



City of Bethel, Alaska

Local Hazard Mitigation Plan Update

Prepared by:
City of Bethel
LeMay Engineering & Consulting, Inc.

August 2017

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Photos by the Bethel Planning Department

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- E Plan Maintenance Documents

Acronyms/Abbreviations

°F	Degrees Fahrenheit
AFG	Assistance to Firefighters Grant
AHFC	Alaska Housing Finance Corporation
AICC	Alaska Interagency Coordination Center
ANA	Administration for Native Americans
ANTHC	Alaska Native Tribal Health Consortium
APA	American Planning Association
ARC	American Red Cross
BIA	Bureau of Indian Affairs
BLM	Bureau of Land Management
CD	compact disc
CDBG	Community Development Block Grant
cfs	cubic feet per second
CHEMS	Community Health and Emergency Medical Services
CFR	Code of Federal Regulations
City	City of Bethel
DCCED	Department of Commerce, Community, and Economic Development
DCRA	Division of Community and Regional Affairs
DGGS	Division of Geological and Geophysical Survey
DEC	Department of Environmental Conservation
DHSS	Department of Health and Social Services
DHS	Department of Homeland Security
DHS&EM	Division of Homeland Security and Emergency Management
DMA 2000	Disaster Mitigation Act of 2000
DMVA	Department of Military and Veterans Affairs
DNR	Department of Natural Resources
DOF	Division of Forestry
DOI	Division of Insurance
DOT/PF	Department of Transportation and Public Facilities
DSS	Division of Senior Services
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FMA	Flood Mitigation Assistance
FP&S	Fire Prevention and Safety
FY	Fiscal Year
<i>g</i>	gravity as a measure of peak ground acceleration

HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HWE	High Water Elevation
HMP	Hazard Mitigation Plan
HUD	Housing and Urban Development
IBHS	Institute for Business and Home Safety
ICDBG	Indian Community Development Block Grant
IHBG	Indian Housing Block Grant
IRS	Internal Revenue Service
M	Magnitude
MMI	Modified Mercalli Intensity
mph	miles per hour
NAHASDA	Native American Housing Assistance and Self Determination Act
NFIP	National Flood Insurance Program
PDM	Pre-Disaster Mitigation
PGA	peak ground acceleration
REAA	Regional Educational Attendance Area
RL	repetitive loss
RFC	Repetitive Flood Claim
SAFER	Staffing for Adequate Fire and Emergency Response
SBA	U.S. Small Business Administration
SHMP	Alaska State Hazard Mitigation Plan
SRL	Severe Repetitive Loss
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
US or U.S.	United States
USC	United States Code
USGS	United States Geological Survey

Letter of Commitment



CITY OF BETHEL
Planning Office

July 25, 2017

George Grady
State of Alaska
DMVA DHS&EM
P.O. Box 5750
JBER, Alaska 99505-5750

Dear Mr. Grady:

This letter serves as the City of Bethel's Letter of Commitment to support DMVA DHS&EM and LeMay Engineering and Consulting Inc., in their Federal Emergency Management Agency (FEMA) Pre-Disaster Mitigation (PDM) planning grant to update the 2008 hazard mitigation plan for the City of Bethel. The end goal of this grant is a State and FEMA approved hazard mitigation plan that the City of Bethel will adopt.

Sincerely,

Pete Williams
City Manager

City Adoption

Introduced by: Peter Williams, City Manager
Date: April 10, 2018
Action: Passed
Vote: 6-0

CITY OF BETHEL

Resolution # 18-08

ADOPTION OF THE CITY OF BETHEL LOCAL HAZARDS MITIGATION PLAN UPDATE, AUGUST 2017

WHEREAS, the City of Bethel recognizes the threat that local natural hazards pose to people and property;

WHEREAS, undertaking hazard mitigation projects before disasters occur will reduce the potential for harm to people and property and save taxpayer dollars;

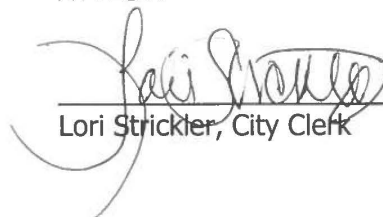
WHEREAS, an adopted Local Hazards Plan Update will be sent to the Alaska Division of Homeland Security and Emergency Management and the Federal Emergency Management Agency for their approval;

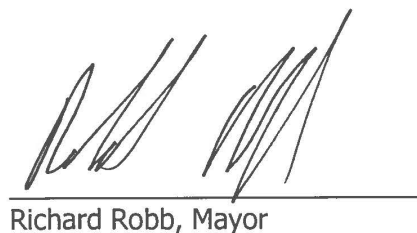
NOW, THEREFORE, BE IT RESOLVED that the Bethel City Council, hereby adopts the City of Bethel Local Hazards Mitigation Plan Update, August 2017, as an official plan;

NOW, THEREFORE, BE IT FURTHER RESOLVED that the City of Bethel will submit the adopted Local Hazards Mitigation Plan Update, August 2017, to the Alaska Division of Homeland Security and Emergency Management and the Federal Emergency Management Agency officials for final review and approval.

ENACTED THIS 10th DAY OF APRIL 2018 BY A VOTE OF 6 IN FAVOR AND 0 OPPOSED.

