Bristol Bay Borough

LOCAL

HAZARD MITIGATION PLAN UPDATE

September 2017

Prepared for:

Bristol Bay Borough

Communities of King Salmon, Naknek and South Naknek

By:

Ecology & Environment, Inc.

Updated By:

LeMay Engineering & Consulting, Inc.

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Plan Administration

The Bristol Bay Borough (BBB or "the Borough") Local Hazard Mitigation Plan (LHMP), including appendices and annexes, will be reviewed annually and updated every five years, after a disaster response, or as appropriate in response to community mitigation activities. This LHMP initially will be submitted to the State of Alaska (SOA) Division of Homeland Security and Emergency Management (DHS&EM) for review and approval. Then, the SOA will send the Borough LHMP to the Federal Emergency Management Agency (FEMA) for pre-approval. Following FEMA's pre-approval of the LHMP, the Borough will adopt the Plan. The updated LHMP will be formally re-promulgated by the Borough and sent to the SOA and FEMA for approval once every five years.

Record of Plan Changes

All updates and revisions to the plan will be tracked and recorded in the following table. This process will ensure that the most recent version of the plan is disseminated and implemented as appropriate.

Date	Change No.	Purpose of Update
August 2011	Original Release	
September 2017	1	LHMP Update

Plan Distribution List

Copies of this plan have been provided to the following communities, agencies, and persons. Updates will be provided, when available. Recipients will be responsible for updating their respective LHMP documents when changes are received. The Bristol Bay Borough Manager is ultimately responsible for dissemination of all plan updates.

Date	No. of Copies	Community/Agency/Person
		Bristol Bay Borough Manager
		Bristol Bay Borough Fire Department
		Bristol Bay Borough Police Department
		Bristol Bay Borough Planning Department
		Bristol Bay Borough School District Superintendent
		Port of Bristol Bay
		Bristol Bay Borough Local Emergency Planning Committee
		Naknek Native Village Council
		Qinuyang - South Naknek Village Council
		King Salmon Village Council
		Paug-Vik Village Corporation
		National Park Service, Katmai National Park and Preserve, Chief Ranger
		Chugach Federal Solutions, Inc. (King Salmon AFS) Manager
		U.S. Fish & Wildlife Service, Alaska Peninsula/Becharof National Wildlife Refuge Manager

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1 Introduction

1.1 General

This Local Hazard Mitigation Plan (LHMP) establishes guidance for the Bristol Bay Borough to mitigate hazards in order to reduce or eliminate the loss of life and property damage resulting from natural and human-caused hazards. Specifically, this LHMP describes the planning process and methodology used, discusses the profiles of the three Borough communities, identifies unique hazards these communities face, assesses the vulnerabilities of the communities to these risks, and puts forth a sustainable mitigation strategy to create a more resilient community.

1.1.1 Purpose

This LHMP forms the foundation for the Bristol Bay Borough's long-term strategy to reduce disaster losses and damage. The LHMP creates a framework for risk-based decision making to reduce damages to lives, property, and the economy from future disasters.

This plan is designed to fulfill the requirements set forth in the 44 Code of Federal Regulations (CFR) 201.4 Disaster Mitigation Act 2000 (DMA 2000) to identify hazards facing the communities of King Salmon, Naknek, and South Naknek, to complete a risk assessment and vulnerability analysis, and to identify and coordinate mitigation efforts with State, Federal, and local partners.

1.1.2 Assumptions

The Alaska Hazard Mitigation Plan of October 2010 states the following assumptions, which apply to this LHMP:

> *A devastating naturally occurring event, technological incident, or terrorist attack, may occur without warning and at the worst possible time*
>
> *Mitigation financial assistance may be available for State, tribal and local governments and to communities through the disaster funded Hazard Mitigation Grant Program (HMGP), other FEMA Hazard Mitigation Assistance Grants (HMA), or other Federal, State, or local funds.*
>
> *Effective Mitigation results stem from a broad, cooperative effort among Federal, State, local, non-governmental organizations and the private sector*

There are certain facilities in Alaska that are critical for the State's resilience. These critical facilities must be identified, risk assessments conducted, and vulnerability analysis completed to determine which actions should be taken to ensure their post-disaster operability.

Due to isolation from the lower-48 states and the challenges presented by Alaska's weather, Alaskans should expect to be self reliant for at least 72 hours following a disaster event.

Given the transportation distances involved in Alaskan commerce, the extreme weather, the limited construction season and the remoteness of many communities, mitigation projects in Alaska will be considerably more expensive than the lower-48 states and will often require customized mitigation approaches.

1.1.3 Authorities

Table 1 identifies applicable legal authorities that support the LHMP.

Table 1 Legal Authorities

Federal
– Disaster Mitigation Act 2000, PL 106-390
– Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707
– Code of Federal Regulations, Part 201.
– National Flood Insurance Act of 1968, 42 USC 4104c, as amended by the National Flood Insurance Reform Act of 1944, Public Law 103-325
– The Bunning-Bereuter-Blumenauer Flood Insurance Reform Act of 2004, Public Law 108-264
State of Alaska
– State of Alaska Hazard Mitigation Plan, October 2013
– Alaska Statute 26.23, Department of Military and Veterans Affairs, Disasters
Bristol Bay Borough
– Bristol Bay Borough Alaska Coastal Management Program (1983), updated 2006

1.2 Planning Process

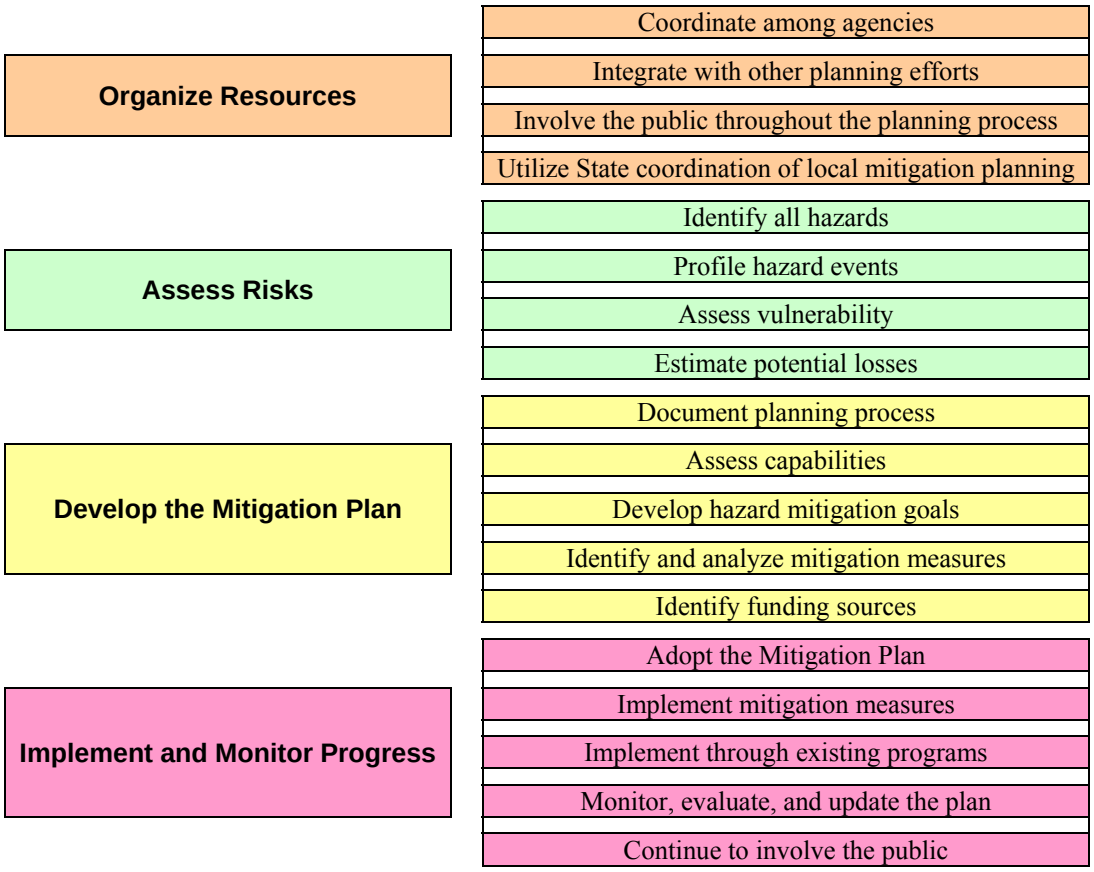
The DMA 2000 highlights the importance of mitigation planning and emphasizes planning for disasters before they occur. This act provides funding for mitigation planning and projects. Mitigation plans must demonstrate that their proposed mitigation measures are based on a sound planning process that accounts for the risk to, and the capabilities of, the individual communities.

1.2.1 Phases of the Planning Process

The hazard mitigation planning process for the Bristol Bay Borough includes several phases: the organization of the Borough and planning resources (staff, technical experts, and interested community members), assessing the communities' risks to hazards, development of a multi-jurisdictional LHMP (this

document), and implementation of the LHMP and monitoring future progress. Refer to Figure 1 as well as Sections 1.2.1.1 through 1.2.2.4 for additional information on the phases of hazard mitigation planning.

Figure 1 - Phases of Hazard Mitigation Planning



1.2.1.1 Phase One: Organize Resources

From the beginning of the planning process, communities should focus on the resources needed for successful mitigation. Essential steps include identifying and organizing interested members of the community, including representatives from agencies, businesses, academia, nonprofits, and other interested parties and representatives from neighboring communities. Individuals or agencies with technical expertise on both the hazards that threaten a community and the potential mitigation strategies for the community should also be identified. Material references should be gathered. This includes community plans including, if available, emergency operations plans, economic development plans and comprehensive plans, hazard assessments, and reports from previous hazard events.

1.2.1.2 Phase Two: Assess Risks

Communities need to identify the characteristics and potential consequences of their local hazards. It is important to understand and evaluate which populations

and facilities are most vulnerable to natural hazards and how these hazards would impact important community assets.

1.2.1.3 Phase Three: Develop a Mitigation Plan

Once they have developed an understanding of the risks posed by potential hazards, communities then need to determine their priorities and identify ways to avoid or minimize the hazards' undesirable effects. The result is a hazard mitigation plan and strategy for its implementation.

1.2.1.4 Phase Four: Implement the Plan and Monitor Its Progress

Communities can activate the plan in a variety of ways, ranging from implementing specific mitigation projects to modifying the daily operations of the local government. To ensure the success of an ongoing program, it is important to conduct an annual review and following a disaster, make revisions as needed.

1.2.2 Approval Process

Once created, the draft of the LHMP is submitted to the State for review. The State Hazard Mitigation Officer (SHMO) reviews the draft using FEMA's review tool developed from the DMA 2000 legislation. The SHMO will review and, if appropriate, submit the plan to FEMA Region X for their review and comment. When FEMA determines the LHMP meets the DMA 2000 minimum criteria, FEMA will return the LHMP to the State with pre-approval. Next, the SHMO advises the community of the pre-approval, and the community formally adopts the plan. Once the community formally adopts the plan, the SHMO submits the adoption to FEMA Region X which provides for the plan's final approval.

The Alaska Division of Homeland Security and Emergency Management (DHS&EM) uses local mitigation plan information to enhance the State plan. DHS&EM will incorporate newly approved local mitigation plans into the State plan periodically, as described in the State planning process flowchart (see State of Alaska's Hazard Mitigation Plan, October 2013 for more information).

Refer to Appendix D for Adoption Resolution.

1.3 Planning Committee

The Borough's Mitigation Planning Group is led by Community Development Coordinator Becky Savo, with assistance from Bristol Bay Borough employees, private-sector stakeholders, and residents who have extensive experience in a variety of fields. LeMay Engineering & Consulting, Inc., and DHS&EM also provided assistance to the hazard Mitigation Planning Group. Table 2 identifies the hazard Mitigation Planning Group members.

Table 2 Hazard Mitigation Planning Group Members

Name	Title	Organization	Telephone (907)	Email Address
John Fulton	Manager	Bristol Bay Borough (BBB)	246-4224, ext. 307	jfulton@bbbak.us
Becky Savo	Community Development Coordinator	BBB	246-4224, ext. 312	bsavo@bbbak.us
Stan Swetzof	Chief of Police	BBB Police Department	246-4222	policechief@bbbak.us
Susan Alexander	Alaska Peninsula Becharof NWRS Manager	US Fish & Wildlife Service	246-3339	Susan_alexander@fws.gov
William Hill	Superintendent	BBB School District		bhill@bbbsd.net
Linda Halverson	President	Naknek Native Village Council	246-4210	president@gmail.com
Lucy Goode	General Manager	Paug Vik Inc., Ltd.	246-4277 #1	Pvil.generalmanager@gmail.com
Peter Harvey	Law Enforcement Pilot	US Fish & Wildlife Service	246-3339	Peter_harvey@fws.gov
Kate Conley	Borough Clerk	Lake and Peninsula Borough	246-3421	kateconley@lakeandpen.com
Jason Lux	Chief Ranger	National Park Service	246-2127	Jason_Lux@nps.gov
Martin Angasan	Public Works (South Naknek)	Public Works	246-6556	snpw@bbbak.us
Deborah Jones	EMS Coordinator	EMS Department	246-4224#309	djones@bbbak.us
Open Position	Fire Chief	BBB Fire Department	246-4224#315	firechief@bbbak.us
Roylene Gottschalk	Public Works Director	BBB	246-8223	roy@bbbak.us
Robert McDermott	Harbormaster	Port of Bristol Bay	246-6168	herk@bbbak.us

1.4 Plan Research and Coordination

The hazard Mitigation Planning Group utilized a variety of resources to research applicable information for this LHMP, including existing plans, studies, and reports. The following existing plans, studies, reports and technical information were reviewed and incorporated into this Plan:

- Bristol Bay Borough Hazard Mitigation Plan, 2011

- Bristol Bay Borough, Comprehensive Plan 2017 Seafood Industry Profile & Analysis, October 2016 by McDowell Group
- Bristol Bay Borough, Comprehensive Plan 2017 Socioeconomic Baseline Report, September 2016 by McDowell Group
- Lake and Peninsula Borough, Comprehensive Plan Update, September 2012 by Agnew::Beck Consulting
- Southwest Alaska Municipal Conference, Comprehensive Economic Development Strategy, 2014-2019
- Bristol Bay Comprehensive Economic Development Strategy, 2017-2022
- Bristol Bay Regional Vision, November 2011
- Naknek Community Plan, 2005 by Naknek Village Council Counsel
- Bristol Bay Area Plan, Alaska Department of Natural Resources, 2005
- State of Alaska Department of Labor and Workforce Development, 2016
- Bristol Bay Borough Comprehensive Community Plan, 2017
- *Community Impacts of Restructuring the Bristol Bay Salmon Fishery*, prepared for Bristol Bay Economic Development Corporation, Northern Economics, Inc., November 2004
- *Economics of Wild Salmon Ecosystems: Bristol Bay, Alaska,* USDA Forest Service Proceedings RMRS-P-49, 2007
- *Chapter Six: Specific Issues Related to Oil and Gas Exploration, Development, Production and Transportation,* Final Best Interest Finding, Alaska Peninsula Areawide Lease Sale
- Miscellaneous Publication 132, *Geologic Hazards in and Near the Northern Portion of the Bristol Bay Basin,* D. Stevens, P. Craw, Alaska Division of Geological & Geophysical Surveys, December 2003
- Miscellaneous Publication 134, *Geologic Hazards On and Near the Northern Coast of the Alaska Peninsula,* D. Stevens, P. Craw, Alaska Division of Geological & Geophysical Surveys, May 2004
- *Novarupta – The Most Powerful Volcanic Eruption of the 20th Century,* Geology.com

- *Mount Redoubt Volcanic Eruptions March – April 2009,* U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, January 2010
- *Some Effects of Recent Volcanic Ash Falls With Especial Reference to Alaska, Investigations of Alaskan Volcanoes,* Geological Survey Bulletin 1028-N, Ray E. Wilcox, 1959
- *Can Another Great Volcanic Eruption Happen in Alaska?, U.S. Geological Survey—Reducing the Risk from Volcano Hazards,* USGS Fact Sheet-075-98, 1998
- *Witness, Firsthand Accounts of the Largest Volcanic Eruption in the Twentieth Century,* National Park Service, U.S. Department of the Interior, Katmai National Park and Preserve, 1999
- *Coastal Erosion Responses for Alaska,* O. Smith, P.E., Ph.D., Mikal Hendee, P.E., presentation for Coastal Processes and Erosion Responses Seminar, October 2009
- *A Naknek Chronicle, Ten Thousand Years in a Land of Lakes and Rivers and Mountain of Fire,* National Park Service, U.S. Department of the Interior, Katmai National Park and Preserve, Don E. Dumond, September 2005
- *Appendix D. Initial environmental evaluation, physical and biological environment summary Bristol Bay Borough for Naknek Crossing Intermodal Economic Impact and Airport Use Study, An approved component of the Alaska Statewide Transportation Plan, 4/25/2005,* State of Alaska Department of Transportation & Public Facilities
- *Final Report, Wind Energy Feasibility Study, Naknek and Unalaska, Alaska,* Dames & Moore, for State of Alaska Department of Community and Regional Affairs, Division of Energy, May 24, 1999
- *Coastal Erosion: Strategies for Alaska,* Proceedings of a Workshop, D. Atkinson, O. Smith, Hajo Eicken, International Arctic Research Center, University of Alaska Fairbanks, April 11, 2007
- *Preliminary Volcano-Hazard Assessment for the Katmai Volcanic Cluster, Alaska,* Open File Report 00-489, U.S. Geological Survey, J. Fierstein, W. Hildreth

Additional resources available for hazard mitigation planning and disaster preparedness can be found in Appendix A.

Ecology and Environment, Inc. (E & E) planners consulted the following organizations during development of the plan in 2011. These organizations were also invited to comment on the 2017 plan update.

- Naknek Native Village Council
- Naknek Electric Association
- National Park Service, Katmai National Park and Preserve
- Alaska Department of Fish and Game
- Bristol Bay Borough
- Paug Vik, Inc. Ltd.
- Bristol Bay Borough School District
- U.S. Fish and Wildlife
- Port of Bristol Bay
- North Pacific Processors, Inc. (Red Salmon and Peterson Point)
- Ocean Beauty Seafoods, Inc.
- Copper River Seafoods, Inc.
- Trident Seafoods
- Silver Bay Seafoods, LLC
- Leader Creek Fisheries, LLC
- Peter Plan
- Icicle
- Chugach Federal Solutions, Inc.
- Alaska General Seafoods

1.5 Public Involvement

- The Borough hosted the public meeting as an agenda item on the Planning Commission Meeting on September 20, 2017. LeMay Engineering & Consulting, Inc., contractor for the SOA DHS&EM, presented information on the hazard mitigation planning process and the update of the LHMP for the Borough communities of King Salmon, Naknek, and South Naknek. Paug Vik, Inc. Ltd. presented

the plan to their members on September 26, 2017. The Planning Commission Meeting held a Public Hearing on October 10, 2017. The LEPC presented the plan to their members on October 12, 2017. Additionally, the Borough posted the plan on its website on September 25, 2017.

Refer to Appendix C for Public Involvement Documentation.

Copies of the draft plan were provided at the Borough offices and the public library. Copies of the draft plan were emailed to the Naknek Native Village office, King Salmon Village Council, Qinuyang - South Naknek Village Council, Paug Vik Incorporated, Ltd. office, and upon request to the public to review and to provide comments. Additionally, the draft plan was sent electronically to members of the Mitigation Planning Group, Katmai National Park and Preserve, and U.S. Fish and Wildlife Service, and individuals that participated in the public meeting. All recipients were encouraged to provide comments to the draft plan.

2 Community Profile

2.1 Introduction

The Bristol Bay Borough is comprised of three communities in southwestern Alaska: King Salmon, Naknek, and South Naknek. The Bristol Bay Borough was the first organized Borough in the state of Alaska and is the smallest borough by area and population, with 505 square miles of land and a total population of approximately 874 in 2016.

2.2 Community Overview

2.2.1 Location

2.2.1.1 King Salmon

King Salmon is located on the north bank of the Naknek River on the Alaska Peninsula. It is about 15 miles east of the community of Naknek, at the outlet of the Naknek River into Bristol Bay. King Salmon is the Borough's air transportation hub, with an 8,500-foot runway and access to the Katmai National Park and Preserve. The King Salmon Air Force Station (AFS) is located in King Salmon. The 15-mile long Alaska Peninsula Highway connects King Salmon and Naknek. King Salmon is located 284 miles southwest of Anchorage, at approximately 58.688° North Latitude and 156.661° West Longitude (Sec. 23, T017S, R045W, Seward Meridian). King Salmon is located in the Kvichak Recording District.

2.2.1.2 Naknek

Naknek is located on the north bank of the Naknek River, at the northeastern end of Bristol Bay, about 297 miles southwest of Anchorage. Naknek is the seat of the Borough government and the hub for the area's commercial fishing industry. The community lies at approximately 58.728330 North Latitude and -157.013890 West Longitude (Sec. 03, T017S, R047W, Seward Meridian).

2.2.1.3 South Naknek

South Naknek is located on the south bank of the Naknek River on the Alaska Peninsula, 297 miles southwest of Anchorage. It lies west of the Katmai National Park and Preserve at approximately 58.715560 North Latitude and -156.998060 West Longitude (Sec. 11, T017S, R047W, Seward Meridian). The community can be accessed by air or water transportation.

2.2.2 Climate

The climate of the Borough area is considered maritime, which is typically cool, humid, and windy. Temperatures during the summer range from 42° to 63°F, with a recorded high of 88°F. Fog is common during the summer months. Temperatures range from 29°F to 44°F during the winter months, with a recorded low of -46°F. The total precipitation is 20 inches annually, with 45 inches of snowfall. The Kvichak River is ice-free from June through mid-November.

2.2.3 Demographics

As of 2016, the total population estimate for the Borough was 874. The economy is highly seasonal, with fish harvesting and processing as the primary source. Tourism and sport fishing also contribute to the Borough's economy, with the Katmai National Park and lodges attracting visitors from all over the world for bear hunting, sport fishing, bird watching, and the growing popularity of eco-tours. Total wages for the Borough were nearly $16 million in 2015.[1]

2.2.3.1 King Salmon

The 2016 Alaska Department of Labor (ADOL) and Workforce Development estimate was 316 people.[2] As of the 2010 census, 27.81% of the population is Alaska Native. The median age of the population of King Salmon is 40.

The median income for a household was $84,583, and the median income for a family was $97,500. The per capita income was $44,125. About 9.6% of the population is below the poverty line.

2.2.3.2 Naknek

The ADOL 2016 estimate for Naknek was 494 people.[3] As of the 2010 census, 40.66% of the population is Alaska Native. The median age of Naknek is 44. During the summer months, the population grows to about 5,000, mostly fishers and cannery processor workers.

The median income for a household was $78,750, and the median income for a family was $91,250. The per capita income was $35,000. About 5.0% of the population is below the poverty line.

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1 http://live.laborstats.alaska.gov/alari/details.cfm?yr=2015&dst=01&dst=03&dst=04&dst=02&dst=06&dst=12&dst=09&dst=11&dst=07&dst=13&r=6&b=5&p=0

2 http://live.laborstats.alaska.gov/alari/details.cfm?yr=2015&dst=01&dst=03&dst=04&dst=06&dst=07&r=6&b=5&p=158

3 http://live.laborstats.alaska.gov/alari/details.cfm?yr=2015&dst=01&dst=03&dst=04&dst=06&dst=07&r=6&b=5&p=209

2.2.3.3 South Naknek

The ADOL 2016 estimate for South Naknek was 64 people.[4] As of the 2010 census, 80.49% of the population was Alaska Native. The median age of South Naknek was 46.

The median income for a household was $58,750, and the median income for a family was $100,625. The per capita income was $41,308. About 21.7% of the population is below the poverty line.

2.2.4 Culture

2.2.4.1 King Salmon

The Alaska Native population is a mixture of Aleuts, Alutiiq, and Yup'ik Eskimos. King Salmon was not included in the 1972 Alaska Native Claims Settlement Act (ANCSA); however, the King Salmon Tribe became a federally recognized tribe on December 29, 2000.

2.2.4.2 Naknek

Naknek is a fishing community, with a mixed population of non-Natives, Yup'ik Eskimos, Alutiiq and Athabascans. The Russians may have explored Bristol Bay as early as 1791; however, in 1818, Petr Korsakovski led an expedition that really commenced the Russian exploration of the area. The Russians built a fort at Naknek and conducted fur trading in the area. The Russian Orthodox Church built its first chapel in the 1870s in Naknek. Behind the Borough building is a small chapel surrounded by a cemetery with the distinctive Russian Orthodox crosses. The first salmon cannery opened on the Naknek River in 1890. Naknek Village Council is the federally recognized traditional council.

2.2.4.3 South Naknek

South Naknek is a traditional Sugpiaq village with a fishing and subsistence lifestyle. The residents are descendants of people displaced from New Savonoski village by Katmai-Novarupta volcanic eruptions of 1912. The New Savonoski village was later abandoned for the South Naknek location.

The population of South Naknek has experienced a steady decline due to a downturn in the commercial fishery. Since the school closed in 2004, children take a 5-minute flight by small aircraft daily across the Naknek River to attend school in Naknek. South Naknek Village Council, also know as Quinuyang, is a member of the Alaska Peninsula Corporation (APC), the local ANCSA corporation. The APC began in 1978 with the merger of the village corporations for South Naknek and Port Heiden. By 1981, the village corporations for Ugashik, Kokhanok, and Newhalen joined APC.

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[4] http://live.laborstats.alaska.gov/alari/details.cfm?yr=2015&dst=01&dst=03&dst=04&dst=06&dst=07&r=6&b=5&p=297

2.2.4.1 Cultural Assets

Cultural assets include archeological, historic, and cultural resources. The following buildings in the Borough are listed in the National Register of Historic Places and Historic American Building Survey or were identified by community members:

- Trefon's Cabin - Alaska Department of Fish & Game marker, outlet of Naknek Lake;
- Russian Orthodox Church and Cemetery, South Naknek, King Salmon Vicinity;
- Elevation of the Holy Cross Russian Orthodox Church, South Naknek;
- Original Paug Vik Incorporated, Ltd.Village Site;
- Graveyard Point;
- Nakeen Cannery at Squaw Creek;
- AR Davey Building (Bristol Bay Historical Society Building); and
- St. John the Baptist Russian Orthodox Chapel, Naknek.

The website "Visit Bristol Bay" states that there are "numerous archaeological sites, hunting camps, old villages, and evidence of use along the river and its tributaries. Old Savonoski, on Savonoski River at the east end of Naknek Lake and New Savonoski and Paugvik on the Naknek River are all abandoned village sites."[5]

2.2.5 Natural Environment

The natural environment is dominated by the Kvichak River, Naknek River, and Bristol Bay. In general, the terrain exhibits little topographic relief and is predominantly marshy lowlands. The floodplains of the Kvichak are mostly free of permafrost.

2.2.5.1 Kvichak River

The Kvichak River has headwaters in Lake Iliamna and flows approximately 60 miles to Kvichak Bay, an arm of Bristol Bay. The river is navigable its entire length and is used as a short-cut for boats from Cook Inlet to Bristol Bay via Lake Iliamna and the portage road connecting the lake to Cook Inlet.

All five species of Pacific salmon (king, sockeye, pink, silver, and chum) spawn in the Kvichak River system. The watershed is considered the single most

[5] "Visit Bristol Bay" website, *www.**visitbristolbay**.org/*

important source of salmon in the world. These salmon are important to commercial, subsistence, and sport users.[6]

2.2.5.2 Naknek River

The Naknek River drainage area is approximately 3,700 square miles. The coastline includes sandy beach areas and bluff escarpments along the Naknek River, as well as several areas of low-lying brackish tidal marsh. The coastal and river bluffs are composed of glacial drift and fluvial deposits which are unconsolidated and unstable. Erosion due to wind, wave, and tidal action can be severe in these areas. The Naknek River is a primary spawning and rearing area for all five species of Pacific Salmon, which migrate from the Gulf of Alaska. The communities of Naknek and South Naknek are located on the bluffs above the Naknek River.[6]

2.2.5.3 Bristol Bay

Bristol Bay is the easternmost arm of the Bering Sea. The ocean in Bristol Bay is shallow. Lack of seasonal sea ice is causing more erosion. Kvichak Bay of Bristol Bay has some of the highest tides worldwide, with tidal extremes in excess of 30 feet.

