied building onsite. They may only be developed land, and occupancy may also relate to seasonal use outside of winter months. Temporary residences, such as tents, trailers, and motor homes, are typically located on the lots during the spring, summer, and fall months.

Table 56 provides information on lots in or near avalanche zones in the Moose Pass area. This data may include lots that are not located within these zones; these avalanche zones have been digitized into GIS. The possibility of avalanches reaching areas outside the avalanche zones is not unreasonable, so it is important to include the few lots that fall near the zones as well. Because of the reliance on the single access of the Seward Highway through these communities, the Borough considers the populations of all three communities to be at a heightened risk. One potential solution would be to rehabilitate an existing interior subdivision road to be used as an alternate access in the event of an emergency.

Table 55. Moose Pass Area Communities at Risk from Avalanche Hazard Events

Community	Population	Residential Structures	Residential Lots in/near Mapped Zones	Residential Structures Values	Commercial Structures Values	Institutional Structures Values	Total Structure Values
Moose Pass	228	221	84	$14,774,500	$2,289,600	$6,310,500	$23,374,600
Primrose	90	100	5	$6,688,200	$262,500	$0	$6,950,700
Crown Point	111	77	0	$4,896,000	$3,813,300	$1,502,800	$10,212,100
TOTAL	**429**	**398**	**89**	**$26,358,700**	**$6,365,400**	**$7,813,300**	**$40,537,400**

(2023 US Census Data & KPB GIS and 2024 Assessing data)

Section 12.4 Impact of Future Climate Conditions

Ongoing glacial retreat, permafrost degradation, and changes to the active layer that freezes and thaws each year can lead to more landslide and avalanche activity. Additionally, increased weather related to freeze-thaw cycles amplifies potential for avalanches and ground failure slides, flows, and creep. Increases in the potential for tsunami-producing landslides in Alaska can be attributed to retreating glaciers. Rock-ice face collapse is most common in areas with glaciers and steep topography, frequently the same areas that attract tourists in the borough.

The KPB is experiencing an increase in rainfall and extreme rain events (e.g., atmospheric rivers). The effects are noticeable as an increase in coastal and river erosion but are also widely seen as rockfalls and debris flows. Rainfall can trigger landslides by loosening soils, lubricating rock joints, and mobilizing the material downslope. Faster-flowing water can carry larger soil particles and rocks.

Changing conditions are expected to increase avalanche and landslide frequency of all intensities, and as people expand across the landscape, including into hazardous areas, there could be an increase in catastrophic outcomes in the future. The intensity of avalanche and landslide hazards in the KPB can range from minor to severe. If the atmosphere continues to warm, a higher frequency of atmospheric river events that bring moisture in larger quantities and duration compared to regular frontal rain events can be anticipated.

Section 12.5 Hazard Mitigation Efforts

There are several mitigation efforts and policies in place to mitigate or eliminate the potential for fatal accidents associated with avalanches and landslides. Some of these mitigation programs and policy actions include:

Alaska Railroad (ARRC): The ARRC maps avalanche hot spot areas and rock fall areas along its rail network. They have multiple tools to deal with avalanche threats and occurrences, including remote monitoring in some known avalanche paths. They maintain a searchable database and have teamed with the US Forest Service to install remote avalanche towers at specific areas of

the rail line. In addition to teaming with the US Forest Service on installation of these towers there are ongoing efforts to educate ARRC passengers on the avalanche risk in Alaska.

Utility Companies: Before Chugach Electric sends any of its maintenance crews to do work in a known avalanche area, it requires an avalanche assessment to ensure worker safety. Infrastructure in known avalanche hazard areas has been upgraded to make it more disaster resistant. KPB would like to see more such efforts which could reduce impacts to utility systems in the event of an avalanche or landslide.

Alaska Department of Transportation & Public Facilities: ADOT&PF monitors landslides and avalanches that affect its maintained roadways. It has identified areas, and installed signage along stretches of the Seward and Sterling Highways in avalanche hazard zones. There are also gates that can be lowered to block off sections of highway when danger is extreme and/or clearing work is underway.

Kenai Peninsula Borough: Proposed Street Layout (*Borough Code 20.20.030*) requires that "Adequate and safe access for emergency and service vehicle traffic shall be considered in street layout." Under this portion of the code, the Borough could refuse acceptance of new dedications in an avalanche or run-out zone, which could make subdividing in a hazardous area less desirable. There is a small amount of land that exists in avalanche zones that is currently private and there would be limited areas affected by this Borough Code.

Section 12.6 City of Seward Hazard Overview

The City of Seward faces significant landslide and avalanche risks due to its steep mountainous terrain and heavy snowfall. These natural hazards are exacerbated by seismic activity in the region, which can trigger landslides and avalanches. Most recently the Lowell Point landslide is an example of the potential for major events that disrupt travel and access to areas throughout the community.

Section 12.7 City of Seldovia Hazard Overview

The City of Seldovia landslide risk is primarily outside of City limits along Jakolof Bay Road. This area has seen an increase in landslide activity that has caused growing concern among the community as this road is a primary access and evacuation road for the City of Seldovia and the Seldovia Village. Mitigation efforts and improvements along with funding to support upgrading and protecting this road are an ongoing priority for the City of Seldovia.

Section 13 Human-Caused Hazards

If you don't think it's safe, it probably isn't.

- Jerry Smith

Section 13.1 Hazard Overview

Most of the focus of hazard mitigation is on natural hazards such as earthquakes and floods, but there are also hazards that are human-caused. While the risks presented by natural hazards may be increased or decreased as a result of human activity, most are not human-induced.

Technological hazards originate from technological or industrial conditions, dangerous procedures, infrastructure failure or human activity. On the Kenai Peninsula, one example of a human-created hazard could be sudden flooding due to potential dam and levee breaches. Another example is hazards related to the storage, use, release, and transportation of hazardous materials near sensitive areas such as rivers, lakes, or waterways.

Bradley Lake spillway dam and hydroelectric plant near Kachemak Bay in the KPB. (HEA)

Oil and gas infrastructure, shipping, docks, and seafood processing facilities all have the potential for large chemical or hazardous material releases. This infrastructure is heavily regulated by the Alaska Department of Environmental Conservation (ADEC) and US Environmental Protection Agency (EPA) which also mandate company regulatory oversight.

There are additional human-caused hazards that do not reference hazardous materials releases in the normal context of manufacturing, storage, or transport. The following hazards may also pose potential threats and risk factors to the KPB:

- **Workplace Violence:** Incidents of violence in the workplace, including shootings, assaults, or threats. The KPB has been systematically implementing restricted access areas in its buildings to limit interactions with angry or aggressive persons. The School District has already implemented these types of restrictions. This restricted access could mitigate an incident of workplace violence, especially if the violator is not an employee.
- **Cyberattacks:** Deliberate attacks on computer systems and networks. The KPB regularly updates cybersecurity measures, including addressing attacks generated by Artificial Intelligence (AI) that may pose risks to systems throughout the borough.

- **Unregulated Construction:** Erosion-producing land development and coastal construction in unapproved areas are examples of unregulated construction.
- **Negligence in Public Spaces:** Human errors or negligence in public spaces such as parks, recreational areas, or tourist attractions can lead to wildfires, accidents, injuries, or other hazards.
- **Correctional Facility Unrest:** Two large correctional facilities are located in the KPB: the Spring Creek Correctional Center in Seward, which houses some of the state's most violent offenders, and the Wildwood Correctional Complex located in Kenai, a medium-security prison and pretrial intake facility. A juvenile facility in Kenai also exists and serves as a Youth Detention Facility under the Alaska Department of Family and Community Services (ADFCS).

Section 13.2 Regulatory & Management Programs

Most regulatory oversight and management of human-caused hazards are conducted by the ADEC and EPA in the borough. Additional agencies that provide monitoring and management include USACE, NOAA, United States Coast Guard (USCG), EPA, USFWS, Centers for Disease Control and Prevention (CDC), and the State of Alaska. The list below provides insight into how borough, state, federal governments, and private industry monitor human-caused hazards:

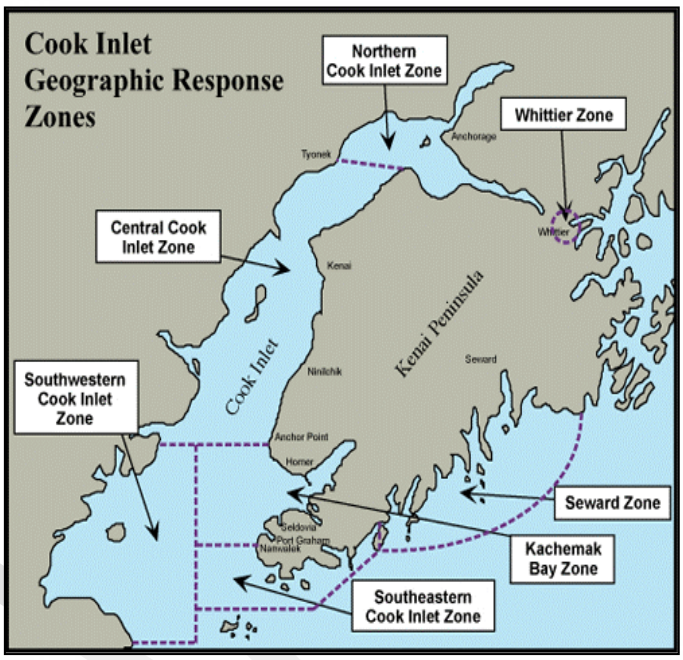
- **Borough**

  The KPB has limited ordinances regulating toxic and hazardous substances. *Title 10 of the Borough Code of Ordinances* has reporting and signage requirements for facilities handling certain hazardous materials. The KPB Comprehensive Plan, Chapter 7 (Environmental Quality), notes that a borough function is the preparation of plans for and response to hazardous materials spills and incidents through the KPB OEM and the LEPC. OEM's Emergency Operations Plan (EOP) incorporates response checklists for oil and hazardous material releases. The EOP response checklist for transportation accidents also includes steps to be taken if hazardous materials are involved.

- **State of Alaska**
  - **ADEC:** ADEC monitors and regulates many of the activities that can result from human-caused hazards, including fuel spills, water contamination, illicit substance contamination and air quality monitoring. ADEC through its contaminated sites program provides mapping and monitoring insight that is updated to include whether a site is:
    - *Actively being cleaned up*
    - *Where cleanup has been completed and*
    - *Areas where institutional and information controls are in place even after being identified with a cleanup complete designation.*
  - **SERC:** The State Emergency Response Commission (SERC) establishes Local Emergency Planning Districts within Alaska and manages the State's LEPC. Alaska Statutes also direct the SERC to be an all-hazard SERC. This means that the Alaska

SERC is tasked to address hazardous materials issues and all other hazards and threats that might create an emergency situation in Alaskan communities. *Alaska Statute 26.23.071* establishes the Alaska SERC and identifies how it is employed for state operations.

- **CISPRI:** In accordance with ADEC criteria, ten petrochemical operators also have jointly sponsored a nonprofit response unit, Cook Inlet Spill Prevention and Response, Inc. (CISPRI) certified by the USCG to respond to emergency spills. This organization is a primary participant in the Cook Inlet Geographic Response Strategies program. This program divides the Cook Inlet Region into seven zones that can be activated regionally when a hazard event occurs.



CISPRI Response Zones Map (ADEC)

- **Federal Agencies**
  - **EPA**: The transfer of hazardous waste via road, rail, water, or air has the potential to be more hazardous to the public than monitored hazardous waste sites. All hazardous waste transporters defined under the Resource Conservation and Recovery Act (RCRA) require each of the following:
    - EPA Identification (ID) Number: transporter ID numbers assigned to a transportation company or waste department.
    - EPA Hazardous Waste Manifest System: Used to track hazardous waste from the time it leaves the facility where it was produced to when it reaches its destination.

    Exceptions can be made based on certain circumstances including small quantity generators of certain recyclable materials. More information on the EPA hazardous waste requirements for transportation as well as what is required in the event of a discharge or spill can be found on the EPA Hazardous Waste Management website.

    The National Response Center (NRC) serves as the point of contact for reporting oil, chemical, radiological, biological, and etiological discharges within the U.S. for

several federal agencies including the EPA as well as the Department of Transportation.

- **USACE**: The U.S. Army Corps of Engineers (USACE) plays a critical role in regulating activities that affect waters and wetlands. The USACE regulatory program is focused on ensuring that the nation's aquatic resources are protected while allowing reasonable development. The primary regulatory authority of the USACE in Alaska, as in other states, comes from the *Clean Water Act (Section 404)* and the *Rivers and Harbors Act of 1899 (Section 10)*. USACE also provides regulatory oversight for many of the borough's levees and dams.
- **USFWS:** The United States Fish and Wildlife Service (USFWS) has a dedicated focus on the conservation of fish and aquatic species, particularly in Alaska, where diverse and pristine aquatic habitats support a wide range of species. The USFWS's Fish and Aquatic Species Conservation program aims to protect and restore fish populations and their habitats through its initiatives and activities.
- **USCG:** The United States Coast Guard (USCG) plays a significant role in regulating and overseeing maritime activities. The USCG responsibilities include ensuring maritime safety, security, and environmental protection in Alaskan waters. The primary regulatory authority of the USCG in Alaska involves enforcing federal laws and regulations related to vessel safety, maritime security, and environmental protection.
- **CDC:** The Centers for Disease Control and Prevention (CDC) is a national public health institute in the United States and a key agency for public health and disease control. In Alaska, the CDC works in collaboration with state and local health agencies to protect public health and ensure disease prevention and control. The KPB does not have health related oversight or management related to disease control measures and these measures will not be included in the plan as a human-caused hazard. The State Department of Health is responsible for most health-related issues in the state and may work in cooperation with the CDC.
- **NOAA:** The National Oceanic and Atmospheric Administration (NOAA) plays a vital role in Alaska, particularly through its regulatory agencies and programs focused on the stewardship of marine and coastal resources. NOAA's work in Alaska is crucial due to the state's extensive coastline, rich marine ecosystems, and significant dependence on marine resources.

- **Multi Agency**
  - **Emergency Response Plans:** Emergency Response Plans (ERPs) are in place at the borough, state, and federal levels of authority. Individual facilities (oil and gas and major coastal fishing operators, among others) must also maintain and have up to date response plans in place, which are regulated by both the EPA and ADEC.

- **The Cook Inlet Regional Citizens Advisory Council (CIRCAC):** This is a nonprofit corporation created to give citizens a greater voice in oil transportation and production. CIRCAC in collaboration with the Alaska Ocean Observing System (AOOS) has developed the Cook Inlet Response Tool (CIRT). This tool is an application that allows approved users the ability to monitor real-time AOOS data as it relates to weather, wave size and ocean circulation. This GIS-enabled tool includes shoreline oil persistence indices, salmon stream locations, and information for sensitive areas that could be affected in the event of an oil spill. More information on this tool and what it can provide for mitigation efforts in the event of an oil spill can be found on the CIRT Tool website. The AOOS ocean data explorer provides real-time mapping data related to wind speed, weather, and temperature in the KPB. The Cook Inlet Subarea Plan that works on mitigation measures related to oil and hazardous substance discharges and releases can be found on the ADEC Oil and Hazardous Response Plan website.

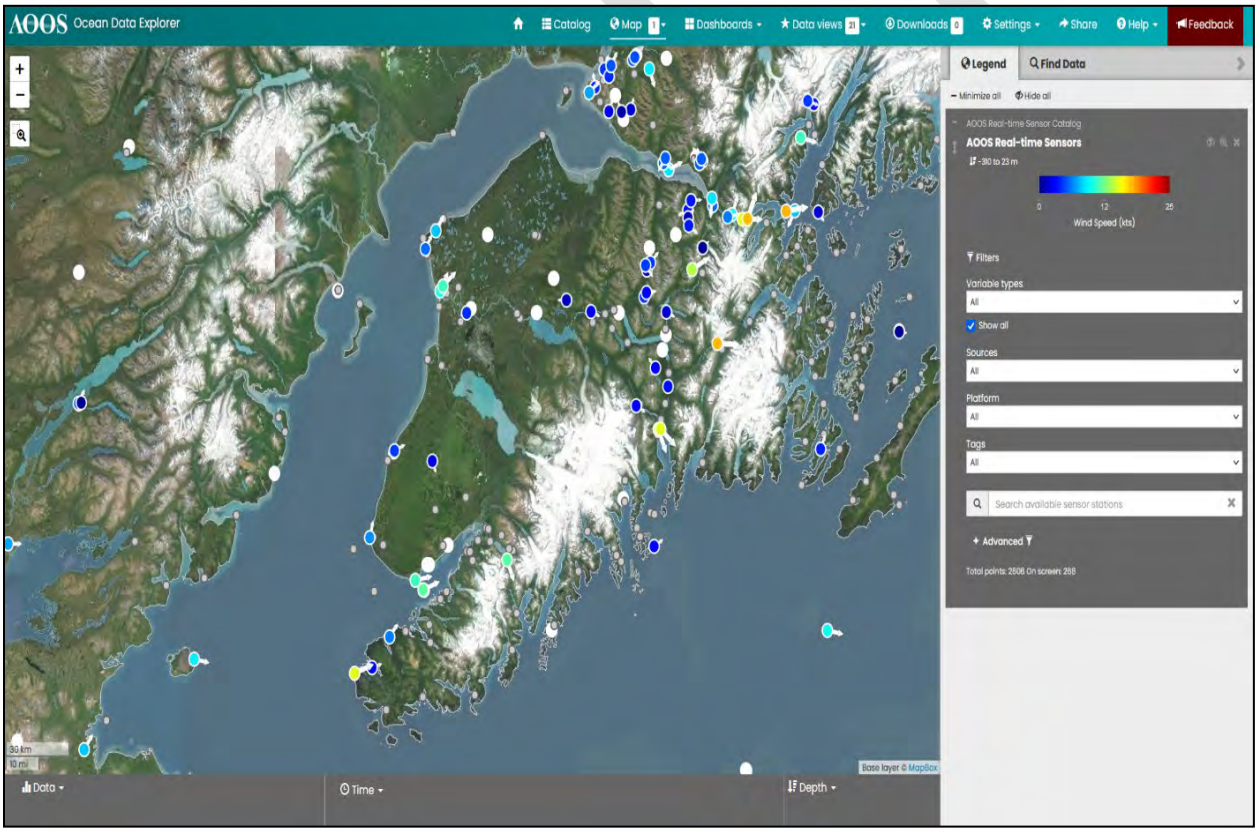


Figure 35. AOOS Mapping Portal for the KPB region.
This figure shows scientific and management information including real-time sensor feeds, operational oceanographic and atmospheric models, satellite observations, and GIS data sets that describe the biological, chemical, and physical characteristics of Alaska and its surrounding waters. (NOAA)

Section 13.3 Human-Caused Hazards by Location

The KPB has various human-caused hazards that affect different areas of the borough. The regions that are covered by hazard location can be divided into the Cook Inlet Area, Kachemak Bay Area (Seldovia) Central Area, and Seward Area (Prince William Sound).