ATTEST:


Lori Strickler, City Clerk


Richard Robb, Mayor

FEMA Approval

U.S. Department of Homeland Security
FEMA Region 10
130 – 228th Street, SW
Bothell, Washington 98021



FEMA

March 14, 2018

Mr. Brent Nichols
State Hazard Mitigation Officer
Alaska Division of Homeland Security and Emergency Management
P.O. Box 5750
Fort Richardson, Alaska 99505-5750

Dear Mr. Nichols:

As requested, on March 13, 2018, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA), Region 10, completed a pre-adoption review of the *City of Bethel Hazard Mitigation Plan*. This letter serves as Region 10's commitment to approve the plan upon receiving documentation of its adoption by the community. The plan successfully contains the required criteria, excluding the adoption, for hazard mitigation plans, as outlined in Code of Federal Regulation Title 44 Part 201.

Once FEMA approves the plan, the community is eligible for mitigation project grants.

Please contact our Regional Mitigation Planning Program Manager, Brett Holt, at (425) 487-4553 with any questions.

Sincerely,

X 

Tamra Biasco
Chief, Risk Analysis Branch
Mitigation Division

AS:vl

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This section provides a brief introduction to hazard mitigation planning, the grants associated with these requirements, and a description of this update to the 2008 City of Bethel Hazard Mitigation Plan (HMP).

1.1 HAZARD MITIGATION PLANNING

Hazard mitigation, as defined in Title 44 of the Code of Federal Regulations (CFR), Part 201.2, is “any action taken to reduce or eliminate the long-term risk to human life and property from natural hazards.” Many areas have expanded this definition to also include human-caused hazards. As such, hazard mitigation is any work done to minimize the impacts of any type of hazard event before it occurs. It aims to reduce losses from future disasters. Hazard mitigation is a process in which hazards are identified and profiled, people and facilities at risk are analyzed, and mitigation actions are developed. The implementation of the mitigation actions, which include long-term strategies that may include planning, policy changes, programs, projects, and other activities, is the end result of this process.

1.2 PLANNING REQUIREMENTS

1.2.1 Local Mitigation Plans

In recent years, local hazard mitigation planning has been driven by a Federal law. On October 30, 2000, Congress passed the Disaster Mitigation Act of 2000 (DMA 2000) (P.L. 106-390) which amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) (Title 42 of the United States Code [USC] 5121 et seq.) by repealing the act’s previous mitigation planning section (409) and replacing it with a new mitigation planning section (322). This new section emphasized the need for State, Tribal, and Local entities to closely coordinate mitigation planning and implementation efforts. In addition, it provided the legal basis for the Federal Emergency Management Agency’s (FEMA) mitigation plan requirements for mitigation grant assistance.

To implement these planning requirements, FEMA published an Interim Final Rule in the Federal Register on February 26, 2002, 44 CFR Part 201 with subsequent updates. The planning requirements for local entities are described in detail in Section 4 and are identified in their appropriate sections throughout this HMP update.

FEMA’s October 31, 2007 and July 2008 changes to 44 CFR Part 201 combined and expanded flood mitigation planning requirements with HMPs (44 CFR §201.6). Furthermore, all hazard mitigation assistance (HMA) program planning requirements were combined, eliminating duplicated mitigation plan requirements. This change also required participating National Flood Insurance Program (NFIP) communities’ risk assessments and mitigation strategies to identify and address repetitively flood damaged properties. Local HMPs and their updates now qualify communities for several HMA grant programs.

1.3 GRANT PROGRAMS WITH MITIGATION PLAN REQUIREMENTS

FEMA HMA grant programs provide funding to States, Tribes, and Local entities that have a FEMA-approved State, Tribal, or Local Mitigation Plan. Two of the grants are authorized under

the Stafford Act and DMA 2000, while the remaining three are authorized under the National Flood Insurance Act and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act. As of June 19, 2008, the grant programs were segregated. The Hazard Mitigation Grant Program (HMGP) is a directly funded competitive disaster grant program, whereas the Unified Mitigation Assistance Programs [Pre-Disaster Mitigation (PDM) and Flood Mitigation Assistance (FMA)], although competitive, rely on specific grant pre-disaster grant funding sources, sharing several common elements.

“The Department of Homeland Security (DHS) FEMA HMA grant programs present a critical opportunity to protect individuals and property from natural hazards while simultaneously reducing reliance on Federal disaster funds. The HMA programs provide PDM grants annually to States, Territories, Tribes, and Local communities. The statutory origins of the programs differ, but all share the common goal of reducing the loss of life and property due to natural hazards.

The PDM program is authorized by the Stafford Act and focuses on mitigation project and planning activities that address multiple natural hazards, although these activities may also address hazards caused by manmade events. The FMA program is authorized by the National Flood Insurance Act and focuses on reducing claims against the NFIP.”

1.3.1 Hazard Mitigation Assistance (UHMA) Unified Programs

The HMGP provides grants to States, Tribes, and Local entities to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Projects must provide a long-term solution to a problem, for example, elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood. In addition, a project’s potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The amount of funding available for the HMGP under a particular disaster declaration is limited. FEMA may provide a State or Tribe with up to 20 percent of the total aggregate disaster damage costs to fund HMGP project or planning grants. The cost-share for this grant is 75 percent Federal/25 percent non-Federal.