Bristol Bay is home to the world's largest sockeye salmon fishery, as well as strong runs of chum salmon, silver salmon, and king salmon. The Bristol Bay region accounts for 44% of global red salmon harvests.

2.3 Built Environment

2.3.1 Land Use and Development Trends

The majority of industrial land use within the Borough is for fish processing. The first salmon cannery opened on the Naknek River in 1890. By 1900, there were approximately 12 canneries in Bristol Bay. In 2017, there are seven large processors and six smaller custom processors in the community. A mix of commercial and residential land use is concentrated within King Salmon, Naknek, and South Naknek, for a total area of 3,000 acres in use, which includes community facilities, governmental offices, and roads. The Bristol Bay Borough Alaska Coastal Management Program (ACMP) document states that,

> *Lower density use is developing along the Alaska Peninsula Highway, with increasing concentration in the vicinity of King Salmon and Paul's Creek.*
>
> *While there are presently 10,000 acres of private land in and around the communities of King Salmon, Naknek, South Naknek, and along the Alaska Peninsula Highway, much of this land is unavailable due to limited*

[6] Bristol Bay Area Plan, Alaska Department of Natural Resources, 2005

roads or large block ownerships. The majority of private land is owned by the Borough's village corporations. Based on demand forecasts for future housing and commercial development, adequate land is available for development over the next 20 years, assuming access and disposition are overcome.

The largest amount of land in the Borough remains in its natural state and is used for recreational purposes and subsistence hunting, trapping, and gathering.

2.3.2 Land Ownership

Paug-Vik Native Corporation owns 125,000 acres of land. Qinuyang - South Naknek Village Council and Alaska Peninsula Corporation are major landowners in South Naknek. National Park Service Katmai National Park and Preserve owns approximately one-sixth of the land within the Borough. The State of Alaska owns one-third of the land within the Borough. The BLM and military own smaller portions of land within the Borough. The Bristol Bay Borough Coastal Zone Management District Boundary, Map 1, illustrates the District Boundary and Generalized Land Status as of September 2010.

2.3.3 Industry

2.3.3.1 King Salmon

Government jobs, transportation, fishing-related employment, tourism, and lodging are the mainstays of the King Salmon economy. The Bristol Bay red salmon fishery is the largest in the world. In 2016, 35 residents held commercial fishing permits for salmon fisheries.

King Salmon AFS bulk fuel storage area, emergency power generation and satellite communications. Photo by Vivian Melde, May 2010.

Tourism is an important aspect of the local economy. The King Salmon Airport is the summer hub for wilderness and fishing adventures in the area. King Salmon is also a departure point for the Katmai National Park and Preserve/Alagnik Wild River, which includes Brooks Camp, the McNeil River State Game Sanctuary, and the Valley of Ten Thousand Smokes. Fishing for all five species of salmon and rainbow trout is one of this area's top attractions and there are multiple guide services and fishing lodges in the area. The airport is also an important transportation hub for

shipping Bristol Bay salmon to markets elsewhere.

The King Salmon Air Force General Surveillance Radar Station was closed in 1983 and was re-designated as a Long Range Radar site as part of the Alaska Radar System. Today, it remains active as part of part of the Alaska NORAD Region and its runways serve the public airport. The site is maintained under contract to the U.S. Air Force by Chugach Federal Solutions, Inc.

Leader Creek Fisheries in Naknek. Photo courtesy of Anton Littau, www.littau.net

2.3.3.2 Naknek

The economy is based on government employment, salmon fishing, and processing. Naknek has a seasonal economy as a service center for the huge red salmon fishery in Bristol Bay. In 2016, 98 residents held commercial fishing permits for salmon fisheries. In excess of 10,000 people typically flood the area during the fishing season, temporarily increasing the population of Naknek with fishermen and cannery workers. Millions of pounds of salmon are trucked to Bristol Bay each summer, where barges transport the fish to the lower 48. A portion of the fish is sent out via air freight. Trident Seafoods, North Pacific Processors Inc., Alaska General Seafoods, Ocean Beauty, Inc., Copper River Seafoods, Inc., Silver Bay Seafoods, LLC, Leader Creek Fisheries, LLC, Peter Pan, Icicle, and other fish processors operate facilities in Naknek. In 2016, the Bristol Bay Borough Comprehensive Plan 2017 Seafood Industry Profile and Analysis stated that the Sockeye salmon fishery in Bristol Bay provided a renewable resource valued at $209 million per year.[7] However, king, sockeye, and silver salmon are important to the recreational sport fishing and tourism industries, as are trout and char. In 2010, these fisheries sent over 11,000 containers through the Port of Bristol Bay; frozen salmon, canned salmon, frozen herring, and smaller commodities.

In 2009, the Bristol Bay commercial fishery celebrated its 125th season. There is one distinct change in the way fish are harvested now. Up until 1951, the salmon were netted from sailboats. [8]

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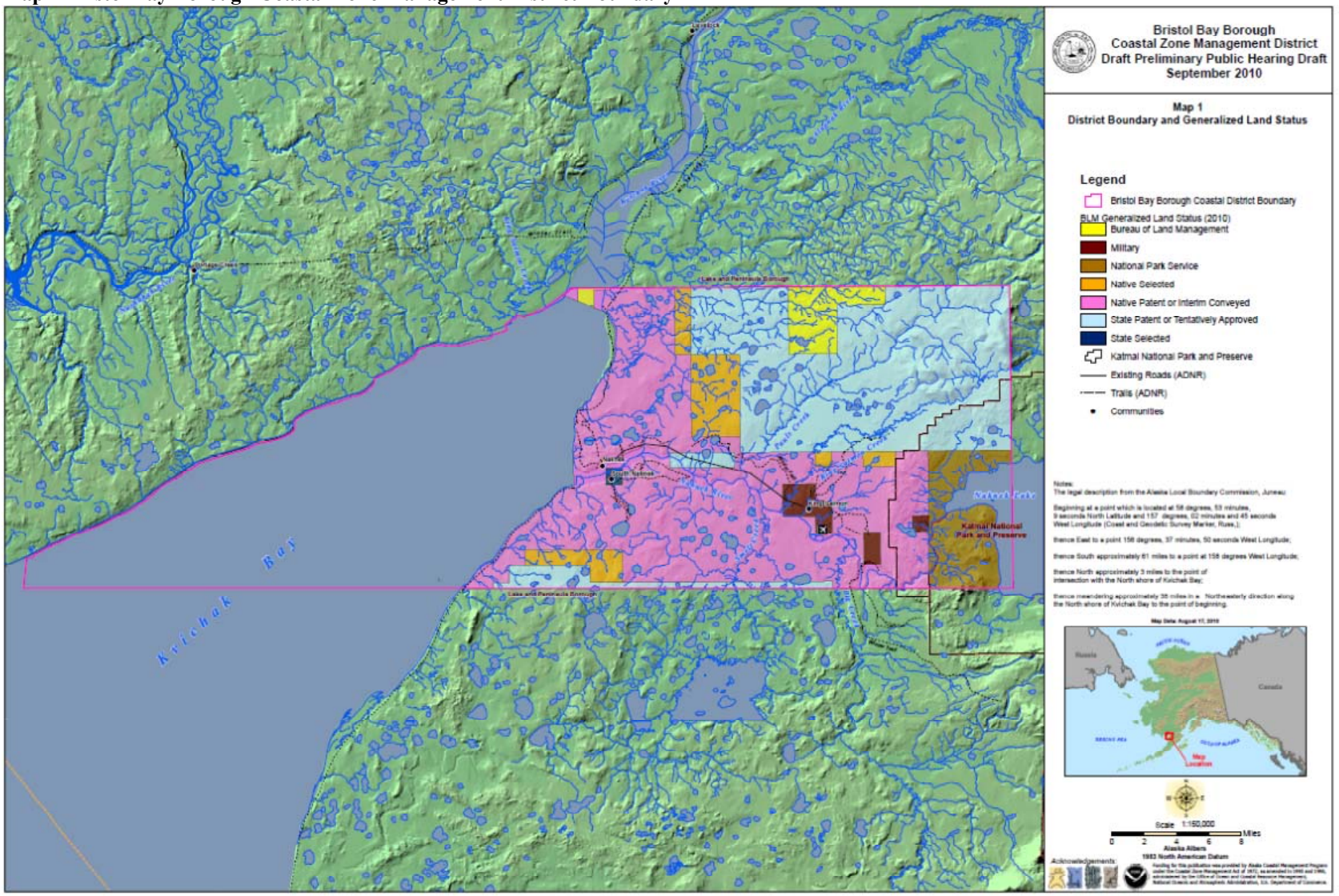
[7] *Bristol Bay Borough Comprehensive Plan 2017 – Seafood Industry Profile & Analysis, McDowell Group*, October 2016

[8] Ray Troll, Anchorage Daily News, June 9, 2009.

Map 1 Bristol Bay Borough Coastal Zone Management District Boundary



The Port of Bristol Bay, located in Naknek, is the largest commercial freight dock in Bristol Bay and is considered a hub for cargo in southwest Alaska. In 2011, Robert McDermott, the Port's Harbor Master/Port Foreman, stated, "*The Port of Bristol Bay is the 'economic engine' for Southwest Alaska, providing the means by which most goods are moved into or out of the region and thereby supporting the regional economy and the livelihoods of many individuals, businesses and communities throughout Southwest Alaska that depend on the services of the Port. The Port currently services over 30 outer ports. According to the National Oceanic and Atmospheric Administration, the Port of Bristol Bay ranks #4 for commercial fishery values at major ports in the nation.*"[9]

Naknek is also the seat of the Bristol Bay Borough government.

2.3.3.3 South Naknek

Commercial fishing is the mainstay of South Naknek's economy. In 2016, 20 residents held commercial fishing permits for salmon.[10] Processing facilities were closed by 2016. Most other employment in South Naknek is in public services. A few people trap, and most residents depend on subsistence hunting and fishing. Salmon, trout, caribou, rabbit, porcupine, and seal are utilized. The elementary school located in South Naknek closed in 2004 due to lack of the minimum requirement of 10 students. Currently, students attend Naknek Elementary School and Bristol Bay Middle/High School in Naknek.

2.4 Critical Facilities and Essential Infrastructure

A critical facility is defined as a local public- or private-sector facility that provides essential products or services to the public, such as preserving the quality of life in the community or fulfilling important public safety, emergency response, and disaster recovery functions including providing temporary shelter for displaced individuals. Critical facilities are used to assess the vulnerability of the community to hazards and include essential facilities for the health and welfare of the whole population (e.g., schools, clinics, fire, and law enforcement facilities); transportation infrastructure; utility systems; facilities with a high potential loss (e.g., airports, roads, communications towers); and hazardous materials facilities (e.g., bulk fuel tank farms and fish processing facilities). Critical facilities and essential infrastructure for the Borough communities of King Salmon, Naknek, and South Naknek are provided in Table 3 and Figure 2 *Bristol Bay Borough Base Map*.

[9] Email to Vivian Melde from Robert McDermott, Port of Bristol Bay, January 27, 2011.

[10] Information provided by Alaska Department of Fish & Game, Commercial Fisheries Entry Commission.

Table 3 Critical Facilities and Essential Infrastructure			
Essential Facilities for Health and Welfare			**Value**
EF-1	Bristol Bay Borough Offices	1 Main Street, Naknek	$1,898,304
EF-2	Borough Police Department/ State Troopers Post/Bristol Bay Borough Jail	Building 150, King Salmon AFS	$431,189
EF-3	Kvimarvik Pool & Gym	School Road, Naknek	$8,644,068
EF-4	Martin Monsen Library	101 Main Street, Naknek	$518,548
EF-5	Bristol Bay Borough Middle/High School	2 School Road, Naknek	$29,170,491
EF-6	Naknek Elementary School	2 School Road, Naknek	See Above
EF-7	St. John the Baptist Russian Orthodox Church	Naknek	$143,300
EF-8	Church of Saint Teresa	58.72966, -157.0118	$287,700
EF-9	Community Bible Chapel		$328,000
EF-10	Naknek Community Bible Chapel		$453,500
EF-11	Hilltop Christian Fellowship, Naknek		
EF-12	Hilltop Christian Fellowship SNN		
EF-13	Kings Chapel, Naknek		
EF-14	King Salmon Chapel		
EF-15	King Salmon Mall - Bank		
EF-16	BBB Cemetery	58.72749, -157.01476	
EF-17	Bristol Bay Borough Fire Station	Mile 0 Alaska Peninsula Highway, Naknek	$784,889
EF-18	BBB Public Works	1 Dock Road	$3,409,234
EF-19	King Salmon Fire Station	Building 300, King Salmon AFS	$281,645
EF-20	Landfill	Alaska Peninsula Highway (shared with Naknek and King Salmon)	$1,431,023
EF-21	Camai Community Health Center	2 School Road, Naknek	$875,172
EF-22	Office of Children's Services	King Salmon	Portion of $814,400
EF-23	Federal Aviation Administration (FAA) Community Services Facility (COMSERFAC) Building	1 mile west of King Salmon, West Housing Road, second left into FAA housing area	unknown
EF-24	KAKN-FM	Mile 2 Alaska Peninsula Highway, Naknek	
EF-25	Naknek Trading Company	Alaska Peninsula Highway	$1,647,200
EF-26	Naknek Health Clinic	Corner of Main Street and 3rd	$415,200
EF-27	Naknek School Library	2 School Road, Naknek	See Above
EF-28	South Naknek Health Clinic	South Naknek Road, South Naknek	Unknown
EF-29	South Naknek Library	#1 School Road, South Naknek	$631,105
EF-30	South Naknek Public Works/Fire Station	South Naknek	$431,189
EF-31	Alaska Court System	Borough Building, 1 Main Street, Naknek	See EF-2
EF-32	King Salmon Village Council		

Table 3 Critical Facilities and Essential Infrastructure			
Essential Facilities for Health and Welfare			**Value**
EF-33	Naknek Native Village Council		
EF-34	BBB Ambulance Barn	School Road, Naknek	$271,376
EF-36	National Park Service Shop Current Maintenance Shop and Equipment Cache	King Salmon	$ 638,865
EF-37	King Salmon Health Clinic	Alaska Peninsula Highway	$487,700
EF-38	BBC Gas Station		
EF-39	AC Gas Station		
EF-40	King Ko Gas Station		
EF-41	Bristol Express 1 & 2 Gas Stations		
EF-42	Naknek Engine Gas Station		
EF-43	Delta Western Gas Station		
EF-44	Worldwide Fuel		
Transportation Infrastructure			**Value**
TI-1	State-owned airport in King Salmon	58.40ºN / 156.38ºW	Unknown
TI-2	Alaska Peninsula Highway		Unknown
TI-3	Port of Bristol Bay	58.45ºN/157.00ºW	$22,522,939
TI-5	State-owned airport in Naknek	58.733ºN/157.020ºW	Unknown
TI-6	State-owned airport in South Naknek	58.703ºN/157.008ºW	Unknown
TI-7	Mid- and high-tide cargo dock at South Naknek	58.72ºN / 156.98ºW	$3,233,716
TI-8	41.7 miles of Bristol Bay Borough maintained roads		
TI-9	26.32 miles of State of Alaska maintained roadways with the Bristol Bay Borough		
TI-10	Pen Air/Alaska Air Terminal		
TI-11	Grant Aviation Terminal		
TI-12	King Air Terminal, King Salmon		
TI-13	King Air Terminal, Naknek		
TI-14	King Salmon Ground Freight Facility		
TI-15	Egli Air Haul		
TI-16	Coastal Air Terminal		
TI-17	Float Plane Facilities		
TI-18	Dock in King Salmon		
TI-19	Port of Bristol Bay – South Naknek		
TI-20	Camai Clinic Helicopter Pad		
TI-21	Helicopter Pad at Leader Creek and Egli		
Utilities			**Value**
U-1	Alaska Teleconferencing Network		unknown
U-2	GCI, earth station		
U-3	AT & T Alascom, earth station	58.68ºN/ 156.66ºW	$131,574
U-4	Alaska Wireless Network		

Table 3 Critical Facilities and Essential Infrastructure			
Utilities			**Value**
U-5	Bristol Bay Telephone Cooperative, local telephone, Internet and cable		$79,900
U-6	General Communications Inc, long distance telephone [11]	58.67ºN/156.65ºW 58.69ºN/156.70ºW 58.74ºN/156.95ºW	$881,625
U-7	Borough Landfill	58.74ºN /156.87ºW	Unknown, see EF-20
U-8	Patrick E. Patterson's Sanitation and Refuse Service, Inc.	Location change from 2011	$151,000
U-9	Naknek Electric Association		$351,800
U-10	South Naknek Landfill		unknown
U-11	Two Borough Sewerage Lagoons	58.72ºN /-157.05162	unknown
U-12	BBB Communications Center Landfill		
High Loss Facilities			**Value**
HL-1	King Salmon Airport	58-40-35.3765N / 156-38-55.2876W	unknown
HL-2	Naknek Landing Strip		unknown
HL-3	South Naknek Number 2 Airport		unknown
HL-4	Bristol Bay Borough Offices	1 Main Street, Naknek	unknown
HL-5	Bristol Bay Borough Middle/High School	2 School Road, Naknek	unknown
HL-6	Naknek Elementary School	2 School Road, Naknek	unknown
HL-7	Bristol Bay Borough Emergency Services	Mile 1 Alaska Peninsula Highway, Naknek	unknown
HL-8	Alaska Peninsula Highway		unknown
HL-9	Port of Bristol Bay		$22,522,939
HL-10	Naknek Electric Power Plant[12]	58.73138, -157.00505	$351,800
HL-11	Alaska Marine Lines	MP 2, Alaska Peninsula Highway, Naknek	$671,000
HL-12	Delta Western Bulk Fuel Storage		$913,000
HL-13	Leader Creek Fisheries	Alaska Peninsula Highway	$3,520,000
HL-14	Alaska General Seafoods		$2,836,000
HL-15	Ocean Beauty		$3,985,300
HL-16	Trident Seafoods		$16,176,000
HL-17	Peter Pan		$1,458,000
HL-18	Icicle Seafoods		$119,000
HL-19	Yardarm Knot		$4,510,900
HL-20	North Pacific Processors Cannery	Pederson Point, located 3.5 miles north of Naknek	$4,078,500
HL-21	Copper River Seafoods	58.43, -157.00	$449,000
HL-22	Crystal Creek Lodge		
HL-23	King Salmon Lodge		

[11] http://www.city-data.com/towers/cell-King-Salmon-Alaska.html

[12] Naknek Power Plant Permit No. AQ0323TVP02

Table 3 Critical Facilities and Essential Infrastructure			
High Loss Facilities			**Value**
HL-24	Alaska Sportsman Bear Trail Lodge		
HL-25	Bering Sea Lodge		
HL-26	Rapids Camp Lodge		
HL-27	King Co		
HL-28	Adam's Enterprises		
HL-29	L M I Boatyard – L and M Equipment		
HL-30	Adesco		
HL-31	Lummi Fisheries Boat Storage		
HL-32	Associated Leader Creek Boat and all Boat Storages		
HL-33	U.S. Fish and Wildlife		
HL-34	National Park Service Seasonal/Transient Housing Complex and Equipment Cache	King Salmon (approximately 500 feet south of King Salmon Airport)	$3,700,000
HL-35	National Park Service Maintenance Shop	King Salmon	$2,440,000
Hazardous Materials Facilities			**Value**
HM-1	Delta Western Fuel Storage Facility	Mile 0 Alaska Peninsula Highway, Naknek	$913,000
HM-2	Naknek Electric Association Fuel Storage Tanks (>500 gal.)		unknown
HM-3	King Salmon AFS River Storage facility*		unknown
HM-4	King Salmon AFS Fuels Service Station		unknown
HM-5	King Salmon AFS Bulk Fuel Storage		unknown
HM-6	Peninsula Airways Bulk Fuel	King Salmon Airport	unknown
HM-7	Leader Creek Fisheries	Alaska Peninsula Highway	$3,520,000
HM-8	Alaska General Seafoods		$2,836,000
HM-9	Ocean Beauty		$3,985,300
HM-10	Trident Seafoods		$16,176,000
HM-11	Peter Pan		$1,458,000
HM-12	Icicle Seafoods		$119,000
HM-13	Snow Pac		$107,600
HM-14	Yardarm Knot Red Salmon NPPI		$4,510,900
HM-15	North Pacific Processors Cannery	Pederson Point, located 3.5 miles north of Naknek	$4,078,500
HM-16	Copper River Seafoods	58.43, -157.00	
HM-17	Silver Bay Seafoods, LLC		
HM-18	Katmai National Park		

Figure 2 - Borough Critical and Essential Facilities Naknek and South Naknek

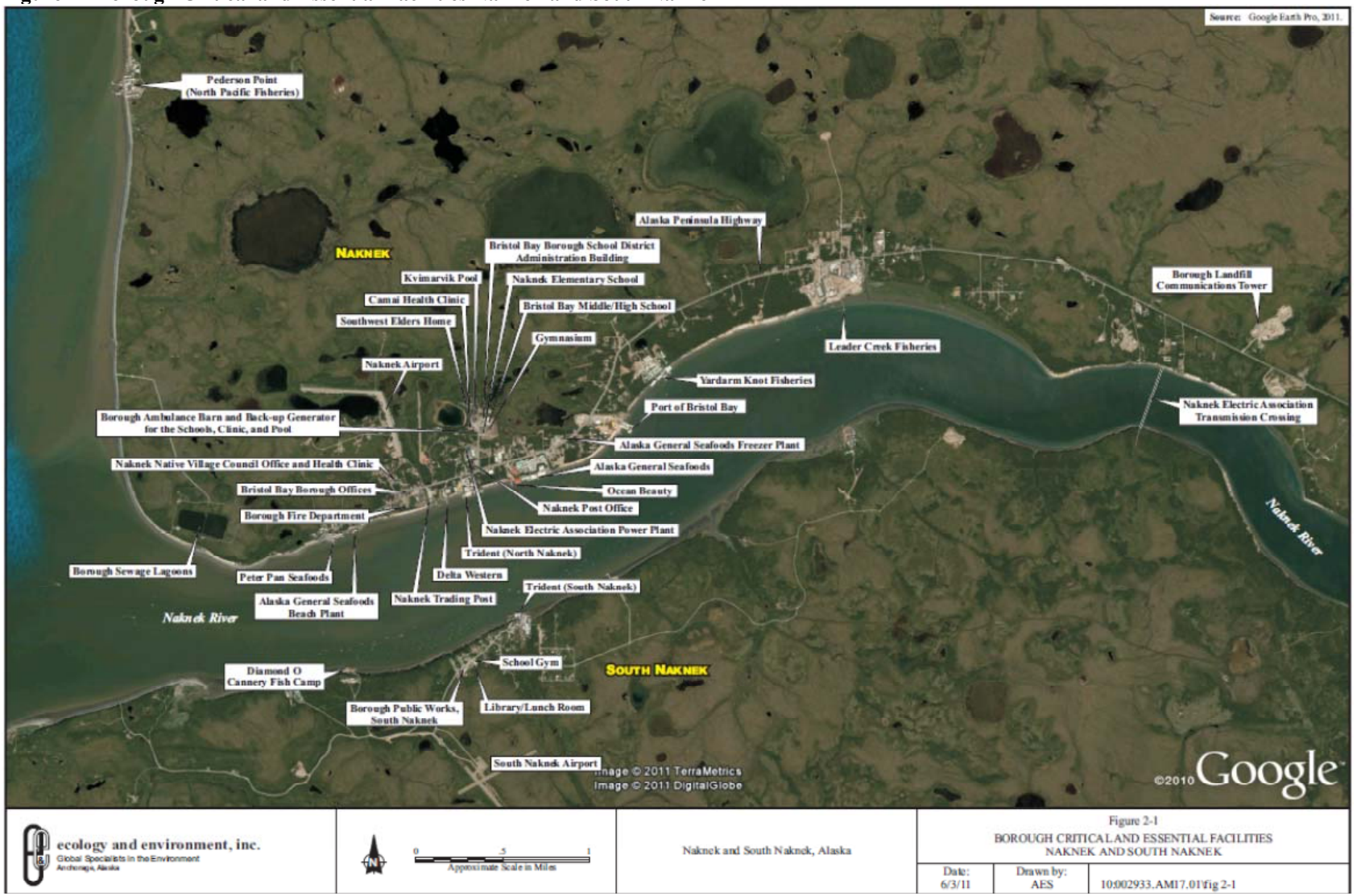
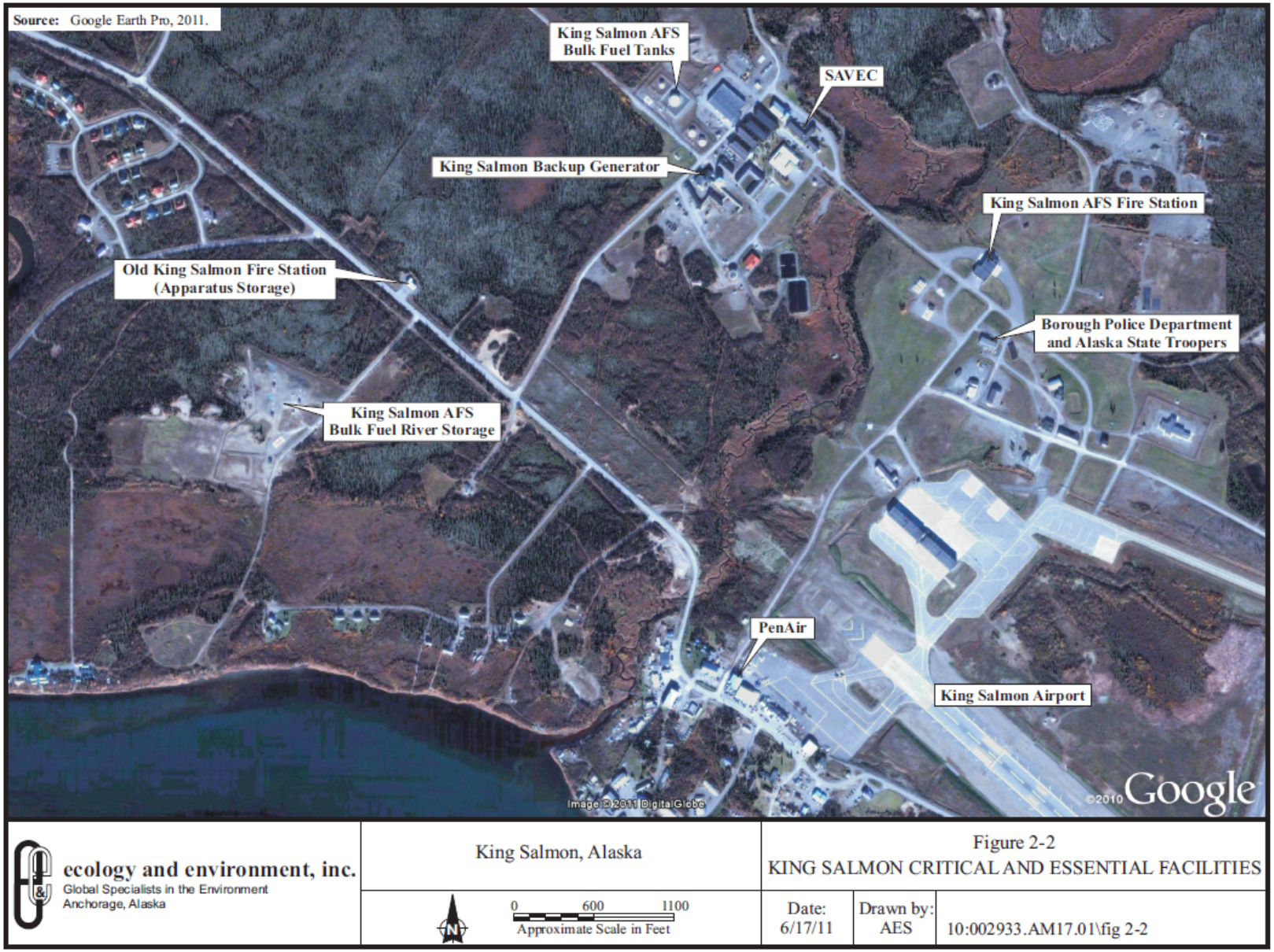


Figure 3 - Borough Critical and Essential Facilities King Salmon



3 Risk Assessment

3.1 Introduction

44 CFR § 201.6(c) (2) requires local jurisdictions to provide sufficient hazard and risk information from which to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

Risk assessment is a process that focuses on evaluating the potential for loss of life, personal injury, economic injury, and property damage resulting from hazards. This process is accomplished using four steps:

Step 1: Identify Hazards

Step 2: Profile Hazard Events

Step 3: Inventory Assets (see Section 2 – Community Profile)

Step 4: Estimate losses

The following sections address the unique hazards faced by Bristol Bay Borough and describe the community's risk based on vulnerability and exposure.