Cook Inlet Zone (CISPRI Response Zones)

The Central Cook Inlet Zone, particularly near Nikiski, is known for oil and gas related businesses. There are several large industrial structures in the area including processing plants and storage facilities. One of the key installations is the Kenai Liquefied Natural Gas (LNG) facility, which began operations in 1969 and was the first of its kind in North America. Another significant site is the Marathon Petroleum Corporation Kenai Refinery, which processes crude oil into gasoline, diesel, jet fuel, and other products, with a capacity of around 68,000 barrels per day. Future developments, such as the proposed Alaska LNG Project and bringing the Agrium fertilizer facility back online, have the potential to add to the number of operating facilities in the area.

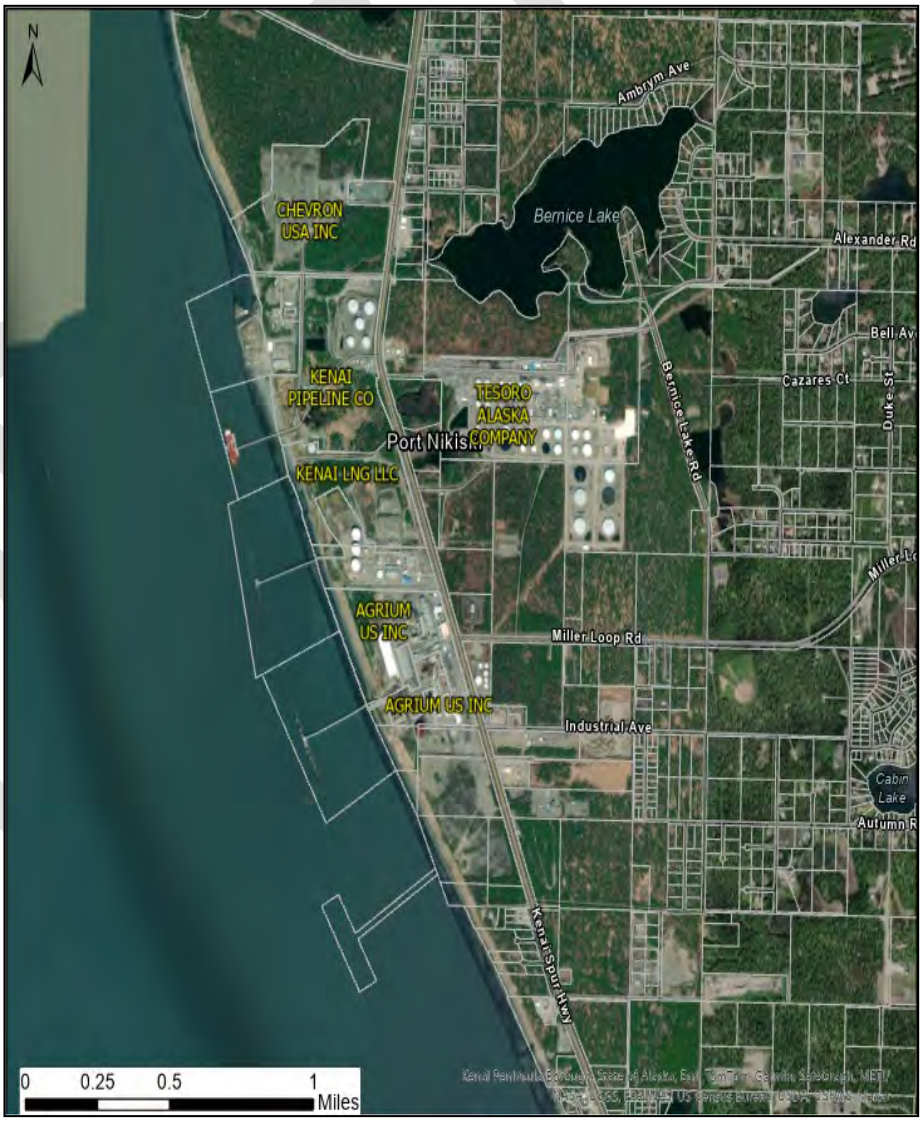


Figure 36. Oil and Gas Facilities and Infrastructure in Nikiski

The area also includes fish processing facilities, with most being located near the mouth of the Kenai River. Many of these facilities are older structures that house fuel and various chemicals, such as chlorine. They also employ a large temporary workforce. The

plants reach peak activity during the summer months, which is also the time the area's population swells with tourists and dip-netters.

Also located within the area is the Wildwood Correctional Complex, three miles north of Kenai off the Kenai Spur Highway. It is a state correctional facility with 264-beds: 115-beds in the Pretrial Facility, and 94-beds in the Transitional Program. The Kenai Peninsula Youth Faculty located in the City of Kenai houses 10-beds.

The KPBSD has initiated stricter access requirements for schools to reduce the risk of violent individuals gaining access to these facilities. The KPB has also worked to reduce the risk of violent individuals accessing borough buildings. This has been done through key card access initiatives in certain high-risk facilities. The following table presents some of the facilities and the human-caused hazards in the Central Cook Inlet Zone.

Table 56. Examples of Facilities Posing Potential Human-Caused Hazards – Central Cook Inlet Zone 2024

Facility	Operator	Hazard Type
Fertilizer Plant (decommissioned)	Agrium US Inc.	Chemical
Natural Gas Liquefaction	Marathon Alaska Production LLC (KENAI LNG)	Chemical
Refinery	Marathon Alaska Production LLC (KENAI crude oil)	Chemical
Gas Fields, Production Facility	Marathon Alaska Production LLC	Chemical
Oil Platforms and Storage	Hilcorp Alaska, LLC/Chevron	Chemical
Drift River Oil Storage Facility	Cook Inlet Pipeline Co.	Chemical
Municipal Airport	City of Kenai	Fuel spill/air accident
North Peninsula Recreational Facility/Pool	KPB Recreation Service Area	Chemical
Kenai HS Pool	KPBSD	Chemical
Water & Sewer Treatment Plants	City of Kenai City of Soldotna	Chemical/Flood/Sewage Release
Seafood Processing Plant	Rogue Wave Processing	Chemical
Seafood Processing Plant	Pacstar, Inlet Fish Processors	Chemical
Seafood Processing Plant	North Pacific Seafoods	Chemical
Wildwood Correctional Facility	Alaska Department of Corrections	Human
Kenai Peninsula Youth Facility	Alaska Department of Corrections	Human

(ADEC)

Seward Zone (PWS Area)

The Seward Region Zone and Prince William Sound (PWS) Area are highly dependent on the marine economy and tourism. The Resurrection Bay boat harbor and a harbor-side fish processing plant serve a large fleet of commercial fishermen. Although the main salmon fisheries take place during the summer months, numerous other small fisheries occur during the remainder of the year. A large fleet of fishing charter boats and tour boats work out of the harbor during the summer tourist and cruise ship season. The USCG moors the cutter Mustang at the harbor. According to the Seward Harbor Master, the harbor has 566 reserved slips and

5,800 feet of transient moorage. Recently the Seward Company announced plans to construct a new cruise ship terminal that is scheduled to be completed in 2026. This cruise ship terminal will allow the port to accommodate increased cruise ship traffic and host two ships at the same time. Cruise ship season occurs in Seward from May-September. During these months the community has hundreds of thousands of tourists visit Seward and the cruise ship terminal project will undoubtingly increase those numbers over time.

The Alaska Railroad Corporation (ARRC) facilities in Seward are an important starting point to the railroad system in Alaska. These facilities include the dock, which is planned to be replaced as part of the cruise ship development project. The coal loading facility that is integrated into the ARRC system is planned to be decommissioned in the coming years. It no longer is serviceable for global markets and bidding is currently being processed through the ARRC for demolition of the facility and associated infrastructure. In March 1986, a chemical tank car began leaking formaldehyde in Crown Point near Moose Pass and required ARRC to evacuate the residents and spend about $650,000 on cleanup.

The Seward Zone dams and levees are at risk of failure and heavily monitored by the SBCFSA during times of increased precipitation and flooding. The Lowell Canyon Diversion Tunnel, built in 1940 by the USACE, is constantly under scrutiny; its failure would be devastating to the population and infrastructure in the City of Seward. The USACE has developed a new flood diversion system for Lowell Creek that will upgrade the current system. USACE has received funding for the project with plans to start construction of the project in 2026.

Lowell Creek Diversion Dam and outflow creek. (USACE)

The Seward area is home to the Spring Creek Correctional Center, a large maximum-security correctional facility, was built in 1988 in a fairly remote location on the west side of Resurrection Bay. The 535-bed facility employs more than 200 people and is the largest correctional facility in operation in the state. Providence Health and Services owns the only hospital in the region, located in the City of Seward.

Table 57. Examples of Facilities Posing Potential Human-Caused Hazards – Seward / PWS Region 2024

Facility	Operator	Hazard Type
Seafood Processing Plants	Pacific Seafoods, Icicle Seafoods	Chemical
Ship Repair Facility	JAG Alaska	Air quality
Fuel Transfer Station	Petro Marine Services	Chemical
Diversion Levees and Tunnel	City of Seward, SBCFSA	Flooding
Municipal Airport	City of Seward	Fuel spill/Air accident
Hospital	Providence Medical Center	Chemical/Bio
Boat Harbor & Dock	City of Seward	Fuel spill
Cruise Ship Terminal	Alaska Railroad/Seward Company	Fuel spill
Spring Creek Correctional Center	Alaska Department of Corrections	Human

(ADEC)

Kachemak Bay Zone (Seldovia Area)

The Seldovia Region / Kachemak Bay Area is similar to the PWS Area in that it is highly dependent on the marine economy and tourism. The Alaska Marine Highway System (AMHS) is one of the main transportation resources in the area and serves the region seasonally from May-September. In addition to the AMHS, independent boat ferry services provide access to communities in the region. These include the Kachemak Voyager operated by the Seldovia Village Tribe (SVT) which connects the communities of Homer and Seldovia.

Seldovia Harbor has 143 slips available for moorage year-round, and 4,830 total feet of docking for annual moorage slips. The dock also has seaplane access in addition to air service provided at the Seldovia Airport. The Homer Boat Harbor hosts 920 reserved slips and over 6,000 feet of transient moorage. The Homer Boat Harbor serves a large number of charter boat operators, a commercial fishing fleet, and a fish processing plant. Ninilchik also has a small boat harbor that includes slips for 30 vessels. There are 16 schools located in the Region and the South Peninsula Hospital has 22 medical beds and 28 nursing home beds.

Table 58. Examples of Facilities Posing Potential Human-Caused Hazards – Seldovia/Kachemak Bay 2024

Facility	Operator	Hazard Type
Ninilchik Gas Fields	Hilcorp Alaska LLC	Chemical
Seafood Plant	Icicle Seafoods	Chemical
Municipal Airport	City of Homer	Fuel/air accident
South Peninsula Hospital	KPB SPHSA	Chemical/bio
Homer HS Swimming Pool	KPBSD	Chemical
Water & Sewer Treatment Plants	City of Homer	Chemical/bio
Water & Sewer Treatment Plants	City of Seldovia	Chemical/bio
Homer Harbor	City of Homer	Fuel spill
Seldovia Harbor	City of Seldovia	Fuel spill

(ADEC)

Central Cook Inlet Zone

The Central Cook Inlet Zone of the KPB includes areas other than the coastal regions of the Borough and is home to the Borough's main administrative facilities, including the government and school district administration offices. Most KPBSD facilities have initiated secure access measures to reduce the risk of physical or violent conduct in their buildings from unauthorized persons. These measures aim to ensure the safety of students and staff by controlling access to the school premises.

The Central Area is the location of the largest hospital in the Borough. The hospital has initiated secure access initiatives for certain areas of the facility, enhancing the safety of patients and staff. While administrative facilities are fairly secure, access to the main areas of the hospital remains open. Ongoing security implementations include the addition of security staff and security cameras to monitor and manage access throughout the facility.

The areas around Cooper Landing, Hope, and Sterling experience a high influx of seasonal and transient residents who recreate in the region during the summer months. This seasonal population increase can strain local facilities, including schools and hospitals. The presence of temporary residents necessitates heightened security measures and resource management to ensure the safety and well-being of both permanent and transient populations.

Table 59. Examples of Facilities Posing Potential Human-Caused Hazards – Central KPB Area 2024

Facility	Operator	Hazard Type
Sterling Gas Field	Hilcorp Alaska LLC	Chemical
Swanson River Oil Field	Hilcorp Alaska LLC	Chemical
Municipal Airport	City of Soldotna	Fuel spill/Fire/Air accident
Water & Sewer Treatment Plants	City of Soldotna	Chemical
Soldotna HS Swimming Pool	KPBSD	Chemical
Skyview Middle School Pool	KPBSD	Chemical
Central Peninsula Hospital	KPBSD	chemical/bio
George A. Navarre Admin Building	KPB	Human
School District Building	KPBSD	Human

(ADEC)

Section 13.4 Dams

The KPB is home to several significant dams that play a crucial role in providing renewable energy and supporting water management in the region. The Bradley Lake Dam, located 27 miles across Kachemak Bay from Homer, is a prominent hydroelectric facility that generates electricity for the region. Similarly, the Cooper Lake Dam near Cooper Landing provides hydroelectric generation, contributing to the local energy supply (Chugach Electric Association). Another proposed project, the Grant Lake Hydroelectric Dam near Moose Pass, would further enhance the region's renewable energy capacity. These dams are integral to the local infrastructure, offering sustainable power solutions and aiding in flood control and water management for the communities on the KPB.

Fortunately, there have been no dam failure events in the Kenai Peninsula Borough to date. The USACE has rated two dams as High Hazard: Lowell Creek Diversion Tunnel in Seward, and Bridge Creek Dam in Homer. Most dams in the KPB have minimal risk of failure but USACE routinely monitors them for classification and recommended improvements. In addition to Lowell Creek Dam and Bridge Creek Dam, dam failure in Cooper Landing and Seldovia are of particular interest for review in this Plan due to proximity to populated areas.

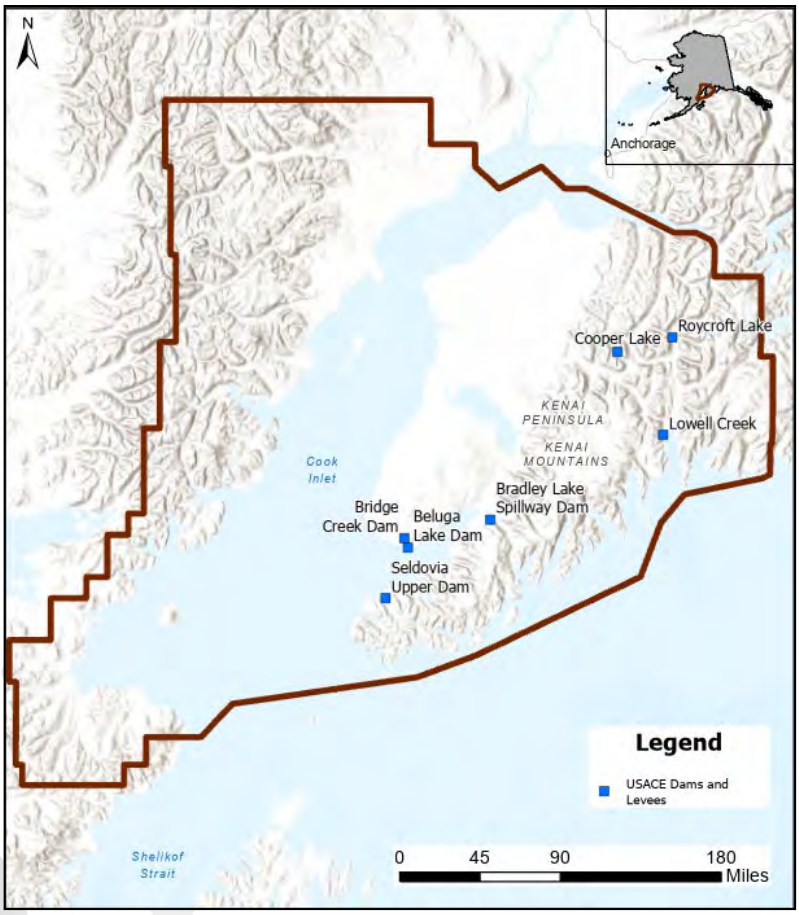


Figure 37. Dams and Levees in the KPB (USACE).

Lowell Creek Diversion Tunnel: The current Lowell Creek Dam diversion is 400 feet long with a maximum height of 25 feet. The tunnel which runs through Bear Mountain is 10 feet in diameter and 2,068 feet in length. It is lined with concrete, and the floor is armored with 40-pound railroad rails. The outlet of the tunnel is located at the toe of Bear Mountain. It is an open concrete flume (a man-made channel or trough constructed from concrete that is used to convey water from one place to another) 10 feet wide and about 109 feet long, which discharges into Resurrection Bay.

The history of Lowell Creek flooding since 1940 has been one of repeated and expensive repairs to the tunnel and intake system and near complete disaster in 1966 and 1986 due to blockage of the tunnel during major flood events. The tunnel has deteriorated due to debris abrasion. The railroad rails armoring the tunnel's floor have been torn out through the years and the floor has periodically eroded to bedrock. The existing flood diversion system in Lowell Creek Canyon does not adequately manage high-water events and presents a risk to public safety, property and critical infrastructure with little to no warning. Excessive flood waters from the current system continue to threaten the community and pose a significant risk of economic damage. Debris flowing from the outfall creates a tenuous situation with a history of damage to the bridge on Lowell Point Road, as well as flooding additional infrastructure in the vicinity. Due to the amount and size of debris that flows down Lowell Creek during flood events there is ongoing concern

that debris could block the tunnel and cause it to fail. In order to prepare for such an event, the City of Seward and USACE have been pursuing plans to develop an alternative flood diversion system for the site.

Cooper Lake Dam: This dam is located near the community of Cooper Landing. Outbursts from Cooper Lake would generally follow the Kenai River, adjacent to the Sterling Highway, until Mile 58, where the Kenai River turns south of the highway and flows toward Skilak Lake. Flooding would be expected downstream all the way to the mouth of the Kenai River, as well as upstream to the mouth of Kenai Lake. From the Refuge boundary, approximately five miles downstream from the river's outflow from Skilak Lake, development is fairly heavy, with both seasonal and year-round residences interspersed with commercial development. Flood levels from a dam failure could surpass the one percent flood event level. There is an EOP/COOP for this facility on file at the OEM office.