The PDM grant program provides funds to State, Tribes, and Local entities, including universities, for hazard mitigation planning and mitigation project implementation prior to a disaster event. PDM grants are awarded on a nationally competitive basis. Like HMGP funding, a PDM project’s potential savings must be more than the cost of implementing the project. In addition, funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The total amount of PDM funding available is appropriated by Congress on an annual basis. In Fiscal Year (FY) 2016, PDM program funding totaled approximately \$90 million. The cost-share for this grant is 75 percent Federal/25 percent non-Federal.

The goal of the FMA grant program is to reduce or eliminate flood insurance claims under the NFIP. Particular emphasis for this program is placed on mitigating repetitive loss (RL) properties. The primary source of funding for this program is the National Flood Insurance

Fund. Grant funding is available for three types of grants, including Planning, Project, and Technical Assistance. Project grants, which use the majority of the program's total funding, are awarded to States, Tribes, and Local entities to apply mitigation measures to reduce flood losses to properties insured under the NFIP. In FY 2016, FMA funding totaled \$199 million. The cost-share for this grant is 75 percent Federal/25 percent non-Federal. However, 90 percent Federal/10 percent non-Federal to mitigate severe repetitive loss (SRL) properties is available in certain situations.

The City of Bethel has participated in the National Floodplain Insurance Program (NFIP) since March 16, 1976 with a flood hazard map dated September 25, 2009. NFIP participation qualifies the City for all five FEMA mitigation grant programs.

The SRL program provides funding to reduce or eliminate the long-term risk of flood damage to residential structures insured under the NFIP. Structures considered for mitigation must 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; or for which at least two separate claim payments have been made with the cumulative amount of the building portion of such claims exceeding the value of the property, when two such claims have occurred within any 10-year period.

The Repetitive Flood Claim (RFC) program provides funding to reduce or eliminate the long-term flood damage risk to residential and nonresidential structures insured under the NFIP. Up to \$10 million is available annually to assist States and communities with reducing flood damages to structures which have had one or more claim payments for flood damages. All RFC grants are eligible for up to 100 percent Federal assistance.

1.4 2017 HMP UPDATE DESCRIPTION

The remainder of this HMP update consists of the following sections and appendices:

Prerequisites

Section 2 addresses the prerequisites of plan adoption, which include adoption by the City of Bethel (City). The adoption resolution is included on page vii of this plan update.

Community Description

Section 3 provides a general history and background of the City, including historical trends for population and the demographic and economic conditions that have shaped the area. Trends in land use and development are also discussed.

Planning Process

Section 4 describes the planning process and identifies the Planning Team Members, the meeting held as part of the planning process, the LeMay Engineering & Consulting, Inc. consultant, and the key stakeholders within the City and the surrounding area. In addition, this section documents public outreach activities (Appendix A) and the review and incorporation of relevant plans, reports, and other appropriate information.

Hazard Analysis

Section 5 describes the process through which the Planning Team identified, screened, and selected the hazards to be profiled in this update of the 2008 HMP. The hazard analysis includes the nature, history, location, extent, impact, and probability of future events for each hazard.

Vulnerability Analysis

Section 6 identifies potentially vulnerable assets—people, residential and nonresidential buildings, critical facilities, and critical infrastructure—in the City. The resulting information identifies the full range of hazards that the City could face and potential social impacts, damages, and economic losses.

Mitigation Strategy

Section 7 defines the mitigation strategy which provides a blueprint for reducing the potential losses identified in the vulnerability analysis. The Planning Team developed a list of mitigation goals, potential actions, and strategies to address the risks facing the City. Mitigation actions include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities.

Plan Maintenance

Section 8 describes the Planning Team’s formal plan maintenance process to ensure that the HMP and its update remain an active and applicable document. The process includes monitoring, evaluating (Appendix E), and updating the HMP; implementation through existing planning mechanisms; and continued public involvement.

References

Section 9 lists the reference materials used to prepare this HMP.

Appendix A

Appendix A provides public outreach information, including newsletters and meeting minutes.

Appendix B

Appendix B provides a land use map for Bethel.

Appendix C

Appendix C provides the FEMA Local Mitigation Plan Review Tool, which documents compliance with FEMA criteria.

Appendix D

Appendix D contains the Benefit-Cost Analysis Fact Sheet used to prioritize mitigation actions.

Appendix E

Appendix E provides the plan maintenance documents, such as an annual review sheet and the progress report form.

2.1 ADOPTION BY LOCAL GOVERNING BODIES AND SUPPORTING DOCUMENTATION

The requirements for the adoption of this HMP update by the local governing body, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 REQUIREMENTS: PREREQUISITES

Local Plan Adoption

Requirement §201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, Commissioner, Tribal Council).

Element

- Has the local governing body adopted the new or updated plan?
- Is supporting documentation, such as a resolution, included?

Source: FEMA, July 2008.

The City of Bethel is the local jurisdiction represented in this HMP update and meets the requirements of Section 409 of the Stafford Act and Section 322 of DMA 2000.

The local governing body of the City adopted the HMP update by resolution on April 10, 2018. A scanned copy of the resolution is included on page vii of this document.

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This section describes the location, geography, and history; demographics; and land use development trends of the City of Bethel.

3.1 LOCATION, GEOGRAPHY, AND HISTORY

Bethel is located at the mouth of the Kuskokwim River, 40 miles inland from the Bering Sea and is in the Yukon Delta National Wildlife Refuge, 400 air miles west of Anchorage. It lies at approximately 60.792220° North Latitude and -161.75583° West Longitude (Sec. 09, T008N, R071W, Seward Meridian). Bethel is located in the Bethel Recording District. (Division of Community and Regional Affairs [DCRA] 2017)



Figure 3-1 Bethel Location Map

The area encompasses 43.8 square miles of land and 5.1 square miles of water. Precipitation averages 16 inches a year in this area, and snowfall averages 50 inches per year. Summer temperatures range from 42 degrees Fahrenheit (°F) to 62°F. Winter temperatures range from -2 °F to 19 °F.