3.2 Federal Requirements

In accordance with 44 CFR §201.6, the Risk Assessment (Chapter 3) is the basis for the mitigation strategy (Chapter 4). Information in this chapter is used by the Planning Committee to identify and prioritize mitigation actions. 44 CFR §201.6 Risk Assessment criteria and applicable 44 CFR §78 Flood Mitigation Assistance criteria for profiling hazards and vulnerability assessments are provided in Table 4.

Table 4 Federal Requirements

44 CFR §201.6 Local Mitigation Plans *(c) Plan Content (2) Risk Assessment*
(i) *A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events*
(ii) *A description of the jurisdiction's vulnerability to the hazards described in paragraph (c) (2) (i) of this section. This description shall include an overall summary of each hazard and its impact on the community. The plan should describe vulnerability in terms of:*
(A) *The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;*

Table 4 Federal Requirements
44 CFR §201.6 Local Mitigation Plans *(c) Plan Content (2) Risk Assessment*
(B) *An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate;* ***(C)****Providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.* ***(iii)*** *For multi-jurisdictional plans, the risk assessment section must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.*
44 CFR §78.5 Flood Mitigation Plan development
(b) *Description of the existing flood hazard and identification of the flood risk, including estimates of the number and type of structures at risk, repetitive loss properties, and the extent of flood depth and damage potential.*

3.3 Identification of Hazards

In accordance with 44 CFR §201.6(c) (2) (i) and §78.5(b) (see Table 4), this section identifies hazards that might affect the communities of Bristol Bay Borough. Historic records, newspapers, local and State plans, personal interviews, and the internet were utilized by the Planning Committee to identify eight possible hazards (Table 5). The Planning Committee identified flood, wildland and community conflagration fire, earthquake, volcano, weather, erosion, technological, and climate change hazards that pose the greatest risk to the Borough communities. These hazards are profiled below in Section 3.4. Other identified hazards pose a lesser risk to human life and property. This LHMP has been updated in 2017 to address those increased hazard-specific risks.

Table 5 Identification of Hazards

Hazard	Profile Justification
Flood	Profiled in Section 3.4.1
Wildland and Conflagration Fire	Profiled in Section 3.4.2
Earthquake	Profiled in Section 3.4.3
Volcano	Profiled in Section 3.4.4
Snow Avalanche	Not profiled; communities located away from threats of avalanche
Tsunami and Seiche	Not profiled; communities are not likely to be affected by tsunami; only one recorded volcanogenic tsunami, which occurred 3,500 years ago
Weather	Profiled in Section 3.4.5
Ground Failure	Not profiled; although the 2006 update of the Borough Coastal Management Plan mentions landslide hazard potential for developed areas of the Borough, there were no documented events; therefore, the Mitigation Planning Group felt that ground failure should not be considered.
Erosion	Profiled in Section 3.4.6
Technological	Profiled in Section 3.4.7
Climate Change	Profiled in Section 3.4.8

3.4 Hazard Profiles

In accordance with §44 CFR §201.6(c) (2) (i), (ii) and §78.5(b), this section profiles hazards that pose the greatest risk to the community of Bristol Bay Borough (see Section 3.2). Specifically, this section identifies the nature of each hazard, including typical impacts, history of occurrences, probability of future events, and the location and extent of areas potentially affected. Land use and development trends within the community of Bristol Bay Borough are provided in Section 2.3.1.

The following hazard summaries were taken from the State of Alaska All-Hazard Mitigation Plan, dated October 2013.

3.4.1 Flood

3.4.1.1 Description

Flooding occurs when rain, snow, or glacial melt causes a waterway to exceed its capacity. While there are many different types of flooding, the community of Bristol Bay Borough primarily experiences rainfall runoff, snowmelt, and ice jam floods. Snowmelt flooding occurs in the spring. Rainfall runoff flooding, the most common type of flooding, usually occurs in the late summer and early fall. Localized flooding can also occur due to inadequate storm drainage. In extreme cases, an overflow of the storm water system can result in several feet of water in buildings, causing high damage levels.

3.4.1.1.2 Ice Jam Floods

Ice jam floods occur after an ice jam develops, causing water to rise upstream behind the jam. When the jam fails (releases), the stored water causes downstream flooding. Damage from ice jam floods is usually worse than those caused by rainfall-runoff or snowmelt floods because ice jam floods are usually higher, water levels change more rapidly, and ice causes physical damage beyond that caused by water alone. Ice jams usually develop where the channel slope decreases or becomes shallower, or where constrictions occur such as at bridges, bends in the river, headwaters, and reservoirs. During spring breakup, ice jams commonly dam water along big rivers. This type of flooding is exacerbated by snowmelt.

3.4.1.1.3 Glacial Outburst Floods (Jökulhlaups)

Glacial outburst floods, called *jökulhlaups*, are caused by a sudden release of water from a glacier or glacially dammed lake, resulting in rivers rapidly rising downstream. As with most types of flooding, glacial outburst flooding is sometimes, but not always, predictable.

Typical impacts from floods include water damage to buildings and their contents, structural damage from high-velocity water impact, erosion, agricultural damage, and hazardous materials and waste water/sewage releases. In addition, floods can profoundly disrupt transportation to and from affected areas.

3.4.1.2 History of Events

The community of Bristol Bay Borough has experienced few historic flood events. Table 6 provides information on past flood events, impacts, and estimated losses.

Table 6 History of Flood Events

Date	Location and Extent	Impact	Estimated Loss
1917	Naknek	Unknown	Unknown
October 2001	King Salmon/Naknek – Naknek River; Beach Access Road to Pederson Point Cannery; and Leader Creek.	King Salmon/Naknek – Naknek River flooded its banks and threatened several homes and cabins. The Beach Access Road out to Pederson Point North Pacific Seafoods Cannery had the" worst erosion ever seen in such a short period of time" according to a representative of the City Borough Office. Areas where there were stairs going up to set-net cabins were completely destroyed and a good 10 foot section of the Bluff is now gone. A small boat at the Leader Creek dock was set adrift by overflowing river water.	Unknown
September 26-October 3, 2003	04-207 2003 Fall Flood. Unseasonable amount of rain damaged Department of Transportation facilities at South Naknek airport	Flood	Unknown
August 23, 2005; declaration in October 2005 (06-214)	On August 23, 2005 strong storm with high winds combined with high tides produced storm surge 2-3 feet above maximum spring tide levels and caused significant flooding along lower lying villages of the Bristol Bay coast	Widespread coastal flooding in upper Bristol Bay area; weather and flooding damage; Naknek River private dock destroyed and 18-foot skiff washed away; at Clark's Point located west of Naknek, four homes flooded by surge and dock owned by Trident Fisheries was destroyed and Ekuk dock "gone."	Unknown
2009	King Salmon Creek ice jam during breakup threatened Alaska Peninsula Highway	Ice jam came close to flooding highway	Unknown

3.4.1.3 Probability of Future Events, Location and Extent of Impacts

According to an Alaska Department of Transportation & Public Facilities study for a bridge across the Naknek River[13], flood plains have not been mapped for the Bristol Bay region. There has been no flooding reported for King Salmon or South Naknek. The report states that based on the U.S. Army Corps of Engineers definition of flood plains, the Naknek River and its tributaries would be

[13] *Naknek Crossing Intermodal Economic and Airport Use Study, An approved component of the Alaska Statewide Transportation Plan 4/25/2005, Appendix D.* Initial environmental evaluation, Physical and biological environment summary Bristol Bay Borough

considered flood plains. The probability of flood for Naknek is considered low, because Naknek is on a bluff 30 feet above mean sea level. However, members of the mitigation planning group expressed flooding concerns for the Alaska Peninsula Highway at the bridges for the King Salmon Creek, Paul's Creek, and Leader Creek. Figure 4 provides a map of flood hazard areas for King Salmon and Naknek. There were no flood hazard areas identified for South Naknek.

3.4.2 Wildland and Community Conflagration Fire

3.4.2.1 Description

Wildland fire and community conflagration fires are important issues in the community of Bristol Bay Borough due to the expanses of tundra in the surrounding area and industrial development in Naknek along the north shore of the Naknek River. The abundant amount of fuel, in addition to topography and weather, all influence fire behavior.

3.4.2.1.1 Wildland Fires

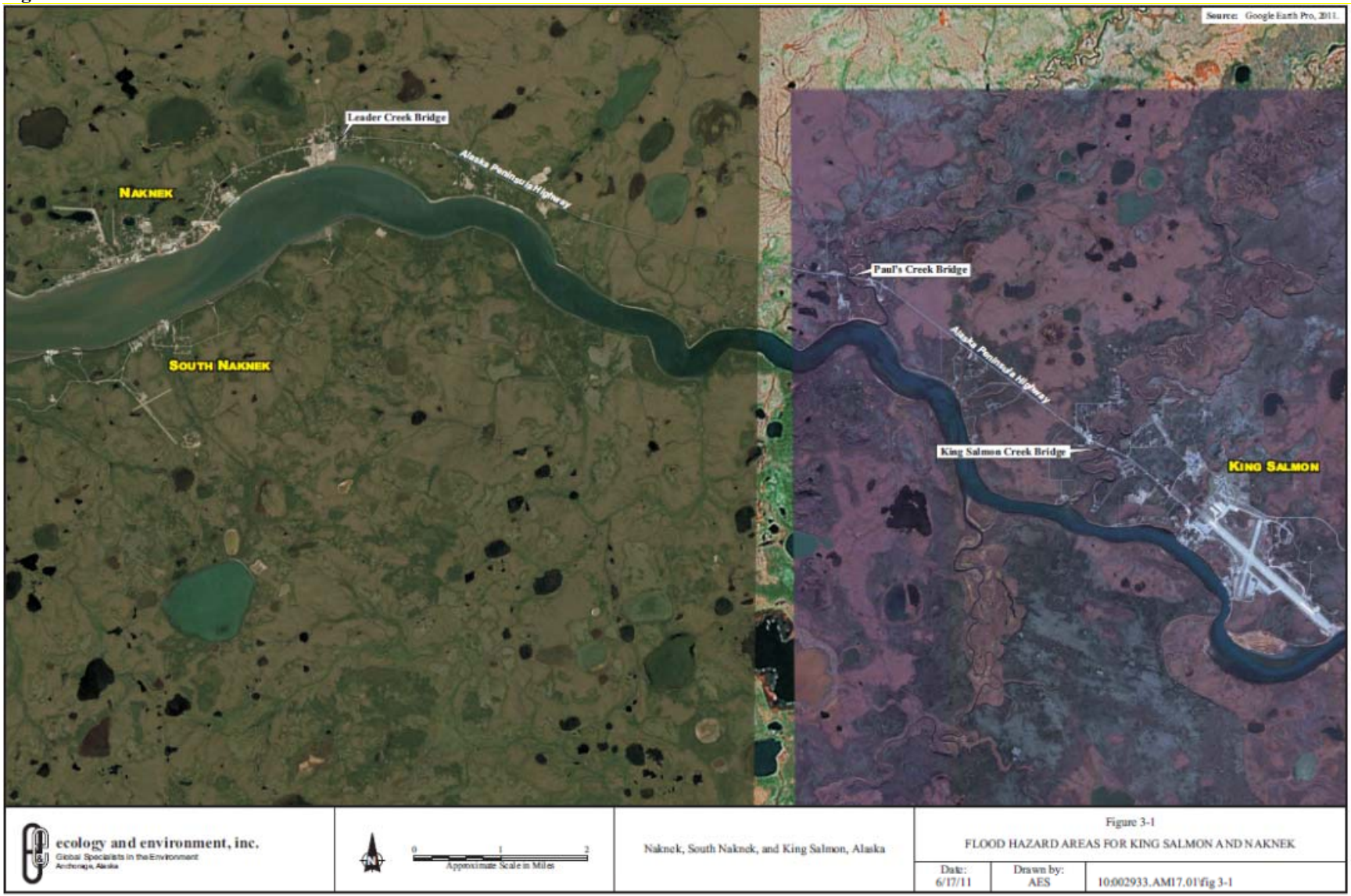
Types of wildland fire include wildland fires, urban interface fires, firestorms, prescribed fires (ignited by management action), and prescribed natural fires (naturally ignited).

Wildland fire risk in Alaska has increased in recent years due to the spruce bark beetle infestation. In addition, ice storms and high winds have killed large stands of trees. Dead trees are very dry and, therefore, highly flammable. This will present an even higher risk of fire in the coming years as the trees fall and die, increasing the fuel load with flammable material. Impacts common to wildland fires include structural damage from urban interface fires, ecological damage, and agricultural damage (loss of crops). Fire events can also impair transportation to and from affected populations as well as smoke impacts on the air quality, causing public health issues.

3.4.2.1.2 Community Conflagration Fires

In addition to wildland fires, this section includes community conflagration fires (fires in the built environment). These fires can occur at any time and quickly spread from building to building. Impacts typical of community conflagration fires include structural and smoke damage, as well as loss of the structures' contents. Some members in the Naknek and South Naknek communities spoke of their concerns for fires within fish processing facilities.

Figure 4 - Flood Hazard Areas



3.4.2.2 History of Events

Since 1939, the community of Bristol Bay Borough has experienced many historic wildland fire and community conflagration events. Table 7 provides information on past fire events, impacts, and known estimated losses, and Figure 5 shows historic wildland fire information.

Table 7 History of Fire Events

Date	Location and Extent	Impact	Estimated Loss
April 1, 1943	Koggiung-Naknek fire; report includes 8 fires that burned between Naknek and Koggiung, with a concentration of starts along Popeouk Creek[14]	192,000 acres burned	Unknown
July 11, 1945	Naknek fire, 58.50N, 156.40W	100,000 acres burned	Unknown
June 21, 1946	Naknek fire, 58.45N, 156.57W	10 acres burned from campfire	Unknown
July 12 – 16, 1953	Naknek fire, 58.44N, 157.2W	200 acres burned from debris burning	Unknown
July 18, 1957	One mile downstream of King Salmon, 58.41N, 156.42W	1 acre burned from lightning	Unknown
July 26, 1957	Five miles east of King Salmon, 58.41N, 156.30W	5 acres burned from lightning	Unknown
July 25 – 26, 1957	Naknek fire, 58.42N, 157.3W	0.1 acres burned from debris burning	Unknown
May 31, 1958	King Salmon S3, 58.36N, 156.36W	6 acres burned from recreation	Unknown
March 20, 1995	King Ko Hotel fire	Burned down	Unknown
July 10 – 11, 1996	Naknek, 58.37N, 156.30W	1.5 acres burned from cooking fire	Unknown
March 16, 1997	Naknek – South fire; 58.43N, 156.52W	300 acres burned from exhaust	Unknown
June 16, 2001	Peter Pan (Warren Camp), 2 miles from South Naknek	Several warehouse buildings that held boats and fishing gear were burned down, along with a repair shop. Up to 30 boats were destroyed. Two of the boats that burned were tied up at the dock.[15]	$2-3 million
July 16 – 19, 2006	Naknek; 58.75N, 156.96W	0.5 acres burned, human caused	Unknown
2006	Quinnat Landing Hotel fire	50-room hotel burned	$2.5 million
April 8 – 10, 2008	Savonoski, 58.42N, 156.53W	5 acres burned, human caused	Unknown
July 2008	Pederson Point tundra fire	Burned tundra; threatened Pederson Point Cannery and fishermen's setnet cabin;	Unknown
June 25 – August 16, 2009	Naknek; 58.44N, 157.3W	19.1 acres burned, caused by human (debris burning)	Unknown
May 2010	King Salmon Inn fire	Smoke damage to the hotel	$500,000[16]
May 30, 2011	Rapids Camp 58.63N, 156.53W	10 acres burned	Unknown
June 17, 2012	Alagnak 59.00N, 156.78W	78 acres burned from lightning	Unknown

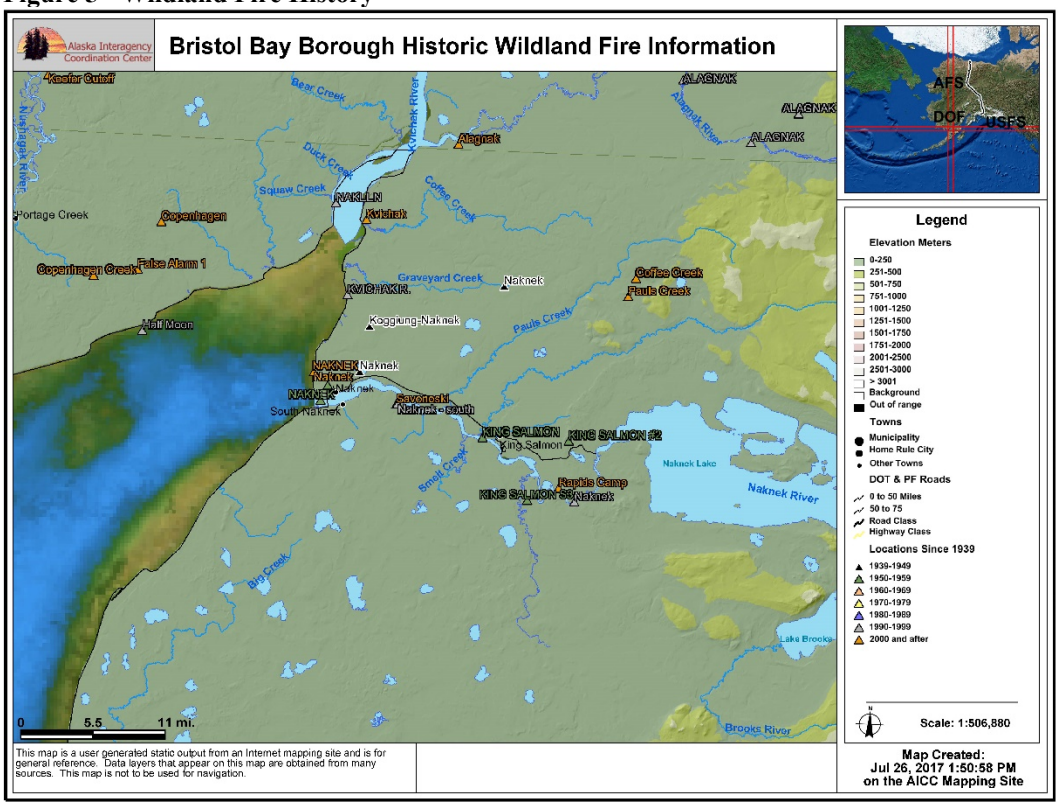
[14] http://afsmaps.blm.gov/imf_firehistory/imf.jsp?site=firehistory

[15] http://www.peninsulaclarion.com/stories/061801/ala_061801ala0030001.shtml

[16] Email from Lynn Shawback, owner of King Salmon Inn to V. Melde, E & E, April 4, 2011.

Table 7 History of Fire Events			
Date	**Location and Extent**	**Impact**	**Estimated Loss**
June 20, 2015	Coffee Creek 58.86N, 156.39W	6,760.1 acres burned from lightning	Unknown
June 20, 2015	Pauls Creek 58.84N, 156.40W	2,518.6 acres burned from lightning	Unknown
2015	Pederson Point	The community noted water planes were sent out.	Unknown
2015	Sugar Loaf	Outside the Borough	Unknown
2015	Copenhagen	The community noted this.	Unknown

Figure 5 - Wildland Fire History



3.4.2.3 Probability of Future Events, Location and Extent of Impacts

Historic fire events were used to determine the probability of future wildland fire and community conflagration fire events (Table 7). Based on historical information, it is estimated that there is a 17% recurrence interval for wildland fires and an 80% recurrence interval of community conflagration fires. The Alaska Interagency Coordination Center and Alaska Fire Service (http://fire.ak.blm.gov/) is the primary source for historic fire events.

Historic wildland and community conflagration fire events are identified. The fish cannery and hotels have experienced, or are located in areas that have experienced, historic fire events. Several community members and volunteer

firefighters expressed concern with a fire in the canneries because several facilities are located close together in Naknek. A fire resulting in the loss of the canneries could devastate the fishing economy. Members of the planning group stated that, during the winter, all the canneries are locked up and there is no easy access to the buildings. During winter months, snow narrows the roads to the canneries, which could slow fire trucks. These facilities store reportable quantities of diesel fuel, heating oil, ammonia, propane, and chlorine. The mixing of ammonia or chlorine with other chemicals or water could be extremely hazardous and reactive resulting in fire and explosion.[17]

Based on historic events and community planning committee input, the following facilities were determined to be in extreme hazard areas:

King Salmon

- Pen Air fuel tanks
- King Salmon Air Station River Storage

Naknek

- Delta Western bulk fuel facility
- North Pacific Processors, Pederson Point
- Naknek Electric Association bulk fuel tanks
- Peter Pan Seafoods
- Trident Seafoods
- Alaska General Seafoods main facility, Beach Plant, and Freezer Plant for Naknek and South Naknek
- Ocean Beauty Seafoods
- Yardarm Knot Fisheries
- Leader Creek Fisheries

South Naknek

- Trident Seafoods

[17] CAMEO Chemicals Predictability Chart.

Figures 6 and 7 provide fire and hazardous materials areas of concern for Naknek, South Naknek, and King Salmon.

3.4.3 Earthquake

3.4.3.1 Description

Two of the strongest earthquakes recorded on the North American continent occurred in Alaska. One was the magnitude 9.2 earthquake on Good Friday, March 27, 1964, which was North America's strongest recorded earthquake. The other was the largest inland earthquake in North America in almost 50 years—the Denali Fault earthquake of November 3, 2002, which was a magnitude 7.9 earthquake. Two of the world's top ten magnitude earthquakes had epicenters located in Southwest Alaska near the Bristol Bay Borough. Bristol Bay Borough, located within the Aleutian seismic zone, is vulnerable to three types of earthquakes: subduction zone, transform fault, and intraplate.

3.4.3.1.1 Subduction Zone Earthquakes

A subduction zone earthquake is caused by one crustal plate moving beneath another plate. This type of action usually leads to the Earth's largest earthquakes, such as the Good Friday earthquake. Volcanoes are associated with these plate convergences.

Figure 6 - Fire and Hazardous Materials Areas of Concern Naknek and South Naknek

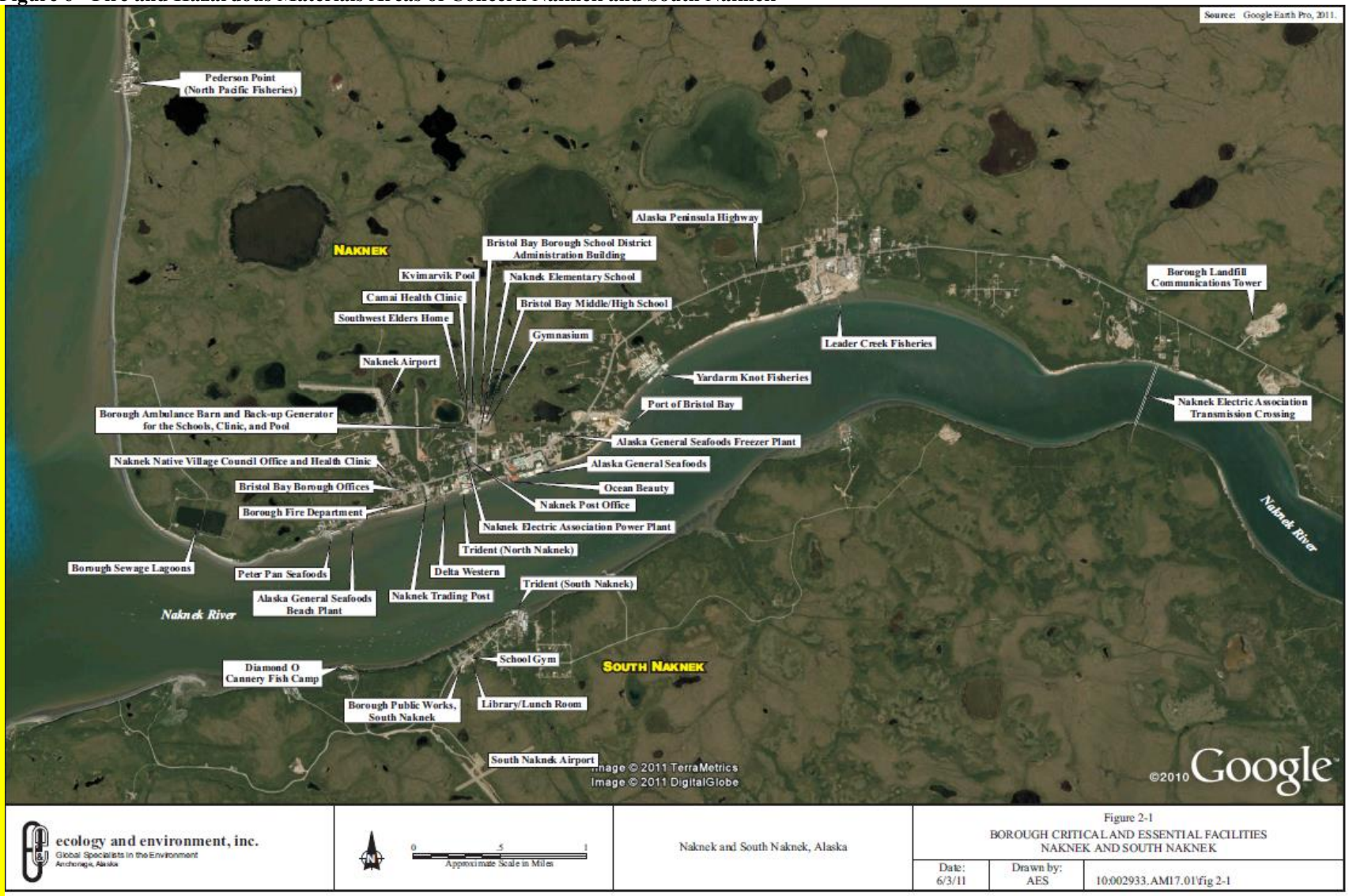
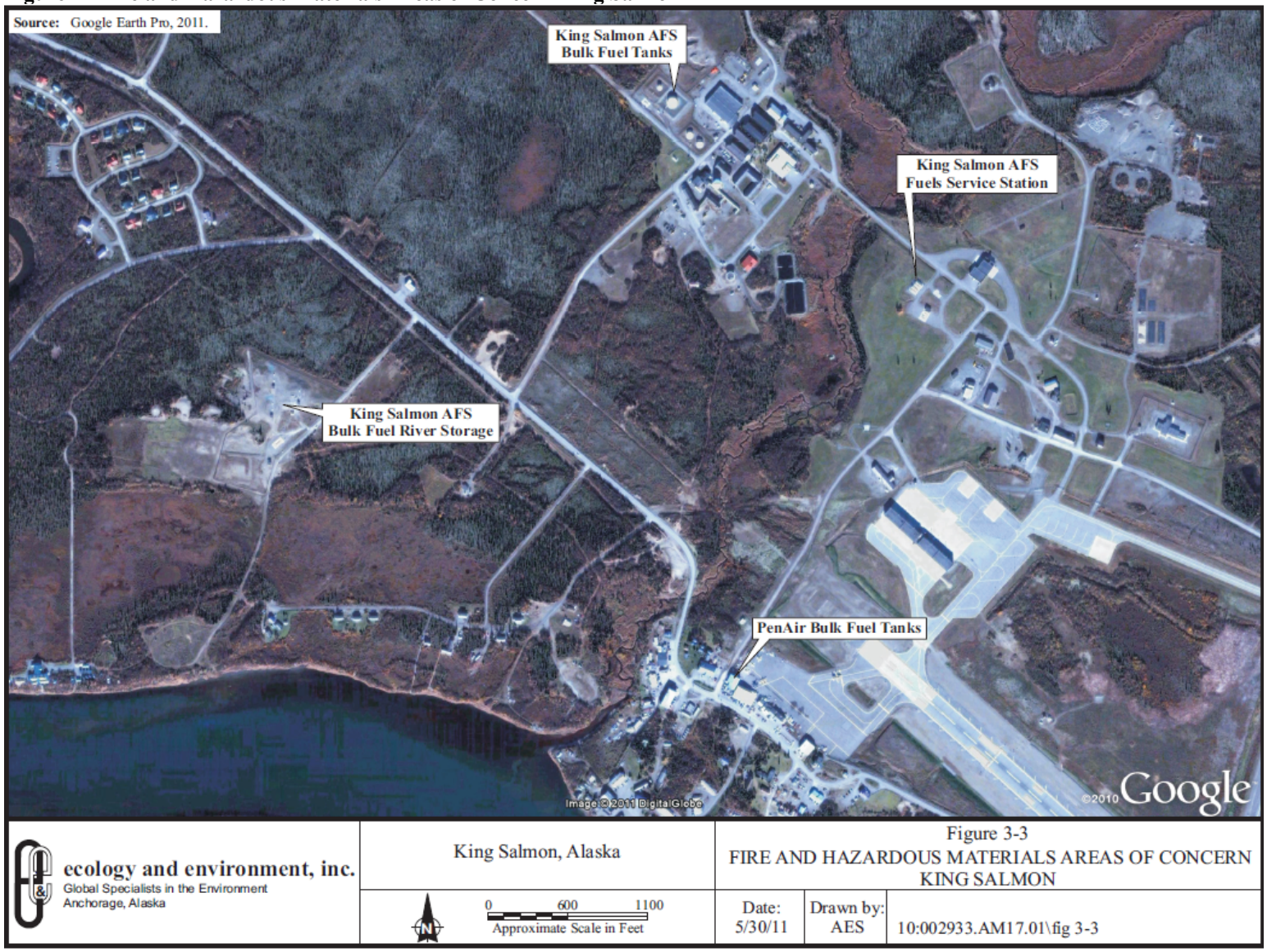