Seldovia Upper Dam: The City of Seldovia consistently monitors and determines the needs for ongoing and required repairs to the dam. This ongoing work is important for the community as a dam failure would be an enormous liability to the isolated community. The City has been working with NOAA to find grant options that can be used to improve the dam and provide improved fish access to spawning areas upriver from the dam. Ongoing discussions with NOAA have also taken place to determine the longevity of the dam and renewable energy sources that could add to the community's power supply.

Table 60. Dams in the KPB

National Inventory of Dams (NID)	Name	Owner	General Location	Hazard Potential Classification	Emergency Action Plan
AK00060	Lowell Creek	City of Seward	Seward	High	Yes
AK00101	Bridge Creek Dam	City of Homer	Homer	High	Yes
AK00001	Cooper Lake Dam	Chugach Electric Association	Remote	High	On file at OEM
AK00082	Roycroft Lake	Estes Brothers Inc	Moose Pass	Significant	Yes
AK00262	Beluga Lake Dam	State	Homer	Significant	Yes
AK00024	Seldovia Upper Dam	City of Seldovia	Seldovia	Low	Not required
AK00079	Jerome Lake Dam	Federal	Remote (East)	Low	Not required
AK83016	Bradley Lake Dam	State (AEA)	Remote (South)	Low	Yes, though not required
AK00096	Fish Creek Dam	City of Seldovia	Seldovia	Low	Not required
AK00097	Port Graham Dam #2	Port Graham Corporation	Port Graham	Low	Not required
AK00160	Port Graham Dam #1	Port Graham Corporation	Port Graham	Low	Not required

(State and USACE)

Section 13.5 Levees

SBCFSA maintains a network of levees, drainage channels, and other flood control structures. These levees, also called revetments, are crucial in safeguarding residential, commercial, and public properties from flood damage, particularly during heavy rainfall and snowmelt periods. The service area undertakes various flood mitigation projects, including the construction and maintenance of levees along the Resurrection River and other critical waterways. These levees are designed to manage and redirect floodwaters, preventing them from inundating populated areas. Some SBCFSA levee projects of note include:

Levee locations in City of Seward Area & SBCFSA (USACE)

Japanese Creek Levee: The levee was constructed in 1986, following several flood events. It was rebuilt in 2001 and underwent major renovations in 2007. Infrastructure at risk on the Japanese Creek alluvial fan includes all three Seward schools, Seward Sanitary Landfill, major businesses, the Seward Military Resort, and several highly developed subdivisions. Japanese Creek has a history of stream damming and surge-related floods that carry debris, with 11 such floods reported in the last 50 years. The USACE has indicated that a flood event that breaches the levee could result in a sudden surge release that could cause severe and possibly catastrophic damage along the alluvial fan. The USACE has developed a feasibility project for the levee and flood mitigation options for the flood risk area.

This study is ongoing and is expected to need additional funding before proposed mitigation actions can be initiated.

Levee locations in SBCFSA (USACE)

Fourth of July Creek Levee: This levee is located on the east side of Resurrection Bay. With its continuously shifting channels, Fourth of July Creek and its tributaries have created a segmented alluvial fan on which government, commercial, and industrial facilities have been constructed. This includes the $80 million maximum security State prison - Spring Creek Correctional Center. In 2007, further development of the Seward Marine Industrial Complex was approved by the Seward City Council as well as a project to add on to Spring Creek Correctional Center. Flood control levees were constructed in 1982 to protect the infrastructure and development on the alluvial fan. Flood events in 1982, 1986, and 1989 caused extensive damage to these levees. Failure of the Fourth of July Creek levee would result in considerable damage to public and private infrastructure, including the Spring Creek Correctional Center, the City of Seward's water supply, and the Seward Marine Industrial Center. Reinforcement of the levee and continuous improvements are part of SBCFSA's ongoing flood mitigation efforts for the site.

Additional levees are situated on creeks in the SBCFSA including Salmon Creek, Bear Creek, flood prone areas near the Seward Airport and areas along the Resurrection River. North Forest Acres Levee and Access Road Project including the lower portion of Japanese Creek is an additional ongoing flood mitigation for the service area.

Section 13.7 Hazardous Materials Monitoring

The KPB OEM works closely with local emergency responders, ADEC, and other agencies to prepare for and respond to hazardous materials incidents. They coordinate emergency response efforts, conduct training exercises, and ensure that appropriate measures are in place to mitigate the impacts of hazardous waste spills or releases.

Figure 38. Water Quality Monitoring Locations on Kenai River (KWF).

In addition, various local governments, organizations, non-profits, and community groups conduct outreach and educational activities to raise awareness about hazardous waste issues and promote environmentally responsible practices. These efforts aim to empower residents and businesses with knowledge on safe waste disposal methods and encourage recycling and reuse of materials to reduce hazardous waste generation.

Section 13.7.1 Water Quality Monitoring

The Kenai Watershed Forum (KWF), a non-profit organization, is the regional watershed organization of the KPB. The KWF has been an important resource to the KPB in offering ongoing water quality monitoring and restoration within the Kenai River Watershed. In addition to its work in restoration and research, the KWF is also an important education resource for the KPB.

Water quality monitoring has been conducted by KWF since 2000; data and information from this work have been used to facilitate improvements, including reducing the number of hydrocarbons in the Kenai River and reducing the number of outboard motors that were causing most of the water pollutants. Water quality monitoring is conducted by KWF staff and volunteers at water quality monitoring locations along the Kenai River throughout the spring, summer and fall.

Section 13.7.2 Solid Waste Monitoring

The ADEC regulates health and environmental compliance for solid waste facilities throughout the borough. This Solid Waste Program provides permitting, authorizations, inspections, and monitoring, as well as compliance assistance for waste management. The ADEC maintains a database of solid waste sites known as the Solid Waste Information Management System (SWIMS). This database provides site information including:

- Name
- Classification (Facility, Landfill, Transfer Station)
- Site Location
- Site Status (Active, Closed, Inactive, Undefined, Removed, Retired, Under Construction)
- Region

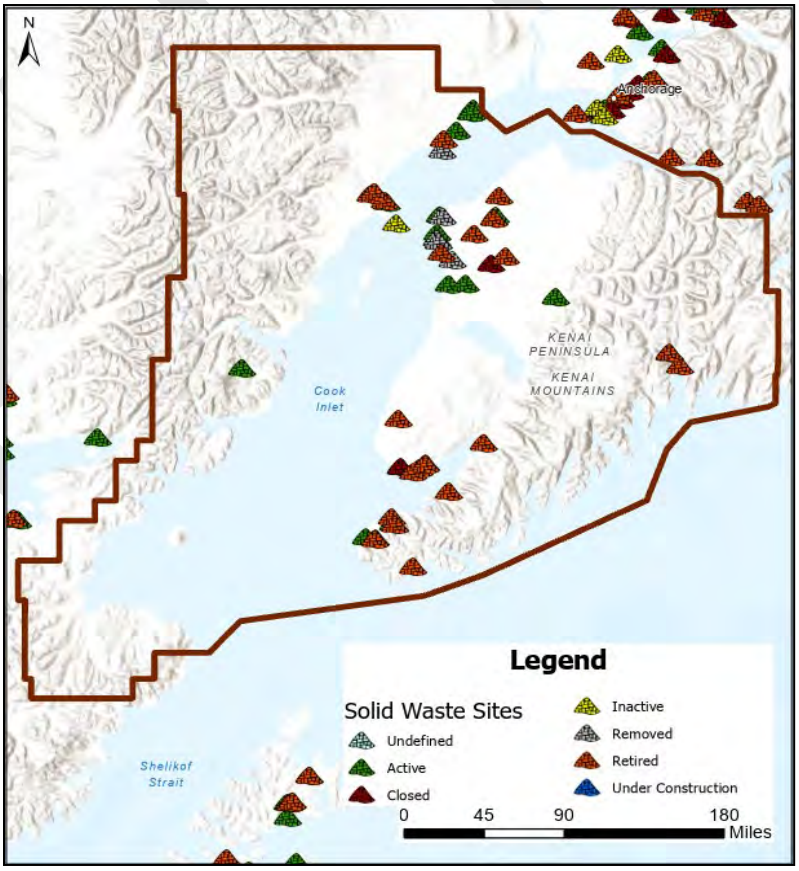


Figure 39. Solid Waste Monitoring Locations (ADEC)

In addition to monitoring of solid waste sites in the KPB, the ADEC Solid Waste Program monitors sewage lagoon closures, waste generated erosion, and depending on the size of the

solid waste site, complaints from the public. The KPB does not have regulations covering disposal conducted on private property. While commercial disposal is fee-based, waste disposal is free at the landfill and area transfer stations for household or residential refuse; more information can be found on the KPB Solid Waste Program website.

Section 13.7.3 Monitoring of Transportation of Waste

The State Hazard Mitigation Plan lists the two primary types of hazard releases as *Stationary* and *Transportation*. Hazardous materials are routinely transported through the Kenai Peninsula via truck, railroad, boat, air, and pipelines. Major incidents involving hazardous materials typically result from accidents at an industrial facility or during transportation.

The transfer of hazardous waste via road, rail, water, or air has the potential to be more hazardous to the public than monitored hazardous waste sites. All hazardous waste transporters defined under the RCRA require each of the following:

- EPA ID Number: transporter ID numbers assigned to a transportation company or waste department.
- EPA Hazardous Waste Manifest System: used to track hazardous waste from the time it leaves the facility where it was produced to when it reaches its final destination.

Exceptions can be made based on certain circumstances including for small quantity generators of certain recyclable materials. More information on the EPA hazardous waste requirements for transportation as well as what is required in the event of a discharge or spill can be found on the EPA Hazardous Waste Management program website.

Table 61. Hazardous Materials Transported on KPB Transportation Infrastructure

Material	Classification
Anhydrous Ammonia	Extremely Hazardous
Formaldehyde	Extremely Hazardous
Sulfuric Acid	Extremely Hazardous
Chlorine	Extremely Hazardous
Nitric Acid	Extremely Hazardous
Acetylene	Hazardous
Oxygen	Hazardous
Nitrogen	Hazardous
Argon	Hazardous
Aviation Fuel	Oil
Gasoline	Oil
Diesel, Heating Oil	Oil

(ADEC)

An accident involving hazardous materials could occur anywhere, but communities located near industrial facilities that use or store large quantities of hazardous chemicals are particularly at risk. However, given that hazardous materials are routinely and frequently transported on local roadways and railways, all communities on the Kenai Peninsula are potentially exposed. The

limited road infrastructure, with few if any alternate access routes, lends itself to isolation of communities if a major road is blocked by a hazardous material release.

The ARRC transports nine classes of hazardous materials on its system. Hazardous materials enter the state at the ports of Seward, Anchorage, and Whittier and are then transferred to the rail system. The ARRC has plans in place for response to hazardous releases.

Natural gas supplies are transported by pipelines from Cook Inlet drilling platforms and other fields on the Kenai Peninsula and the west side of Cook Inlet to facilities located in Trading Bay, Granite Point, and Nikiski. Twelve- and sixteen-inch pipelines run from the Kenai Peninsula, with a sub-marine portion at Turnagain Arm, to other Railbelt communities. Tesoro Alaska ten-inch pipeline transports Jet A fuel, gasoline, and diesel #2 from Nikiski to the Ted Stevens Anchorage International Airport.

Cook Inlet oil platforms and offloading infrastructure on KPB (ADNR)

The oil and gas industry has strict reporting guidelines and response protocols as it relates to spill or release accidents. ADEC has a Disaster Response Plan that utilizes the Incident Command System (ICS). They have a Crisis Management Team (CMT) that responds to releases. There is an Industry Preparedness Program that *"ensures producers, transporters and distributors of crude oil and refined oil products prevent oil spills and are fully prepared materially and financially to clean up spills"*. They also have an Environmental Crimes Unit that is responsible for the investigation and prosecution of violations of environmental law. The State has an Alaska Federal and State Preparedness Plan for Response to Oil and Hazardous Substance Discharge and Releases. There are also Subarea Plans, including a Cook Inlet Plan that is to be utilized in the event of a reportable oil or hazardous substance release.

Section 13.7.4 Hazardous Material Releases

The ADEC defines a hazardous substance as "an element or compound which, when it enters into the atmosphere or in or upon the water or surface or subsurface land, presents an imminent and substantial danger to the public health and welfare, including but not limited to fish, animals, vegetation, or any part of the natural habitat in which they are found". The ADEC monitors and regulates many of the activities that result in hazardous material releases, including fuel spills, water contamination, illegal drug lab contamination, and air quality issues. Hazardous materials locations are monitored through the Contaminated Sites Program. These

sites are determined to be "Active" sites until cleanup complete verification can be made and approved to environmental cleanup standards.

With the State and Federal oversight of the oil and gas industry, the KPB can focus more attention to mitigate private human caused releases. According to the ADEC's Alaska Heating Oil Tanks Guide (ADEC Manuals and Guidance Documents), the average cost of cleanup for a residential oil release in 2003 was $15,000, or over $25,000 in 2023 costs. These costs can be much higher if the groundwater is polluted or if the release extends to neighboring properties. Home heating oil tanks are not regulated by state or federal law, but any associated release is. The owner is responsible for reporting releases to ADEC and for the cleanup of those releases. Natural hazards such as earthquakes or severe weather can result in a fuel release and associated cleanup costs could be covered by hazard insurance for residential customers. According to ADEC, tanks located in the cities of Kenai, Seward, and Soldotna are regulated by those cities. In addition, commercial and sport fishing vessel oil leaks or spills in water bodies are reportable incidents that are required to be reported to the harbormaster or Alaska Department of Fish and Game (ADF&G).

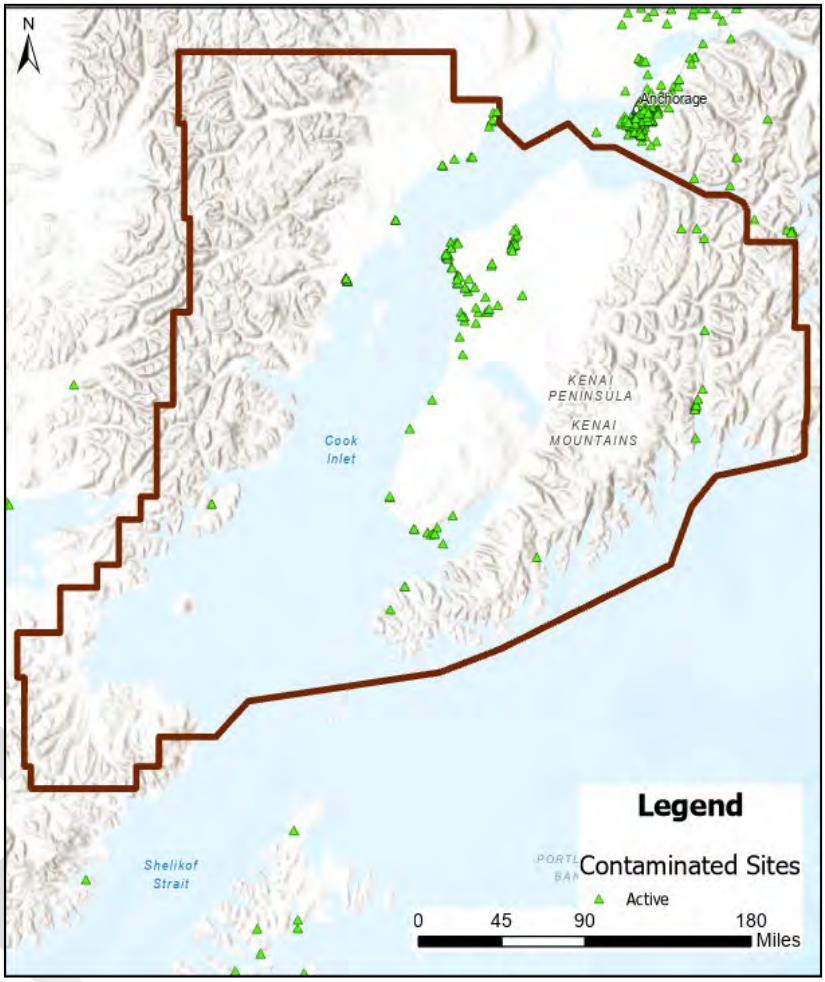


Figure 40. Contaminated Sites Program - Active Cleanup Sites (ADEC)

According to the ADEC, any spill in excess of 55 gallons must be reported within 48 hours after the person has knowledge of the discharge. The following table lists some of the larger releases that are listed in the ADEC database for the KPB area as well as more recent significant releases of 55 gallons or more. Most incidents in the table are attributed to the oil and gas industry, with the largest number of private releases appearing to come from home heating oil tanks.