Bethel was first established by Yup'ik Eskimos, who called the village "Mumtrekhlogamute," meaning "Smokehouse People," named for the nearby fish smokehouse. There were 41 people in Bethel during the 1880 U.S. Census. At that time, it was an Alaska Commercial Company Trading Post. The Moravian Church established a mission in the area in 1884. The community was moved to its present location due to erosion at the prior site. A post office was opened in 1905. Before long, Bethel was serving as a trading, transportation, and distribution center for the region, which attracted Natives from surrounding villages. In 2017, Bethel is the main port on the Kuskokwim River and is an administrative and transportation hub for the 56 villages in the Yukon-Kuskokwim Delta (a region that is home to 25,000 people). (City 2011)

The region is fortunate in that rapid development did not occur before the importance of protecting Native culture was realized. The traditional Yup'ik Eskimo practices and language remain predominant in the area. Subsistence activities and commercial fishing are major contributors to residents' livelihoods. (DCRA 2017)

3.2 DEMOGRAPHICS

The 2010 census recorded 6,080 residents, of which the median age was 29, indicating a relatively young population. The population of Bethel is expected to continue to increase due to the historical population of the City (see Figure 3-2). Bethel has approximately 52% males and 48% females in a blended non-native and Yup'ik Eskimo community. About 66% of residents recognize themselves as Alaska Native. The 2010 census revealed that there are 1,896 households with the average household having approximately four individuals. The most recent 2016 Department of Labor (DOL) estimated population is 6,244.

3.3 ECONOMY

Government and social services are the dominant force in Bethel's economy. As the regional hub for 56 villages in the Yukon-Kuskokwim Delta, Bethel's economy is composed of a mix of transportation, trade, government, and institutional (education, health care) sectors. Food, fuel and supplies are transported to Bethel via barge (increasingly by air freight) and redistributed to other communities in the region. Regional residents travel to Bethel for travel to other communities, medical care, legal services, education, and other government services. Over 50 percent of jobs in Bethel are local, state or federal government jobs. Bethel's private sector largely rests on the foundation of these government or government-supported jobs, which support a range of commercial services. Bethel has over 100 business licenses for a variety of retail establishments, law offices, transportation and health services, among others. Bethel also has a number of local artisans who produce handcrafted artwork, clothing, and other articles for Anchorage and world markets. (City 2011)

According to the U.S. Census Bureau's 2010 – 2014 ACS 5-Year Estimates, the median household income in Bethel was \$78,190. Approximately 12.3% of Bethel's population were reported to be living below the poverty level. In 2015, the potential work force (those aged 16 years or older) in Bethel was estimated to be 3,861, of which 2,677 were actively employed. In June 2017, the unemployment rate was 15.9 percent; however, this rate included part-time and seasonal jobs, and practical unemployment or underemployment is likely to be significantly higher.

From 2000 to 2010, the City's low to moderate income percentage of residents decreased which correlates to the community of Bethel improving its standard of living. (DCRA, 2017)