Figure 7 - Fire and Hazardous Materials Areas of Concern King Salmon



The Alaska Division of Geological and Geophysical Surveys Miscellaneous Publication 134, dated May 2004, states that a seismic event characterization study by Woodward-Clyde Consultants in 1978, indicated that magnitude 5—8.5 earthquakes could be generated from shallow-dipping Aleutian megathrust where the North Pacific plate is being subducted beneath the North American plate, in addition to smaller earthquakes in the magnitude range of 5—6.25 from distant offshore and outer shelf faults as well as the Aleutian volcanoes. One 1990 study calculated probabilities for future large and great earthquakes in the Queen Charlotte-Alaska-Aleutian seismic zone and determined that the Kodiak Island-Alaska Peninsula segments of the megathrust have an 11-37 percent conditional probability of having a magnitude range 7.7—8.2 event between 1988 and 2008. Also, the Shumagin segment of the seismic zone was predicted to have a 74-84 percent conditional probability of having a magnitude 7.4 event during that period. The lack of recent large-magnitude seismic events suggested that the fault may be locked and is building strain. More recent studies done in 1999 with GPS measurements to record surface deformation "seem to confirm that no significant strain is present; therefore, significantly reduces the probability of a large-magnitude megathrust event in this area."[18]

3.4.3.1.2 Transform Fault Earthquakes

Another type of earthquake is the transform fault earthquake, which occurs when crustal plates slide by each other. This type of earthquake can occur where secondary faults branch off the main boundary fault.

3.4.3.1.3 Intraplate Earthquakes

Intraplate earthquakes occur within a tectonic plate, sometimes at great distance from the plate boundaries. Intraplate earthquakes can have magnitudes of 7 on the Richter scale.

Map 3.3 entitled Earthquakes in Alaska, found in Chapter 3 of the Southwest Alaska Comprehensive Economic Development Strategy, 2009-2014[19], shows the Borough located within the North American plate southwest of the Castle Mountain Fault and north of the Pacific plate and the 1964 earthquake rupture zone. The map narrative states,

> *Earthquake risk is high in much of the southern half of Alaska, but it is not the same everywhere. . . . The Pacific plate. . . is sliding northwestward past southeastern Alaska and then dives beneath the North American plate . . . in southern Alaska, the Alaska Peninsula, and the Aleutian Islands. Most*

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[18] Alaska Division of Geological & Geophysical Surveys, Miscellaneous Publication 134, *Geologic Hazards On and Near the Northern Coast of the Alaska Peninsula*, De Anne S.P. Stevens and Patty A. Craw, May 2004

[19] Southwest Alaska Comprehensive Economic Development Strategy, 2009-2014, Southwest Municipal Conference, May 2010.

earthquakes are produced where these two plates come into contact and slide past each other. . .[20]

Earthquakes can occur on different or segments of faults at different times. Earthquakes can trigger secondary hazards including landslides, avalanches, tsunamis, seiches, uplift, subsidence, infrastructure failures and soil liquefaction.

Typical damage associated with earthquakes includes structural damage (in severe earthquakes, building collapse) and damage to utilities such as water and sewer pipes. For example, the Denali Fault earthquake caused damage to the Trans Alaska Pipeline System; however, no spills resulted from the damage.

The Bristol Bay Borough Alaska Coastal Management Program document states that the Borough is located "north of the major areas of seismic activity." The document concludes that "the earthquake potential within the Borough is low, though the coastal and river bluffs present increased hazards due to their geologic formation and soils.**Error! Bookmark not defined.** The Bruin Bay and Castle Mountain/Lake Clark faults are located within 100 miles of the Borough. Earthquakes that occur in the area are deep and low strength.[13]

3.4.3.2 History of Events

The community of Bristol Bay Borough has experienced many earthquake/seismic events, although none have caused catastrophic damage. Community members say they may have felt earthquakes; however, the earthquakes did not damage facilities or buildings. Table 8 provides information on past seismic events, impacts, and estimated losses for earthquakes greater than a magnitude 6.0. This information was provided from the U.S. Geological Survey Earthquake Data Base, using a circle search within a 200 kilometer radius, from King Salmon center point of 56.680 North and -156.640 West.

Table 8 History of Earthquake Events

Date	Location and Extent	Impact (Magnitude)	Estimated Loss
October 9, 1900	57.09 North, 153.48 West	7.7	Unknown
December 23, 1906	56.85 North, 153.9 West	7.3	Unknown
November 7, 1912	57.5 North, 155 West	7.3	Unknown
December 5, 1912	57.5 North, 154 West	6.9	Unknown
May 4, 1923	55.55 North, 156.75 West	7.1	Unknown
July 28, 1934	55.5 North, 156.75 West	6.7	Unknown
November 10, 1934	55.48 North, 158.37 West	8.3	Unknown
November 17, 1938	55.45 North, 157.55 West	7.3	Unknown
September 28, 1941	56.5 North, 157.5 West	6.5	Unknown
May 26, 1948	56.3 North, 153.8 West	6	Unknown
February 13, 1951	55.55 North, 156.35 West	7.1	Unknown
November 29, 1952	56.3 North, 153.8 West	6.7	Unknown

[20] Map 3.3: Earthquakes, Active Faults and Rupture Zones in Alaska, Earthquakes in Alaska, USGS, Peter J. Haessler and George Plafker, 2003.

Table 8 History of Earthquake Events

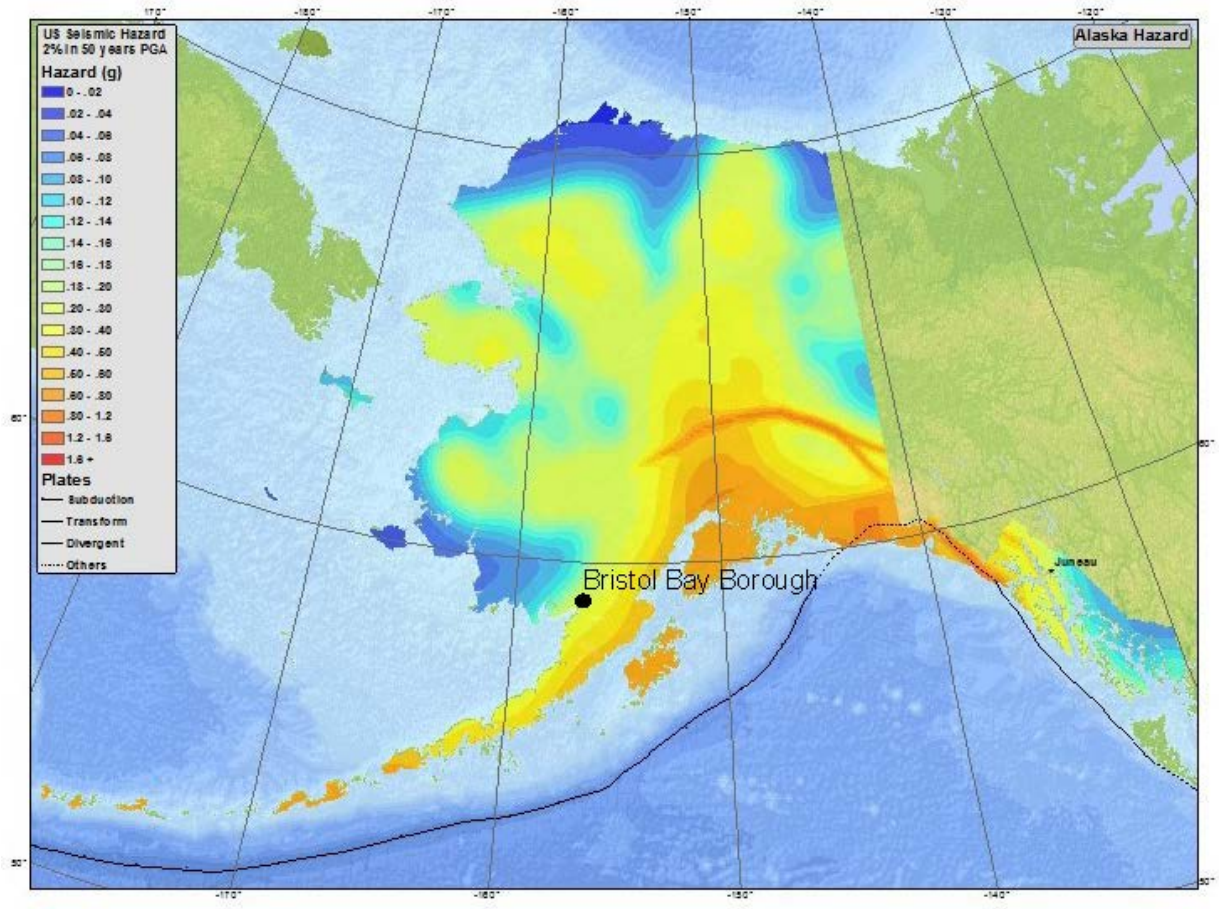
Date	Location and Extent	Impact (Magnitude)	Estimated Loss
February 25, 1953	56 North, 156.2 West	6.7	Unknown
June 15, 1953	56.3 North, 153.8 West	6.5	Unknown
June 17, 1954	56.29 North, 154.09 West	6.5	Unknown
November 15, 1955	55.27 North, 155.64 West	6.3	Unknown
April 4, 1957	58.06 North, 155.18 West	6	Unknown
April 10, 1957	55.84 North, 153.88 West	6.9	Unknown
April 14, 1959	57.95 North, 155.01 West	6	Unknown
August 7, 1959	56.45 North, 153.51 West	6	Unknown
September 1, 1960	56.25 North, 153.59 West	6.1	Unknown
January 31, 1961	56.17 North, 153.77 West	6.2	Unknown
January 1, 1963	56.57 North, 157.56 West	6.5	Unknown
May 12, 1963	57.3 North, 154 West	6.5	Unknown
February 6, 1964	55.75 North, 155.79 West	7	Unknown
March 28, 1964	56.45 North, 153.94 West	6.5	Unknown
April 4, 1964	56.3 North, 154.4 West	6.5	Unknown
April 4, 1964	56.51 North, 154.33 West	6.1	Unknown
January 22, 1966	56.03 North, 153.78 West	6	Unknown
April 16, 1966	56.93 North, 153.61 West	6.2	Unknown
November 24, 1969	56.14 North, 153.66 West	6	Unknown
March 11, 1970	57.39 North, 153.97 West	6.4	Unknown
March 24, 1972	56.142 North, 157.18 West	6	Unknown
February 13, 1979	55.45 North, -157.16 West	6.8	Unknown
May 20, 1979	55.65 North, -156.73 West	6.5	Unknown
January 2, 1985	55.43 North, -157.84 West	6.1	Unknown
September 4, 1989	55.54 North, -156.84 West	6.9	Unknown
May 1, 1990	Northeast of Naknek	6.1	Unknown
December 6, 1999	57.36 North, -154.49 West	7.0	Unknown
December 7, 1999	57.36 North, -154.51 West	6.4	Unknown
July 11, 2000	57.37 North, -154.21 West	6.6	Unknown
April 9, 2005	56.17 North, -154.52 West	6.0	Unknown
May 25, 2008	56.09 North, -153.78 West	6.0	Unknown
May 29, 2015	56.59 North, -156.43 West	6.7	Unknown

3.4.3.3 Probability of Future Events, Location and Extent of Impacts

While it is not possible to predict an earthquake, the USGS has developed Earthquake Probability Maps that use the most recent earthquake rate and probability models. These models are derived from earthquake rate, location, and magnitude data from the USGS National Seismic Hazard Mapping Project. Figure 8 indicates that the USGS earthquake probability model places the probability of an earthquake with a likelihood of experiencing strong shaking (0.3g to 0.4g peak ground acceleration) with a 2% probability in 50 years, based on the USGS Alaska hazard model. Historic earthquake activity was obtained from the U.S. Geological Survey Earthquake Catalog (https://earthquake.usgs.gov/earthquakes/search/). Members of the Mitigation Planning Group could not recall any damaging earthquakes that have impacted

the Borough and research did not reveal any record of earthquake damage. Since 1900 to 2017, there have been 44 events recorded for earthquakes greater than magnitude 6.0; however, given the limited information on damage to critical infrastructure or essential facilities found during the development and update of this plan, it was difficult to make an estimate of future damage. Members of the planning group believed that there would be a low percentage of critical infrastructure that would sustain damage during a future seismic event. Additionally, no high rise buildings exist in this region.

Figure 8 - Earthquake Probability Map



3.4.4 Volcanoes

3.4.4.1 Description

Alaska contains more than 130 volcanoes and volcanic fields, which is nearly three quarters of the volcanoes in the United States (U.S.). Currently, there are 52 active volcanoes in Alaska. Because of this large number of active volcanoes, Alaska has the highest cumulative aviation threat.[21]

3.4.4.1.1 Novarupta 1912 Eruption

The largest volcanic eruption in the 20th century occurred at Novarupta in June 1912. Novarupta is located in what is known as the Valley of Ten Thousand Smokes, southeast of the Bristol Bay Borough. A 2001 USGS Open-File Report states that most of the magma vented at Novarupta caused Mount Katmai, located 10 km away, to collapse during the eruption, and the resulting caldera is now filled with a 250-meter-deep lake.[22] About 50 of these volcanoes have been active in Alaska since about 1760.

Volcanic eruptions during the early 20th century also led to the abandonment of native settlements within the Katmai region. According to a National Park Service brochure entitled *Witness, Firsthand Accounts of the Largest Volcanic Eruption in the Twentieth Century:*

> Increasingly severe earthquakes in the days preceding the June 6th [1912] eruption led to the complete abandonment of the native villages in the Katmai region. Most families were already in Kodiak or Naknek by late May, as men were employed as fishermen and women worked in the canneries during the salmon runs. Remaining residents of Katmai village and the Severnovsk (Savonoski) settlements fled to Cold Bay (Puale Bay) and to the Bristol Bay coast a few days prior to the main eruption.[23]

Two families were reported to live in Old Savonoski for a year following the eruption; however, they joined a settlement on the lower Naknek River called New Savonoski. Later the residents abandoned that settlement for the current South Naknek location, at the mouth of the Naknek River.

> The native villages of Katmai, Kaflia, and Kaguyak on the Pacific coast, and the Severnovsk settlements of Iqkhagmiut, Nunamiut and Kangmiut were abandoned during the eruption and never re-established.[23]

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[21] *Aviation Concerns About Volcanic Ash,* Leonard Salinas, Flight Dispatch, United Airlines, Congressional Hazards Caucus Alliance, April 21, 2010.

[22] Preliminary Volcano-Hazard Assessment for the Katmai Volcanic Cluster, Alaska, Judy Fierstein and Wes Hildreth, U.S. Geological Survey Open-File Report 00-489,2001:28.

[23] *Witness, Firsthand Accounts of the Largest Volcanic Eruption in the Twentieth Century,* Jeanne M. Schaaf, National Park Service, Katmai National Park and Preserve/Aniakchak National Monument and Preserve, Lake Clark-Katmai Studies Center, 2004.

3.4.4.1.2 Mt. Redoubt Eruptions

The Alaska Volcano Observatory estimates the recent eruptions of Mt. Redoubt (1989–1990) were the second most costly in U.S. history. These eruptions impacted aviation and oil industries, with damage to five commercial jets, airport closures, flight cancellations, and drifting volcanic ash clouds that disrupted air traffic as far away as Texas.

3.4.4.1.3 Volcanic Ash Fall

The single greatest volcanic hazard to the community of Bristol Bay Borough is airborne volcanic ash, fine fragments of rock blown high into the atmosphere during explosive volcanic eruptions. Coarse particles fall near the volcano, but the fine particulates travel downwind as an eruption cloud, posing a hazard to aircraft and populations even hundreds or thousands of miles away. Often, air transportation is the only means of transportation for remote communities in Alaska, particularly during the winter months. For the Borough communities, disruption of air service affects passengers, food, equipment, supplies, mail and medicines for days or weeks due to volcanic ash. This disruption could be a hardship and potentially life-threatening during a medical emergency, if a patient needed to be transported to a hospital.

Volcanic ash is extremely abrasive, does not dissolve in water, and is heavy and slippery when wet. It is also conductive when wet. One typical impact is inhaling volcanic ash, which can be dangerous, especially for children, the elderly, and those with breathing problems. Volcanic ash can also affect machinery such as cars and electrical generators. Lahars (volcanic mudflows), pyroclastic flows and surges, lava flows, debris avalanches, volcanic gases, and tsunami-generating landslides are also potential hazards during a volcanic eruption. The severity of each of these hazards depends on the type of eruption and distance from the volcano.

The community of Bristol Bay Borough may experience volcanic ash fall hazards. According to an Alaska Division of Geological & Geophysical Surveys (DGGS; formerly referred to as AGGS) Miscellaneous Publication 132, *Geologic Hazards In and Near the Northern Portion of the Bristol Bay Basin* (December 2003),

> ". . . ash clouds drift thousands of kilometers from the source volcanoes and are a severe hazard to mechanical and electronic equipment . . . and heavy ashfall can disrupt activities by interfering with power generation and impairing visibility. Resuspension of dry ash by wind can cause the effects of ash fallout to persist well beyond the eruption."[24]

[24] *Geologic Hazards In and Near the Northern Portion of the Bristol Bay Basin* (December 2003), AGGS, MP 132

3.4.4.1.4 Tsunamis and Earthquakes

The DGGS study states that volcanoes can cause tsunamis when debris avalanches from gravitational instability or erupts large-volume pyroclastic flows. The material flows so quickly into water that it generates large waves that travel for long distances—thus, tsunamis. There is evidence, documented in various studies from 1989 to 2003, of a 3,430 year-old eruption that caused a volcanogenic tsunami from an eruption of Aniakchak caldera located more than 200 kilometers away on the Alaska Peninsula. Another study done in 1998 found evidence of a fast-moving tsunami wave up to 7.8 meters high in Bristol Bay and deposited material 18.4 meters above mean high tide on the shores of Nushagak Bay.

Also, there were many large earthquakes before and during the 1912 eruption. Some of the Katmai volcanoes remain seismically active; there is ongoing intermittent monitoring for seismicity. The Alaska Volcano Observatory uses Global Positional Systems (GPS) measurements to detect changes in ground elevation that correlates to "precursory volcanic activity."

3.4.4.2 History of Events

The Bristol Bay Borough has experienced several volcanic ash fall events triggered from Cook Inlet and Alaska Peninsula volcanoes. Table 9 provides information on past volcanic ash fall events, impacts, and estimated losses.

Table 9 History of Volcanic Events

Date	Location and Extent	Impact	Estimated Loss
June, 1912	Novarupta Volcano and Mount Katmai eruption	Documented effects of salmon runs and broods of 1911 to 1915[25]; corrosive rains at Seward and Cordova[26] ; abandonment of villages in Katmai region.	Unknown
1953	Mount Trident	Trident erupted intermittently from 1953 to 1974, with lava flows and ash clouds.[27]	Unknown
1986	Mount Augustine eruption	Volcanic ashfall in Bristol Bay Borough	Unknown
1989-1990	Redoubt volcano	Volcanic ash; Borough experienced aviation impacts due to volcanic ash; cancelled flights. Between 3-15-2009	Estimated additional costs to

[25] Effects of Lake Fertilization by Volcanic Activity on Abundance of Salmon, George J. Eicher, Jr. and George A. Rousefell, Fishery Research Biologists, U.S. Fish and Wildlife Service, Woods Hole, Massachusetts, 1957.

[26] Bristol Bay Borough Alaska Coastal Management Program, updated January 2006.

[27] *Geologic Hazards In and Near the Northern Portion of the Bristol Bay Basin* (December 2003), AGGS, MP 132

Table 9 History of Volcanic Events			
Date	**Location and Extent**	**Impact**	**Estimated Loss**
		and 4-4-2009, eruption and ash cloud resulted in 60 re-routes, 20 diversions, 10 turn backs to originating departure cities and cancelations due to no operations at night.[28]	carriers approximately $500,000.
January and February 2006	Augustine Volcano eruptions	Military exercises in Naknek and Stony Mountain delayed 5.5 hours due to ash cloud and need for contingency air corridor for flights diverted to Anchorage.[29]	Unknown
September 17, 2006	Fourpeaked eruption	Potential disruption of air travel	Unknown
March-April 2009	Mount Redoubt eruptions	Ashfall closed Anchorage International Airport for 20 hours; air travel disruption for all other airports, including King Salmon Airport	Economic impact estimated to be less than or equal to impacts of 1989-1990 eruptions, which was $160 million[30]

3.4.4.3 Probability of Future Events, Location and Extent of Impacts

Volcano eruptions in Alaska are difficult to predict and the locations of impacts from the eruptions and resulting ash clouds and the re-suspension of ash are equally difficult to determine because of wind direction and weather patterns. In the event of an eruption of a volcano in Alaska and specific winds, volcanic ash fall could affect all the communities of Bristol Bay Borough. Although volcanic ash fall would affect these communities, some populations and critical infrastructure may be impacted more than others.

One USGS study states that:

> *Most at risk from future eruptions of the Katmai volcanic cluster are (1) air-traffic corridors of the North Pacific, including those approaching*

[28] *Aviation Concerns About Volcanic Ash,* Leonard Salinas, Flight Dispatch, United Airlines, Congressional Hazards Caucus Alliance, April 21, 2010

[29] The 2006 Eruption of Augustine Volcano, Alaska, Edited by John A. Power, Michelle L. Coombs, and Jeffrey T. Freymueller, USGS Professional Paper 1769, 2010

[30] *Mount Redoubt Volcanic Eruptions March – April 2009, Service Review*, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, January 2010.

> *Anchorage, one of the Pacific's busiest international airports, (2) several regional airports and military air bases, (3) fisheries and navigation on the Naknek Lake system and Shelikof Strait, (4) pristine wildlife habitat, particularly that of the Alaskan brown bear, and (5) tourist facilities in and near Katmai National Park.*[31]

Figure 9 identifies critical infrastructure that supports populations with increased susceptibility to volcanic ash fall events (e.g., children and elderly adults), as well as susceptible infrastructure (e.g., electric power plants and freshwater treatment plants). King Salmon, Naknek, and South Naknek communities have historically sustained damage during volcanic ash fall events. More-so, delays, re-routing, and cancellations of air traffic would have a greater impact from ash fall, because air is a major mode of transportation for anyone or anything coming into or traveling from these communities.

Many of the North Pacific air transportation routes across the North Pacific could be impacted by volcanic ash. According to a recent study in which ash from Novarupta was spewed once a week for five years, the results would close most airports in the northern hemisphere and ash fall could affect most of Europe and reach as far south as Australia.[32]

Additionally, an ash fall event following an eruption with the magnitude of the 1912 Novarupta event could potentially have a devastating impact on the sockeye salmon industry, which could devastate the Borough's economy. Given historical volcanic ash fall damage, a worst case scenario would be an ash fall event that would affect the power plant, water supply, fish habitat, and air traffic, which would limit transportation of response resources, food, equipment and supplies, medical evacuations and potentially cause catastrophic damage to energy supply and the economy of the Borough communities.

In 2017, community members noted that there are annual aviation warnings due to volcanoes from communities outside the Borough. For example, Sand Point in the East Aleutians Borough has issued warnings in the past two years. No ash has been spread to the Borough although residents report smelling a sulfur-type odor.