Table 62. Large Hazardous Material Releases in the KPB

Date	Location	Amount/Substance	Source or Responsible Party
Large Reportable Historical Releases			
4/1986	Crown Point	Formaldehyde, trimethylamine	ARRC, Leaking railcar
1/1992	Soldotna	Chlorine gas	Wastewater Treatment Plant
4/1994	Kenai	Explosives	Halliburton – explosion and fire
5/1997	Nikiski	12,000 lbs. ammonia	Unocal Chemical Plant
9/1997	Ninilchik	Sulfur, 17 tons	Overturned container
10/1997	Nikiski	17,946 lbs. Ammonia	Unocal valve failure
4/1998	Nikiski	49,605 lbs. Ammonia	Unocal valve failure
7/1998	Homer Spit	35,000 lbs. Ammonia	Icicle Seafood Plant fire
8/1999	Nikiski	9000 lbs. MDEA, 500 lbs. Ammonia	Unocal tank explosion
10/2001	Cooper Landing	Fuel - 8800 gallons	Overturned tanker
7/2004	Nikiski	13,200 lbs. Ammonia	Agrium – human error
7/2005	Nikiski	324 gallons Hydrochloric Acid	Corrosion – OSK Dock
5/2009	Nikiski	20,000 lbs. Sulfur Dioxide	Tesoro Refinery
6/2020	Cook Inlet	Crude Oil - 14000 gallons	Harvest Alaska, oil spill
4/2021	Cook Inlet	175000 lbs. of natural gas	Hilcorp LLC, pipeline leak

(ADEC 2023)

Table 63. Significant Hazardous Material Releases in the KPB of 55 gallons or more 2018-2023

Spill Date	Material Release Site	Location	Substance Type	Quantity Released (Gallons)
5/30/2018	Moose Point	North Cook Inlet	Process Water	200
6/25/2018	Fritz Creek General Store & Gas Station	Homer City	Non-crude Oil	100
6/25/2018	Aspen Water Disposal Well/Sand Separation Tank	Tyonek CDP	Process Water	100
6/27/2018	Nikiski CISPRI Yard	Nikiski	Non-crude Oil	55
7/16/2018	Hilcorp Trading Bay Production Facility	Trading Bay	Process Water	314
9/6/2018	North Pacific Rim 4 plex housing unit	Tatitlek	Non-crude Oil	200
10/17/2018	Residence	Seward City	Non-crude Oil	200
12/9/2018	Seward Dock	Seward City	Non-crude Oil	2100
1/7/2019	Hilcorp Kalotsa Gas Pad	Ninilchik	Process Water	141
2/6/2019	Discovery Cabins	Hope CDP	Non-crude Oil	150
3/4/2019	BlueCrest Cosmopolitan Development Project	Anchor Point CDP	Crude Oil	112
3/4/2019	BlueCrest Cosmopolitan Development Project	Anchor Point CDP	Process Water	168
3/13/2019	MP 33 Seward Hwy	Moose Pass	Non-crude Oil	300

Spill Date	Material Release Site	Location	Substance Type	Quantity Released (Gallons)
3/17/2019	41364 Charlie Drive Residence	Homer City	Non-crude Oil	275
4/10/2019	Fire Control Systems	Kenai City	Hazardous Substance	1134
4/15/2019	Hilcorp MGS Onshore Facility	Nikiski	Crude Oil	126
4/15/2019	Hilcorp King Salmon Platform	Trading Bay	Hazardous Substance	588
4/27/2019	Harvest Drift River Terminal	Drift River	Crude Oil	14000
5/2/2019	Hilcorp Swanson River Field Tank Setting 3-4 Line Heater	Swanson River Field	Process Water	514.5
5/9/2019	Nicolai Creek #10	Tyonek CDP	Hazardous Substance	100
6/25/2019	Eshleman Gravel Pit	Sterling	Non-crude Oil	260
6/29/2019	Drift River Terminal	Central Cook Inlet	Crude Oil	60
7/12/2019	Hilcorp Swanson River SRU 242-16	Swanson River Field	Process Water	70
7/31/2019	Drift River Terminal	Central Cook Inlet	Crude Oil	61
8/3/2019	Harvest Drift River Terminal	Drift River	Crude Oil	635
8/12/2019	Hilcorp Swanson River well SCU 21B-16	Swanson River Field	Unknown	1600
10/7/2019	Nikiski Bay	Nikiski	Hazardous Substance	68
10/20/2019	Trading Bay	West Central Kenai	Crude Oil	126
12/21/2019	Marathon Petroleum Refinery	Nikiski	Process Water	150
12/27/2019	Swanson River Field SRU 23B-22	Swanson River Field	Crude Oil	60
1/5/2020	Hilcorp Alaska Beluga River Gas Field - Beluga River Unit (BRU) 1	North Cook Inlet	Hazardous Substance	88
2/7/2020	Wolf Lake Pad	Nikiski	Non-crude Oil	84
3/27/2020	Hilcorp Ninilchik NAA Pad	Ninilchik	Non-crude Oil	292
4/5/2020	Hilcorp Cannery Loop Unit- CLU-3	Kenai Gas Field	Non-crude Oil	84
5/10/2020	Ivan River Pad	Central Cook Inlet	Process Water	210
6/15/2020	Kenai Airport	Kenai City	Non-crude Oil	150
6/19/2020	Hilcorp Alaska Platform A	Central Cook Inlet	Hazardous Substance	180
7/7/2020	Residence	Nikolaevsk	Non-crude Oil	300
7/17/2020	Hilcorp Alaska Beluga River Gas Field	North Cook Inlet	Process Water	210
8/7/2020	Bradley Lake Hydroelectric Plant	Central Kenai Unknown	Non-crude Oil	350
9/9/2020	Residence	Homer City	Non-crude Oil	280

Spill Date	Material Release Site	Location	Substance Type	Quantity Released (Gallons)
9/16/2020	Residence	Soldotna City	Non-crude Oil	350
10/2/2020	Seward Marine Industrial Complex	Seward City	Non-crude Oil	660
10/6/2020	Eadsville Auto	Seward City	Non-crude Oil	200
11/24/2020	Residence	Kenai City	Non-crude Oil	150
11/24/2020	Hilcorp Yard	Central Kenai	Non-crude Oil	150
12/15/2020	Hilcorp Trading Bay Production Facility	Trading Bay	Crude Oil	7980
12/27/2020	Hilcorp Beaver Creek Pad 1A	Beaver Creek Gas Field	Process Water	980
3/1/2021	N Cook Inlet Platform	North Cook Inlet	Non-crude Oil	100
3/29/2021	Kenai Landing	Kenai City	Extremely Hazardous Substance	61
4/27/2021	Residence	Homer City	Non-crude Oil	65
5/30/2021	Hilcorp Swanson River Field Compressor Plant	Swanson River Field	Crude Oil	84
6/15/2021	Resurrection Bay	Seward City	Non-crude Oil	100
6/28/2021	Hilcorp Trading Bay Production Facility	Trading Bay	Process Water	157
7/15/2021	KPB - Central Peninsula Landfill	Soldotna City	Non-crude Oil	80
7/18/2021	Granite Point Platform	Central Cook Inlet	Hazardous Substance	126
7/27/2021	MP 142 Carlile Tanker Truck	Central Kenai Unknown	Crude Oil	900
8/5/2021	Hilcorp Trading Bay Production Facility	Trading Bay	Crude Oil	100
8/21/2021	Shoreside Petroleum Bulk Plant — Seward	Seward City	Non-crude Oil	150
8/26/2021	Hilcorp Beluga River E Pad	Beluga	Process Water	748
9/23/2021	Hilcorp Beluga River Gas Field F Pad	North Cook Inlet	Non-crude Oil	55
10/14/2021	JAG Alaska	Seward City	Non-crude Oil	100
1/7/2022	Residence	Kasilof CDP	Non-crude Oil	250
2/18/2022	Residence	Ninilchik	Non-crude Oil	450
2/22/2022	Residence	Sterling	Non-crude Oil	300
4/17/2022	Residence	Seward Hwy S. Unknown	Non-crude Oil	300
4/28/2022	Residence	Homer City	Non-crude Oil	200
6/7/2022	OBI Seafoods Fish Dock Rd	Homer City	Extremely Hazardous Substance	250
8/4/2022	Doyle's Fuel Company	Kenai City	Non-crude Oil	95
8/23/2022	Hilcorp Swanson River Tank Setting 1-9	Swanson River Field	Crude Oil	210
8/25/2022	Beaver Creek Gas Field	Beaver Creek Gas Field	Hazardous Substance	63

Spill Date	Material Release Site	Location	Substance Type	Quantity Released (Gallons)
8/30/2022	Hilcorp Trading Bay Production Facility	Trading Bay	Extremely Hazardous Substance	90
1/13/2023	Alaska Oil Sales	Soldotna City	Non-crude Oil	75
2/12/2023	Beluga River Gas Field - J Pad	North Cook Inlet	Hazardous Substance	110
4/2/2023	556 Hidden Way	Homer City	Non-crude Oil	100
4/8/2023	Hilcorp Swanson River Field TS 1-33	Swanson River Field	Non-crude Oil	60
4/25/2023	59845 Kittiwake Ct	Homer City	Non-crude Oil	250
5/12/2023	Central Peninsula Hospital	Soldotna City	Non-crude Oil	2500
5/23/2023	Cook Inlet Energy/Glacier Oil West McArthur River Unit	Trading Bay	Hazardous Substance	100
6/6/2023	Moose Pass	Moose Pass	Non-crude Oil	60
6/16/2023	Marathon Kenai Refinery	Nikiski	Non-crude Oil	100
7/7/2023	Cook Inlet Energy/Glacier Oil West McArthur River Unit	Trading Bay	Process Water	630
7/13/2023	Hilcorp Beaver Creek Pad 4	Beaver Creek Gas Field	Hazardous Substance	84
10/6/2023	Cook Inlet Energy Kustatan	Trading Bay	Process Water	60
10/13/2023	HEA	Homer City	Non-crude Oil	65
10/20/2023	Hilcorp SRF Well Pad 32A-33	Swanson River Field	Process Water	378
1/28/2024	Hilcorp SRF Well Pad 32A-33	Swanson River Field	Process Water	210
3/26/2024	Colaska Seward	Seward City	Non-crude Oil	100
4/10/2024	JAG Water Dock	Seward City	Non-crude Oil	200
4/14/2024	Hilcorp Kenai Gas Field Pad 34-31	Kenai Gas Field	Process Water	420
4/26/2024	Residence	Homer City	Non-crude Oil	300

(ADEC)

Section 13.8 Hazard Risk Analysis

Many human-caused hazards listed in this section have the potential to be damaging and cause critical failures to facilities, residences, and/or other infrastructure. The sudden flooding potential of dam or levee failure is more probable in the SBCFSA due to its alluvial nature and high number of rivers and streams in the area. The Kenai River is also a high-risk area due to the large number of people that use or live on the river and its susceptibility to repeated seasonal and glacier dam release flooding.

Hazardous materials releases are more probable in oil and gas facilities due to the amount of such materials encountered daily. The transport of hazardous materials throughout the Borough puts all areas at risk but it is a larger risk to those communities on the road system, railroad system, or marine highway.

The risk analysis shows that each natural hazard can heighten the risk for human caused hazards. Earthquakes, flooding, erosion, wildfires, and tsunamis have led to chemical releases during past historical hazard events.

Human-caused hazards from violent conduct or illegal activity are also of ongoing concern to the KPB. More recent technological risks including those from cyber security concerns to Artificial Intelligence (AI) use in day-to-day workflows are of increasing concern due to their ever-evolving nature.

Section 13.9 Impact of Future Climate Conditions

Though limited in application to human-caused hazards, changing climate conditions can still impact KPB infrastructure. Shifting weather patterns increase the risk of flooding, especially in areas with inadequate drainage systems, and in areas where dams are located. There is also a potential for severe weather events to cause chemical spills from industrial sites that can contaminate local water sources. The rising prevalence of extreme weather events strains emergency response systems and disrupts power supplies, complicating hazard management. Evolving climate conditions necessitate enhanced preparedness and adaptive strategies to mitigate these risks effectively in the future.

Section 13.10 City of Seward Hazard Overview

The City of Seward is affected by industrial spills from the shipping and petroleum industries in the harbor, which pose significant risks to its coastal and marine environments. Additionally, infrastructure vulnerabilities, like those exposed during the 1964 Good Friday Earthquake, highlight the potential dangers from inadequate maintenance and disaster preparedness measures for exposed utility infrastructure and hazardous material storage facilities.

Section 13.11 City of Seldovia Hazard Overview

The City of Seldovia faces human-caused hazards primarily from potential marine oil spills and industrial pollution associated with shipping and fishing activities in the harbor and around the community, which can harm its coastal and marine ecosystems. Additionally, the community is at risk from contamination due to improper waste disposal and aging infrastructure including the upper dam and water treatment facility, posing threats to local water quality and public health.

Section 14 Risk Assessment

A Risk Assessment provides a method to evaluate potential loss of life and economic damage following a disaster by assessing community and infrastructure vulnerability. The extent and quality of available information determines the depth of risk analysis possible for each hazard and community. This assessment guides the development of prioritized mitigation strategies. FEMA outlines four essential steps involved in a Risk Assessment:

1. **Hazard Description**: This step identifies the hazards affecting the KPB, including new events since the last plan update and their impacts. Updated information or data on hazards is incorporated into the assessment.
2. **Hazard Identification**: Each hazard is thoroughly analyzed, understanding its characteristics and profiling its spatial extent, historical occurrences, and future probabilities. The goal is to gain a comprehensive understanding of each hazard to predict and prepare for potential impacts effectively.
3. **Vulnerability Assessment**: This step evaluates the community's vulnerability to identified hazards. It identifies assets such as population, buildings, and infrastructure susceptible to damage, considering factors like construction standards, critical infrastructure, and social demographics (e.g., age, income, disability, special needs, under-served). The assessment aims to pinpoint the most vulnerable areas and assets and assesses the potential consequences of each hazard.
4. **Risk Analysis**: Information from hazard profiling and vulnerability assessment is combined to determine the overall risk for each hazard. Risk is typically quantified by assessing the likelihood of the hazard occurring and the severity of its consequences. This results in a prioritized list of risks that inform decision-making on mitigation strategies, resource allocation, and emergency planning. Recent initiatives such as the Ready, Set, Go! and Know Your Zone programs exemplify efforts to enhance risk readiness and public awareness.

Section 14.1 Hazard Risk Analysis

In risk management, understanding the relationship between the magnitude and severity of a hazard and its probability of occurrence is crucial for effective risk assessment. Hazard magnitude and severity refers to the potential impact of a hazard, which can range from negligible (minimal impact) to catastrophic (severe impact involving multiple fatalities or widespread damage). The probability of a hazard denotes the likelihood of its occurrence, ranging from improbable (very unlikely) to frequent (highly likely). Combining these two dimensions helps in prioritizing risks and implementing appropriate mitigation measures. A risk matrix is a common tool used for this purpose, plotting severity against probability to visually represent different risk levels. This combined analysis aids in allocating resources efficiently to manage and mitigate hazards effectively.

Table 64. Hazard-Magnitude and Severity & Probability Table

Magnitude and Severity	Criteria
4 – Catastrophic	• Multiple deaths. • Complete shutdown of facilities for 30 or more days. • More than 50 percent (%) of property is severely damaged.
3 – Critical	• Injuries and/or illnesses result in permanent disability. • Complete shutdown of critical facilities for at least two weeks. • More than 25% of property is severely damaged.
2 – Limited	• Injuries and/or illnesses do not result in permanent disability. • Complete shutdown of critical facilities for more than one week. • More than 10% of property is severely damaged.
1 – Negligible	• Injuries and/or illnesses are treatable with first aid. • Minor quality of life lost. • Shutdown of critical facilities and services for 24 hours or less. • Less than 10% of property is severely damaged.

Probability	Criteria
4 – Highly Likely	• Event is probable within the calendar year. • Event has up to 1 in 1 year chance of occurring (1/1=100 percent [%]). • History of events is greater than 33% likely per year.
3 – Likely	• Event is probable within the next three years. • Event has up to 1 in 3 years chance of occurring (1/3=33%). • History of events is greater than 20% but less than or equal to 33% likely per year.
2 – Possible	• Event is probable within the next five years. • Event has up to 1 in 5 years chance of occurring (1/5=20%). • History of events is greater than 10% but less than or equal to 20% likely per year.
1 – Unlikely	• Event is possible within the next ten years. • Event has up to 1 in 10 years chance of occurring (1/10=10%). • History of events is less than or equal to 10% likely per year.

The hazard risk assessment looked at HMP plan probability and magnitude severity analysis (2020 Seward HMP, 2019 Kenai HMP, and 2018 Seldovia HMP), historical hazard events and scientific analysis from State and Federal agencies. The KPB developed a hazard risk analysis related to community hazards to determine probability, magnitude and severity of hazard events. The KPB HMP risk analysis was assessed using a hazard rating matrix that was integrated into a KPB hazard risk assessment matrix. The initial probability, magnitude and severity of each local community's vulnerability was rated between 0 and 4 (0 being the lowest or no risk and 4 being the highest risk). This is based on the results of the current hazard events since the last plan update, past HMP risk assessment data collected for the KPB, Seldovia and Seward, knowledge of historical events, and subject matter expert review. Additional risk assessment data related to the KPB and its communities can also be found in the 2023 SHMP.

As an example, below is the magnitude and severity and probability for the City of Seward, City of Seldovia, and specific KPB communities profiled:

Table 65. KPB Hazard Risk Assessment

	Earthquake		Erosion		Flooding		Landslide/ Avalanche		Tsunami		Volcano		Severe Weather		Wildfire	
Community Name	**Magnitude/Severity**	**Probability**	**Magnitude/Severity**	**Probability**	**Magnitude/Severity**	**Probability**	**Magnitude/Severity**	**Probability**	**Magnitude/Severity**	**Probability**	**Magnitude/Severity**	**Probability**	**Magnitude/Severity**	**Probability**	**Magnitude/Severity**	**Probability**
Anchor Point	3	3	2	2	2	2	1	2	3	2	2	2	2	4	3	3
Cooper Landing	3	3	2	3	2	3	2	2	1	1	2	2	2	4	3	3
Funny River	3	3	2	3	2	3	1	1	1	1	2	2	2	4	3	3
Hope	3	3	2	3	2	3	2	2	2	2	2	2	2	4	3	3
Moose Pass	3	3	2	2	2	3	2	2	1	1	2	2	2	4	3	3
Nikiski	3	3	1	2	1	2	1	1	2	2	2	2	2	4	2	3
Nikolaevsk	3	3	2	2	2	2	1	1	1	2	2	2	2	4	3	3
Ninilchik	3	3	2	2	2	2	1	1	3	2	2	2	2	4	3	3
Port Graham	3	3	2	2	2	2	2	2	3	2	2	2	2	4	3	3
City of Seldovia	3	3	2	2	2	2	2	2	3	2	2	2	2	4	3	3
City of Seward	3	3	2	3	3	4	2	3	3	2	2	1	2	4	2	2
Tyonek	3	3	2	3	1	3	2	3	3	2	2	2	2	4	2	2
Average	**3**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	2	2	**2**	**4**	**3**	**3**

The community assessments were limited in scope to communities and regions with readily available past hazard analysis that could be used to develop the assessment. The community areas above encompass the community within its Census Designated Place (CDP) boundaries, the critical infrastructure maps show detailed boundary coverage areas. Smaller unorganized communities can be looked at for further analysis in future HMP updates as more information and data is made available to help in the assessment process. The average for the KPB for each of the associated hazards is used to determine hazard risk as an overall assessment for the borough. Human-caused hazards and functions of a changing climate including cryosphere change were not included as part of the SHMP risk assessment.

KPB Hazard Assessment Matrix: The KPB Hazard Risk Matrix looks at categories based on whether the hazard is a low, moderate, high, or extreme risk to the Borough. Communities were assessed based on the magnitude and severity rating assessment, historical hazard events and the future potential for hazard events.

Table 66. KPB Hazard Assessment Matrix

E = Extreme High Risk **H** = High risk **M** = Moderate Risk **L** = Low Risk		**PROBABILITY**			
		4 – Highly Likely	3 – Likely	2 – Possible	1 - Unlikely
Magnitude and Severity	**4 – Catastrophic**	**E**	**E**	**H**	**H**
	3 – Critical	**E**	**H**	**H**	**M**
	2 – Limited	**H**	**M**	**M**	**L**
	1 – Negligible	**M**	**L**	**L**	**L**

As hazard risk is dependent on community, the KPB Hazard Matrix looked at specific communities that might be affected and developed hazard risk based on that information. The borough average can be used as a baseline for analysis, but community-specific hazard information should be used when analyzing events specific to that area and region.