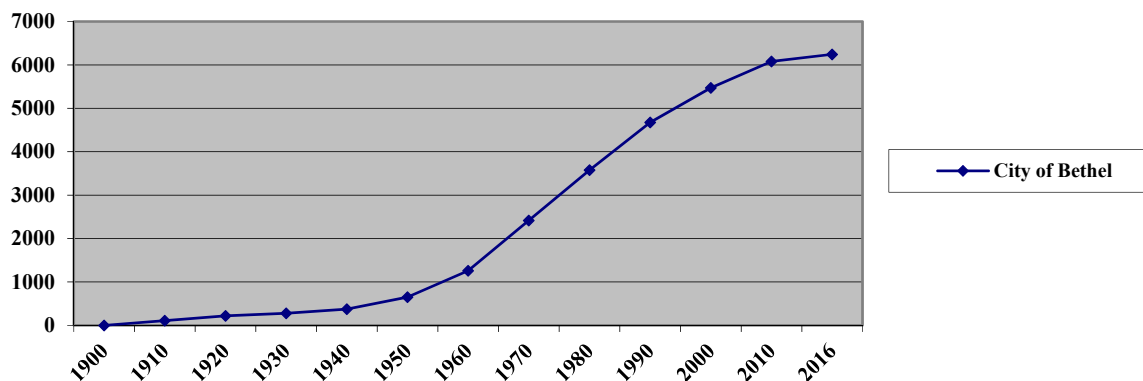


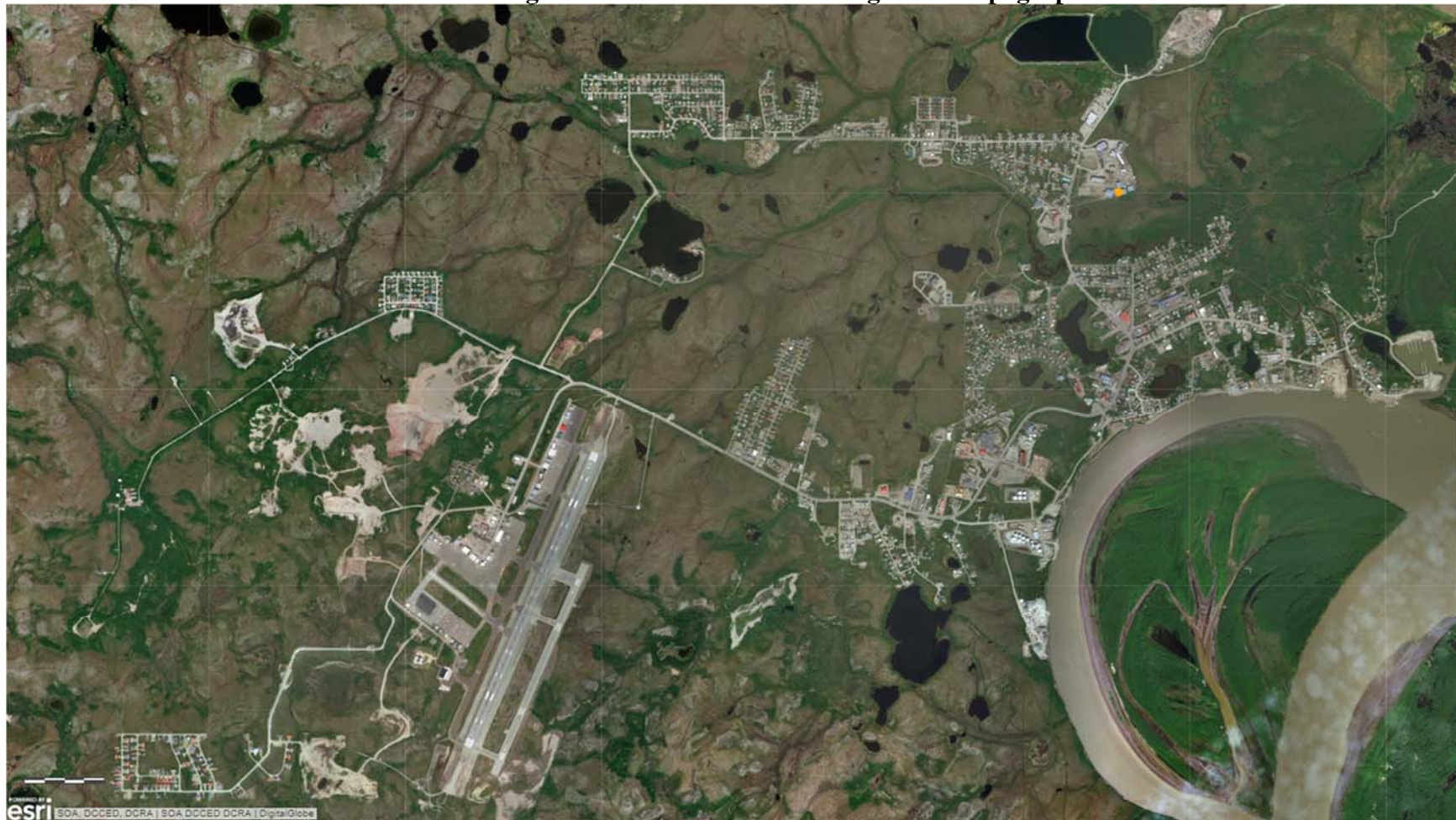
Figure 3-2 Bethel's Historic Population

3.4 CULTURAL SITES

Bethel is also home to the Orutsararmuit Native Council, a federally recognized Native Alaska tribe of 2,900 members. The Bethel Native Corporation is the local native village corporation, and the regional corporation is Calista Corporation.

Figure 3-3 depicts the City of Bethel's geographic location in conjunction with the Kuskokwim River and the surrounding topography.

Figure 3-3 Bethel's Geologic and Topographic Area



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This section provides an overview of the planning process; identifies the Planning Team Members and key stakeholders; documents public outreach efforts; and summarizes the review and incorporation of existing plans, studies, and reports used to develop this HMP update. Additional information regarding the Planning Team and public outreach efforts is provided in Appendix A.

The requirements for the planning process, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Planning Process

Local Planning Process

Requirement §201.6(b): An open public involvement process is essential to the development of an effective plan.

In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

Element

- An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
- An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia and other private and nonprofit interests to be involved in the planning process; and
- Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

Requirement §201.6(c)(1): [The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Element

- Does the plan provide a narrative description of the process followed to prepare the new or updated plan?
- Does the new or updated plan indicate who was involved in the planning process?
- Does the new or updated plan indicate how the public was involved?
- Does the new or updated plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?
- Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?
- Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?

Source: FEMA, July 2008.

4.1 OVERVIEW OF PLANNING PROCESS

The first step in the planning process began with the City Planner, Ted Meyer, being appointed the community point of contact in April 2017. Mr. Meyer determined that the Planning Team would work via email and present the updated plan at the August 10, 2017, regularly scheduled Planning and Zoning meeting at 6:30 pm as one of the agenda items.

On August 4, 2017, Newsletters #1 and #2 were posted around Bethel announcing the availability of the working draft copy of the updated HMP in the City Office for public review and inviting the community to comment by either calling or emailing Jennifer LeMay with LeMay Engineering & Consulting, Inc. or by bringing comments to the Planning and Zoning meeting on August 10. Newsletters #1 and #2 were also posted on the City of Bethel's webpage (www.cityofbethel.org).