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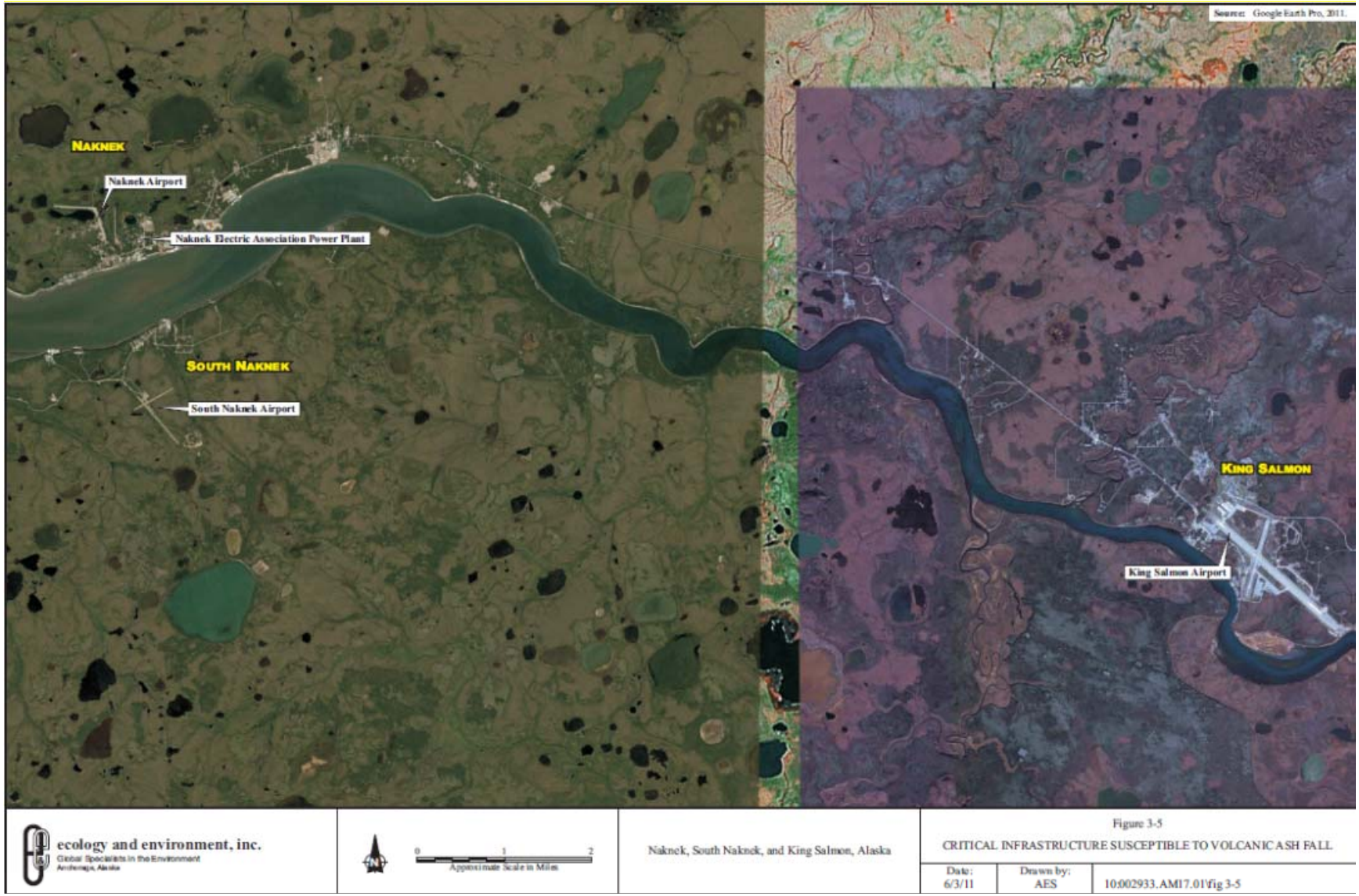
[31] *Preliminary Volcano-Hazard Assessment for the Katmai Volcanic Cluster, Alaska*, Judy Fierstein and Wes Hildreth, U.S. Geological Survey Open-File Report 00-489,2001:28.

[32] *Volcanic eruption could bring world to standstill,* Ned Rozell, Geophysical Institute, University of Alaska Fairbanks, Anchorage Daily News, April 27, 2011.

Figure 9 - Critical Infrastructure Susceptible to Volcanic Ash Fall



3.4.5 Weather

3.4.5.1 Description

Weather hazards include winter weather, thunder and lightning, hail, high wind, storm surges, coastal storms, and drought. Winter weather includes heavy snows, ice, *aufeis*, and extreme cold. *Aufeis* is glaciation or icing of streams and rivers, often affecting road surfaces and infrastructure.

3.4.5.1.1 Heavy Snowfall

Heavy snowfall can bring the community of Bristol Bay Borough to a standstill by inhibiting transportation, knocking down trees and utility lines, and causing structural collapse in buildings not designed to withstand the weight of the snow. Typical impacts also include repair and snow removal costs.

3.4.5.1.2 Ice

Ice buildup can collapse utility lines and communications towers, as well as make transportation difficult. Ice can also become a problem on roadways if the temperature warms up just enough for precipitation to fall as freezing rain where a pressure differential occurs across a mountain range.

Icy roads Naknek. Photo courtesy of Anton Littau, http://littau.net

3.4.5.1.3 *Aufeis*

Aufeis forms during the winter when emerging ground water freezes. Stream glacial flooding occurs when ice forms from the bottom up instead of the top down, forcing water out of the stream channel. If *aufeis* occurs on a roadway, it makes travel difficult.

3.4.5.1.4 Extreme Cold

Extreme cold can lead to hypothermia and frostbite, which are both serious medical conditions. Cold causes fuel to congeal in storage tanks and supply lines, stopping electric generators. Without electricity, heaters do not work, causing water and sewer pipes to freeze or rupture. Extreme cold can also interfere with transportation if the ambient temperature is below an aircraft's minimum operating temperature. Extreme cold increases the likelihood of ice jams and flooding. If extreme cold conditions are combined with low/no snow cover, the ground's frost level can change, creating problems for underground infrastructure.

3.4.5.1.5 Thunderstorms

Turbulence and atmospheric imbalance cause thunderstorm events. They arise from a combination of unstable rising warm air, moisture to form clouds and rain, and the upward lift of air currents resulting from interacting weather fronts (warm and cold), sea breezes, or mountains.

3.4.5.1.6 Lightning

Lightning exists in all thunderstorms, resulting from a buildup of charged ions within the thundercloud. When lightning connects with a grounded object, electricity is released, which can be harmful to humans. Lightning can also start fires. Hail is associated with thunderstorms. Hailstones are ice formations greater than 0.75 inches in diameter that fall with rain. The size and severity of the storm determine the size of the hailstones.

3.4.5.1.7 High Winds

High winds occur when there are winter low-pressure systems in the North Pacific Ocean and the Gulf of Alaska. High winds in the community of Bristol Bay Borough can equal hurricane force but fall under a different classification because they are not cyclonic nor possess other characteristics of hurricanes. High winds have the potential to seriously damage port facilities, fishing industry facilities, and community infrastructure (especially aboveground utility lines causing localized power failure).

3.4.5.1.8 Cyclones

Low pressure cyclones either develop in the Bering Sea, Gulf of Alaska or are transported to the region through wind systems from the North Pacific Ocean to Alaska. They are most common from the fall through the spring. They often bring wide swathes of hurricane force winds and occasionally cause coastal flooding and erosion. The storm's intensity and location, and the local topography

all influence the storm's impact. One key factor that influences the damage done by these storms is the status of the coastal shore ice. Solid shore ice protects coastal areas against erosion and physical damage to coastal development. Weak or absent shore ice allows the full force of the storm surge to impact the coast. Fierce storm conditions do not have to be present to cause damage. Northwestern communities suffer from storms where high-water storm surges erode and undercut the banks melting the permafrost (sometimes called silent storms). Sometimes ice blocks are moved by large ocean waves into villages causing severe damage to structures and vehicles. Alaska has suffered severe damage from coastal storms historically.

Large chunks of ice forms along the coastline during extreme cold temperatures. These large blocks of ice, called "anchor ice" holds sheets of ice in place while the Naknek River freezes over. Anchor ice has contributed to erosion of the shoreline and damage to docks and facilities in Naknek and South Naknek. Photo of Anton Littau and anchor ice, courtesy of Jeanine Littau, http://littau.net

3.4.5.1.9 Storm Surges

Storm surge occurs when the water level of a tidally influenced body of water increases above the high tide mark. Storm surge is generally associated with winter low-pressure systems or coastal storms. They most commonly occur from late fall to early spring. The problem is especially severe during the highest tides of the monthly cycle. Storm surge is controlled by the intensity (wind speed) of the storm, low barometric pressures, astronomical tides, and coastline configurations.

3.4.5.2 History of Events

The community of Bristol Bay Borough has experienced 18 severe weather events between 1974 and 2017. Table 10 provides information on past severe weather events, impacts, and estimated losses.

Table 10 History of Severe Weather Events

Date	Location and Extent	Impact	Estimated Loss
Bering Sea storm, November 9-12, 1974	Storm moved north-northeast from central Aleutians through Bering Strait with winds 50-75 knots; coincident with highest tides of the month	Water level raised 5 feet at Naknek and 12 feet at Nome, causing major flood damage from Bristol Bay to Kotzebue Sound	Unknown
August 17-18, 1980	A strong low pressure system moved rapidly into Bristol Bay causing 30-foot tides	Fishing boats, homes and canneries damaged; fish processing plant sustained $100,000 of damage losing boats, a dock with a crane, a mess hall and bunkhouses.	>$100,000

Table 10 History of Severe Weather Events

Date	Location and Extent	Impact	Estimated Loss
January 28, 1989	The Omega Block statewide disaster declaration, 89-83	Month-long high pressure system throughout Alaska. Airplanes grounded, no mail, no medevac; F-15s could not scramble; Anchorage International Airport closed, affecting flights in/out of King Salmon	Unknown dollar impact; however, loss of air service for several weeks
January 24, 2000	Ice storm in Naknek and South Naknek	Power lines brought down across the area; Naknek Electric Association estimated 1-2 inches of ice accumulation on power line conductors and loss of 88 power poles; gale force winds and wet snow also impacted area. Power loss for approximately 2 weeks in South Naknek.	$750,000[33]
March 17, 2000	00-191; high impact weather events throughout the state	Weather damage	Unknown
January 25-26, 2001	High winds and preceding frontal system associated with southwesterly winds rotated into southeast semicircle affecting western coast of Alaska.[34]	Highest gusts at King Salmon airport were only 44 mph with stronger 67 mph winds in Naknek.	Unknown
September 4-5, 2001	Bristol Bay southwest of King Salmon; strong low and remnants of typhoon "Wutip" caused gale-force southwesterly winds along the south side of the low.[35]	Tug Mercury and 130-ft barge en route from Naknek to Seward had to release barge near Ugashik Bay.	$7,000
January 13-14, 2002	Strong pressure gradient over the Bering Sea and Southwest Alaska	Highest sustained wind observed 63 mph at Port Heiden, southwest of the Borough; and 62 mph at Cape Newenham on 1-13-02. The Borough communities are sandwiched between two strong high pressure areas; On 1-14-02, winds at Cape Newenham at 69 mph.	Unknown
January 16, 2002	Large and complex low pressure system moved north northwest from Cape Sarichef, preceded by brisk southeasterly winds.	Peak winds 63 mps at Cape Newenham; 68 mph at Platinum	Unknown
January 28-29, 2002	Strong North Pacific low and associated frontal system winds and snow across southwest Alaska and the Aleutians	Flight service in Dillingham reported 14 inches of snow overnight; snowfall at King Salmon on 3 inches; blizzard	Unknown

[33] Email from Donna Vukich, General Manager, Naknek Electric Association, May 10, 2011.

[34] http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~ShowEvent~414386

[35] http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~ShowEvent~414517

Table 10 History of Severe Weather Events

Date	Location and Extent	Impact	Estimated Loss
		conditions across the Alaska Peninsula lingered into late afternoon and evening.	
September 12, 2002	Bering Sea storm moved into Norton Sound with strong southerly winds preceded the associated front and strong westerly winds along the "back side" of the low.	Strong onshore winds combined with maximum astronomical tides to produce the potential for coastal flooding; King Salmon Village Public Safety Officer estimated tide about 10 feet above normal."	Unknown
October 27-28, 2002	Intensifying low pressure system moved north into Alaska Peninsula.	Strong pre-fontal winds in the southeast arc of intensifying low pressure system produced winds in excess of 60 mph on southern end of Kodiak Island and into King Salmon.	Unknown
May 13, 2003	Persistent upper level low and cold advection across southwest Alaska.	Intense snow showers over Bristol Bay region; amount of snowfall established new record for the most snowfall (4.7 inches) for month of May for King Salmon.	Unknown
May 23, 2008	Strong low cross the Alaska Peninsula	Strong east wind in advance of the associated front; peak gusts reported at 84 mph in Naknek; resulted in damaged roofs, the Naknek Trading Post and the Peterson Point fish plant.	$25,000
December 4-7, 2009	Two north Pacific storms moved across the eastern Aleutians, producing winds of 125 mph across eastern Aleutians and Alaska Peninsula and to 70-85 mph across Bristol Bay area.	Colville RAWS at Brooks Camp reported peak gust of 85 mph	Unknown
February 24-25, 2009	Hurricane force storm moved across the Aleutians into eastern Bering Sea; produced hurricane force wind and blizzard conditions along Bering Sea coast from Bristol Bay north across the Kuskokwim Delta	Reports received from Dillingham chief of police that storm surge occurred in Naknek and Clarks Point; wind gusts in excess of 100 mph in Bristol Bay and Pribilof Islands	Unknown
February 25, 2009	Pederson Point Cannery dock, pier, boat warehouse and beach access road impacted by water and large icebergs	Hydraulic affects; pushed icebergs up under the pier boards; fender ice builds up in front of pilings; when ice melts ice breaks up pilings; fish holds filled with water and swamped boats at Pederson Point Cannery	$4 million to repair dock[36]
November 7-13, 2011	A severe storm with hurricane force winds impacted the west coast from the Yukon-Kuskokwim Delta south to	Two low pressure systems hit the western coast back to back with hurricane force winds exceeding	$8,724,744 total for whole west coast.

[36] Telephone conversation with North Pacific Processors General Manager, Robert Torres, 3-17-2011.

Table 10 History of Severe Weather Events			
Date	**Location and Extent**	**Impact**	**Estimated Loss**
	Bristol Bay.	85 mph.	

3.4.5.3 Probability of Future Events, Location and Extent of Impacts

The communities of Bristol Bay Borough are subject to a risk of severe weather. Based on historical information, it is estimated that in the past 35 years, there is a 2-year recurrence interval for severe weather events, which equates to an annual probability of 50%. The coastal areas of Naknek, King Salmon, and South Naknek, which include marine and cannery dock facilities near the mouth of and along the north and south banks of the Naknek River have historically sustained damage during severe weather events. Figure 10 depicts the Severe Weather hazard areas of most concern for Borough residents. Given the range of severe weather and resulting damage, it is estimated that 60% of critical infrastructure and buildings are susceptible to high damage.

3.4.6 Erosion

3.4.6.1 Description

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

Erosion is a problem in developed areas where the disappearing land threatens development and infrastructure. There are three main types of erosion that affect the community of Bristol Bay Borough: coastal erosion, riverine erosion, and wind erosion.

3.4.6.1.1 Coastal Erosion

Coastal erosion is the wearing away of land and loss of beach, shoreline, or dune material because of natural activity or man-made influences. It can occur gradually or suddenly. Erosion is usually a long-term event, but it happens quickly during storm events.

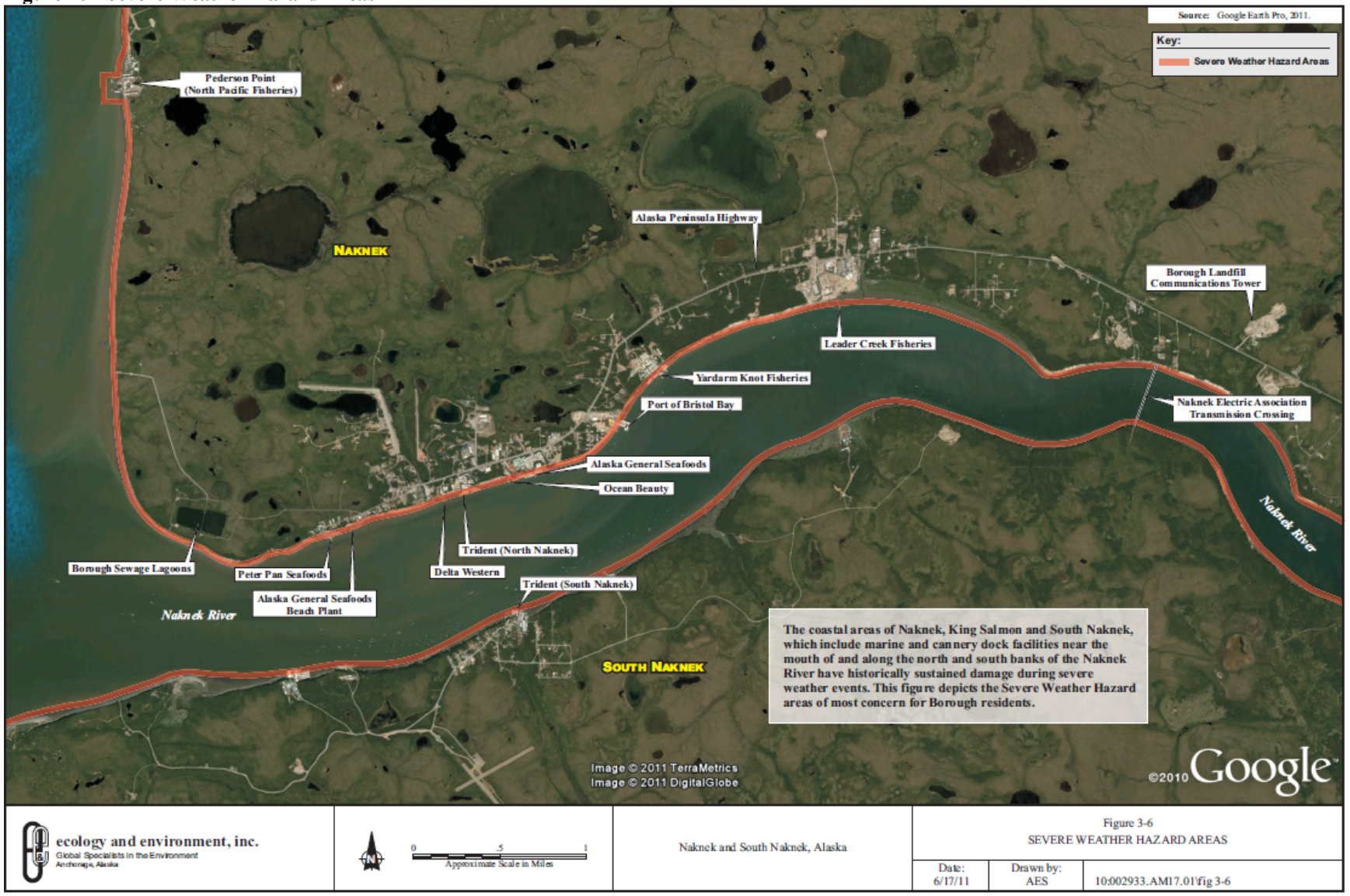
3.4.6.1.2 Riverine Erosion

Riverine erosion results from the force of flowing water in and adjacent to river channels. This type of erosion affects the bed and banks of the channel and can alter or preclude any channel navigation or riverbank development. In less stable braided channel reaches, erosion and deposition of material are a constant issue. In more stable meandering channels, episodes of erosion may only occur occasionally.

3.4.6.1.3 Wind Erosion

Wind erosion occurs when wind is responsible for the removal, movement, and redeposition of land. It can cause a loss of topsoil, which can hinder agricultural production. The blowing dust can also reduce visibility and have a negative effect on air quality.

Figure 10 - Severe Weather Hazard Areas



3.4.6.2 History of Events

The community of Bristol Bay Borough has experienced several erosion events. Members of the planning group have acknowledged that riverine and wind erosion along the Naknek River has been ongoing for many years. Noted in a summary of a presentation by Yvonne Kopy, a former Borough planner, erosion is more complex where the Naknek River meets the sea. The river shoreline ranges from sheer bluffs about 70 feet high to low areas at the level of the river. The article discussed the need for educational outreach for home owners on building restrictions utilizing setback restrictions for erosion mitigation.[37]

Erosion along the shoreline of the Naknek River at the base of a bluff from the sewage lagoon (prior to 2011) exposed a sewage pipe that the Borough relocated away from the shoreline in 2017. The threat of raw sewage releasing into Bristol Bay is of concern for the devastating effects that it would have on its vital fish habitat and resources.

Wind driven high tides also impact the eroding shoreline. One resident estimated that, in the last 30 years, they had lost about 50 feet of the bluffs near the sewage lagoon west of Naknek along the north bank of the Naknek River. Another resident said that a platform that the Borough installed for visitors to take photographs on is gone from the edge of bluff several years ago. He estimated that it originally stood 30 to 40 feet from the bluff's edge.

Robert Torres, general manager of North Pacific Processors, said their Pederson Point Cannery is very exposed to the wind, waves, and tides. He has noticed coastal erosion impacts within the past 30 years, which he attributed to the ice not freezing solid during the winter, which usually protects the coast and their dock.[38]

Figure 3-8 provides information on where the Mitigation Planning Group perceives erosion impacts along the coasts of Naknek and South Naknek up the Naknek River on both shorelines, as an ongoing, continuous impact and not one specific event. Some members of the Planning Group believe that the erosion is occurring along both sides of the Naknek River and the coast of the Kvichak Bay from Johnson Hills west of South Naknek to Graveyard Point, north of Naknek. The river has shifted, wind erosion has been undercutting banks which fall into the river. The river no longer reaches to the docks on the south side which has caused the closure of all canneries in South Naknek. Three new poles for the powerline have been installed at South Naknek Beach since development of the plan in 2011. The estimated loss listed in Table 11 is for the loss of the setnet sites. Another impact from erosion is the sandbar that has formed in the middle of the Naknek River at the mouth and upriver almost to the Port of Bristol Bay. The

[37] Coastal Erosion: Strategies for Alaska, Proceedings of a Workshop, April 11, 2007, International Arctic Research Center, University of Alaska Fairbanks

[38] Telephone conversation with Vivian Melde, E & E and North Pacific Seafoods General Manager Robert Torres, 3-17-2011.

sandbar growth is attributed to erosion of soil from the river bank that is deposited into the river channel and has increased during the 2015 and 2016 warm winters. The Borough has been dredging the dock area every year in recent years.

The community noted in 2017 that the river is not freezing like it used to with warmer winter temperatures and that at least 100 feet of the beach at Graveyard Point has been eroded away within the past five years.

Figure 11 - Erosion Hazard Areas

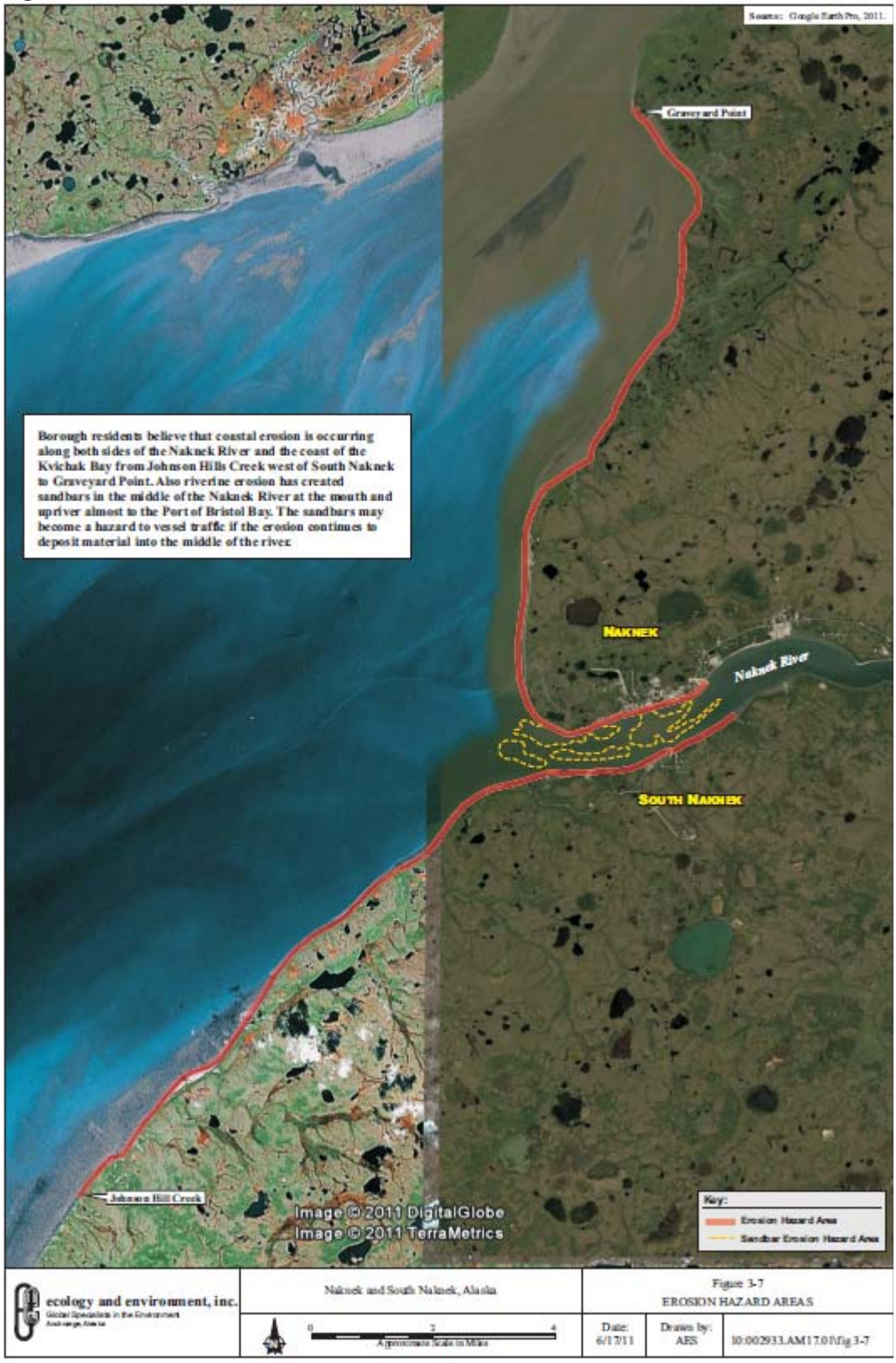


Table 11 History of Erosion Events			
Date	**Location and Extent**	**Impact**	**Estimated Loss**
Ongoing	Johnson Hills up to Graveyard Point erosion Bristol Bay; Graveyard Point land diminishing[39]	Eroding shoreline; setnet sites 300 feet apart; loss of sites	$500,000

3.4.6.3 Probability of Future Events, Location and Extent of Impacts

The probability of future events is based on physical observations by long term residents of both Naknek and South Naknek. The weather, lack of protective shore ice, wind driven tides and waves has affected the rate of erosion occurring along the coasts and shorelines of both the Kvichak Bay and Naknek River. A growing concern for the Borough residents is that erosion is causing sandbars in the middle of the Naknek River, which could become hazardous for vessel traffic. These areas are identified in Figure 11. The U.S. Coast Guard evaluated barge exits and entrances in 2016. Canneries have started sending notices to residents announcing when barge traffic will occur so that fishing vessels can be parked accordingly.

Erosion impacts on the bluffs of the Naknek River, below the Borough sewage lagoons. The pump station for the sewage line is near the middle of the photo, taken from South Naknek by Vivian Melde, May 2010.

[39] http://www.adfg.alaska.gov/static/fishing/PDFs/commercial/map_ugashik_salmon_districts.pdf

3.4.7 Technological

3.4.7.1 Description

Technological hazards are those that are not natural in origin, or considered human-caused. The community of Bristol Bay Borough faces a wide variety of technological hazards, including hazardous materials accidents, infrastructure failures, oil and hazardous materials releases, and structural fires (including remote rural communities, bulk fuel farms, commercial fishing vessels, fish processing facilities, and fuel barges and storage tanks).