Table 67. KPB Hazard Risk Assessment

Community Name	Extreme	High	Moderate	Low
Anchor Point		Earthquake, Tsunami, Severe Weather, Wildfire	Erosion, Flooding, Volcano	Landslide, Avalanche
Cooper Landing		Earthquake, Severe Weather, Wildfire	Erosion, Flooding, Landslide, Avalanche, Volcano	Tsunami
Funny River		Earthquake, Severe Weather, Wildfire	Erosion, Flooding, Volcano	Landslide, Avalanche, Tsunami
Hope		Earthquake, Severe Weather, Wildfire	Erosion, Flooding, Tsunami, Volcano, Landslide, Avalanche	
Moose Pass		Earthquake, Severe Weather, Wildfire	Landslide, Avalanche, Volcano, Flooding, Erosion	Tsunami
Nikiski		Earthquake, Severe Weather	Wildfire, Tsunami, Volcano	Landslide, Avalanche, Erosion, Flooding,
Nikolaevsk		Earthquake, Severe Weather, Wildfire	Erosion, Flooding, Volcano	Landslide, Avalanche, Tsunami
Ninilchik		Earthquake, Tsunami, Severe Weather, Wildfire	Erosion, Flooding, Volcano	Landslide, Avalanche
Port Graham		Earthquake, Tsunami, Severe Weather, Wildfire	Erosion, Flooding, Landslide, Avalanche, Volcano	
Seldovia		Earthquake, Tsunami, Severe Weather, Wildfire	Flooding, Erosion, Avalanche, Volcano, Landslide	
Seward	Flooding	Earthquake, Tsunami, Severe Weather	Avalanche, Landslide, Wildfire, Erosion	Volcano
Tyonek		Earthquake, Severe Weather	Wildfire, Erosion, Landslide, Avalanche, Tsunami, Volcano	Flooding
KPB Areawide		Earthquake, Severe Weather, Wildfire	Landslide, Avalanche, Erosion, Flooding, Tsunami, Volcano	

In the review of the matrix figures, the overall assessment shows that many of the communities have either a High or Moderate hazard risk for most of the hazards included in the plan. The outlier is the Seward assessment which shows an extreme risk for flooding, this is a quantifying factor and can be used as justifiable reasoning behind the creation of the SBCFSA. The SBCFSA

in particular requires ongoing mitigation and improvements to help reduce the potential impacts of flooding in the area. Communities assessed were determined based on regional geography and available data related to hazard risk from past events affecting the area. Future assessments could look to include assessments for all the communities in the Borough including communities planned to be included in the future MJHMP.

Section 14.2 Critical Facilities & Infrastructure

FEMA emphasizes the importance of prioritizing critical and essential facilities and infrastructure in regulatory alternatives and hazard management plans. According to the IBC 2021, essential facilities are classified as Occupancy Category IV (Risk Category IV) structures. These are crucial for community safety and functionality during and after emergencies and include:

- Hospitals and healthcare facilities providing critical medical services
- Fire and police stations essential for emergency response
- Emergency shelters and operations centers for coordinating disaster response
- Power-generating stations and utility facilities vital for maintaining essential services
- Structures containing hazardous materials that pose significant risks if released

The IBC requires these facilities to be designed to withstand extreme environmental loads, ensuring their operational continuity during disasters and supporting community resilience and recovery. FEMA allows local jurisdictions to designate additional facilities as Risk Category IV based on their critical community functions. Mitigation strategies in this plan aim to minimize hazard effects on these facilities and support their continued operation following a hazard event. The table below highlights the KPB's emergency response facilities and programs.

Table 68. 2023 KPB Emergency Response Facilities and Services

Emergency Services	Hospital and Medical Services	Law Enforcement Resources
Anchor Point Volunteer Fire Dept.	Central Peninsula Hospital (Soldotna)	Alaska DPS – Alaska Wildlife Troopers
Bear Creek Fire Dept. (Seward)	Chugachmiut North Star Health Clinic (Seward)	Alaska DPS – Fish and Wildlife Protection Seward (Seward)
Central Emergency Services (Soldotna)	Central Peninsula Surgery Center (Soldotna)	Alaska State Troopers (Homer)
City of Homer – Port & Harbor	Indian Creek Health Dept. (Tyonek)	Alaska State Troopers (Seward)
City of Seward – Port & Harbor	Kachemak Bay Medical Clinic (Homer)	Alaska State Troopers (Soldotna)
City of Seldovia – Port & Harbor	Nanwalek (English Bay) Clinic (Chugachmiut)	City of Seward Police Dept.
Cook Inlet Spill Prevention & Response, Inc. (Nikiski)	Ninilchik Community Clinic	USFS Park District Office (Moose Pass)
Homer Emergency Services Department	Port Graham Clinic	DNR Division of Parks – Kachemak Bay District (Homer)
Homer Volunteer Fire Dept.	Providence Seward Medical and Care Center (Seward)	DNR Division of Parks – Kenai River District (Soldotna)
		Homer Police Dept.

Emergency Services
Hope/Sunrise EMS
Indian Creek Health Dept. (Tyonek) Kachemak Emergency Services
Kachemak Emergency Services
Kalifornsky Beach, Sterling, Funny River, Kasilof)
Kenai Composite Squadron
Kenai Fire Department
Lowell Point Emergency Service Area
Moose Pass Volunteer Fire Co. & EMS
Nikiski Fire Department
Ninilchik Community Ambulance Assoc. (Soldotna)
Ninilchik Volunteer Fire Dept.
Seldovia Village Tribe Volunteer Fire Dept. (Seldovia)
Seward Bear Creek Flood Service Area
Seward Civil Air Patrol
Seward Volunteer Ambulance Corps

Hospital and Medical Services
South Peninsula Hospital
State of Alaska Public Health (Kenai)
SVT Medical Care (Anchor Point)
SVT Medical Clinic (Homer)
Seward Community Health Center

Law Enforcement Resources
Kenai Fjords National Park
Kenai Police Department
Nanwalek Village Public Safety Officer
Port Graham Village Public Safety Officer
Seldovia Police Dept.
Soldotna Police Department
Spring Creek Correctional Center (Seward)
U.S. Forest Service – Seward Ranger
USFWS – Kenai National Wildlife Refuge (Soldotna)

Schools: The KPBSD serves the KPB and its communities. The district operates 42 schools, which include elementary, middle, and high schools, as well as several charter and alternative schools. These schools collectively cater to an enrollment of around 8,500 students (2023), providing comprehensive educational programs, and extracurricular activities. The School District has a confidential Emergency Action Plan that it keeps in the District Office in Soldotna.

Table 69. Borough Public Schools and Private/Charter Schools by Region

Central Peninsula
Aurora Borealis (K-8)
Connections Homeschool (K-12)
Kaleidoscope School (K-5)
Kenai Alternative High (9-12)
Kenai Central High (9-12)
Kenai Middle (6-8)
K-Beach Elementary (K-6)
Marathon (7-12)
Mountain View Elementary (K-5)
Nikiski Middle/High School (6-12)
Nikiski North Star Elementary (K-5)
Redoubt Elementary (K-6)
River City Academy (7-12)
Skyview Middle (7-8)
Soldotna Elementary (K-6)
Soldotna High (9-12)
Soldotna Montessori (K-6)
Sterling Elementary (K-6)
Tustumena Elementary (K-6)
Academy of Higher Learning (Charter)
Cook Inlet Academy (Private
Grace Lutheran School (Private)
Wings Christian Academy (Private)

Eastern Peninsula
Connections Homeschool (K-12)
Moose Pass School (K-8)
Seward Elementary (K-5)
Seward High (9-12)
Seward Middle (6-8)

Southern Peninsula
Chapman School (K-8)
Connections Homeschool (K-12)
Fireweed Academy (K-6)
Homer Flex (9-12)
Homer High (9-12)
Homer Middle (7-8)
Kachemak-Selo (K-12)
McNeil Canyon Elementary (K-6)
Nikolaevsk School (K-12)
Ninilchik School (K-12)
Paul Banks Elementary (K-2)
Razdolna (K-12)
Voznesenka School (K-12)
West Homer Elementary (3-6)

Outlying Schools
Cooper Landing (K-12)
Hope School (K-12)
Nanwalek (K-12)
Port Graham (K-12)
Susan B. English (K-12)
Tebughna (K-12)

(KPBSD 2023)

Roadways: Maintaining road connections is critical for providing emergency response and evacuation. Road systems in the KPB are maintained by multiple jurisdictions: federal, state, borough, city and village governments. Borough-owned roads are managed and maintained through the Kenai Peninsula Borough Road Service Area.

The KPB has a comprehensive network of roadways and highways crucial for transportation and connectivity across the region. The Sterling Highway (AK-1) stretches from Homer to the Tern

Lake Junction or "T". The highway passes through the communities of Sterling, Cooper Landing, Soldotna, Kasilof, Clam Gulch, Ninilchik and Anchor Point, terminating in the City of Homer. It provides access to recreational areas, businesses, and residential areas in the KPB. The Seward Highway (AK-9) links the Kenai Peninsula to Anchorage. Other significant routes include Kalifornsky Beach (K-Beach) Road, Funny River Road, East End Road, North Fork Road, Hope Highway, and Kenai Spur Hwy.

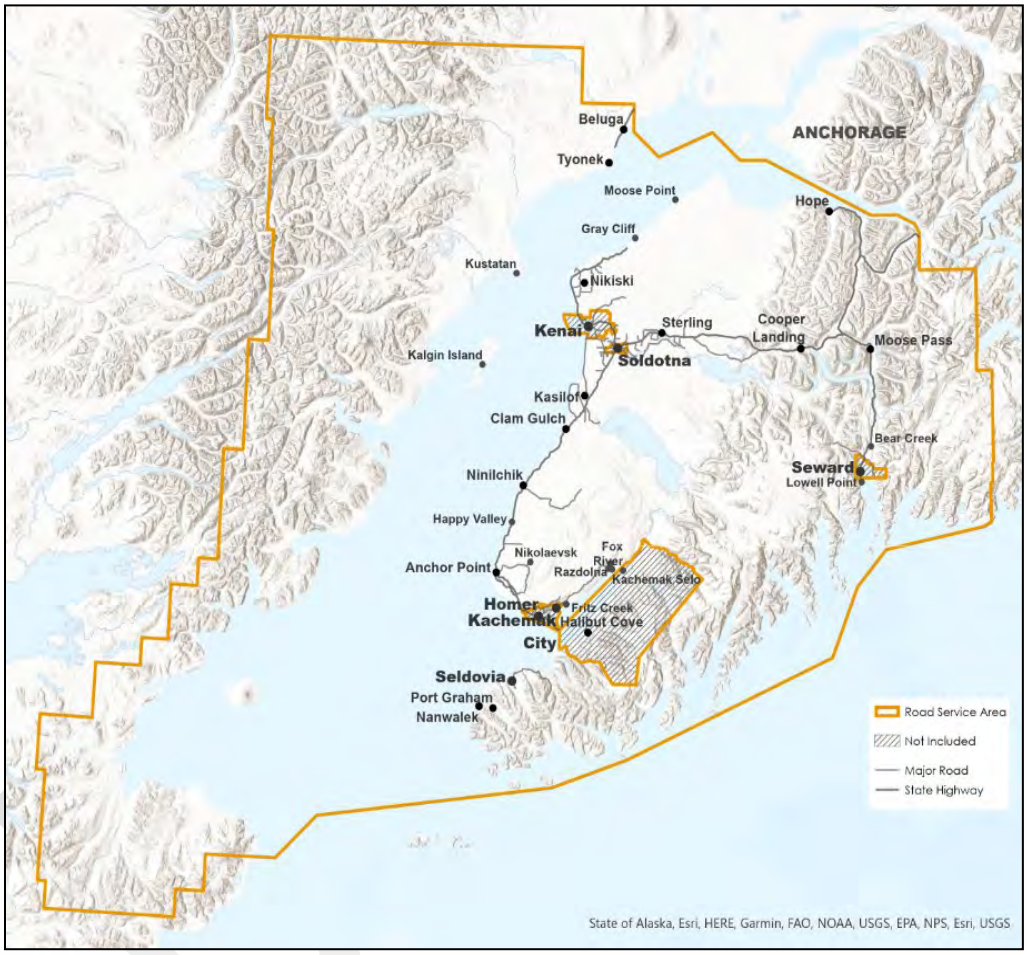


Figure 41. KPB Road Service Area

Of the approximate 1,916 miles of roads in the Borough, the State maintains 584 miles; the Borough Road Service Area (RSA) is responsible for the remaining 1,332 miles with 646 of those miles being Borough maintained. The RSA has established five regions within the Kenai Peninsula Borough as follows:

Eastern

- Sterling Highway at approximate mile post (MP) 43 to approximate MP 51 (Cooper Landing area).
- Seward Highway at approximate MP 1 to approximate MP 35 (Moose Pass/Seward).
- Hope Highway at approximate MP 15 to approximate MP 17 (Hope).

Western

- Kalifornsky Beach Road (K-Beach) from intersection at approximate MP 96 of Sterling Highway in Soldotna to intersection at approximate MP 109 Sterling Highway in Kasilof.
- Sterling Highway at approximate MP 96 to approximate MP 149. (Kasilof/ Ninilchik).

Central

- Sterling Highway at approximate MP 76 (Sterling) to approximate MP 92 (Sterling/Soldotna).
- Spur Highway at MP 1 to approximate MP 5 (Soldotna).
- Funny River Road (Soldotna)

Northern

- Kenai Spur Highway at MP 15 to approximate MP 35 (North Kenai/Nikiski).

Southern

- Sterling Highway at approximate MP 150 to approximate MP 18 East End Road (Anchor Point/Homer).
- Seldovia

Airports: ADOT&PF maintains 10 airports in the Borough: Kasilof, Quartz Creek, Ninilchik, Homer, Nanwalek, Port Graham, Beluga Lake, Seldovia, Seward, and Lawing. The City of Soldotna maintains a municipal airport, as does the City of Kenai. There are several small, private airstrips located in the Borough. These, along with public airports, are included within the State and KPB GIS maps and database.

Bridges and Large Culverts: The State owns and maintains the majority of the bridges and large culverts in the Borough (82 structures), the Borough owns and maintains 10 bridges, the National Parks Service and the City of Seward each own and maintain one bridge. There are numerous large culverts, which are essential for managing water flow and preventing flooding under roadways throughout the borough as well. The ADOT&PF performs biennial bridge inspections on all state-owned structures to ensure safety for the public who utilize the roadways. The most recently completed bridge improvement project in the KPB is the Anchor River Bridge Replacement, on Old Sterling Highway at MP 8.4. The new bridge was designed without piers in the river to avoid negatively impacting fish and wildlife habitat, to not affect natural water currents, and to not impede personal boats or watercraft on the river. Bridge replacement is being done for Quartz Creek (2023-2024), Sterling Highway MP 40.9. This includes removal and replacement of the existing bridge that was aging and needed to be upgraded.

Table 70. KPB Bridges 2023 Inventory

State Number	Seward Hwy MP	Sterling Hwy MP	Bridge Name	Owner
7059		37.6	Sterling Hwy Daves Creek #1 (culvert)	State
7174		37.6	Daves Creek #2 (culvert)	State
0676		40.9	Quartz Creek (Replacement 2023)	State
0675		47.8	Kenai River (Cooper Landing)	State
0674		50.6	Cooper Creek	State
0673		53.1	Kenai River (Schooners)	State
2270		35.1	East Fork Moose River	State
0672		82.0	Moose River	State
7057		91.8	Sterling Hwy-Soldotna Creek (culvert)	State
0671		96.0	Kenai River (Soldotna)	State
0670		109.4	Kasilof River	State
7152		110.6	Crooked Creek (culvert)	State
1873			Mile 0.3 Running Water Rd. – Crooked Creek (Kasilof area)	KPB
1149			Warren Ames Memorial Bridge (Kenai River Mile 5)	State
7079			Seward Hwy/Seward Lagoon (culvert)	State
7080			Seward Hwy/Resurrection Bl (culvert)	State
0596	2.8		Resurrection River No 1	State
0597	3.0		Resurrection River No 2	State
0598	3.1		Resurrection River No 3	State
0599	3.8		Clear Creek	State
0600	5.9		Salmon Creek	State
0601	6.6		Bear Creek	State
4004	8.0		Grouse Creek No 1 (large culvert)	State
4003	8.5		Grouse Creek No 2 (large culvert)	State
4006	12.1		Seward Hwy OH – Golden Fin (large culvert)	State
4054	14.2		MP 14.0 Railroad Crossing (large culvert)	State
4056	16.2		Grayling Creek (large culvert)	State
0603	17.1		Snow River West Channel	State
0605	17.7		Snow River Center Channel	State
4001	19.1		Seward Hwy OH (Snow R, large culvert)	State
0607	19.7		Victor Creek	State
060	23.1		Ptarmigan Creek	State
0609	25.0		Falls Creek	State
0610	25.4		Trail River	State
4090	31.8		Moose Creek (large culvert)	State
4010	42.3		Quartz Creek (large culvert)	State
4011	42.5		Summit Creek (large culvert)	State
4012	46.1		Colorado Creek (large culvert)	State
7052	51.7		Seward Hwy Pass. (culvert)	State
1964	56.4		Canyon Creek	State
7051	59.5		Seward Hwy-Silvertip (culvert)	State
0615	61.5		East Fork Six Mile Creek	State
7050	64.7		Seward Hwy-Bertha (culvert)	State

State Number	Seward Hwy MP	Sterling Hwy MP	Bridge Name	Owner
0616	63.3		Granite Creek	State
4029	68.2		Lyon and Tincan Creek (large culvert)	State
0620	75.2		Ingram Creek	State
7055			MP 2.6 Hope Hwy - Alder (culvert)	State
7054			MP 15.8 Hope Hwy - Bear (culvert)	State
1025			MP 17.1 Hope Hwy	State
4041			Mile .2 Exit Glacier Rd-No Name Creek (lg culvert) (Seward area)	State
1295			Mile 1.4 Exit Glacier Rd-Box Canyon Creek (Seward area)	State
1389			Mile 4.6 Exit Glacier Rd-Unnamed Creek (Seward area)	State
1390			Mile 7.1 Exit Glacier Rd-Resurrection River (Seward area)	Federal (NPS)
0853			Mile 0.5 Nash Rd-Salmon Creek (Seward area)	State
0854			Mile 1.9 Nash Rd-Small Creek (Seward area)	State
0855			Mile 2.0 Nash Rd-Small Creek (Seward area)	State
1821			Mile 0.1 Timber Lane Dr-Grouse Creek (Seward area)	KPB
1838			Mile 0.1 Forest Dr-Lost Creek (Seward area)	KPB
1820			Mile 0.7 Bruno Rd-Glacier Fork of Salmon Creek (Seward area)	KPB
1024			Mile 0.2 Salmon Creek Rd-Salmon Creek (Seward area)	State
1136			Mile 9.1 Lowell Pt Rd-Lowell Creek (Seward area)	City
1783			Mile 1.9 Lowell Pt Rd-Spruce Creek (Seward area)	KPB
666		17.6	South Fork Anchor River	State
1199		15.3	South Fork Anchor River	State
4020			Anchor River, MP 8.4, Old Sterling Highway (new 2022)	State
1875			North Fork Anchor River, Chakok Rd	KPB
1701			North Fork Anchor River, Cottonwood Lane	KPB
1876			North Fork Anchor River, Dorothy Drive	KPB
1834			North Fork Anchor River, MP 0.5, Anchor River/Pioneer	State
1877		42.5	Ninilchik River	State
2402			Ninilchik River, MP 0.2, Ninilchik Road	State
1877			Ninilchik River, Brody Lane	KPB
2401			Henry Creek, Lee Roy Ave	KPB
668		40.9	Deep Creek	State
1017			Seldovia Slough, MP 0.5 Seldovia Airport Rd.	State
433			Barabara Creek, MP 4.8 Jakolof Bay Rd.	State
2293		27	Stariski Creek (2 culverts)	State
4020		21	Anchor River, (4 culverts)	State

(ADOT)

Ports, Harbors, and Docks: The KPB is home to several key ports, harbors, and docks that help support both commercial and recreational activities in the region. Homer Harbor is the largest harbor in the Borough, providing extensive facilities for commercial fishing, cargo, and recreational boating. Seldovia Harbor serves as a crucial hub for local fishermen and ferry travelers from Homer along the Alaska Marine Highway. Seward Harbor is another large port, known for its deep-water facilities that accommodate large vessels and cruise ships, as well as

tourist activities. These facilities serve as a gateway to the Kenai Fjords National Park. In addition to these major ports and harbors, KPB also includes several docks and smaller facilities. The Ninilchik Harbor and Anchor Point Dock support local fishing activities and serve as vital access points for the community and tourists. The Kenai Dock and the Nikiski Dock (a privately-owned facility), support maritime infrastructure, facilitating the transport of goods and resources.