The Planning Team held a public meeting on August 10, 2017. Jennifer LeMay, PE, PMP with LeMay Engineering & Consulting, Inc. attended the meeting to assist the Planning Team with updating hazards, mitigation actions, and projects.

In summary, the following five-step process took place from April through August, 2017.

1. Organize resources: Members of the Planning Team identified resources, including staff, agencies, and local community members, who were able to provide technical expertise and historical information needed in updating the 2008 HMP.
2. Assess risks: The Planning Team confirmed the hazards specific to Bethel, and with the assistance of a hazard mitigation planning consultant (LeMay Engineering & Consulting, Inc.), updated the risk assessment for the identified hazards. The Planning Team reviewed the risk assessment, including the vulnerability analysis, prior to and during the development of the mitigation strategy.
3. Assess capabilities: The Planning Team reviewed current administrative and technical, legal and regulatory, and fiscal capabilities and determined whether existing provisions and requirements adequately addressed relevant hazards.
4. Develop a mitigation strategy: The Planning Team reviewed and confirmed the comprehensive range of potential mitigation goals and actions developed in 2008 were still applicable at the present time. Subsequently, the Planning Team concluded that no new actions are required and that reprioritization of the actions from 2008 to be implemented was unnecessary.
5. Monitor, evaluate, and update the plan: The Planning Team developed a process to ensure the plan was monitored to ensure it was used as intended while fulfilling community needs. The team then reviewed the process to evaluate the plan to compare how their decisions affected hazard impacts. They then outlined a method to share their successes with community members to encourage support for mitigation activities and to provide data for incorporating mitigation actions into existing planning mechanisms and to provide date for the plan's five year update.

4.2 HAZARD MITIGATION PLANNING TEAM

Table 4-1 identifies the hazard mitigation Planning Team. The State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) provided funding and project

oversight. LeMay Engineering & Consulting, Inc., DHS&EM's contractor, provided assistance to the Planning Team.

Table 4-1 Hazard Mitigation Planning Team

Name	Title	Organization	Phone
Ted Meyer	City Planner, Team Leader	City of Bethel	543-5306
Betsy Jumper	Planning Technician	City of Bethel	543-5301
John Sargent	Grant Writer	City of Bethel	543-2047
Peter Williams	City Manager	City of Bethel	543-2047
Bill Howell	Fire Chief	City of Bethel	543-2047
Jennifer LeMay, PE, PMP	Planner/Consultant	LeMay Engineering & Consulting, Inc.	350-6061
George Grady	State Hazard Planner	DHS&EM	428-7055
Brent Nichols	State Hazard Mitigation Officer	DHS&EM	428-7085

4.3 PUBLIC INVOLVEMENT & OPPORTUNITY FOR INTERESTED PARTIES TO PARTICIPATE

Table 4-2 lists the community's public involvement initiatives focused to encourage participation and insight for the HMP update effort.

Table 4-2 Public Involvement Mechanisms

Mechanism	Description
Newsletter #1 Distribution (July 31, 2017)	On August 4, 2017, the City posted newsletters all over Bethel announcing the August 10, 2017 meeting. This newsletter was also posted on the City's website.
Public Notice (August 9 th edition)	The City placed a newspaper ad "Public Notice" in the Delta Discovery local paper announcing the August 10, 2017 meeting.
Newsletter #2 Distribution (August 4, 2017)	On August 4, 2017, the City posted newsletters all over Bethel announcing availability of the working draft copy of the updated 2008 hazard mitigation plan and encouraged participation in reviewing the plan and providing comments via phone or email to Jennifer LeMay or by bringing comments to the August 10, 2017 meeting.
Post on City Web Page	The City posted the Draft HMP on its webpage prior to the August 10, 2017 meeting.

An invitation was extended to the public and entities via two project newsletters describing the planning update process and announcing the upcoming public meeting and availability of the draft working copy of the updated plan for review. See Table 4-2.

The Planning Team held a public meeting during their regularly scheduled Planning and Zoning meeting on August 10, 2017. During the meeting, the Planning Team led the attending public through a hazard identification update and screening exercise. The attendees confirmed the hazards identified in development of the 2008 hazard mitigation plan: earthquake, erosion, flood, severe weather, climate change, and wildland fire which periodically impact the City. After discussion, permafrost and volcano ash were added as a seventh and eighth hazard.

LeMay Engineering & Consulting, Inc. described the specific information needed from the Planning Team and public to update the risk assessment. An updated risk assessment was completed that illustrated the assets that are exposed and vulnerable to specific hazards. Mitigation actions were also reviewed. The Planning Team concluded there was no need to reprioritize the mitigation actions identified in 2008 based on the results of the risk assessment. Hazards, risks, and vulnerabilities remain the same as in 2008.