For more than 20 years, the Alaska Department of Environmental Conservation (ADEC) has been working with the U.S. Air Force, Borough communities and the U.S. Environmental Protection Agency (EPA) to address environmental concerns at King Salmon Air Station. Recent efforts have focused on evaluating how best to treat trichloroethylene (TCE) contamination in groundwater. Hazardous and potentially hazardous substances include diesel fuel and gasoline, oil, antifreeze, solvents, and transformers containing polychlorinated biphenyls (PCBs). The ADEC Contaminated Sites Program Site Summary for King Salmon lists the environmental concerns and response actions. The following table from ADEC is a summary of those environmental concerns for soil and groundwater.[40]

Table 12 Summary of King Salmon Air Station Contaminated Sites

Location	Contaminants	Response Action
Base living area and industrial area former tank farm, two former dry wells, and various industrial sites; contaminated groundwater migrated to Eskimo Creek	Petroleum and TCE	Bioventing curtain and groundwater treatment system to treat petroleum in soil and groundwater prior to entering Eskimo Creek
Base living area and industrial, fire training area and landfill; contamination impacted soil and groundwater	Petroleum releases and spills from former underground storage tanks	Six bioventing systems installed within former tank areas for soil remediation; monitored natural attenuation for groundwater remediation
Wetlands of Naknek River storage area	Petroleum releases from former tank farm seeped into wetlands	Petroleum-contaminated soil removed/ treated in bioremediation cells; treated soil reused as landfill capping material; passive remediation system treats residual contamination prior to entering wetlands and the Naknek River; majority of groundwater remediated

[40] http://www.dec.state.ak.us/spar/csp/sites/kingsalmon.htm#map

Table 12 Summary of King Salmon Air Station Contaminated Sites		
Location	**Contaminants**	**Response Action**
Former fire training area and Red Fox Creek	Petroleum and TCE	Contaminated soil removed from fire training areas and treated in bioremediation cells; treated soil reused as landfill capping material at facility; bioventing system installed to treat contamination prior to entering the creek; further soil removal in a former dump
North and South Bluff Sites	Buried drums and dumped items are potential impact to King Salmon Creek and wetlands	Limited removal action; recontouring and capping of sites and groundwater treatment installed at South Bluff; operation, monitoring and maintenance program established for the Bluff sites.
Lake Camp dump, aka Naknek II Recreation Camp, 6 miles east of the Air Station	Buried drums and dumped items and petroleum contaminants from former generator pad	Limited removal action, capping, maintenance, and monitoring; removal and treatment of petroleum-contaminated soil for generator pad and vehicle maintenance area; continued groundwater monitoring throughout the site

Ms. Melde contacted Mr. Dick Homan, a U.S. Air Force (USAF) program manager, who oversees the Base Operations and Support (BOS) contractor for the King Salmon AFS. [Note: As of May, 2011, the BOS contractor is Chugach Federal Solutions, which succeeded Chugach World Services, with whom E & E toured the air station in 2010.] Mr. Homan stated that there are numerous ongoing remediation projects for the King Salmon AFS facilities. Projects include the groundwater restoration of the tank farm for JP-8 fuel at the King Salmon River Storage near the Naknek River. He did not feel there were impacts from erosion or earthquakes to the three large underground storage tanks at River Storage facility. The facility is undergoing downsizing in fuel storage and distribution. According to Mr. Homan, by 2012, the USAF is planning to phase out its existing on-site fuel supply and looking for a commercial contractor to provide fuel for the air station.[41] In 2017, the ADEC Contaminated Sites Database lists all of these contaminated sites as open.

Power outages are also a type of common infrastructure failure in the community of Bristol Bay Borough. They are often caused by high winds and result in

[41] Dick Homan, program manager for U.S. Air Force, telecon May 24, 2011 with V. Melde, E & E.

additional damages, such as water and sewer system freeze-ups. A wide range of impacts and severity of impacts can result from technological hazard events.

Hazardous materials releases also concern residents of the Borough, particularly in Naknek where the majority of the fish canneries operate. During E & E's site visit in 2010, a volunteer fire fighter expressed concerns for ammonia releases associated with fish processing industry. Other hazardous materials include releases for fuel transfer at the Port of Bristol Bay, oil spills from drums or tanks. Other potential spills could occur during the transport of fuel from the Port of Bristol Bay in Naknek to the King Salmon AFS River Storage, where fuel is stored for military aircraft, site vehicles, fuel for power generation and generators, and heating fuel for facilities.

The most common Extremely Hazardous Substance (EHS) chemical reported to the State on Tier Two reports for Borough facilities is anhydrous ammonia. In 2017, six facilities reported a total of 62,346 pounds of anhydrous ammonia and one facility reported 736 pounds of sulfuric acid in inventory. Five of the six facilities were located in Naknek. Other flammable chemicals in inventory reported included diesel, gasoline, and propane.

Another hazard associated with the commercial fishery is the potential for grounding or sinking of fishing vessels or fish processors in Bristol Bay or at the port or marine docks of the Naknek River.

The perceived threat of impacts of mining development on the Bristol Bay watershed is of concern to the Borough communities. The proposed development of a large scale project at Pebble Mine has prompted nine federally-recognized Bristol Bay tribes to petition the EPA to use its authority under the Clean Water Act to protect Bristol Bay. On February 7, 2011, EPA announced that the agency "will conduct a scientific assessment of the Bristol Bay watershed to better understand how future large-scale development projects may affect water quality and Bristol Bay's salmon fishery, an extraordinary salmon resource for the United States. . ."[42] The EPA completed their scientific assessment and adopted 404C to force development out of the mine. Lawsuits were filed, and in 2017, there is still no resolution.

3.4.7.2 History of Events

The community of Bristol Bay Borough has experienced a few technological disaster events. Table 13 provides information on past technological disaster events, impacts, and estimated losses.

Table 13 History of Technological Disaster Events

Date	Location and Extent	Impact	Estimated Loss
May 26, 1918	Influenza epidemic	South Naknek APA	Unknown

[42] *EPA plans scientific assessment of Bristol Bay watershed,* EPA news release, February 7, 2011

Table 13 History of Technological Disaster Events

Date	Location and Extent	Impact	Estimated Loss
		cannery quarantined; 52 died in vicinity of the cannery and 65 on south shore of Naknek River[43]	
1985	King Salmon Air Station, River Storage	Groundwater contamination	Unknown
May 12, 1999	Naknek, Alaska General Seafoods Tank	Line ruptured and released 593 gallons of diesel[44]	Unknown
January 24, 2000	South Naknek power loss	Power loss in South Naknek for 2 weeks; food and fuel had to be flown into town; loss of power lines; loss 88 power poles[45]	$750,000
Unknown	Erosion of northern shoreline at the base of the bluff of Borough's sewage lagoon and pumping station	Sewage pipe along shore exposed and threatens release of raw sewage	Unknown

3.4.7.3 Probability of Future Events, Location and Extent of Impacts

The communities of Bristol Bay Borough are subject to a risk of technological hazards. Since the hazards are varied, it is difficult to consider the probability of future events or the range and severity of potential technological hazards. Infrastructure that has historically experienced impacts due to technological hazards includes: power lines, sewage lines, and fuel tanks. Members of the mitigation planning group expressed more concern with the potential for contamination of the Naknek River and its tributaries, or Kvichak Bay, which would devastate the salmon fishery and the Borough's economy.

3.4.8 Climate Change

3.4.8.1 Description

For this LHMP, climate change refers to the long term variation in atmospheric composition and weather patterns on a global scale. Global climate change may occur gradually due to small variations or rapidly due to large catastrophic forces.

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[43] *A Naknek Chronicle,* Don E. Dumond, National Park Service, Katmai National Park and Preserve, p. 93.

[44] Bristol Bay Subarea Contingency Plan, Part 3 – Subarea Spill History, June 2001

[45] Information from Donna Vukich, General Manager, Naknek Electric Association via email to V. Melde, May 10, 2011.

Greenhouse gasses, especially carbon dioxide and methane are commonly regarded as the most significant factors influencing the Earth's current climate.

Significant atmospheric variations may also be influenced by more than one event, for instance, an asteroid impact and a major eruption over a longer time period. For scientists studying climate change, both hazards imply different time periods. Therefore the time period estimates for previous climate change events tend to vary and cannot be accurately applied to current predictive climate change models, which now must account for human activity. This is significant because hazard mitigation planning relies greatly upon the historical record.

3.4.8.2 Location

Climate change and mass extinctions are global events. Therefore, the entire community of Bristol Bay Borough is vulnerable to climate change.

3.4.8.3 Extent

Through studies of the historical record, we know climate change affects water acidity, atmospheric composition, precipitation, weather patterns, and temperatures.

3.4.8.4 Local Impact

Residents noticed a changing climate in the Bristol Bay Borough. Excessive winds, less snow, more rain, warmer winters, and more extreme weather patterns (60 degree temperature fluctuations in winter from one day to the next—i.e., -30 to 30 ° F in one day) are common. Birds and fish species that were never in Bristol Bay Borough are being sited. Birch trees are growing taller.

3.4.8.5 Global Impact

The major effect of climate change, and therefore, mass extinctions are the abrupt decline of the earth's bio-diversity and population of organisms. However, periods of mass extinction have been followed by periods of new species development. The dinosaurs developed and flourished after one of the most thorough mass extinctions in Earth's history. Today, they are the most popular subject of the most studied mass extinction ever, the Cretaceous event. The Cretaceous event cleared the path for mammals such as humans to evolve.

3.4.8.6 Probability

Given the Earth's history of mass extinctions attributed to climate change and the current observed changes in the atmosphere, it is "Credible" a disaster event attributed to climate change will occur in the next ten years as the probability is less than or equal to 10 percent likely per year.

3.4.8.7 Previous Occurrences

Previous rapid changes in the earth's climate appear in the fossil record as global mass extinctions. According to National Geographic, more than 90 percent of all organisms that have ever lived on Earth are extinct. Not all of them were subject

to mass extinction events from climatic forces. However, fossilized remains of species known to be alive during periods of mass extinction are under scrutiny for evidence of root causes.

3.5 Vulnerability Assessment

This overview of the community's vulnerability provides a summary of the impacts of the hazards described above may have on the community and its vulnerable structures.

3.5.1 Community Assets

This section identifies the Bristol Bay Borough assets that, if damaged, could impact public safety or the environmental or economic stability of Bristol Bay Borough. These assets include critical facilities and essential infrastructure, the population and built environment, and other community resources.

3.5.1.1 Critical Facilities and Essential Infrastructure

Critical facilities and essential infrastructure for the Bristol Bay Borough is provided in Section 2.4 and Figures 2 and 3. Additionally, critical facilities affected by hazard type are identified in Section 3.4. Table 15 provides a loss estimate for each critical facility or essential infrastructure. Loss estimates are evaluated based on the cost of the structure well as costs associated with the structure's contents and its function within the community.

3.5.1.2 Cultural Assets

Cultural assets, including historic structures, are identified in Section 2.2.4 and Figure 2-1. Cultural assets impacted by specific hazard types are also identified in Section 3.4; a loss estimate for cultural assets also provided in Table 14. Loss estimates for cultural assets are evaluated similarly to critical facilities and essential infrastructure.

Table 14 Cultural Assets Facility Loss Estimate

Type	Facility	Loss Estimate		
		Structure	Contents	Total
CA	Trefon Angasan's trapping cabin			Unknown
CA	Russian Orthodox Church and Cemetery, South Naknek			Unknown
CA	Original Paug Vik Inc., LTD Village Site			Unknown
CA	Graveyard Point			Unknown
CA	Nakeen Cannery at Squaw Creek			Unknown
CA	AR Davey Building (Bristol Bay Historical Society Building)			Unknown
CA	Russian Orthodox Chapel, Naknek			Unknown

Notes:
CA - Cultural Asset

3.5.1.3 Population and Buildings

As identified in Section 2.2.3, the Bristol Bay Borough has an estimated population of 874, extrapolated from the Alaska Department of Labor Workforce Division 2016 estimate. There are approximately 423 residential, 19 commercial, 2 industrial, 5 religious, 19 government, 3 utilities, and 3 education buildings in the community of Bristol Bay Borough (identified in Section 2.3.1). A loss estimate for these facilities is provided in Table 15 (J LeMay to update this table once BBB agreement is reached on Table 3). Loss estimates are based on average building replacement values and contents value (expressed as a percentage of building replacement value) provided by the Consumer Price Index, represented in year 2000 dollar figures.

Table 15 Building Loss Estimate

# or Name	Occupancy Class	Loss Estimate				
		Building Value	Building Total	Contents% Value	Contents Total	Total
Residential 50%						
King Salmon 157 units occupied	Residential	$143,800 (median value per unit)	$143,800 x 157= $22,576,600	50%	$11,288,300	$33,864,900
Naknek 231 units occupied	Residential	$108,900 (median value per unit)	$108,900 x 231 = $25,155,900	50%	$12,577,950	$37,733,850
South Naknek 35 units occupied	Residential	$54,600 (median value per unit)	$54,600 x 35 = $1,911,400	50%	$955,500	$2,866,900
Commercial 100%						
Camai Community Health Center	Commercial	$875,172	$875,172	100%	$875,172	$1,750,334
KAKN-FM	Commercial	$234,400	$234,400	100%	$234,400	$468,800
King Salmon Health Clinic	Commercial	$487,700	$487,700	100%	$487,700	$975,400
Naknek Health Clinic	Commercial	$415,200	$415,200	100%	$415,200	$830,400
Naknek Trading Company	Commercial	$1,647,200	$1,647,200	100%	$1,647,200	$3,294,400
Inlet Salmon, Naknek Dock	Commercial	$449,000	$449,000	100%	$449,000	$898,000

Table 15 Building Loss Estimate (cont.)

# or Name	Occupancy Class	Loss Estimate				
		Building Value	Building Total	Contents% Value	Contents Total	Total
Commercial 100% (cont.)						
Leader Creek Fisheries	Commercial	$3,520,000	$3,520,000	100%	$3,520,000	$7,040,000
Alaska General Seafoods	Commercial	$2,836,000	$2,836,000	100%	$2,836,000	$5,672,000
Ocean Beauty	Commercial	$3,985,300	$3,985,300	100%	$3,985,300	$7,970,600
Trident Seafoods	Commercial	$16,176,000	$16,176,000	100%	$16,176,000	$32,352,000
Peter Pan	Commercial	$1,458,000	$1,458,000	100%	$1,458,000	$2,916,000
Icicle Seafoods	Commercial	$119,000	$119,000	100%	$119,000	$238,000
Snow Pac	Commercial	$107,600	$107,600	100%	$107,600	$215,200
Yardarm Knot Red Salmon Cannery	Commercial	$4,510,900	$4,510,900	100%	$4,510,900	$9,021,800
North Pacific Processors Cannery	Commercial	$4,078,500	$4,078,500	100%	$4,078,500	$8,157,000
Northland Cargo	Commercial	$671,000	$671,000	100%	$671,000	$1,342,000
Delta Western	Commercial	$913,000	$913,000	100%	$913,000	$1,826,000
Industrial 150%						
Patrick E. Patterson's Sanitation and Refuse Service, Inc.	Industrial	$151,000	$151,000	150%	$226,500	$377,500

Table 15 Building Loss Estimate (cont.)

# or Name	Occupancy Class	Loss Estimate				
		Building Value	Building Total	Contents% Value	Contents Total	Total
Naknek Religious 100%						
St. John the Baptist Russian Orthodox Church	Religious	$143,300	$143,300	100%	$143,300	$286,600
Church of Saint Teresa	Religious	$287,700	$287,700	100%	$287,700	$575,400
Community Bible Chapel	Religious	$328,000	$328,000	100%	$328,000	$656,000
Naknek Community Bible Chapel	Religious	$453,500	$453,500	100%	$453,500	$907,000
South Naknek Religious 100%						
Lutheran Church	Religious			100%		
Naknek Government 150%						
Bristol Bay Borough Offices	Government	$1,898,304	$1,898,304	150%	$2,847,456	$4,745,760
Kvimarvik Pool & Gym	Government	$8,644,068	$8,644,068	150%	$12,966,102	$21,610,170
Martin Monsen Library	Government	$518,548	$518,548	150%	$777,822	$1,296,370
Borough Sewerage Lagoons	Government	unknown	unknown	150%	unknown	unknown
Bristol Bay Borough Fire Station	Government	$784,889	$784,889	150%	$1,177,334	$1,962,223
BBB Public Works	Government	$3,409,234	$3,409,234	150%	$5,113,851	$8,523,085
Port of Bristol Bay	Government	$22,522,939	$22,522,939	150%	$33,784,409	$56,307,348

Table 15 Building Loss Estimate (cont.)						
King Salmon Government 150%						
King Salmon Fire Station	Government	$281,645	$281,645	150%	$422,468	$704,113
Borough Police Department	Government	$431,189	$431,189	150%	$646,784	$1,077,973
Landfill	Government	$1,431,023	$1,431,023	150%	$2,146,535	$3,577,558
Office of Children's Services	Government	Portion of $814,400	Portion of $814,400	150%	Portion of $1,221,600	Portion of $2,036,000
Federal Aviation Administration (FAA) Community Services Facility (COMSERFAC) Building	Government	Unknown		150%		
King Salmon Government 150% (cont.)						
National Park Service, Katmai National Park and Preserve Seasonal Transient Housing	Government	$2,440,000	$2,440,000	150%	$3,660,000	$6,100,000
National Park Service, Katmai National Park and Preserve Maintenance Shop	Government	$3,700,000	$3,700,000	150%	$5,550,000	$9,250,000
South Naknek Government 150%						
South Naknek Health Clinic	Government	Unknown	Unknown	150%		
South Naknek Library	Government	$631,105	$631,105	150%	$946,658	$1,577,763
South Naknek Public Works/Fire Station	Government	$431,189	$431,189	150%	$646,784	$1,077,973
Mid- and high-tide cargo dock at South Naknek	Government	$3,233,716	$3,233,716	150%	$4,850,574	$8,084,290
South Naknek Landfill	Government	unknown	unknown	150%	unknown	unknown

Table 15 Building Loss Estimate (cont.)						
Naknek Education 100%						
Bristol Bay Borough Middle/High School	Education	$29,170,491	$29,170,491	100%	$29,170,491	$58,340,982
Elementary School	Education	See Above		100%		See Above
Naknek School Library	Education	See Above		100%		See Above
Bristol Bay Borough Administrative Building	Education					
Utilities						
Bristol Bay Telephone Cooperative	Utilities	$79,900	$79,900	150%	$119,850	$199,750
General Communications Inc	Utilities	$881,625	$881,625	150%	$1,322,438	$2,204,063
Naknek Electric Association	Utilities	$351,800	$351,800	150%	$527,700	$879,500
Note: Structure value is based on values provided by the Borough or individual assumptions per community in association with the Planning Committee.						

3.5.1.4 Repetitive Loss Properties

As defined by FEMA, Repetitive Loss Properties are:

Any property for which two or more flood insurance claims have been paid for more than $1,000 within any rolling 10-year period since January 1, 1978. Severe Repetitive Loss Properties are defined under the National Flood Insurance Program (NFIP)as any property for which have at least four NFIP claim payments over $5,000 each, when at least two such claims have occurred within any 10-year period, and the cumulative amount of such claim payments exceeds $20,000.

The Bristol Bay Borough does not participate in the NFIP; therefore, no Repetitive Loss Properties are located in the communities.

3.5.2 Hazard Mitigation Planning and Disaster Preparedness Resources

A number of Federal, State, and local resources provide hazard mitigation planning and disaster preparedness assistance. See Appendix A for more information.

3.5.3 Methodology

The vulnerability assessment estimated expected losses "damage" from single hazard events based on information provided in Section 3.4 Hazard Profiles and

Section 3.5.1 Community Assets. Expected losses are expressed in dollar amounts and account for percent damage to structures and population identified in high hazard areas, as well as estimates of the cost of the functional loss and displacement of structures and services. Percent damage reflects the different losses expected per hazard (e.g., a flood may cause structural damage valued at 20% of the cost of the building, whereas a fire may cause 100% structural damage). Percent damages are based on insurance estimates, historical occurrences, and Planning Committee assessments. As an example, see Figure 12, below, for additional detail on estimated loss calculations for a single structure due to a single hazard event. The estimated loss calculation for each hazard will account for all affected structures and population.

Figure 12 - Example Port of Bristol Bay Estimated Loss

Loss Estimate= $3,669,978

Port of Bristol Bay	$22,522,939			X		5%		=		$1,126,147
Facility (Identify per hazard in Section X-X)	**Structure Loss Estimate** (Table 3-13)			**X**		**Percent Damage**		**=**		**Loss to Structure**
Port of Bristol Bay	$33,784,409			X		7.5%		=		$2,522,831
Facility (Identify per hazard in Section X-X)	**Contents Loss Estimate** (Table 3-13)			**X**		**Percent Damage**		**=**		**Loss to Contents**
Port of Bristol Bay	$5,000	X	2 days	+	2,000	X	0 days	=		$10,000
Facility (Identify per hazard in Section X-X)	**Daily Operating Budget**	**X**	**Functional Downtime**	**+**	**Displacement costs per day**	**X**	**Displacement Time**	**=**		**Structural Use and Function Loss**

3.5.3 Analysis

Table 16 provides the vulnerability analysis for the community of Bristol Bay Borough. It identifies populations affected by hazards, as well as estimates of critical infrastructure loss and building stock loss. Please note that figures contained in Table 16 are extremely rough estimates and should not be used for purposes other than this hazard mitigation planning process.

Table 16 Vulnerability Analysis

Hazard	Population	Critical Facilities and Essential Infrastructure		Building Stock		Total Loss Estimate
	—	# of Structures	Loss Estimate[1]	# of Structures	Loss Estimate[2]	—
Flood	874 (if only King Salmon and Naknek, 810); estimate could be more during salmon fishery when population increases to approximately 10,000	Bridges on the Alaska Peninsula Highway that cross Leader Creek, King Salmon Creek, and Paul's Creek	unknown	0	0	Loss is the only means of surface transportation between King Salmon and Naknek, which, during salmon fishery, would represent millions of dollars to get salmon shipped out via airplane; also medevacs from Naknek to King Salmon airport
Wildland and Conflagration Fire	100% of population plus additional seasonal population if fires occurred during salmon fishery	6 cannery facilities with multiple structures, 1 bulk fuel supplier, and the Port of Bristol Bay	Potential economic loss in the millions of dollars if a fire were to impact the canneries and the Port of Bristol Bay	Leader Creek, Alaska General Processors, North Pacific Processors, Ocean Beauty, Trident Seafoods, Peter Pan, and Yardarm Knot	$64,972,400	$198,030,348 Depending on winds and fire scenario, a fire could quickly spread and impact all 7 neighboring canneries in Naknek, the Delta Western fuel tanks, and the Port of Bristol Bay.
				Delta Western Bulk Fuel Facility	$1,826,000	
				Port of Bristol Bay	$56,307,348	

Table 16 Vulnerability Analysis (cont.)

Hazard	Population	Critical Facilities and Essential Infrastructure		Building Stock		Total Loss Estimate
	–	# of Structures	Loss Estimate[1]	# of Structures	Loss Estimate[2]	–
Earthquake	874	Many of the critical facilities could be affected by an earthquake >6.5	Potential losses could be in the millions of dollars	Total Borough Residential = 423	$74,465,650	$341,963,579 Potentially in the millions of dollars, depending on where damage impacted
				Total Commercial = 19	$89,976,034	
				Utilities = 3	$3,283,313	
				Industrial = 2	$743,000	
				Total Government = 19	$115,154,600	
				Education = 4	$58,340,982	
Volcano	874	Many of the critical facilities could be affected by volcanic ashfall; particularly the power plant and airports	Potential losses could be in the millions of dollars if volcano erupted and ashfall occurred during salmon fishery, impacting power and air transportation of fish to markets			Potentially in the millions of dollars, depending on where damage impacted
Weather (power outage)	874	An outage would impact all facilities in the Borough	Potential losses could be in the millions if outage occurred during cold winter months			Potentially in the millions of dollars, depending on where damage impacted

Table 16 Vulnerability Analysis (cont.)

Hazard	Population	Critical Facilities and Essential Infrastructure		Building Stock		Total Loss Estimate
	–	# of Structures	Loss Estimate[1]	# of Structures	Loss Estimate[2]	–
Technological (sewage line failure)	874	A sewage line failure would impact all facilities in Naknek and King Salmon connected to the utility	Potential losses could be in the millions of dollars if raw sewage were released into the Naknek River or Kvichak Bay, impacting salmon runs and habitat.	Total Naknek and King Salmon Residential = 423	$74,465,650	Potentially in the millions of dollars, depending on where damage impacted
				Total Commercial = 19	$89,976,034	
				Utilities = 3	$3,283,313	
				Industrial = 2	$743,000	
				Total Government = 19	$115,154,600	
				Education = 4	$58,340,982	
Climate Change	874	Many of the critical facilities could be affected by the change to more extreme weather activity and flooding.	Potential losses could be in the millions of dollars	Total Borough Residential = 423	$74,465,650	Potentially in the millions of dollars, depending on where damage impacted
				Total Commercial = 19	$89,976,034	
				Utilities = 3	$3,283,313	
				Industrial = 2	$743,000	
				Total Government = 19	$115,154,600	
				Education = 4	$58,340,982	

[1] Total of Structure, Contents, Function and Displacement Loss Estimates
[2] Total of Structure and Contents Loss Estimates

4 Mitigation Strategy

4.1 Introduction

In accordance with 44 CFR §201.6, the Mitigation Strategy is a plan for reducing damages losses identified by the Risk Assessment (Chapter 3). Information in this chapter is based on existing resources, programs, polices, and authorities, as well as its ability to improve and expand on existing tools.

4.2 Federal Requirements

44 CFR §201.6 Mitigation Strategy criteria and applicable 44 CFR §78 Flood Mitigation Assistance criteria for mitigating risks are provided in Table 17.

Table 17 Federal Mitigation Strategy Requirements

44 CFR §201.6 Local Mitigation Plans *(c) Plan Content (3) Mitigation Strategy*
(i) *A description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.* ***(ii)*** *A section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.* ***(iii)*** *An action plan describing how the actions identified in paragraph (c) (2) (ii) of this section will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.* ***(iv)*** *For multi-jurisdictional plans, there must be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.*
44 CFR §78.5 Flood Mitigation Plan development
(c) *The applicant's floodplain management goals for the area covered by the plan.* ***(d)*** *Identification and evaluation of cost-effective and technically feasible mitigation actions considered.* ***(e)*** *Presentation of the strategy for reducing flood risks and continued compliance with the NFIP, and procedures for ensuring implementation, reviewing progress, and recommending revisions to the plan.* ***(f)*** *Documentation of formal plan adoption by the legal entity submitting the plan (e.g., Governor, Mayor, County Executive).*

4.3 Mitigation Strategy Development

By utilizing the Risk Assessment (Chapter 3), the Planning Committee identified ways to reduce damages from future hazards in accordance with FEMA criteria for local mitigation plans (44 CFR §201.6(c)(3)).

4.3.1 Mitigation Goals

The Planning Committee identified nine goals to address the primary hazards profiled (Section 3.4) and vulnerability analysis (Section 3.5). Mitigation goals identified in Table 18 are long-term policy objectives to reduce the costs of disaster response and recovery and to minimize disruption to the community following a disaster. Section 4.3.2 and Table 19 identify specific mitigation actions that stem from these mitigation goals. Through this planning process, the Planning Committee intends to reduce the overall vulnerability of the community of Bristol Bay Borough to all hazards.

Table 18 Mitigation Goals

Goal	Description	Hazards Mitigated
1	Prevent structural fires particularly near the fish processing and canneries in Naknek	Community Conflagration Fire 2017 Update: New structure designs must now be approved by the Fire Marshall.
2	Install back up generator for the Naknek Fire Station	Wildfire and Community Conflagration Fire; Technological 2017 Update: A backup generator was installed for the Naknek Fire Station, BBB Main Office, and Library.
3	Relocate sewage line inland off the beach. Sewage line currently located on coast below eroding bluffs on the north shore of Naknek River	Technological 2017 Update: This action has been implemented and is complete.
4	Install emergency back-up heating system for the Naknek School during extended power outages; particularly for outages that occur during cold winter months.	Severe weather; Technological 2017 Update: This goal is on the 2018 CIP List.
5	Build up spill response and recovery capabilities for oil and hazardous waste releases in King Salmon, Naknek and South Naknek	Technological 2017 Update: Some has been done but not enough.
6	Build up fire response and hazardous materials capabilities for Borough Volunteer Fire Department	Wildfire and Community Conflagration 2017 Update: Needs to be implemented.
7	Provide emergency power supply for Borough communities in the event of extended power outage	Severe weather; Technological 2017 Update: Needs to be done for shelters.
8	Install back up power for communications center located at Naknek Landfill	Technological 2017 Update: This action has been implemented and is complete.
9	Replace bridges along Alaska Peninsula Highway on Leader Creek, King Salmon Creek, and Paul's Creek	Flood; Earthquake; Technological 2017 Update: This project is funded and will be implemented in 2018.