Table 71. Ports, Harbors and Docks Reserved Slips and Feet in Transient Mooring

Name	Location	Reserved Slips	Feet in Transient Mooring
Homer Harbor	Homer	920	6000
Seldovia Harbor	Seldovia	143	800
Seward Harbor	Seward	670	2000
Ninilchik Harbor	Ninilchik	32	100
Anchor Point Dock	Anchor Point	0	0
Kenai Dock	Kenai	20	300
Nikiski Dock	Nikiski	10	200

(ADOT 2022)

Railroad: The Alaska Railroad, run by the ARRC encompasses a network of tracks, bridges, and stations that facilitate the movement of goods and passengers across a portion of the Peninsula north into Fairbanks. Railroad bridges span rivers and ravines, providing crucial connections and ensuring the smooth flow of traffic along the route. Stops in the City of Seward, Grandview, and Spencer Glacier are included in the KPB. The stations along the line serve as hubs of activity, where passengers embark and disembark, and freight is loaded and unloaded. Seward serves as the Southern terminus of the railroad and is the one of the primary locations where tourist and cruise ship passengers access the railroad for travel through the rest of the state.

Southcentral Region ARRC Map

Section 14.3 Critical Facility Hazard Susceptibility

Critical facilities in the KPB are highly susceptible to all hazards included in this Plan. These facilities are essential for the Borough's functionality and safety, and any disruptions can have cascading effects. Natural hazards can cause structural damage, power outages, and access

issues. The following tables show hazards affecting critical infrastructure in the KPB, City of Seward, and City of Seldovia.

Table 72. KPB Critical Infrastructure

Facility Name	Facility Type	Location	Avalanche/Landslide	Earthquake	Flooding/Erosion	Tsunami/Seiche	Volcano	Severe Weather	Wildfire
Western Emergency Services Fire Station No. 3	Fire Station	Anchor Point		X			X	X	X
Anchor Point Senior Center	Senior Center	Anchor Point		X			X	X	X
Western Emergency Services Fire Station No. 4	Fire Station	Anchor Point		X			X	X	X
Nikolaevsk School	School	Anchor Point		X			X	X	X
Chapman School	School	Anchor Point		X			X	X	X
Anchor Point Chamber of Commerce	Government Office	Anchor Point		X			X	X	X
Cooper Landing Community Center and Library	Community Center / Library	Cooper Landing	X	X			X	X	X
Cooper Landing Fire Station	Fire Station	Cooper Landing	X	X			X	X	X
Cooper Landing Elementary	School	Cooper Landing	X	X			X	X	X
Cooper Landing Senior Center	Senior Center	Cooper Landing	X	X			X	X	X
Kachemak Emergency Services Fire Station	Fire Station	Homer		X			X	X	
McNeil Canyon Elementary	School	Homer		X			X	X	X
Kachemak Emergency Services Diamond Ridge Fire Station	Fire Station	Homer		X			X	X	
South Peninsula Hospital	Hospital	Homer		X			X	X	
Homer Medical Center	Medical Center	Homer		X			X	X	
Homer Middle School	School	Homer		X			X	X	
West Homer Elementary	School	Homer		X			X	X	
Community Christian School	School	Homer		X			X	X	
Homer Chamber of Commerce	Government Office	Homer		X			X	X	
Kenai Peninsula Borough Homer Maintenance	Government Office	Homer		X			X	X	
Homer Police Station	Police Station	Homer		X			X	X	
Homer Volunteer Fire Department	Fire Station	Homer		X			X	X	

Facility Name	Facility Type	Location	Avalanche/Landslide	Earthquake	Flooding/Erosion	Tsunami/Seiche	Volcano	Severe Weather	Wildfire
Homer High School	School	Homer		X			X	X	
Homer Flex School	School	Homer		X			X	X	
Homer City Hall	College	Homer		X			X	X	
Kenai Peninsula College Kachemak Bay Campus	College	Homer		X			X	X	
Homer Senior Center / Housing	Senior Center	Homer		X			X	X	
Paul Banks Elementary / Fireweed Academy	School	Homer		X			X	X	
City of Homer Ferry Terminal	Terminal	Homer		X			X	X	
Voznesenka School	School	Voznesenka		X			X	X	X
Kachemak Selo Elementary School	School	Kachemak Selo		X		X	X	X	X
Razdolna School	School	Port Graham		X		X	X	X	X
Port Graham School	School	Port Graham		X	X	X	X	X	X
Port Graham Volunteer Fire Station	Fire Station	Port Graham		X	X	X	X	X	X
Port Graham Medical Clinic	Medical Clinic	Port Graham		X	X	X	X	X	X
Port Graham Community Center	Community Center	Port Graham		X	X	X	X	X	X
Port Graham Generator	Generator	Port Graham		X	X	X	X	X	X
Port Graham Museum	Museum	Port Graham		X	X	X	X	X	X
Nanwalek School	School	Nanwalek		X	X	X	X	X	X
Nanwalek Generator	Generator	Nanwalek		X	X	X	X	X	X
Tustumena Elementary	School	Kasilof		X			X	X	X
Central Emergency Services Fire Station No. 6	Fire Station	Kasilof		X			X	X	X
Chuda House	Vulnerable population housing	Kenai		X			X	X	X
Wildwood Correctional Center	Correctional Facility	Kenai		X			X	X	X
Nikiski Fire Station No. 1	Fire Station	Kenai		X			X	X	X
Hope Social Hall	Community Hall	Hope		X	X	X	X	X	X
Hope and Sunrise Emergency Services	Emergency Services	Hope		X	X	X	X	X	X

Facility Name	Facility Type	Location	Avalanche/Landslide	Earthquake	Flooding/Erosion	Tsunami/Seiche	Volcano	Severe Weather	Wildfire
Hope School	School	Hope		X	X	X	X	X	X
Kaleidoscope Charter School	School	Kenai		X			X	X	X
Kenai Courthouse	Courthouse	Kenai		X			X	X	X
Kenai Police Station	Police Station	Kenai		X			X	X	X
Kenai Public Library	Library	Kenai		X			X	X	X
Kenai City Hall	City Hall	Kenai		X			X	X	X
Kenai Public Health Center	Health Center	Kenai		X			X	X	X
Marathon School (Youth Correctional Facility)	Correctional Facility	Kenai		X			X	X	X
Kenai Central High School	School	Kenai		X			X	X	X
Kenai Middle School	School	Kenai		X			X	X	X
Mountain View Elementary	School	Kenai		X			X	X	X
Kenai Senior Center	Senior Center	Kenai		X	X		X	X	X
Independent Senior Housing (Vintage Pointe)	Senior Housing	Kenai		X	X		X	X	X
Aurora Borealis Charter School/Kenai Alternative School	School	Kenai		X			X	X	X
Wings Christian Academy	School	Kenai		X			X	X	X
Grace Lutheran School	School	Kenai		X			X	X	X
Cook Inlet Aquaculture	Aquaculture Facility	Kenai		X			X	X	X
Kenai Airport	Transportation	Kenai		X			X	X	X
Central Emergency Services Fire Station No. 4	Fire Station	Kenai		X			X	X	X
Moose Pass School	School	Moose Pass	X	X			X	X	X
Moose Pass Volunteer Fire Station	Fire Station	Moose Pass	X	X			X	X	X
Trail Lake Fish Hatchery	Fish Hatchery	Moose Pass	X	X			X	X	X
Nikiski Middle/High School	School	Nikiski		X			X	X	X
Nikiski Community Center	Community Center	Nikiski		X			X	X	X
Nikiski Fire Station No. 2	Fire Station	Nikiski		X			X	X	X
Nikiski Senior Center - Apartments	Vulnerable population housing	Nikiski		X			X	X	X
Nikiski Senior Center	Senior Center	Nikiski		X			X	X	X
Nikiski Fire Station No. 3	Fire Station	Nikiski		X			X	X	X
North Star Elementary	School	Nikiski		X			X	X	X
Western Emergency Services Station No. 1	Fire Station	Ninilchik		X			X	X	X

Facility Name	Facility Type	Location	Avalanche/Landslide	Earthquake	Flooding/Erosion	Tsunami/Seiche	Volcano	Severe Weather	Wildfire
Ninilchik School	School	Ninilchik		X			X	X	X
Ninilchik Senior Center	Senior Center	Ninilchik		X			X	X	X
Alaska Christian College	College	Soldotna		X			X	X	X
Kenai Peninsula Borough Public Works	Government Office	Soldotna		X			X	X	X
Central Emergency Services Fire Station No. 2	Fire Station	Soldotna		X			X	X	X
Central Peninsula Hospital	Hospital	Soldotna		X			X	X	X
Kenai Peninsula Borough Administration and School District	Government Office	Soldotna		X			X	X	X
Soldotna Elementary and Soldotna Montessori Charter School	School	Soldotna		X			X	X	X
Soldotna City Hall	City Hall	Soldotna		X			X	X	X
Soldotna Senior Center	Senior Center	Soldotna		X			X	X	X
Soldotna High School	School	Soldotna		X			X	X	X
Redoubt Elementary	School	Soldotna		X			X	X	X
Soldotna Prep School	School	Soldotna		X			X	X	X
ADNR - Division of Forestry	Government Office	Soldotna		X			X	X	X
Central Peninsula Hospital - Withdrawal Management Services	Hospital	Soldotna		X			X	X	X
City of Soldotna Maintenance	Maintenance Facility	Soldotna		X			X	X	X
Central Peninsula Hospital - Transitional Housing	Hospital	Soldotna		X			X	X	X
Alaska State Troopers	Government Office	Soldotna		X			X	X	X
K-Beach Elementary School	School	Soldotna		X			X	X	X
Kenai Peninsula College	College	Soldotna		X			X	X	X
Kenai Peninsula Borough Office of Emergency Management	Government Office	Soldotna		X			X	X	X
Central Emergency Services Fire Station No. 1	Fire Station	Soldotna		X			X	X	X
Soldotna Police Station	Police Station	Soldotna		X			X	X	X
Donald E. Gilman River Center	Community Center	Soldotna		X			X	X	X
Central Emergency Services Fire Station No. 5	Fire Station	Soldotna		X			X	X	X
Amundsen Educational Center	School	Soldotna		X			X	X	X
ADOT&PF - Soldotna Maintenance Station	Government Office	Soldotna		X			X	X	X

Facility Name	Facility Type	Location	Avalanche/Landslide	Earthquake	Flooding/Erosion	Tsunami/Seiche	Volcano	Severe Weather	Wildfire
Skyview Middle School / River City Academy	School	Soldotna		X			X	X	X
Cook Inlet Academy	School	Soldotna		X			X	X	X
Soldotna Airport	Transportation	Soldotna		X			X	X	X
Kenai National Wildlife Refuge Headquarters	Government Office	Soldotna		X			X	X	X
Sterling Senior Center	Senior Center	Sterling		X			X	X	X
ADT&PF - Sterling Weigh Station	Transportation	Sterling		X			X	X	X
ADNR Division of Parks and Outdoor Recreation, Kenai Peninsula Region Office	Government Office	Sterling		X			X	X	X
Central Emergency Services Fire Station No. 3	Fire Station	Sterling		X			X	X	X
Sterling Elementary School	School	Sterling		X			X	X	X
Tebughna School	School	Tyonek		X	X	X	X	X	X

Table 73. City of Seward Critical Infrastructure

Facility Name	Facility Type	Location	Avalanche/Landslide	Earthquake	Flooding/Erosion	Tsunami/Seiche	Volcano	Severe Weather	Wildfire
Bear Creek Volunteer Fire and EMS	Fire and EMS Station	Seward	X	X	X	X	X	X	X
Seward High School	School	Seward		X	X	X	X	X	X
Seward Middle School	School	Seward		X	X	X	X	X	X
Seward Elementary	School	Seward		X	X	X	X	X	X
Spring Creek Correctional Facility	Correctional Facility	Seward		X	X	X	X	X	X
Alaska Vocational Technical Center	School	Seward		X	X	X	X	X	X
Seward Harbormaster	Harbormaster Office	Seward		X	X	X	X	X	X
Providence Seward Medical Center	Medical Center	Seward	X	X	X	X	X	X	X
Seward Senior Center	Senior Center	Seward		X	X	X	X	X	X
Seward Volunteer Fire Department	Fire Station	Seward	X	X	X	X	X	X	X
Seward City Hall / Police Station	Government Office	Seward		X	X	X	X	X	X

Facility Name	Facility Type	Location	Avalanche/Landslide	Earthquake	Flooding/Erosion	Tsunami/Seiche	Volcano	Severe Weather	Wildfire
Seward Association for Advancement of Marine Science	Research Facility	Seward		X	X	X	X	X	X
University of Alaska Institute of Marine Science	Research Facility	Seward		X	X	X	X	X	X
Alaska Sealife Center	Research Facility	Seward		X	X	X	X	X	X
Lowell Point Volunteer Fire Department	Fire Station	Lowell Point	X	X	X	X	X	X	X
Lowell Point Community Center	Community Center	Lowell Point	X	X	X	X	X	X	X
Eastern Road Service Area	Transportation	Seward	X	X	X	X	X	X	X
Spruce Creek Bridge	Transportation	Seward	X	X	X	X	X	X	X
Lowell Point Road Bridge	Transportation	Seward	X	X	X	X	X	X	X
Seward Airport	Transportation	Seward		X	X	X	X	X	X
Providence Med Center Heliport	Transportation	Seward		X	X	X	X	X	X
Seward Small Boat Harbor	Transportation	Seward		X	X	X	X	X	X
City of Seward Boat Launch	Transportation	Seward		X	X	X	X	X	X
Seward East Side Boat Launch	Transportation	Seward		X	X	X	X	X	X
Cruise Ship & State Ferry Dock	Transportation	Seward		X	X	X	X	X	X
Alaska Railroad Depot	Transportation	Seward		X	X	X	X	X	X

Table 74. City of Seldovia Critical Infrastructure

Facility Name	Facility Type	Location	Avalanche/Landslide	Earthquake	Flooding/Erosion	Tsunami/Seiche	Volcano	Severe Weather	Wildfire
Barabara Heights Volunteer Fire Station	Fire Station	Seldovia		X	X	X	X	X	X
Seldovia City Hall	City Hall	Seldovia		X	X	X	X	X	X
Seldovia Police / Fire / Library / Medical Clinic	Combined Facility	Seldovia		X	X	X	X	X	X
Seldovia Senior Center / Housing	Senior Center	Seldovia		X	X	X	X	X	X
Seldovia Harbormaster	Harbormaster Office	Seldovia		X	X	X	X	X	X
Susan B English School	School	Seldovia		X	X	X	X	X	X
Seldovia Community Center	Community Center	Seldovia		X	X	X	X	X	X

Facility Name	Facility Type	Location	Avalanche/Landslide	Earthquake	Flooding/Erosion	Tsunami/Seiche	Volcano	Severe Weather	Wildfire
Southern Road Service Area	Transportation	Seldovia		X	X	X	X	X	X
Seldovia Harbor	Transportation	Seldovia		X	X	X	X	X	X
Seldovia Ferry Dock	Transportation	Seldovia		X	X	X	X	X	X
City of Seldovia Airport	Transportation	Seldovia		X	X	X	X	X	X
Seldovia Slough Bridge	Transportation	Seldovia		X	X	X	X	X	X
Barabara Creek Bridge	Transportation	Seldovia		X	X	X	X	X	X

Section 14.4 Structure Values

The KPB Assessing Department provides property values for the entire borough, including unincorporated communities and, for this partial MJHMP, the cities of Seldovia and Seward. The department is responsible for discovering, listing, and fairly valuing all taxable properties in accordance with state law and borough code. It also administers tax exemption programs as authorized by law. The Borough Assessment, representing the estimated full and true value of a property as of January 1 of the assessment year, forms the basis for calculating both Borough and City taxes. Table 76 lists the 2023 structure values for residential, commercial, and institutional properties as provided by the KPB Assessing Department.