4.4 INCORPORATION OF EXISTING PLANS AND OTHER RELEVANT INFORMATION

The Planning Team reviewed and incorporated information from existing plans, studies, reports, and technical reports into the HMP update. The following were reviewed and used as references for the jurisdiction information and hazard profiles in the risk assessment of the HMP for Bethel:

- Alaska Dispatch News, July 9, 2017 article by Lisa Demer, “*The Permafrost is Dying: Bethel’s Roads, Buildings Shifting*”
- *Kuskokwim Delta Watershed, Alaska Discovery Report*, November 2016 was prepared by FEMA as a preparatory phase to begin development of a Risk MAP.
- U.S. Army Corps of Engineers, *Bethel Bank Stabilization Report*, 2016.
- *City of Bethel Comprehensive Plan*, September 2011 is a guide for the provision of City services and the development of the community through 2035.
- *City of Bethel, Bethel Bank Stabilization Project Narrative Capital Budget Request*.
- *City of Bethel, Bethel Small Boat Harbor Project, FY2018 State of Alaska Capital Budget Request*.
- *City of Bethel, Bethel Small Boat Harbor Bank Stabilization, FY2018 State of Alaska Capital Budget Request*.
- *City of Bethel, Request for Proposals, Engineering Services to Design Phase 1 (Design, Bidding, and Construction Management) and Phase 2 (Design Only) of the Institutional Corridor Piped Water Delivery System*, RFP Release Date: September 22, 2014.
- *City of Bethel, Request for Proposals, Institutional Corridor Piped Water System Mainline Installation*, RFP Release Date: July 2017.
- *U.S. Army Corps of Engineers, Alaska Baseline Erosion Assessment, Erosion Information Paper – Bethel, Alaska*. 2009. Defined the City’s erosion threat.
- *State of Alaska, Department of Commerce, Community and Economic Development Community Profile Map* provided historical and demographic information.

- *The City of Bethel Hazard Mitigation Plan, 2008*. Defines hazards and impacts up to the year 2008.
- *State of Alaska All-State Hazard Mitigation Plan, 2013 (SHMP)*. Defines statewide hazards and their potential locational impacts.
- *Climate change impacts, vulnerabilities, and adaptation in Northwest Alaska (No. 06-11)*. Gregory, R., Failing, L., & Leiserowitz, A. (2006). Eugene: Decision Research.
- *Potential Consequences of Climate Variability and Change for Alaska*. Parson, Edward A., et al. (1999) A Report of the Alaska Regional Assessment Group for the U.S. Global Change Program. Prepared for the Center for Global Change and Arctic Research. Fairbanks.

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This section identifies and profiles the hazards that could affect the City of Bethel.

5.1 OVERVIEW OF A HAZARD ANALYSIS

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

Hazard profiling is accomplished by describing hazards in terms of their nature, history, magnitude, frequency, location, extent, and probability. Hazards are identified through the collection of historical and anecdotal information, review of existing plans and studies, and preparation of hazard maps of the study area. Hazard maps are used to determine the geographic extent of the hazards and define the approximate boundaries of the areas at risk.

5.2 HAZARD IDENTIFICATION AND SCREENING

The requirements for hazard identification, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Risk Assessment: Identifying Hazards

Identifying Hazards

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type of all natural hazards that can affect the jurisdiction.

Element

- Does the new or updated plan include a description of the types of all natural hazards that affect the jurisdiction?

Source: FEMA, July 2008.

For the first step of the hazard analysis, the Planning Team reviewed the eleven possible hazards that could affect the Lower Kuskokwim Regional Educational Attendance Area (REAA). They then evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of their threat and the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected availability of information on the hazard (see Table 5-1). The Planning Team determined that the six hazards that posed the greatest threat to the City in the 2008 HMP are equally applicable in the 2017 HMP update: earthquake, erosion, flood, severe weather, wildland fire, and climate change. The Planning Team decided to add permafrost and volcano ash as a seventh and eighth hazard in the 2017 HMP update. The remaining hazards excluded through the screening process were considered to pose a lower threat to life and property in the City due to the low likelihood of occurrence or the low probability that life and property would be significantly affected.

Table 5-1 Identification and Screening of Hazards

Hazard Type	Should It Be Profiled?	Explanation
Avalanche	No	Bethel is located on a flat floodplain with a gentle topographic relief in the city estimated to be 10 to 12 feet. There is no danger from avalanche because there are no mountains or steep slopes in the city.
Earthquake	Yes	The entire state of Alaska has periodic, unpredictable occurrences of earthquakes.
Erosion	Yes	Riverine erosion by high water flow, ice flows, wind, and surface runoff occurs.
Flood	Yes	Snowmelt and ice jam flooding occurs during spring thaw. Rainy season events occur from soil saturation.
Landslide	No	Bethel is located on a flat floodplain with a gentle topographic relief in the city estimated to be 10 to 12 feet. There is no danger from avalanche because there are no mountains or steep slopes in the city.
Permafrost	Yes	Permafrost is present throughout Alaska and periodically causes road surface and building impacts from permafrost thawing and upheaval.
Tsunami & Seiche	No	There is no danger of tsunamis and seiches since Bethel is located forty miles from the Bering Sea.
Volcano	Yes	In 2009, a volcano erupted. No ash fell in Bethel; however, for a week, no jets could land in Bethel due to a change in flight patterns. The City receives goods and supplies via air and barge, and if the no fly period had been extended, there could have been a shortage in supplies.
Weather	Yes	Annual weather patterns, severe cold, freezing rain, and snow accumulations are the predominant threats. Severe weather events cause fuel price increases and frozen pipes. Heavy snow loads potentially damage residential, commercial, and public facility damages.
Fires	Yes	The City and the surrounding area has the potential to be dry in summer months with weather and human-caused incidents igniting dry vegetation (e.g., lightning, trash burning, etc.).
Climate Change	Yes	The community is experiencing an increase in severity and frequency of severe weather.