4.3.2 Identification and Analysis of Mitigation Actions

From the mitigation goals identified in Table 4-2, the Planning Committee identified eight mitigation actions (Table 19) focusing on reducing hazard impacts

to existing and new development. Mitigation actions are practical and achievable actions that the communities of Bristol Bay Borough can undergo to reduce its vulnerability to hazards. Mitigation actions strive to achieve the following:

- Prevent development that is vulnerable to hazards. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.
- Protect current critical infrastructure and buildings from hazard damages. Examples include acquisition, elevation, relocation, structural retrofits, storm shutters, and shatter-resistant glass.
- Educate the public on hazard mitigation and ways they can support planning efforts. These actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
- Protect natural resources from hazard damages. These actions include sediment and erosion control, stream corridor restoration, watershed forest and vegetation management, and wetland restoration and preservation.
- Protect emergency services against hazard damages. Services include warning systems, emergency response services, and protection of critical facilities.
- Promote structural projects that decrease community vulnerability. Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include dams, levees, floodwalls, seawalls, retaining walls, and safe rooms.

Table 19 Mitigation Actions

1	Prevent structural fires particularly near the fish processing and canneries in Naknek
a	The Borough should take action to ensure that existing facilities are accessible for fire response all year round and that facility response plans are current for all facilities required to submit them. The canneries in Naknek are located near large bulk fuel tanks and adjacent to other fish processing and cannery facilities. In the event of a conflagration fire at one of the canneries and strong winds, fire has the potential to spread quickly to other fish processing and cannery facilities as well as to bulk fuel facilities. 2017 Update: The Borough does not have the jurisdiction to enforce this action.
b	Ensure that Borough volunteer firefighters have adequate training and conduct annual training exercises with industry for scenarios involving response to cannery or bulk fuel tank fire. 2017 Update: Annual training exercises are conducted. Adequate training has been provided.
c	Establish building ordinances relative to new structures near the fish processing and bulk fuel areas on the river. 2017 Update: The Borough does not require setbacks. However, new structure plans must be approved by the State Fire Marshall.
d	See mitigation action #5.

Table 19 Mitigation Actions	
2	**Install backup generator at Naknek Fire Station**
a	During a power outage, the Naknek Fire Station bay doors cannot open. This would inhibit fire response with the tanker equipment and potentially could cause critical delays. 2017 Update: Maintenance issue status unknown.
b	Purchase and installation of a backup generator at the Naknek Fire Station would benefit the entire Borough for wildfire, community conflagration and hazardous materials responses. 2017 Update: This action has been implemented.
3	**Relocate Borough sewage line below bluffs on north side of Naknek River**
a	Relocate the sewage line away from the Naknek River to reduce the risk of damage to the line from erosion and aging. Erosion has exposed parts of the sewage outfall line that runs along the base of the bluffs near the mouth of the Naknek River. The threat of raw untreated sewage releasing into the Naknek River and Bristol Bay could devastate the sockeye fishing industry and threaten the prime economic source for the Borough, local businesses, and its residents. 2017 Update: This action has been implemented.
b	Obtain easement from land owner (Paug Vik) to relocate sewage line to existing lagoons above the river on the bluff where lagoons are located. 2017 Update: This action has been implemented.
c	Long-term goal would be to move the two sewage lagoon locations. 2017 Update: This action needs funding.
4	**Install emergency back-up heating system for the Naknek School during extended power outages that occur during cold winter months**
a	Installing a back-up heating system for the school would be beneficial for students and the community shelter during extended outages. The Naknek School is a community shelter during emergencies. The school's heating system works off heat captured from operation of the power plant's generator; therefore, when there is a power outage, there is no source for heat at the school. During cold winter months, this could pose a problem for extended outages. 2017 Update: This action is on the 2018 CIP List.
b	Provide storage and fuel for the emergency heating system. 2017 Update: This action is on the 2018 CIP List.
c	Ensure building plant operators for the school have adequate training on the emergency back-up system. 2017 Update: This action is on the 2018 CIP List.
d	Develop procedures for maintenance and operation of the back-up system and test the system to ensure the reliability of the system. 2017 Update: This action is on the 2018 CIP List.
5	Build up spill response and recovery capabilities for oil and hazardous materials (hazmat) releases in King Salmon, Naknek and South Naknek
a	The Borough should assess equipment, supplies, and training for oil and hazmat responses. 2017 Update: There is a shared spill trailer connex and personnel.
b	Provide funding to purchase additional supplies and to provide training to emergency responders. 2017 Update: There is a shared spill trailer connex and personnel.
c	Update Borough emergency procedures for oil and hazmat releases. 2017

Table 19 Mitigation Actions	
	Update: This action has been completed.
d	Develop drills and exercises to test training and response capabilities. 2017 Update: At least two drills are conducted each year.
e	Track certifications of emergency responders and update call-out lists annually. 2017 Update: The EMT Coordinator tracks this information.
6	**Build up fire response and hazardous materials capabilities for BBB Volunteer Fire Department**
a	The Borough should assess local response capabilities for fire and hazmat responses that could assist until outside resources arrive. 2017 Update: This action has been completed.
b	Research funding sources to help purchase additional response equipment and supplies for the VFD. 2017 Update: The Borough does not have adequate equipment and has informed OSHA that they are not prepared to respond to hazmat incidents. Industry is expected to respond to their hazmat incidents.
c	Conduct drills and exercises to test the response capabilities. 2017 Update: At least two drills are conducted each year.
d	Install water fill site and pump at Nornek Lake next to the Naknek Airport. 2017 Update: This has not been done, but the Fire Department has a truck and practices drawing water from the lake.
7	**Provide emergency power supply for the critical Borough facilities in the event of power outage or loss of power lines during hazard event.**
a	Provide funding to study cost of providing emergency power supply for the Borough. 2017 Update: This action has been completed.
b	Fund implementation of emergency power supply. 2017 Update: This action has been implemented in the Borough Office Building, Clinic, Port, Fire Hall, all wastewater stations, and the phone company. Emergency power is needed for the shelters.
c	Improve reliability of service throughout the Borough's service territory. 2017 Update: This action has been implemented in the Borough Office Building, Clinic, Port, Fire Hall, all wastewater stations, and the phone company. Emergency power is needed for the shelters.
8	**Install back up power supply for communications system that houses all radio and telecommunications for the Borough.**
a	Install back-up propane generator for communications system that houses all radio and telecommunications for the Borough. Currently only 2-hours of battery backup on the communications system, which is not sufficient. This system is located at the Borough Landfill. 2017 Update: This action has been completed.
b	Provide storage building for the generator and enough fuel to run the generator for a minimum of 5 days. 2017 Update: Becky to ask Jeff
c	Design building addition to utilize waste heat from other landfill operations, which will help keep the generator system on constant "ready" status for emergencies. 2017 Update: Becky to ask Roylene
9	**Replace bridges on the Alaska Peninsula Highway that cross King Salmon Creek, Leader Creek and Paul's Creek**
a	The Alaska Department of Transportation & Public Facilities should plan for failure of 50 year-old bridges on Alaska Peninsula Highway in event of flood, earthquake, or structural failure. As the only arterial between

Table 19 Mitigation Actions	
	Naknek and King Salmon, the structural integrity of these bridges is vital to the entire Borough. The failure of any one bridge on the highway, particularly during fishing season could be devastating to the economy. 2017 Update: Funding has been obtained. Project will be completed in 2018.
b	ADOT&PF should seek funds for the replacement of the three bridges and include plans for a temporary route to bypass the bridge construction, or plan for a secondary road to bypass the bridges during emergencies. 2017 Update: Funding has been obtained to replace the bridges. Project will be completed in 2018.

4.3.3 Benefit Cost Review

Benefit Cost Review was utilized to prioritize mitigation actions. Actions are evaluated to determine a community's vulnerability before and after the implementation of each mitigation action. The difference in vulnerability from before to after a mitigation action is implemented, as well as benefits (pros) and costs (cons), is utilized to review mitigation actions (Table 19).

Based on this review, the Planning Committee used a Simple Listing Benefit Cost Review method to assign priority to each of the mitigation actions (Table 20). Mitigation actions prioritized as *high* are actions that, once implemented, will substantially reduce the community's vulnerability to hazards that occur frequently. Mitigation actions that substantially reduce the community's vulnerability to hazards that occur less frequently are prioritized as *medium,* and finally, *low* priority actions are mitigation actions that do not substantially reduce the community's vulnerability and/or mitigate rare hazards.

Table 20 Benefit Cost Review

Action	Vulnerability			Benefit (Pro)	Cost (Cons)	Priority
	Before Action is Implemented	After Action is Implemented	Difference			
1 – Prevent structural fires particularly near the fish processing and bulk fuel storage tanks located on the north end of Naknek River in Naknek. Current Situation: The canneries in Naknek are located near large bulk fuel tanks and adjacent to other fish processing and cannery facilities. In the event of a conflagration fire at one of the canneries and strong winds, fire has the potential to spread quickly to other fish processing and cannery facilities as well as to bulk fuel facilities. **1a – Ensure existing cannery and bulk fuel storage facilities are accessible for fire response all year round and that facility response plans are current for all facilities required to submit them.**						
1a	During winter months, access to approximately nine canneries and one bulk fuel storage facilities on the north shore of the Naknek River is limited because facilities are located within fenced gates and during winter, roads are narrowed from snow berms created from plows or from lack of snow removal. During peak season, more than 1,800 persons employed by canneries and bulk fuel facility on the Naknek River and Pederson Point north of Naknek. Fire and emergency response plans for these facilities may be outdated or non-existent.	Access to facilities is adequate year round for fire response, including the winter months. This impacts jobs for more than 1,800 employees at these facilities. Fire and emergency response plans are developed and maintained, particularly for fish processing and bulk fuel storage facilities.	Action reduces hazard for fire and access to facilities is adequate for fire response year round. Facilities are prepared for conflagration fire.	Fire response will have access to these facilities year round and response plans will ensure facilities are prepared for worse case scenarios.	Cost is dependent on what is done to implement accessibility and the development of response plan. The Borough's economy is greatly affected by these facilities; any loss to a facility from fire would have a trickle down effect on the economy.	High
1b – Ensure that Borough volunteer firefighters have adequate training and conduct annual training exercises with industry for scenarios involving response to cannery or bulk fuel tank fire. Current Situation: The Borough conducts training twice a month for approximate 10 volunteer EMS to maintain certifications. During the summer months, staff is augmented with 4-5 EMTs.						
1b	Training twice monthly for volunteer firefighters and	Exercises and training will help prepare	Action provides opportunities for Borough VFD and	Training and exercises involving multiple agencies	Cost is dependent on how many	High

Table 20 Benefit Cost Review

Action	Vulnerability			Benefit (Pro)	Cost (Cons)	Priority
	Before Action is Implemented	After Action is Implemented	Difference			
	summer hires.	responders for worse case scenario involving fire and hazardous materials response. In a worse case scenario, multiple agencies may assist in the response, such as Katmai National Park firefighters or BLM firefighters.	industry to train together and they will be prepared for a quickly-spreading fire involving canneries and bulk fuel storage tank farms.	would benefit the Borough VFD by developing a working relationship with other fire and emergency responders. In the event of a disaster, the responders will be able to react and respond quickly and they will be familiar with agencies providing outside assistance.	exercises and trainings planned; the number of participants; how the exercises are designed; how much industry participates, and various funding available from State and Federal resources.	
1c -- Establish building ordinances relative to new structures near the fish processing and bulk fuel storage areas on the Naknek River. Current Situation: New developments are affected by Borough ordinances.						
1c	Fish processors and the bulk fuel storage tank farm are very close proximity of each other.	New development must be approved by the Borough and building ordinance should not allow construction of new buildings close to existing fish processing or bulk fuel storage areas.	Any new building developments will be constructed in areas away from existing fish processing and bulk fuel storage areas.	The action will help to prevent community conflagration fires that potentially could spread in the fish processing and bulk fuel storage areas.	Cost will depend on where new developments are planned and whether there are roads and/or utilities to the proposed location for new development.	High
1d	Refer to Mitigation Action #5.					
2 – Install backup generator at Naknek Fire Station. 2a/b – Current Situation: The Naknek Fire Station bay doors cannot open without electrical power. In the event of an outage, fire and emergency response could be critically delayed.						
2a/b	These mitigation actions have been implemented since development of the 2011 LHMP.					

Table 20 Benefit Cost Review

Action	Vulnerability			Benefit (Pro)	Cost (Cons)	Priority
	Before Action is Implemented	After Action is Implemented	Difference			
3 – Relocate Borough sewage line below bluffs on north side of Naknek River. **3a – Current Situation:** Erosion has exposed parts of the sewage line that runs along the base of the bluffs near the mouth of north side of the Naknek River. **3b – Current situation:** Sewage line was buried below the bluffs along the north side of the Naknek River to the pumping station below the bluffs and the sewage lagoons.						
3a/b	These mitigation actions have been implemented since development of the 2011 LHMP.					
3c – Long term goal is to relocate the sewage lagoons. Current situation: Sewage lagoons are located in an area on a bluff above the north end of the Naknek River.						
3c	In the long term, the sewage lagoons should be moved to another location due to the erosion of the bluffs.	The current location may not allow for growth in population and capacity for handling sewage.	Increased capacity for handling sewage treatment in a new location away from any threat of erosion.	Sewage capacity that allows for population growth in the future.	Cost depends on where sewage lagoons are relocated, the cost of construction, easements, and permits.	Medium
4 – Install emergency back-up heating system for the Naknek School. Current situation: The Naknek School relies on waste heat captured from operation of the Naknek Electric Association power plant's generator. During a power outage, the school does not have any back-up heating source, and the school is the designated trauma center in case of emergency.						
4a	No back-up heat available for Naknek School during power outage.	Emergency back-up heating system will allow Naknek School to stay heated for use as a community shelter during outages that occur during cold winter months.	Any extended outages would not affect heating the school with an emergency back-up heating system in the Naknek School.	As a community shelter, during emergencies, the Naknek School will provide a warm shelter during an extended power outage in the cold winter months.	Cost dependent upon type of emergency back-up heating system and cost of fuel to run the system.	Medium
4b	Storage and fuel for emergency heating system is non-existent at this time.	A secure dry space is designated to store the emergency back-up heating system.	Emergency back-up heating system available, with enough fuel readily available to keep the system running for up to five days without assistance.	Emergency back-up heating system is secure and ready for use, including fuel to run the system, when needed.	Cost dependent on size of space and cost of fuel;	Medium

Table 20 Benefit Cost Review

Action	Vulnerability			Benefit (Pro)	Cost (Cons)	Priority
	Before Action is Implemented	After Action is Implemented	Difference			
4c	Building plant operators currently do not have a system to run or maintain.	With an emergency back-up heating system, building plant operators should be training on the system and to maintain and test the system periodically.	More than one or two trained staff at the Naknek School will be available during emergencies to start up the system as needed and to monitor and maintain the system during extended operation.	Action will ensure adequately trained staff and alternates available to start up the emergency back-up heating system.	Cost of training staff to run and maintain the system.	Medium
5 – Build up spill response and recovery capabilities for oil and hazardous materials releases in King Salmon, Naknek and South Naknek. Current situation: Spill response and recovery capabilities for oil and hazardous waste releases potentially could be overwhelmed in a disaster event. Certain facilities that store or use oil and hazardous materials should have written Facility Response Plans (FRPs) and/or Spill Prevention Control and Countermeasure (SPCC) plans, which include the facilities' plans to respond to worst case discharges.						
5a/b/c/d	These mitigation actions have been implemented.					
6 – Build up fire response and hazmat capabilities for Borough Volunteer Fire Department (VFD). Current situation: The Borough VFD has approximately 10 volunteer firefighters and 4-5 seasonal summer hires.						
6a	Although no formal assessment has been conducted, the Borough is aware of local response capabilities for fire and hazmat responses. Also see 5a/b.	The Borough conducts an assessment that results in a list of local response capabilities for fire and hazmat.	During a disaster event, the Borough can call on assistance from local response resources.	The action is beneficial to the Borough VFD and to Borough residents and businesses if the Borough VFD becomes overwhelmed in a disaster event.	Cost will be to develop the assessment, to conduct the assessment, and to compile the data.	Medium
6b	The Borough has not researched funding sources to help purchase additional response equipment and supplies for the VFD	The Borough identifies funding sources to purchase response equipment and supplies for the VFD.	The Borough has funding resources for fire and hazmat response equipment and supplies.	The action benefits the Borough VFD with the purchase of additional equipment and supplies for fire and hazmat response.	Cost is staff time to research funding sources.	Medium
6c	The Borough VFD conducts drills and exercises every two years.	The Borough conducts drills and exercises more frequently.	More drills and exercises for fire and hazmat response.	The action benefits the Borough VFD and the Borough residents and businesses in better-prepared firefighters.	See cost for 5d/e.	Medium

Table 20 Benefit Cost Review

Action	Vulnerability			Benefit (Pro)	Cost (Cons)	Priority
	Before Action is Implemented	After Action is Implemented	Difference			
6d	There is no water fill site and pump near the Naknek Airport.	The Borough has installed a water fill and pump at Nornek Lake next to the Naknek Airport.	The Borough VFD has access to more water for an airport fire response.	The action benefits the Naknek Airport, the Borough VFD and airport businesses and users of the airport services.	Cost estimated to be $85,000.[46]	High
7 – Provide emergency power supply for the Borough for essential facilities in the event of a power outage or loss of power lines during a hazard event. Current situation: No emergency power supply for the Borough shelters.						
7a/b	The Borough has not funded to study cost of providing and implementing the installation of an emergency power supply.	The Borough implements funds to study cost of providing and to install emergency power supply.	Emergency power supply is provided for essential Borough facilities.	The action benefits fire, EMS, police, and clinic facilities.	Cost includes the study, purchase, and installation of emergency power supply.	Medium
7c	Naknek Electric Association (NEA) is the electric service provider for the Borough. The last extended power outage affected South Naknek for nearly two weeks in December 2000.	NEA upgrades its system to improve reliability of service for the Borough.	NEA has reliable service throughout the Borough.	The action benefits all customers of NEA, including the Borough.	Cost depends on actions taken by NEA; potentially cost could be in thousands to millions of dollars for system upgrades.	Low
8 – Install back-up power supply for communications system that houses all radio and telecommunications for the Borough. Current situation: There is not back-up power supply for the communications system located at the Borough Landfill.						
8a/b	Currently there is a 2-hour battery backup installed on the communications system and no emergency generator.	The Borough has constructed a storage addition to the Borough Landfill building and installed an emergency	Back-up power supply is available to kick on when there is a power outage. This provides the Borough with uninterrupted radio and telecommunications.	The action benefits emergency radio and telecommunications for the entire Borough.	Cost estimated at $_____.	High

[46] Email from Arlie Colvin, Borough Fire Chief and Emergency Manager, to V. Melde, June 14, 2011.

Table 20 Benefit Cost Review

Action	Vulnerability			Benefit (Pro)	Cost (Cons)	Priority
	Before Action is Implemented	After Action is Implemented	Difference			
		propane generator and stored enough fuel to run the generator for 5 days.				
8/c	No building addition to house an emergency power generator.	The Borough designs the building addition to utilize waste heat from other landfill operations.	Use of waste heat from other landfill operations keeps cost of heating down.	The action benefits the Borough for landfill facility operations and maintenance.	Cost could be included in design of building addition.	Medium
9 – Replace bridges on the Alaska Peninsula Highway that cross King Salmon Creek, Paul's Creek, and Leader Creek. Current situation: These bridges are about 50 years old and need to be replaced due to increased use of the highway.						
9a/b	Funding has been obtained, and this project will occur in 2018.					
10 – New in 2017: Naknek Runway needs runway lights. Current situation: Planes cannot land in the dark when medical emergencies could occur.						
11 – New in 2017: The two sewage lagoons need to be moved away from the Naknek River. Erosion, runoff, and high storm surge make the current location undesirable.						
12 – New in 2017: Combined EMS/Police/Ambulance Barn. Naknek and King Salmon would prefer that emergency facilities were co-located midway between the two communities rather than in Naknek. A 14-mile road separates Naknek and King Salmon.						

4.4 Mitigation Action Plan

Table 21 provides the mitigation action plan matrix. Projects are listed by the priority ranked during the benefit cost review process (Section 4.3). Additionally, Table 21 identifies agencies that will be responsible for implementing high priority mitigation actions, coordinating departments, identifying available funding sources, and developing a time frame for completion and initial estimated costs. Mitigation actions currently prioritized as low during benefit cost review were eliminated from the mitigation action plan. On September 20, 2017, the Planning and Zoning Commission updated mitigation actions from the 2011 plan. Updates and new mitigation actions are included on the table below. All mitigation actions will be re-evaluated during subsequent plan updates.

Table 21 Mitigation Actions by Priority Ranking

Project	Priority	Responsibility	Coordinating Departments	Funding Source	Time-frame	Cost
Relocate sewage lagoon and sewage line along the Naknek River		Borough	Planning and Community Development, Public Works	Borough, State, HMGP	This project was completed in 2017.	unknown
Prevent structural fires near Naknek fish processing plants and bulk fuel tanks		Processors	State Fire Marshall	State, HMGP	The Borough does not have the jurisdiction to implement this action. New structural designs must now be approved by the State Fire Marshall.	unknown
Provide emergency backup heating system for Naknek School		BBSD	Borough School District	BBSD, State, DOE, HMGP	Included on 2018 CIP List to Alaska Legislature	unknown
Build up spill response and recovery capabilities for oil and hazardous waste releases in King Salmon, Naknek and South Naknek		Borough Fire Department, Statewide Hazmat	Borough Fire Department, LEPC, Statewide Hazmat Working Group, private businesses	Borough, State, HMGP	unknown	unknown
Build up fire response and hazardous materials capabilities for Borough Volunteer Fire Department		Borough	Borough Fire Department, LEPC, Statewide Hazmat Working Group, private businesses	Borough, State, Federal Fire Fighters Grants	unknown	unknown
Provide emergency power supply for Borough communities in the event of extended power outage or loss of transmission		Borough	Borough, Naknek Electric Association	Borough, FEMA	This needs to occur for the shelters.	unknown

line across Naknek River.						

5 Plan Implementation and Maintenance

5.1 Introduction

The DMA 2000 regulations require proof of formal adoption of the LHMP. The adoption of the plan is necessary because:

- It lends authority to the plan to serve as a guiding document for all local and State government officials;
- It gives legal status to the plan in the event it is challenged in court;
- It certifies to program and grant administrators that the plan's recommendations have been properly considered and approved by the governing authority and the jurisdiction's citizens; and
- It helps ensure the continuity of mitigation programs and policies over time because elected officials, staff, and other community decision-makers can refer to the official document when making decisions about the community's future.

5.2 Plan Implementation

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

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

5.3 Plan Maintenance

A formal plan maintenance process ensures that the LHMP remains relevant to the community. The following sections explain how the Bristol Bay Borough hazard Mitigation Planning Group will ensure that improvements and revisions of the LHMP occur in an efficient and coordinated manner.

5.3.1 Monitoring, evaluating and updating

Prepared as a collaborative effort between the hazard Mitigation Planning Group and the State, the LHMP will be monitored, evaluated, and updated by the hazard Mitigation Planning Group, as appropriate. The Borough Manager, or designee, will serve as the primary point of contact and coordinator for this LHMP. The planning team should include an assessment of the planning process itself. The planning team will review other community plans as they are developed or updated for consistency with this plan and the identified mitigation strategies. Equally important, the planning team will identify necessary changes to this plan to reflect changing conditions or priorities set by the community and/or addressed other plans as they are developed or updated.

5.3.1.1 Monitoring

Each member of the hazard Mitigation Planning Group will conduct an annual review to monitor the implementation progress, paying close attention to the mitigation action plan.

The Borough Manager will initiate the annual review two months prior to the scheduled planning meeting to ensure that all data are assembled for discussion. The findings from these reviews will be presented at the annual hazard Mitigation Planning Group meeting. Evaluations should include:

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

During each annual review, each authority administering a mitigation project will submit a Progress Report to the hazard Mitigation Planning Group. This report should state the current status of the mitigation project, including any changes made to the project, the identification of implementation problems and appropriate strategies to overcome them, and whether the project has helped achieved the appropriate goals identified in the plan.

5.3.1.2 Evaluation

The Borough Manager, or a designee, will collect the questionnaire and summarize the results into an annual report. This report will be distributed to all hazard Mitigation Planning Group members, Borough Assembly members, and other interested agencies, departments, and persons for review and evaluation.

5.3.1.3 Updating

The plan will be updated every five years after its initial adoption, following a State or Federally Declared Disaster, or as required by DHS&EM. Approximately three months prior to the five-year plan review, the Mitigation Planning Group will undertake the following activities to evaluate the plan and ensure that it is adequately updated, submitted for State and Federal review and approval, and adopted in the fifth year:

- Thoroughly analyze and update the risk of natural and human-made hazards;
- Provide a new annual review (as noted above), plus a review of the three previous annual reviews;
- Provide a detailed review and revision of the mitigation strategy;
- Prepare a new mitigation action plan for the community;
- Prepare a new draft LHMP;
- Submit an updated LHMP to the DH&EM and FEMA for approval; and
- Submit the FEMA-approved plan for adoption by the Bristol Bay Borough.

5.3.1.4 Monitoring Mitigation Project Implementation

Each department and agency identified as the responsible party for a mitigation project will be responsible for monitoring mitigation project implementation and closeout. If more than one department or agency is identified for a mitigation project, the Borough Manager, or a designee, will work with the Borough Assembly to identify a single department and/or agency to monitor the mitigation project implementation and closeout. The chosen department will monitor the status of project implementation using the annual review form. The status of the project implementation and closeout will be included with each annual review. The annual review form will include the current status of the mitigation project, including any changes made to the project, total project costs and expected overruns, the identification of implementation problems and appropriate strategies to overcome them, and whether the project has helped to achieve the related goals identified in the plan.

Each overseeing agency and/or department will complete the report on a quarterly basis as a way to monitor and, if necessary, revise the project's implementation. Prior to each annual review, the overseeing agency and/or department will summarize the quarterly reports into one report and submit this report to the Borough Assembly for review. The Borough Assembly will review each report to determine whether progress has been made toward achieving the completion of each mitigation project, as well as the overall goals identified in the Mitigation Strategy.

Additionally, the report will be submitted annually to the Borough Manager or a designee, who will oversee all of the grants associated with this plan. The Borough Manager or a designee may also request that these reports be submitted quarterly, if necessary, for grant management purposes. Finally, each overseeing agency and/or department will be required to submit a closeout report to the Borough Manager or a designee, at the conclusion of any mitigation project.

5.3.2 Continued Public Involvement

The Bristol Bay Borough is dedicated to involving the public directly in the continual reshaping and updating of the LHMP. A downloadable copy of the LHMP and any proposed changes will be posted on the Borough's or DHS&EM SHMO's website. This site will also contain an e-mail address and telephone number that people can direct their comments or concerns.

The Mitigation Planning Group will also identify opportunities to raise community awareness about the LHMP and the hazards that affect the area. This effort could include attendance and provision of materials at community-sponsored events, outreach programs, and public mailings. Any public comments received regarding the LHMP will be collected by the Mitigation Planning Group leader, included in the annual report, and considered during future LHMP updates.

Progress review on achievement of goals and implementation of activities and projects of the Mitigation Strategy will also be accomplished during the annual review process. During each annual review, the entity currently administering a mitigation project will submit a progress report to the Mitigation Planning Group. The report will include the current status of the mitigation project, including any changes made to the project, the identification of implementation problems and appropriate strategies to overcome them, and whether the project has helped achieve the related goals identified in the plan. Finally, the hazard Mitigation Planning Group will review each progress report, as well as other relevant local, State, and Federal mitigation activities to determine if progress has been made toward achieving each goal identified in the mitigation strategy. A summary of the status of all mitigation projects will be presented to all interested parties and project stakeholders identified on the project mailing list during an annual LHMP update public meeting.