Table 75. 2023 KPB Structural Values

Communities	Residential Structures	Residential Structures Values ($)	Commercial Structures Values ($)	Institutional Structures Values ($)	Total Structure Values ($)
Anchor Point	2,183	122,604,500	9,873,700	9,599,500	142,077,700
Bear Creek	1,671	129,876,500	15,319,000	4,855,000	150,050,500
Beluga	65	1,636,200	1,641,200	$0	3,277,400
Clam Gulch	254	12,424,100	969,600	$37,100	13,430,800
Cohoe	1,767	102,161,700	3,492,700	3,700,100	109,354,500
Cooper Landing	674	55,512,700	16,843,100	1,499,700	73,855,500
Crown Point	77	4,896,000	3,813,300	1,502,800	10,212,100
Diamond Ridge	1,185	100,284,300	1,839,000	4,284,000	106,407,300
Fox River	508	23,621,100	129,000	1,708,300	25,458,400
Fritz Creek	2,029	155,406,000	1,624,500	2,413,400	159,443,900
Funny River	1,832	133,608,500	3,098,300	1,711,700	138,418,500
Halibut Cove	244	11,530,800	2,575,500	0	14,106,300

Communities	Residential Structures	Residential Structures Values ($)	Commercial Structures Values ($)	Institutional Structures Values ($)	Total Structure Values ($)
Happy Valley	964	49,398,500	2,898,700	32,600	52,329,800
Homer	3,623	414,599,100	141,525,600	81,391,500	637,516,200
Hope	324	11,011,800	1,065,000	4,820,400	16,897,200
Kachemak City	516	55,206,600	3,383,700	337,900	58,928,200
Kalifornsky	7,453	680,982,900	64,163,700	69,356,800	814,503,400
Kasilof	536	36,645,800	2,298,800	1,279,300	40,223,900
Kenai	4,623	423,341,800	181,398,400	81,354,900	686,095,100
Lowell Point	81	4,265,300	1,226,000	310,100	5,801,400
Moose Pass	221	14,774,500	2,289,600	6,310,500	23,374,600
Nanwalek	49	3,161,200	1,086,300	5,367,700	9,615,200
Nikiski	281	295,285,700	29,861,200	86,754,800	411,901,700
Nikolaevsk	281	13,127,000	194,100	8,927,800	22,248,900
Ninilchik	1,480	13,127,000	14,853,700	2,995,900	30,976,600
Port Graham	75	4,011,100	2,245,600	4,669,900	10,926,600
Primrose	100	6,688,200	262,500	0	6,950,700
Pt. Possession	179	2,062,600	0	0	2,062,600
Ridgeway	2,258	189,627,200	16,198,900	576,600	206,402,700
Salamatof	649	48,278,900	21,687,800	3,670,500	73,637,200
Seldovia	266	19,166,200	7,794,700	21,715,100	48,676,000
Seldovia Village	303	15,335,200	964,600	2,444,700	18,744,500
Seward	1,112	121,018,700	116,967,000	93,498,800	331,484,500
Soldotna	2,912	292,817,500	153,280,900	95,565,900	541,664,300
Sterling	6,435	557,504,100	30,177,400	13,065,000	600,746,500
Sunrise	41	1,858,800	400,000	0	2,258,800
Total	**47,251**	**$4,126,858,100**	**$857,443,100**	**$615,758,300**	**$5,600,059,500**

Section 14.5 Vulnerability Assessment

A vulnerability analysis or assessment predicts the extent of exposure that may result from a hazard event of a given intensity within a specific area. This analysis provides quantitative data to identify and prioritize potential mitigation measures, enabling communities to focus on areas with the greatest risk of damage. This assessment outlines the risk and vulnerability processes from various hazard impacts in determining potential losses for the community.

Section 14.6 Vulnerability Assessment Methodology

The planning team used existing structure values from KPB Assessing (2023), as well as critical facilities that were part of the past HMPs. Any newly constructed critical facilities or closed/deconstructed facilities since the last plans were put in place were included in or

removed from the critical facility inventory. Analysis was conducted to assess the risks of each identified hazard included in the plan. This analysis looked at the potential effects of each hazard on values of critical facilities as well as geographic areas, percentage of population and number or residences affected. GIS Mapping was used to determine areas that were within hazard zones using resources from FEMA, DGGS, USACE, ADOT&PF and the KPB Community Wildfire Protection Plan (2022).

The vulnerability estimates provided use the best data currently available, and the methodologies applied result in a risk approximation. These estimates may be used to understand relative risk from hazards and potential losses. However, uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning hazards and their effects on the built environment as well as the use of approximations and simplifications that are necessary for a comprehensive analysis. It is beyond the scope of this Plan Update to develop a more detailed or comprehensive risk assessment (including annualized losses, people injured or killed because of a hazard, shelter requirements, facility/system function losses and economic losses).

Table 76 summarizes the methodology used to determine vulnerability for each hazard included in the Plan Update (Human-Caused Hazards were not included in this vulnerability assessment).

Table 76. Vulnerability Assessment Methodology 2024

Hazard	Methodology
Flooding and Erosion	FIRM Maps were used for areas at risk for flooding and erosion. Existing 2016 FIRM maps as well as the proposed 2024 FIRM maps were used for these determinations. Areas of concern regarding coastal erosion used DGGS coastal erosion studies as well as information in erosion reports provided by USACE. The KPB as well as the City of Seward are participants in the NFIP; additional flooding data and mapping information was provided from the SBCFSA and KPB River Center to determine specific flood hazard areas.
Wildfire	Utilized ARRA Analysis Area figure from 2022 CWPP. These showed areas in the KPB that were at risk for wildfire and had a probability greater than zero. Areas not included in the coverage include glaciers, water bodies or non-burnable vegetation.
Earthquake	Using the DGGS's Quaternary Fault and Folds Database, as well as historical earthquake data from USGS, the entire KPB is at risk of earthquake.
Severe Weather	Using NWS and historical data from NOAA, the entire KPB is at risk to Severe Weather.
Tsunami/ Seiche	DGGS Tsunami Inundation Maps were used to determine tsunami risk areas as well as tsunami evacuation zone area maps. Areas covered by tsunami inundation mapping include Anchor Point, Homer, Hope, Kachemak Selo, Seldovia and Seward.
Volcano	Ash Fall coverage maps from AVO were used to determine whether the entire KPB is at risk when determined by historical volcanic activity. Mount Spurr, Mount Iliamna, Mount Redoubt and Mount Augustine each have had historical volcanic activity that has affected the borough.
Avalanche/ Landslide	Landslide hazard areas were determined through historical data from ADOT&PF and the USGS historical landslide inventory. DGGS Avalanche coverage area maps were used to determine areas that had historical and ongoing risks of avalanches that were in proximity to infrastructure and communities.

The following tables overview the vulnerability risk for the KPB, and the Cities of Seward and Seldovia, including geographic area, population, residences, and critical facilities affected by percentage.

Table 77. KPB Vulnerability Overview Analysis 2024

Hazard	KPB Vulnerability Overview			
	Borough Land Area (Percent %)	Population Affected (Percent %)	Residences Affected (Percent %)	Critical Facilities Affected (Percent %)
Flooding and Erosion	10	5	3	10
Wildfire	70	90	90	90
Earthquake	100	100	100	100
Severe Weather	100	100	100	100
Tsunami/Seiche	15	20	20	20
Volcano	100	100	100	100
Avalanche/Landslide	3	2	2	3

Table 78. City of Seward Vulnerability Overview Analysis

Hazard	City of Seward Vulnerability Overview			
	City Land Area (Percent %)	Population Affected (Percent %)	Residences Affected (Percent %)	Critical Facilities Affected (Percent %)
Flooding and Erosion	35	50	45	50
Wildfire	100	100	100	100
Earthquake	100	100	100	100
Severe Weather	100	100	100	100
Tsunami/Seiche	100	100	100	100
Volcano	100	100	100	100
Avalanche/Landslide	35	30	10	5

Table 79. City of Seldovia Vulnerability Overview Analysis

Hazard	City of Seldovia Vulnerability Overview			
	City Land Area (Percent %)	Population Affected (Percent %)	Residences Affected (Percent %)	Critical Facilities Affected (Percent %)
Flooding and Erosion	33	50	40	20
Wildfire	100	100	100	100
Earthquake	100	100	100	100
Severe Weather	100	100	100	100
Tsunami/Seiche	100	100	100	100
Volcano	100	100	100	100
Avalanche/Landslide	5	5	5	1

Section 14.7 Vulnerability Exposure Analysis of Critical Assets

Critical assets that may be affected by hazard events include population, residential buildings, critical facilities and infrastructure. A critical facility is defined as a facility that provides essential products and services to the public. Critical facilities assist in preserving the quality of life in the KPB, City of Seward and City of Seldovia and provide fulfilling of important public safety, emergency response, and disaster recovery functions. The critical facilities profiled in this plan include government facilities, emergency response services, educational facilities, medical facilities, roads and bridges, transportation facilities, utilities, and community facilities. A full list of KPB and Cities of Seldovia and Seward critical facilities and their assessed value from the KPB Assessing Department can be found in the State Template Appendix to this plan. Additional costs estimations developed for bridges, utilities, and transportation facilities were developed based on information from existing reports and plans (ADOT&PF, FEMA, 2020 City of Seward HMP, and 2023 State Hazard Mitigation Plan) as well as publicly available information.

Table 80. KPB Vulnerability Exposure Analysis

Hazard	KPB Potential Hazard Exposure Analysis							
	Critical Facilities (number affected)	Critical Facilities (Estimated Value of Losses)	Residential Structures (number affected)	Residences/ Improved Parcels (Estimated value of losses)	Transportation Networks (number of segments/facilities affected)	Transportation Networks (Estimated value of losses)	Utility Systems (number of facilities affected)	Utility Systems (Estimated value of losses)
Flooding and Erosion	31	$202,919,400	456	$22,675,461	144	$2,171,520,000	2	$63,319,500
Wildfire	118	$798,293,600	43,694	$3,704,845,100	228	$3,777,113,000	31	$916,129,000
Earthquake	135	$1,021,089,400	47,317	$4,119,444,200	271	$4,177,983,000	39	$944,589,000
Severe Weather	135	$1,021,089,400	47,317	$4,119,444,200	271	$4,177,983,000	39	$944,589,000
Tsunami/Seiche	33	$186,242,400	12,902	$1,086,710,000	85	$1,491,727,000	18	$210,229,000
Volcano	135	$1,021,089,400	47,317	$4,119,444,200	271	$4,177,983,000	39	$944,589,000
Avalanche/Landslide	16	$164,772,400	481	$24,265,300	54	$1,171,520,000	2	$18,091,286

Table 81. City of Seward Vulnerability Exposure Analysis

Hazard	City of Seward Potential Hazard Exposure Analysis							
	Critical Facilities (number affected)	Critical Facilities (Estimated Value of Losses)	Residential Structures (number affected)	Residences/ Improved Parcels (Estimated value of losses)	Transportation Networks (number of segments/facilities affected)	Transportation Networks (Estimated value of losses)	Utility Systems (number of facilities affected)	Utility Systems (Estimated value of losses)
Flooding and Erosion	10	$164,670,900	507	$54,458,415	10	$121,379,555	5	$7,547,082
Wildfire	16	$164,670,900	1,112	$121,018,700	18	$220,690,100	12	$16,406,700
Earthquake	16	$164,670,900	1,112	$121,018,700	18	$220,690,100	12	$16,406,700
Severe Weather	16	$164,670,900	1,112	$121,018,700	18	$220,690,100	12	$16,406,700
Tsunami/Seiche	16	$164,670,900	1,112	$121,018,700	18	$220,690,100	12	$16,406,700
Volcano	16	$164,670,900	1,112	$121,018,700	18	$220,690,100	12	$16,406,700
Avalanche/Landslide	8	$70,048,900	226	$24,265,300	10	$121,379,555	4	$4,922,010

Table 82. City of Seldovia Vulnerability Exposure Analysis

Hazard	City of Seldovia Potential Hazard Exposure Analysis							
	Critical Facilities (number affected)	Critical Facilities (Estimated Value of Losses)	Residential Structures (number affected)	Residences/ Improved Parcels (Estimated value of losses)	Transportation Networks (number of segments/facilities affected)	Transportation Networks (Estimated value of losses)	Utility Systems (number of facilities affected)	Utility Systems (Estimated value of losses)
Flooding and Erosion	3	$282,600	155	$10,541,410	4	$3,989,920	2	$2,327,000
Wildfire	7	$20,460,400	266	$19,166,200	6	$4,987,400	2	$2,327,000
Earthquake	7	$20,460,400	266	$19,166,200	6	$4,987,400	2	$2,327,000
Severe Weather	7	$20,460,400	266	$19,166,200	6	$4,987,400	2	$2,327,000
Tsunami/Seiche	7	$20,460,400	266	$19,166,200	6	$4,987,400	2	$2,327,000
Volcano	7	$20,460,400	266	$19,166,200	6	$4,987,400	2	$2,327,000
Avalanche/Landslide	1	$74,400	14	$958,310	2	$1,496,220	2	$2,327,000

Section 14. Critical Infrastructure Maps

Due to the expansive coverage area of the KPB critical infrastructure in this HMP, critical infrastructure is mapped based on geographic areas or regions within the borough. A detailed inventory of critical infrastructure maps by area or community is provided in Appendix H.

Section 15 Plan Maintenance

The KPB Office of Emergency Management (OEM) and Local Emergency Planning Committee (LEPC) are responsible for monitoring, evaluating, and updating the KPB Hazard Mitigation Plan in accordance with 44 CFR 201.6. The Hazard Mitigation Plan will be continually monitored, evaluated annually, and updated every five years. In the event of a Presidential Disaster Declaration, in accordance with FEMA requirements, the plan will be reviewed within 90 days of the event and updated within 12 months if necessary. The KPB LEPC will conduct an annual evaluation of the plan. Local government staff from the City of Seward and City of Seldovia participate in these LEPC meetings and it will be the goal that their respective community input is included in any direct updates or changes in the plan. LEPC meetings are open to the public and those members of the community interested in providing input for changes to mitigation goals or projects will be allowed to comment through public testimony. LEPC meetings occur quarterly, and the public is encouraged to attend either in person or remotely through video teleconference. Table 83 outlines the method and schedule for reviewing and updating the plan.

Table 83. LEPC Plan Monitoring and Maintenance

Year	Action
2024	Update approved by FEMA and adopted by KPB Assembly; posted on OEM website; point of contact (POC): Emergency Manager
2025	Year 1 – LEPC works with KPB to identify and seek funding sources for prioritized mitigation projects; status and updates will be posted on OEM website; new events will be evaluated, and the plan will be monitored and updated if necessary; POC – Emergency Manager
2026	Year 2 – LEPC will review status of projects and public outreach; new events will be evaluated, and the plan will be updated if necessary; project status will be monitored and updated on the OEM website: POC – Emergency Manager
2027	Year 3 – LEPC will review status of projects and public outreach; new events will be evaluated, and the plan will be updated if necessary; project status will be updated on OEM website: POC – Emergency Manager
2028	Year 4 – OEM will begin the full public update process, including the remaining 4 cities, to result in a full MJHMP, in coordination with the LEPC and the cities; evaluation of the Plan will include review of new events since the past update, notable new risk changes will be addressed with new goals added if appropriate; status of past goals and the overall Plan will be evaluated; POC – Emergency Manager
2029	Year 5 – the LEPC will review the final draft with recommendations, the KPB Planning Commission will review and make recommendations, the Assembly will review and adopt subject to FEMA approval: POC – Emergency Manager

Section 15.1 Plan Integration

Plan integration outlines how the KPB OEM, Seward Planning Department, and City of Seward will implement and coordinate existing planning mechanisms into future updates, as required by the DMA 2000 and its regulations. Due to continuous staff turnover, the new leadership is working to integrate plan components into existing planning documents and procedures.

The KPB OEM and the Cities of Seward and Seldovia host annual outreach activities to engage the public in hazard mitigation. These activities facilitate public discussions and explain the need to integrate mitigation actions into borough and city planning initiatives. Successful outreach

events include the KPB Ready, Set, Go! Program. The Ready, Set, Go! (RSG) Program provides the knowledge and awareness for helping the public get started with disaster preparedness. The RSG! Program also provides tools and resources for individuals and community influencers to use as they help the community gain an understanding of their disaster risk, and actions that individuals can take to reduce that risk in the event of a natural disaster.

The KPB OEM also collaborates with local agencies, city governments, companies, and stakeholders to prepare for hazard response through direct outreach, training, education, and response exercises. Refer to Table 84 and Table 85 for details.

Table 84. Training, Outreach and Education in the Borough (2018-2024)

Exercises	Type	Host/Facilitated By	Date
PIO Regroup	Tabletop	KPB OEM	February 2018
KPB IMT-III Earthquake Discussion	Tabletop	KPB OEM	August 2018
Community Emergency Response Teams (CERT) Western Shelter Deployment	Drill	KPB OEM	August 2018
KPB Assembly Building All-Call	Functional/Command Post	KPB OEM	August 2018
Homer Open Point of Distribution	Full-Scale	City of Homer	December 2018
Alaska Shield 19	Full-Scale	KPB OEM	April 2019
City of Seward Tsunami Warning	Tabletop	KPB OEM & City of Seward	November 2020
Marathon Refinery Active Shooter	Tabletop	Marathon Petroleum	December 2021
Cooper Lake Dam Response-Pt 1	Tabletop	Chugach Electric	February 2022
Cooper Lake Dam Response-Pt 2	Tabletop	Chugach Electric	March 2022
Resurrection Bay Tsunami Response	Tabletop	KPB OEM	July 2022
Kenai Airport Mass Casualty	Full-Scale	City of Kenai Airport	October 2022
North Pen Rec COOP	Tabletop	KPB OEM	January 2023
Solid Waste Department COOP	Tabletop	KPB OEM	February 2023
Maintenance Department COOP	Tabletop	KPB OEM	May 2023
Nikiski Fire Department COOP	Tabletop	KPB OEM	June 2023
Mass Casualty Response	Full-Scale	Alaska DH&HS	October 2023
Tsunami Response	Tabletop	City of Valdez	October 2023
Marathon Spill Response	Functional	Marathon Petroleum	October 2023
Trucking HAZMAT Response	Tabletop	KPB OEM/ADEC	January 2024
Wildfire Evacuation	Tabletop	KPB OEM	February 2024
AlaskEx 24- Comms & EOC	Functional/Command Post	KPB OEM	March 2024
AlaskEx 24- Sheltering	Tabletop	KPB OEM	March 2024
Alaska Regional Rehearsal of Concept	Tabletop	DHS&EM	April 2024

Table 85. Response Exercises in the Borough 2018-2024

Courses Held/Instructed by KPB OEM	Date
CERT Basic Training- Homer Area	January 2018
Teen CERT- Razdolna	March 2018
CERT Basic Training- Soldotna Area	April 2018
CERT Supplemental Training- Wildfire Refresher	May 2018
CERT Basic Training- Seward Area	September 2018
L0949 Situation Unit Leader	November 2018
CERT Basic Training- Soldotna Area	February 2019
CERT Basic Training- Kenai Area	March 2019
CERT Supplemental Training- Evacuation and Disaster Help Center	April 2019
CERT Basic Training- Homer Area	April 2019
CERT Supplemental Training- Residential Defensible Space	May 2019
CERT Supplemental Training- Leadership and Team Org- Homer	October 2019
CERT Supplemental Training- Leadership and Team Org- Kasilof	October 2019
CERT Supplemental Training- Leadership and Team Org- Sterling	October 2019
CERT Supplemental Training- Leadership and Team Org- Soldotna	October 2019
CERT Supplemental Training- Leadership and Team Org- Nikiski	November 2019
CERT Supplemental Training- Leadership and Team Org- Ninilchik	December 2019
CERT Basic Training- Soldotna Area	December 2019
CERT Supplemental Training- Safety in the Field- Nikiski	January 2020
CERT Supplemental Training- Safety in the Field- Homer	January 2020
CERT Supplemental Training- Leadership and Team Org- Soldotna	January 2020
G0300 Intermediate for Expanding Incidents	May 2021
G0400 Advanced ICS for Command and General Staff	September 2021
L0950 All-Hazards Incident Commander	November 2021
K0419 Shelter Field Guide Management	March 2022
PER-386 Whole Community Inclusive Economic Recovery	September 2022
MGT-403V Underserved Populations Preparedness Planning for Rural Responders and Volunteers	November 2022
L0952 All-Hazards Public Information Officer	April 2023
G0400 (Co-Instructed with Seldovia Village Tribe)	September 2023
MGT-416V Continuity of Government Operations Planning (COOP) for Rural Communities	November 2023
G0361 Flood Response Operations	May 2024
L0964 Situation Unit Leader	September 2024

(OEM)

Once the HMP Update is adopted and receives FEMA's final approval, each Planning Team member will help to integrate components within future plans, processes, and studies. They additionally will seek opportunities to integrate the HMPs mitigation goals or actions into projects or initiatives whenever possible. Members of the planning team will additionally track the status and progress of projects or actions and provide an annual report to the LEPC during one of their quarterly meetings of the progress, as well as reporting on mitigation successes and/or failures.

Section 15.2 Ongoing Public Involvement

The HMP Update Planning Team will involve the public directly to review, reshape and update the HMP. Public involvement in plan maintenance will be achieved by:

- Posting the plan and updates on the OEM website
- Publishing public notice of LEPC meetings that will consider elements of the Plan
- Posting LEPC meeting minutes on the OEM website
- Full inclusion of the cities and the public in the update process through public meetings and outreach

There will be paper copies at Borough offices in Seward and Soldotna as well as City Hall in Seward and the City Office in Seldovia. Included in these documents will also be contact information for planning team members to whom people can direct their comments or concerns. The Plan will also remain available on the OEM, City of Seward, and City of Seldovia websites for public reference. The planning team, during the five-year plan cycle, will strive to continue identifying opportunities to raise community awareness about the HMP and hazards affecting local communities. Any public comments received regarding the HMP during its five-year lifecycle will be collected by the planning team leader and team members who will include the information within the annual report for consideration during future updates to the plan.

Section 15.3 Plan Update

The planning team will review and integrate HMP components into their planning documents throughout the plan's five-year lifecycle and after significant occurrences, such as disaster events. They will conduct annual reviews through questionnaires and progress reports to assess their success in integrating mitigation action plan goals. These annual reviews will help streamline MJHMP updates and reduce the planning team's efforts over the five years. Annual Review Questionnaires and Progress Reports will help identify necessary changes, resource allocations, and support for plan integration and implementation. Completed mitigation actions and goals will be documented in Section 2 of the plan.

Since the KPB aims to develop an MJHMP to include all cities within the Borough and potentially tribal entities in the next update cycle, the update process will continue beyond the 2024 HMP update. In the first year, outreach should be conducted with the governments of Kenai, Soldotna, Homer, and Kachemak City to keep these communities informed. Additionally, discussions with tribal leadership should address the integration of tribal entities in future updates. Ongoing communication and support through the state DHSEM and FEMA will help facilitate these efforts.

The Planning Team will use the Annual KPB Hazard Mitigation Plan Review Questionnaire and Annual Mitigation Action/Project Progress Report below to help evaluate the effectiveness of the Plan and monitor progress on mitigation actions and projects.

Annual KPB Hazard Mitigation Plan Review Questionnaire				
Plan Section	**Questions**	**Yes**	**No**	**Comments**
Planning Process	Are there internal or external organizations and agencies that have been invaluable to the planning process or to mitigation action?			
	Are there procedures (e.g. meeting announcements, plan updates) that can be done more efficiently?			
	Has the Planning Team undertaken any public outreach activities regarding the HMP or implementation of mitigation actions?			
Hazard Profiles	Has a natural disaster occurred during this reporting period?			
	Is there a natural hazard that has not been addressed in this HMP and should be?			
	Are additional maps or new hazard studies available? If so, what have they revealed?			
Vulnerability Analysis	Do any critical facilities or infrastructure need to be added to the asset lists?			
	Have there been development patterns changes that could influence the effects of hazards or create additional risks?			
Mitigation Strategy	Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning within the City of Village as applicable			
	Are the goals still applicable?			
	Should new mitigation actions be added to the Mitigation Action Plan (MAP)?			
	Do existing mitigation actions listed in the Mitigation Strategies' MAP need to be reprioritized?			
	Are the mitigation actions listed in the MAP appropriate for available resources?			

Annual Mitigation Action/Project Progress Report

Progress Report Period Start Date: _____ End Date: _____

Mitigation Action/Project Title: _____

Mitigation Action/Project ID#: _____

Responsible Agency: _____

Contact Name: _____

Contact Phone/Email: _____

Supporting Agencies and Contacts: _____
_____
_____
_____

Action/Project Approval Date: _____ **Action/Project Start Date:** _____

Anticipated Completion Date: _____

☐ Project Status Update ☐ Project Completed ☐ Project Cancelled ☐ Project on Schedule

☐ Project Delayed (explain): _____

_____

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

Milestones	Status (Complete, Incomplete, In Progress)	Projected Completion Date

Annual Mitigation Action/Project Progress Report

Mitigation Action/Project(s) Addressed:

_____
_____
_____
_____

Goal:_____
_____
_____
_____

Success Indicators:

_____
_____
_____
_____
_____

Summary of Mitigation Action/Project Progress

1. What was accomplished for this mitigation action/project during this reporting period?

   _____
   _____
   _____
   _____

2. What obstacles, problems, or delays did the action/project encounter?

   _____
   _____
   _____
   _____
   _____

3. If uncompleted, is the action/project still relevant? Should the action/project be changed or revised?

   _____
   _____
   _____
   _____

4. Other comments

_____

_____

_____

_____

_____

Section 16 Plan Adoption

The 2024 KPB Hazard Mitigation Plan was adopted by the:

- Kenai Peninsula Borough by Ordinance 2024-X on Date. The Ordinance was signed by NAME, the KPB Assembly President.
- The City of Seldovia by City Council Resolution and Adoption on 2024-X on Date.
- The City of Seward by City Council Resolution and Adoption on 2024-X on Date.

Copies of these adoption ordinances will be included in Appendix E

Section 17 References

1. FEMA Benefit-Cost Analysis Website: https://www.fema.gov/grants/guidance-tools/benefit-costanalysis

2. FEMA How to Guides, Website: https://www.fema.gov/emergency-managers/riskmanagement/

Hazard-mitigation-Planning

- Getting Started: Building Support for Mitigation Planning (FEMA 386-1)
- Understanding Your Risks: Identifying Hazards and Estimating Losses (FEMA 386-2)
- Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies
- (FEMA 386-3)
- Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA 386-4)
- Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)

Avalanches and Landslides

1.) "The Landslide Handbook" USGS, 2008, website: https://pubs.usgs.gov/circ/1325/pdf/Sections/Section1.pdf
2.) "Avalanche Types" National Avalanche Center, 2024, website: https://pubs.usgs.gov/circ/1325/pdf/Sections/Section1.pdf
3.) "Avalanche Terrain" Avalanche Canada, 2024, website: https://avalanche.ca/start-here
4.) "Avalanche Resources" CNFAIC, 2024, website: https://www.cnfaic.org/resources/
5.) "Accidents for All Regions" CNFAIC, 2024, website: https://www.cnfaic.org/view-accidents/
6.) "Landslide Hazards" DGGS, 2024, website: https://dggs.alaska.gov/hazards/landslides.html
7.) "Snow Avalanche Programs" ADOT, 2024, website: https://dot.alaska.gov/stwdmno/avalanche.shtml
8.) "Landslide Basics" USGS, 2024, website: https://www.usgs.gov/programs/landslide-hazards/landslide-basics
9.) "Landslide Inventory" USGS, 2024, website: https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=ae120962f459434b8c904b456c82669d
10.) "State of Emergency Due to Landslide On Lowell Point Road" City of Seward, 2022, website: https://www.cityofseward.us/Home/Components/News/News/1601/
11.) "Snow Avalanches" DGGS, 1982, website: https://dggs.alaska.gov/hazards/climate/snow-avalanches.html

Earthquakes

1.) "The Science of Earthquakes" USGS, 2024, website: https://www.usgs.gov/programs/earthquake-hazards/science-earthquakes
2.) "Recent Earthquakes" AEC, 2024, website: http://earthquake.alaska.edu/earthquakes/recent_list
3.) "Earthquake Events Map" AEC, 2024, website: http://earthquake.alaska.edu/earthquakes
4.) "Quaternary Fault and Fold Database of the United States" USGS, 2024, website: https://www.usgs.gov/programs/earthquake-hazards/faults
5.) Risk Report, FEMA Region X-Kenai Peninsula Borough, Alaska and the Incorporated Cities

of Homer, Kachemak, Kenai, Seldovia, Seward, and Soldotna, FEMA, DCCED, DGGS, Published December 2017 website: https://www.commerce.alaska.gov/web/Portals/4/pub/Risk_Report_Kenai_Final.pdf
6.) "Alaska State Adoptions" ICC, 2021, website: https://www.iccsafe.org/advocacy/adoptions-map/alaska/
7.) "Vulnerability of Some Kenai Peninsula Borough Schools to Earthquake Damage Based on Rapid Visual Screening" KPBSD, 2015, website: https://www.eeri.org/images/sesi/Rapid-Visual-Screening-of-Kenai-Borough-Schools-December-1-2015.pdf
8.) "Seismic Hazard Maps" USGS, 1999, website: https://pubs.usgs.gov/imap/i-2679/i2679-1.pdf

Flooding/Erosion

1.) "Salmon Creek Revetment" USACE, 2019, website: https://www.poa.usace.army.mil/Portals/34/docs/operations/EFC/2019SalmonCreekOverview.pdf?ver=2020-04-30-171655-493
2.) "Erosion Information Paper - Seward, Alaska" 2008, website: https://www.poa.usace.army.mil/Portals/34/docs/civilworks/BEA/Seward_Final%20Report.pdf
3.) "Storm Events Tracker" NOAA, 2024, website: https://www.ncdc.noaa.gov/stormevents/
4.) "National Flood Hazards" FEMA, 2024, website: https://www.fema.gov/flood-maps/national-flood-hazard-layer
5.) "Flooding in Alaska" NWS, 2024, website: https://www.weather.gov/safety/flood-states-ak
6.) "Flood Maps" FEMA, 2024, website: https://www.weather.gov/safety/flood-states-ak
7.) "Kenai Peninsula Borough, Alaska FIS Study Vol 1 and 2 " FEMA, 2023, website: https://hazards.fema.gov/femaportal/prelimdownload/searchResult.action
8.) "National Flood Insurance Program (NFIP) Floodplain Management Requirements" FEMA, 2023, website: https://www.fema.gov/sites/default/files/documents/fema-480_floodplain-management-study-guide_local-officials.pdf
9.) "Flood Hazard Analysis of Seward Mapped Area Data" AWR Engineering, SBCFSA 2023, website: https://gis.kpb.us/map/resources/documents/SMFDA_Report_FloodHazardAnalyses.pdf

Severe Weather

1.) "Severe Weather Definitions" NWS, 2024, website: https://www.weather.gov/bgm/severedefinitions
2.) "Disasters and Other Declarations" FEMA, 2024, website: https://www.fema.gov/disaster/declarations
3.) "Alaska 511" ADOT, 2024, website: https://511.alaska.gov/
4.) "StormReady Program" NWS, 2024, website: https://www.weather.gov/StormReady
5.) "Storm Prediction Center" NWS/NOAA, 2024, website: https://www.spc.noaa.gov/
6.) "US Drought Monitor" USDS/NOAA, 2024, website: https://droughtmonitor.unl.edu/
7.) "Scenarios Network for Alaska & Arctic Planning (SNAP)" UAF, 2024, website: https://uaf-snap.org/

Tsunami/Seiches

1.) "Tsunamis" NOAA, 2024, website: https://www.noaa.gov/education/resource-collections/ocean-coasts/tsunamis

2.) "Seiches" NOAA, 2024, website: https://oceanservice.noaa.gov/facts/seiche.html
3.) "Deep-ocean Assessment and Reporting of Tsunamis" NOAA, 2024, website: https://nctr.pmel.noaa.gov/Dart/
4.) "TsunamiReady Program" NOAA, 2024, website: https://www.weather.gov/TsunamiReady/
5.) "Emergency Alert System" DHSEM, 2024, website: https://ready.alaska.gov/Operations/EAS
6.) "US Tsunami Warning System" NOAA, 2024, website: https://tsunami.gov/
7.) "Historic Tsunami Events" NOAA, 2024, website: https://www.ngdc.noaa.gov/hazard/tsu_db.shtml
8.) "Tsunami Inundation Mapping" DGGS, 2024, website: https://dggs.alaska.gov/pubs/tsunami
9.) "Tsunami Modeling" DGGS, 2024, website: https://dggs.alaska.gov/hazards/tsunamis.html

Volcanoes

1.) "Alaska Volcanoes" AVO, 2024, website: https://avo.alaska.edu/volcano/
2.) "Volcano Types" USGS, 1999, website: https://pubs.usgs.gov/gip/volc/types.html
3.) "Volcano Hazard Program" USGS, 2024, website: https://www.usgs.gov/vhp
4.) "Volcanoes & Glaciers" DGGS, 2024, website: https://dggs.alaska.gov/popular-geology/volcanoes-glaciers.html
5.) "Ashfall" DGGS, 2024, website: https://dggs.alaska.gov/pubs/hazards/ashfall
6.) "Redoubt" AVO, 1998, website: https://avo.alaska.edu/volcano/redoubt
7.) "Augustine" AVO, 1999, website: https://avo.alaska.edu/volcano/augustine
8.) "Iliamna" AVO, 1998, website: https://avo.alaska.edu/volcano/iliamna
9.) "Volcanic Alert System" AVO, 2013, website: https://avo.alaska.edu/pdfs/cit8283.pdf
10.) "Volcanic Explosivity Index (VEI)" AVO, 2024, website: https://www.nps.gov/subjects/volcanoes/volcanic-explosivity-index.htm

Human-Caused Hazards

1.) "Hazard Waste Program" ADEC, 2024, website: https://dec.alaska.gov/eh/hazardous-waste/
2.) "Hazardous Waste" EPA, 2024, website: https://www.epa.gov/hw/learn-basics-hazardous-waste
3.) "National Levee Database" USACE, 2024, website: https://levees.sec.usace.army.mil/
4.) "National Inventory of Dams" USACE, 2024, website: https://nid.sec.usace.army.mil/#/
5.) "State Emergency Response Commission" DHSEM, 2024, website: https://ready.alaska.gov/serc
6.) "State Corrections Department" ADOC, 2024, website: https://doc.alaska.gov/corrections/
7.) "Cook Inlet Spill Prevention & Response" NOAA/EPA/ADEC, 2024, website: https://www.cispri.org/
8.) "Clean Water Act" USACE, 2024, website: https://www.spl.usace.army.mil/Missions/Regulatory/Jurisdictional-Determination/Section-404-of-the-Clean-Water-Act/
9.) "Hazard Waste Regulations" ADEC, 2024, website: https://dec.alaska.gov/eh/regulations/hazardous-waste-regulations/
10.) "Alaska Ocean Observing System" NOAA, 2024, website: https://aoos.org/
11.) "Cook Inlet Regional Citizens Advisory Council" NOAA, 2024, website: https://www.circac.org/programs/
12.) "Lowell Creek Flood Diversion" USACE, 2021, website: https://www.poa.usace.army.mil/Portals/34/docs/civilworks/publicreview/LowellCreek/May2021/LowellCreekAppendixA404b1.pdf?ver=Crj4CqmZOLMZqW5pWIEKXg%3D%3D
13.) "Erosion Study" USACE, 2008, website: https://www.poa.usace.army.mil/Portals/34/docs/civilworks/BEA/Seward_Final%20Report.pdf

14.) "Fourth of July Creek Levee" ADEC, 2001, website: https://dec.alaska.gov/media/11840/cikb18fourthofjulycreek.pdf&ved=2ahUKEwinmOD5wriGAxWvHzQIHTigBNkQFnoECA4QAQ&usg=AOvVaw3CZURjdCCdK9pxUkE1_pn8
15.) "Hazardous Waste Compliance Monitoring" EPA, 2024, website: https://www.epa.gov/compliance/hazardous-waste-compliance-monitoring
16.) "Water Research Program" Kenai Watershed Forum, 2024, website: https://www.kenaiwatershed.org/science-in-action/research-information/water-quality/
17.) "Contaminated Sites" ADEC, 2024, website: https://dec.alaska.gov/applications/spar/publicmvc/csp/search
18.) "Solid Waste Sites" ADEC, 2024, website: https://data-soa-adec.opendata.arcgis.com/maps/62fdb1df542a4e178f08cf2453ffc36f/explore
19.) "Hazardous Waste Transportation" EPA, 2024, website: https://www.epa.gov/hw/hazardous-waste-transportation
20.) "Hazardous Waste Reporting" ADEC, 2024, website: https://dec.alaska.gov/spar/ppr/spill-information/reporting

Wildfire

1.) "Evaluating the effectiveness of fuel treatments in Alaska" USFS, 2028, website: https://www.fs.usda.gov/research/treesearch/58856
2.) "All Lands/All Hands Action Plan" KPB, USFS, ADOF, USFWS, 2023-2028 Update, website: https://www.frames.gov/catalog/6611
3.) "Spruce Beetle" USFS, 2023, website: https://www.fs.usda.gov/detailfull/r10/forest-grasslandhealth/?cid=FSEPRD536861
4.) "Spruce Beetle Interagency Website" UAF, 2018, website: https://www.alaskasprucebeetle.org/
5.) "Historical Fire Regimes" USFS, 2024, website: https://www.frames.gov/catalog/7872
6.) "Wildfire and the Wildland Urban Interface (WUI)" FEMA, 2024, website: https://www.usfa.fema.gov/wui/
7.) "Wildfire Research" USFS, 2024, website: https://www.fs.usda.gov/research/rmrs/centers/wire
8.) "Chugach All Lands Quantitative Wildfire Risk Assessment" USFS, 2019, website: https://www.frames.gov/documents/alaska/docs/Chugach_All_Lands_QWRA_Brief.pdf
9.) "Alaska Forest Conditions Report" USFS, 2021, website: https://www.fs.usda.gov/foresthealth/docs/fhh/AK_FHH_2021.pdf
10.) "Healthy Forests Restoration Act" US Congress, 2003, website: https://www.forestsandrangelands.gov/resources/overview/hfra-implementation12-2004.shtml
11.) "Alaska's Changing Wildfire Environment" UAF, 2021, website: https://uaf-iarc.org/alaskas-changing-wildfire-environment/