A Hazard Mitigation Planning and Disaster Preparedness Resources

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A.1 Federal Resources

Several Federal agencies provide guidance and assistance for hazard mitigation planning and disaster preparedness. Agencies and assistance include:

- FEMA
  - Pre-Disaster Mitigation Assistance Program (PDM). Provides funds to state, tribes, and local entities, including universities, for hazard mitigation planning and implementation of mitigation projects prior to a disaster event. The total amount of PDM funding available is appropriated by Congress on an annual basis.
  - Hazard Mitigation Grant Program. Provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. http://www.fema.gov/government/grant/hmgp/
  - Mitigation Technical Assistance Program. Provides hazard mitigation technical assistance to local/tribal jurisdictions via the State of Alaska, which would be the eligible Applicant with FEMA. The State would then provide subgrants to local jurisdictions.
  - Emergency Management Institute. Offers various emergency management trainings, including hazard mitigation. http://training.fema.gov/
  - Publications
    - How-to Guides. A series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. (http://www.fema.gov/fima/planhowto.shtm).
    - FEMA DAP-12 "Post-Disaster Hazard Mitigation Planning Guidance for State and Local Government" (FEMA DAP-12, September 1990). Explains basic concepts of hazard mitigation and shows state and local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster hazard mitigation planning requirements.
    - FEMA 372 "Mitigation Resources for Success CD" (FEMA 372, September 2001). Provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation

measures to homes and businesses, appropriate relevant mitigation publications, and contact information.

- FEMA 262 "A Guide to Federal Aid in Disasters" (FEMA 262, April 1995). Discusses the procedures and process for obtaining Federal disaster assistance and provides a brief overview of each program.
- FEMA 141 "The Emergency Management Guide for Businesses and Industry" (FEMA 141, October 1993.). Provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events.

- Department of Agriculture. Programs include the Emergency Conservation Program, Non-insured Crop Disaster Assistance Program, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.
- Department of Energy (Office of Energy Efficiency and Renewable Energy). Weatherization Assistance Program helps minimize the adverse effects of high energy costs on low income, elderly, and handicapped citizens through client education activities and weatherization services.
- Department of Housing and Urban Development.
  - Section 108 Loan Guarantee Program. Provides loan guarantees as security for federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing.
  - Community Development Block Grants Program (CDBG). Provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons.
- Department of Labor (Employment and Training Administration). Disaster Unemployment Assistance provides weekly unemployment subsistence grants for those who become unemployed because of a

major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible.

- Federal Financial Institutions. May waive Certificate of Deposit and retirement early withdrawal penalties if funds are used for disaster recovery.
- Internal Revenue Service. Provides tax relief by providing extensions to current year's tax returns, allows deductions for disaster losses and allows amendments of previous tax returns to reflect loss back to three years.
- Small Business Administration. May provide disaster loans to individuals and businesses that have suffered a loss due to a disaster.
- American Planning Association. Serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
- Institute for Business and Home safety. Provides information on hazards and ways to protect property from damage.

A.2 State Resources

- Alaska Department of Military and Veteran's Affairs, Division of Homeland Security and Emergency Management (DHS&EM). Responsible for improving hazard mitigation technical assistance for local governments in Alaska. Provides hazard mitigation training, provides current hazard information, and facilitates communication with other agencies to enhance local hazard mitigation efforts. Website: http://ready.alaska.gov/plans/mitigation/mitigati.htm
- Alaska Department of Commerce, Community, and Economic Development, Division of Community and Regional Affairs, Floodplain Management Program. Provides coordination, funding, and technical assistance to National Flood Insurance Program (NFIP) communities to reduce public and private sector losses and damage caused by flooding and erosion. Website: http://www.commerce.state.ak.us/dca/planning/nfip/nfip.htm
- Alaska Department of Commerce, Community, and Economic Development, Division of Insurance. Provides assistance in obtaining copies of policies and provides information regarding filing claims. Website: http://www.dced.state.ak.us/insurance/
- Alaska Department of Commerce, Community, and Economic Development, Division of Community and Regional Affairs, CDBG

Program. The goals of the Alaska CDBG are to provide financial resources to Alaskan communities for public facilities and planning activities that address issues detrimental to the health and safety of local residents and to reduce the costs of essential community services. The program may also fund Special Economic Development activities that result in the creation of jobs for low and moderate income persons. Website: http://www.commerce.state.ak.us/dcra/grt/blockgrants.htm

- Alaska Department of Health and Social Services, Division of Senior and Disabilities Services. Provides resources for seniors, including food, shelter and clothing. Website: http://www.hss.state.ak.us/dsds/

- Department of Health and Social Services, Section of Injury Prevention and Emergency Medical Services (EMS) Program. The mission of the EMS program in Alaska provides leadership in EMS by consensus building, developing and administering guidelines and regulations, and by developing and distributing publications for planning, treatment, and evaluation. The overall goal of the EMS program is to prevent life-threatening and disabling injuries whenever possible and to establish a comprehensive, coordinated system of emergency medical services.

- Department of Environmental Conservation. Primary roles and responsibilities concerning hazard mitigation are ensuring safe food and safe water, and pollution prevention and pollution response. Ensures water treatment plants, landfills, and bulk fuel storage tank farms are safely constructed and operated in communities. Agency and facility response plans include hazards identification and pollution prevention and response strategies.

- Department of Forestry. Participates in a statewide wildfire control programs in cooperation with the forest industry, rural fire departments and other agencies.

- Department of Transportation and Public Facilities. Provides technical assistance to various emergency management programs, to include mitigation. Assistance includes, but is not limited to: environmental reviews, archaeological surveys, historic preservation reviews, and coordination of buyout projects.

- Alaska Department of Natural Resources. Administers various projects designed to reduce stream bank erosion, reduce localized flooding, improve drainage, and improve discharge water quality through the storm water grant program funds.

A.3 Other Funding Sources and Resources

Other organizations that may provide funding or resources for hazard mitigation planning or disaster preparedness include:

- American Red Cross. Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment.
- Crisis Counseling Program. Provides grants to state and borough mental health departments, which in turn provide training for screening, diagnosing, and counseling techniques. Also provides funds for counseling, outreach, and consultation for those affected by disaster.

A.4 Local Resources

- Bristol Bay Borough Comprehensive Community Plan, 2006
- Bristol Bay Borough Code, Title 20 Zoning

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B References

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Local

Bristol Bay Borough Community Comprehensive Plan 2006

Bristol Bay Borough Code, Title 20 Zoning

State

State of Alaska Hazard Mitigation Plan, 2013

Federal

FEMA. 2001. *How-To Guide #2: Understanding Your Risks – Identifying Hazards and Estimating Loss Potential*. U.S. Department of Homeland Security, FEMA 386-2. Available: http://www.fema.gov/fima/planning_toc3.shtm. (December 2006).

FEMA. 2002a. 44 CFR Parts 201 and 206, RIN 3067-AD22, *Hazard Mitigation Planning and Hazard Mitigation Grant Program, Interim Final Rule.* In *Federal Register* 67, No. 38. U.S. Department of Homeland Security. Available: http://www.fema.gov/pdf/fima/fr02_4321.pdf. (December 2006).

FEMA. 2002b. S*tate and Local Plan Interim Criteria under the Disaster Mitigation Act of 2000 – Final Draft*. U.S. Department of Homeland Security. Available: http://www.fema.gov/fima/planning_toc4.shtm. (December 2006).

FEMA. 2002c. *How-To Guide #1: Getting Started: Building Support for Mitigation Planning*. U.S. Department of Homeland Security, FEMA 386-1. Available: http://www.fema.gov/fima/planning_toc5.shtm. (December 2006).

FEMA. 2002d. *How-To Guide #7: Integrating Manmade Hazards into Mitigation Planning.* U.S. Department of Homeland Security, FEMA 386-7. Available: http://www.fema.gov/plan/mitplanning/howto7.shtm. (June 2007).

FEMA. 2002e. 44 CFR Parts 201 and 206, RIN 3067-AD22, *Hazard Mitigation Planning and Hazard Mitigation Grant Program, Interim Final Rule*. In *Federal Register* 67, no. 190. U.S. Department of Homeland Security. Available: http://www.fema.gov/pdf/fima/fr02_24998.pdf. (December 2006).

FEMA. 2003a. *How-To Guide #3: Developing the Mitigation Plan; Identifying Mitigation Actions and Implementing Strategies.* U.S. Department of Homeland Security, FEMA 386-3. Available: http://www.fema.gov/plan/mitplanning/howto3.shtm. (June 2007).

FEMA. 2003b. *How-To Guide #4: Bringing The Plan to Life; Implementing the Hazard Mitigation Plan.* U.S. Department of Homeland Security, FEMA 386-4. Available: http://www.fema.gov/plan/mitplanning/howto4.shtm. (June 2007).

FEMA. 2004. *Multi-Hazard Mitigation Planning Guidance Under the Disaster Mitigation Act of 2000.* Available: http://www.fema.gov/doc/fima/part_3_031904.doc. (March 2006).

FEMA. 2006a. FEMA *Flood Fast Facts*. Accessed http://www.floodsmart.gov/floodsmart/pages/fastfackts.jsp May 2006.

FEMA. 2006b. FEMA *Flood Zones*. Accessed http://www.floodsmart.gov/floodsmart/pages/faq_zones.jsp May 2006.

FEMA. 2006c. FEMA *What is a Flood?* Accessed http://www.floodsmart.gov/floodsmart/pages/whatflood.jsp May 2006

C Public Involvement

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Insert public meeting flyers, meeting sign-in sheets, surveys, and fact sheets.

D Adoption Resolution

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Bristol Bay Borough

RESOLUTION NO. 2011-19

A RESOLUTION ADOPTING THE BRISTOL BAY BOROUGH HAZARD MITIGATION PLAN

WHEREAS, the Bristol Bay Borough, with the assistance from Ecology and Environment, Inc., who was contracted by the State of Alaska Division of Homeland Security and Emergency Management to assist the Borough in the writing of this plan, has gathered information and prepared the Bristol Bay Borough Local Hazard Mitigation Plan; and,

WHEREAS, the Bristol Bay Borough Local Hazard Mitigation Plan has been prepared in accordance with the Disaster Mitigation Act of 2000; and,

WHEREAS, the Bristol Bay Borough is a local unit of government that has afforded the citizens an opportunity to comment and provide input in the Plan and the actions in the Plan; and,

WHEREAS, the Bristol Bay Borough has reviewed the Plan and affirms that the Plan will be updated no less than every five years; and

WHEREAS, the Bristol Bay held numerous announced workshops to develop and refine this plan to the final version presented; and,

NOW THEREFORE, BE IT RESOLVED by the Borough Assembly that the Bristol Bay Borough adopts the Bristol Bay Borough Local Hazard Mitigation Plan as this jurisdiction's Natural Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

Approved and adopted by the Assembly of the Bristol Bay Borough this **6th** day of **September, 2011.** 5 Ayes Ø Nayes

Daniel O'Hara, Mayor

Attest

Tani Schoneman, Borough Clerk

E Hazard Analysis

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In the Hazard Analysis, each of the hazards and threats described in the LHMP is scored using a formula that incorporates four independently weighted rating criteria (history, vulnerability, maximum threat, probability) and three levels of severity (low, moderate, and high). For each hazard, the score for a given rating criterion is determined by multiplying the criterion's severity rating by its weight factor. The four rating criteria scores for the hazard are then summed to provide a total risk score for that hazard. Note that while many hazards may occur together or as a consequence of others (e.g., ice jams cause flooding, and earthquakes may cause landslides), this analysis considers each hazard as a singular event.

Table E-1 Bristol Bay Borough Hazard Analysis Matrix

Hazard	Rating Criteria with Weight Factors				Total Score
	History [1] (WF=2)	Vulnerability [2] (WF=5)	Max Threat [3] (WF=10)	Probability [4] (WF=7)	
	Score for each rating criteria = Rating Factor (High = 10 points; Moderate = 5 points; Low = 1 point) X Weight Factor (WF)				
Flood	**H**-10x2=20	**H**-10x5=50	**H**-10x10=100	**L** - 1x7=7	**177**
Wildfire and Conflagration	**H**-10x2=20	**H**-10x5=50	**H**-10x10=100	**H**-10x7=70	**240**
Earthquake	**H**-10x2=20	**M**-5x5=25	**H**-10x10=100	**L** - 1x7=7	**152**
Volcano	**H**-10x2=20	**H**-10x5=50	**H**-10x10=100	**H**-10x7=70	**240**
Severe Weather	**H**-10x2=20	**H**-10x5=50	**H**-10x10=100	**H**-10x7=70	**240**
Erosion	**L** - 1x2=2	**L** - 1x5=5	**L** - 1x10=10	**L** - 1x7=7	**24**
Technological	**M**-5x2=10	**H**-10x5=50	**H**-10x10=100	**M**-5x7=35	**195**
Climate Change	**H**-10x2=20	**H**-10x5=50	**H**-10x10=100	**H**-10x7=70	**240**

Notes:

1. History addresses the record of previous major emergencies or disasters. Weight Factor is 2. Rating factors: high = 4 or more events in last 100 years; moderate = 3 events in last 100 years; low = 1 or 0 events in last 100 years.
2. Vulnerability addresses the percentage of population or property likely to be affected by a major emergency or disaster. Weight Factor is 5. Rating factors: high = more than 10% affected; moderate = 1%–10% affected; low = less than 1% affected.
3. Maximum Threat addresses the percentage of population or property that could be affected in a worst case incident. Weight Factor is 10. Rating factors: high = more than 25% could be affected; moderate = 5%–25% could be affected; low = less than 5% could be affected.
4. Probability addresses the likelihood of a future major emergency or disaster within a specified period of time. Weight Factor is 7. Rating factors: high = one incident within a 10-year period; moderate = one incident within a 50-year period; low = one incident within a 100-year period.

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Acronyms and Glossary

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Acronyms

ADOT&PF	Alaska Department of Transportation and Public Facilities
BBB	Bristol Bay Borough
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
DHS&EM	State of Alaska, Division of Homeland Security and Emergency Management
DMA 2000	Disaster Mitigation Act of 2000
DOF	Department of Forestry
E & E	Ecology and Environment, Inc.
EMS	Emergency Medical Service
EPA	Environmental Protection Agency
FMA	Flood Mitigation Assistance (Grant Program)
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
HMGP	Hazard Mitigation Grant Program
LHMP	Local Hazard Mitigation Plan
PDM	Pre-Disaster Mitigation Program
SHMO	State Hazard Mitigation Officer
U.S.	United States
USGS	U.S. Geological Survey
VFD	Volunteer Fire Department
WFAS	Wildland Fire Assessment System

Glossary of Key Terms

Acquisition: Local governments can acquire lands in high hazard areas through conservation easements, purchase of development rights, or outright purchase of property.

All Hazards: Any incident caused by terrorism, natural disasters, or any CBRNE accident. Such incidents require a multi-jurisdictional and multi-functional response and recovery effort.

Asset: Any manmade or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

Borough: The basic unit of local government in Alaska.

Building: A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight

Building Code: The regulations adopted by a local governing body setting forth standards for the construction, addition, modification, and repair of buildings and other structures for the purpose of protecting the health, safety, and general welfare of the public

Community: Any state, area or political subdivision thereof, or any Indian tribe or tribal entity that has the authority to adopt and enforce statutes for areas within its jurisdiction.

Community Rating System (CRS): The Community Rating System is a voluntary program that each municipality or county government can choose to participate in. The activities that are undertaken through CRS are awarded points. A community's points can earn people in their community a discount on their flood insurance premiums.

Critical Facility: Facilities that are critical to the health and welfare of the population and that are especially important during and after a hazard event. Critical facilities include, but are not limited to, shelters, hospitals, and fire stations.

DHS&EM: Alaska Division of Homeland Security and Emergency Management provides critical services to the State of Alaska to protect lives and property from terrorism and all other hazards, as well as to provide rapid recovery from all disasters.

DMVA: Alaska Department of Military and Veterans Affairs is in charge of the State's military resources, including Alaska Army and Air National Guard, 103rd Civil Support Team, DHS&EM, Alaska Military Youth Academy, Alaska Space

& Missile Defense, Alaska State Defense Force, State Veterans Affairs Office, and Commander Alaska Naval Militia.

Development: Any man-made change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or of equipment or materials.

Digitize: To convert electronically points, lines, and area boundaries shown on maps into x, y coordinates (e.g., latitude and longitude, universal transverse mercator (UTM), or table coordinates) for use in computer applications.

Disaster Mitigation Act: DMA 2000 (public Law 106-390) is the latest legislation of 2000 (DMA 2000) to improve the planning process. It was signed into law on October 10, 2000. This new legislation reinforces the importance of mitigation planning and emphasizes planning for disasters before they occur.

Earthquake: A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of the earth's tectonic plates.

Emergency Operations Plan: A document that: describes how people and property will be protected in disaster and disaster threat situations; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities, supplies, and other resources available for use in the disaster; and outlines how all actions will be coordinated.

Federal Disaster Declaration: The formal action by the President to make a State eligible for major disaster or emergency assistance under the Robert T. Stafford Relief and Emergency Assistance Act, Public Law 93-288, as amended. Same meaning as a Presidential Disaster Declaration

Federal Emergency Management Agency (FEMA): A federal agency created in 1979 to provide a single point of accountability for all federal activities related to hazard mitigation, preparedness, response, and recovery.

Flood Insurance Rate Map: Flood Insurance Rate Map (FIRM) means an official map of a community, on which the Administrator has delineated both the special hazard areas and the risk premium zones applicable to the community.

Geographic Information System: A computer software application that relates physical features of the earth to a database that can be used for mapping and analysis.

Governing Body: The legislative body of a municipality that is the assembly of a borough or the council of a city.

Hazard: A source of potential danger or adverse condition. Hazards in the context of this plan will include naturally occurring events such as floods, earthquakes, tsunami, coastal storms, landslides, and wildfires that strike

populated areas. A natural event is a hazard when it has the potential to harm people or property.

Hazard Event: A specific occurrence of a particular type of hazard.

Hazard Identification: The process of identifying hazards that threaten an area.

Hazard Mitigation: Any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards. (44 CFR Subpart M 206.401)

Hazard Mitigation Grant Program: The program authorized under section 404 of the Stafford Act, which may provide funding for mitigation measures identified through the evaluation of natural hazards conducted under §322 of the Disaster Mitigation Act 2000.

Hazard Profile: A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

Hazard and Vulnerability Analysis: The identification and evaluation of all the hazards that potentially threaten a jurisdiction and analyzing them in the context of the jurisdiction to determine the degree of threat that is posed by each.

Infrastructure: The public services of a community that have a direct impact to the quality of life. Infrastructure refers to communication technology such as telephone lines or Internet access, vital services such as public water supply and sewer treatment facilities, and includes an area's transportation system, regional dams or bridges, etc.

Intensity: A measure of the effects of a hazard event at a particular place.

Interferometer: A method employing the interference of electromagnetic radiation to make highly precise measurements of the angle between the two rays of light.

Liquefaction: The phenomenon that occurs when ground shaking causes loose soils to lose strength and act like a thick or viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength.

Local Emergency Planning Committee (LEPC): LEPCs consist of community representatives and are appointed by the State Emergency Response Commissions (SERCs), as required by Superfund Amendments and Reauthorization Act (SARA), Title III. They develop an emergency plan to prepare for and respond to a chemical emergency. They are also responsible for coordinating with local facilities to find out what they are doing to reduce hazards, prepare for accidents, and reduce hazardous inventories and releases. The LEPC serves as a focal point in the community for information and discussion about hazardous substances, emergency planning, and health and environmental risks.

Local Government: Any county, borough, municipality, city, township, public authority, school district, intrastate district, council of governments (regardless of whether the council of governments is incorporated as a nonprofit corporation under State law), regional or interstate government entity, or agency, or instrumentality of a local government; any Indian tribe or authorized tribal organization, or Alaska Native village or organization; and any rural community, unincorporated town or village, or other public entity, for which an application for assistance is made by a State or political subdivision of a State.

Magnitude: A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

Mitigate: To cause something to became less harsh or hostile, to make less severe or painful

Mitigation Plan: A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the State and includes a description of actions to minimize future vulnerability to hazards.

Municipality: A political subdivision incorporated under the laws of the State that is a home rule or general law city, a home rule or general law borough, or a unified municipality.

Natural Disaster: Any natural catastrophe, including any hurricane, tornado, storm, high water, wind, driven water… tsunami, earthquake, volcanic eruption, landslide, snowstorm, fire, or drought. (44 CFR Subpart M 206.401)

New Construction: New construction means structures for which the "start of construction" on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvement to such structures.

Overlay Zone: Overlay zones (overlay districts) create a framework for conservation or development of special geographical areas. In a special resource overlay district, overlay provisions typically impose greater restrictions on the development of land, but only regarding those parcels whose development, as permitted under the zoning, may threaten the viability of the natural resource. In a development area overlay district, the provisions may impose restrictions as well, but also may provide zoning incentives and waivers to encourage certain types and styles of development. Overlay zone provisions are often complemented by the adoption of other innovative zoning techniques, such as floating zones, special permits, incentive zoning, cluster development and special site plan or subdivision regulations, to name a few.

Period: The length of time between two successive peaks or troughs of a wave. The Period may vary due to complex interferences of waves. Tsunami wave periods generally range from 5 to 60 minutes apart.

Permeability: The property of soil or rock that allows water to pass through it.

Planning: The act or process of making or carrying out plans; the establishment of goals, policies, and procedures for a social or economic unit.

Preparedness: The steps taken to decide what to do if essential services break down, developing a plan for contingencies, and practicing the plan. Preparedness ensures that people are ready for a disaster and will respond to it effectively. Actions that strengthen the capabilities of government, citizens, and communities to respond to disasters.

Prescribed Fire: Any fire ignited by management actions to meet specific objectives. Prior to ignition, a written, approved prescribed fire plan must exist, and National Environmental Protection Act requirements must be met (National Park Service and others 1998).

Prescribed Natural Fire: Naturally ignited wildland fire that burns under specified conditions where the fire is confined to a predetermined area and produce the fire behavior and fire characteristics required to attain planned fire treatment and resource management objectives (National Wildfire Coordinating Group, Incident Operations Standards Working Team 1996).

Presidential Disaster Declaration: The formal action by the President to make a State eligible for major disaster or emergency assistance under the Robert T. Stafford Relief and Emergency Assistance Act, Public Law 93-288, as amended.

Probability: A statistical measure of the likelihood that a hazard event will occur.

Recovery: The actions taken by an individual or community after a catastrophic event to restore order and lifelines in a community.

Regulatory Power: Local jurisdictions have the authority to regulate certain activities in their jurisdiction. With respect to mitigation planning, the focus is on such things as regulating land use, development, and construction through zoning, subdivision regulations, design standards, and floodplain regulations.

Relocation: The moving of a structure from a flood area to a new location, normally to one where there is no threat of flooding.

Repetitive Loss Property: A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least $1000 each have been paid within any 10-year period since 1978.

Response: Those activities and programs designed to address the immediate and short-term effects of the onset of an emergency or disaster.

Retrofit: The strengthening of structures to reduce or eliminate (mitigate) future disaster risks.

Richter Scale: A numerical scale of earthquake magnitude devised by seismologist C.F. Richter in 1935.

Rift Zone: A rift zone is an elongated system of crustal fractures associated with an area that has undergone extension (the ground has spread apart).

Risk: The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It can also be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Scale: A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Seiche: An oscillating wave (also referred to as a seismic sea wave) in a partially or fully enclosed body of water. May be initiated by landslides, undersea landslides, long period seismic waves, wind and water waves, or a tsunami.

Seismicity: Describes the likelihood of an area being subject to earthquakes.

Special Hazard Area: Special Hazard Area means an area having special flood, mudslide (i.e., mudflow) and/or flood-related erosion hazards, as shown on a FHBM or FIRM as Zone A, AOA, A1-30, AE, A99, AH, VO, V1-30, VE, V, M, or E.

Stafford Act: 1) The Robert T. Stafford Disaster Relief and Emergency Assistance Act, Public Law 93-288, as amended. 2) The Stafford Act provides an orderly and continuing means of assistance by the Federal Government to State, local and tribal governments in carrying out their responsibilities to alleviate the suffering and damage which result from disaster.

Stakeholder: Individual or group that will be affected in any way by an action or policy. They include businesses, private organizations, and citizens

State Coordinating Agency: State Coordinating Agency means the agency of the State government, or other office designated by the Governor of the State or by State Statute at the request of the Administrator to assist in the implementation of the National Flood Insurance Program in that State.

State Disaster Declaration: A disaster emergency shall be declared by executive order or proclamation of the Governor upon finding that a disaster has occurred or that the occurrence or the threat of a disaster is imminent. The state of disaster emergency shall continue until the governor finds that the threat or danger has passed or that the disaster has been dealt with to the extent that emergency conditions no longer exist and terminates the state of disaster emergency by executive order or proclamation.

Along with other provisions, this declaration allows the governor to utilize all available resources of the State as reasonably necessary, direct and compel the

evacuation of all or part of the population from any stricken or threatened area if necessary, prescribe routes, modes of transportation and destinations in connection with evacuation and control ingress and egress to and from disaster areas.

It is required before a Presidential Disaster Declaration can be requested.

State Hazard Mitigation Officer (SHMO): The SHMO is the representative of State government who is the primary point of contact with FEMA, other State and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Structural Mat Slab: The concrete slab of a building that includes structural reinforcement to help support the building's structure.

Structure: A walled and roofed building, including a gas or liquid storage tank that is principally above ground and mounted to a permanent site, as well as a manufactured home.

Subdivision Regulations: Ordinances or regulations governing the subdivision of land with respect to things such as adequacy and suitability of building sites and utilities and public facilities.

Subsidence: Sinking of the land surface, usually due to withdrawals of underground water, oil, or minerals.

Subsidized Rates: Subsidized rates mean the rules established by the Administrator involving in the aggregate subsidization by the Federal Government.

Substantial Damage: Damage of any origin sustained by a structure in a Special Flood Hazard Area whereby the cost of restoring the structure to its before-damaged condition would equal or exceeds 50 recent of the market value of the structure before the damage.

Substantial Improvement: Substantial improvement means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the "start of construction" of the improvement. This term includes structures, which have incurred "substantial damage," regardless of the actual repair work performed. The term does not, however, include either: (1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions or (2) Any alteration of a "historic structure," provided that the alteration will not preclude the structure's continued designation as a "historic structure."

Tectonic Plate: Torsionally rigid, thin segments of the earth's lithosphere that may be assumed to move horizontally and adjoin other plates. It is the friction between plate boundaries that cause seismic activity.

Topography: The contour of the land surface. The technique of graphically representing the exact physical features of a place or region on a map.

Tribal Government: A Federally recognized governing body of an Indian or Alaska Native Tribe, band, nation, pueblo, village or community that the Secretary of the Interior acknowledges to exist as an Indian tribe under the Federally Recognized Tribe List Act of 1994, 25 U.S.C. 479a. This does not include Alaska Native corporations, the ownership of which is vested in private individuals.

Tsunami: A sea wave produced by submarine earth movement or volcanic eruption with a sudden rise or fall of a section of the earth's crust under or near the ocean. A seismic disturbance or land slide can displace the water column, creating a rise or fall in the level of the ocean above. This rise or fall in sea level is the initial formation of a tsunami wave.

Variance: Variance means a grant of relief by a community from the terms of a floodplain management regulation.

Vulnerability: Describes how exposed or susceptible to damage an asset it. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. The vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electrical substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Other, indirect effects can be much more widespread and damaging than direct ones.

Vulnerability Assessment: The extent of injury and damage that may result from hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future built environment.

Wildfire: An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.

Zoning Ordinance: An ordinance under the State or local government's police powers that divides an area into districts and, within each district, regulates the use of land and buildings, height, and bulk of buildings or other structures, and the density of population.