5.3 HAZARD PROFILE

The requirements for hazard profiles, as stipulated in DMA 2000 and its implementing regulations, are described below. The specific hazards selected by the Planning Team for profiling have been examined in a methodical manner based on the following factors:

- Nature;
- History;
- Location;
- Extent (to include magnitude and severity);
- Impact (general impacts associated with each hazard are described in the following profiles – detailed impacts to City residents and critical facilities are further described in Section 6 as part of the overall vulnerability summary for each hazard); and
- Probability of future events.

DMA 2000 Requirements: Risk Assessment – Profiling Hazards

Profiling Hazards

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Element

- Does the risk assessment identify the location (i.e., geographic area affected) of each natural hazard addressed in the new or updated plan?
- Does the risk assessment identify the extent (i.e., magnitude or severity) of each hazard addressed in the new or updated plan?
- Does the plan provide information on previous occurrences of each hazard addressed in the new or updated plan?
- Does the plan include the probability of future events (i.e., chance of occurrence) for each hazard addressed in the new or updated plan?

Source: FEMA, July 2008.

Each hazard is assigned a rating based on the following criteria for probability (Table 5-2) and magnitude/severity (Table 5-3).

Probability is determined based on historic events to provide the likelihood of a future event.

Similar to estimating probability, magnitude and severity are determined based on historic events using the criteria in Table 5-3.

The hazards profiled for the City are presented in the rest of Section 5.3. The order of presentation does not signify the level of importance or risk.

Table 5-2 Hazard Probability Criteria

Probability	Criteria
<i>4 - Highly Likely</i>	Event is probable within the calendar year. Event has up to 1 in 1 year chance of occurring (1/1=100 percent). History of events is greater than 33 percent likely per year. Event is "Highly Likely" to occur.
<i>3 - Likely</i>	Event is probable within the next three years. Event has up to 1 in 3 years chance of occurring (1/3=33 percent). History of events is greater than 20 percent but less than or equal to 33 percent likely per year. Event is "Likely" to occur.
<i>2 - Possible</i>	Event is probable within the next five years. Event has up to 1 in 5 years chance of occurring (1/5=20 percent). History of events is greater than 10 percent but less than or equal to 20 percent likely per year. Event could "Possibly" occur.
<i>1 - Unlikely</i>	Event is possible within the next ten years. Event has up to 1 in 10 years chance of occurring (1/10=10 percent). History of events is less than or equal to 10 percent likely per year. Event is "Unlikely" but is possible to occur.

Table 5-3 Hazard Magnitude/Severity Criteria

Magnitude / Severity	Criteria
<i>4 - Catastrophic</i>	Multiple deaths Complete shutdown of facilities for 30 or more days More than 50 percent of property is severely damaged
<i>3 - Critical</i>	Injuries and/or illnesses result in permanent disability Complete shutdown of critical facilities for at least two weeks More than 25 percent of property is severely damaged
<i>2 - Limited</i>	Injuries and/or illnesses do not result in permanent disability Complete shutdown of critical facilities for more than one week More than 10 percent of property is severely damaged
<i>1 - Negligible</i>	Injuries and/or illnesses are treatable with first aid Minor quality of life lost Shutdown of critical facilities and services for 24 hours or less Less than 10 percent of property is severely damaged

5.3.1 Earthquake

5.3.1.1 Nature

An earthquake is a sudden motion or trembling caused by a release of strain accumulated within or along the edge of the earth's tectonic plates. The effects of an earthquake can be felt far beyond the site of its occurrence. Earthquakes usually occur without warning, and after only a few seconds, can cause massive damage and extensive casualties. The most common effect of earthquakes is ground motion, or the vibration or shaking of the ground during an earthquake.

Ground motion generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. An earthquake causes waves in the earth's interior (i.e., seismic waves) and along the earth's surface (i.e., surface waves). Two kinds of seismic waves occur: P (primary) waves are longitudinal or compressional waves similar in character to sound waves that cause back and forth oscillation along the direction of travel (vertical motion), and S (secondary) waves, also known as shear waves, are slower than P waves and cause structures to vibrate from side to side (horizontal motion). There are also two types of surface waves: Raleigh waves and Love waves. These waves travel more slowly and typically are significantly less damaging than seismic waves.

In addition to ground motion, several secondary natural hazards can occur from earthquakes such as:

- **Surface Faulting** is the differential movement of two sides of a fault at the earth's surface. Displacement along faults, both in terms of length and width, varies but can be significant (e.g., up to 20 feet), as can the length of the surface rupture (e.g., up to 200 miles). Surface faulting can cause severe damage to linear structures, including railways, highways, pipelines, and tunnels.
- **Liquefaction** occurs when seismic waves pass through saturated granular soil, distorting its granular structure, and causing some of the empty spaces between granules to collapse. Pore water pressure may also increase sufficiently to cause the soil to behave like a fluid for a brief period and cause deformations. Liquefaction causes lateral spreads (horizontal movements of commonly 10 to 15 feet, but up to 100 feet), flow failures (massive flows of soil, typically hundreds of feet, but up to 12 miles), and loss of bearing strength (soil deformations causing structures to settle or tip). Liquefaction can cause severe damage to property.
- **Landslides/Debris Flows** occur as a result of horizontal seismic inertia forces induced in the slopes by the ground shaking. The most common earthquake-induced landslides include shallow, disrupted landslides such as rock falls, rockslides, and soil slides. Debris flows are created when surface soil on steep slopes becomes totally saturated with water. Once the soil liquefies, it loses the ability to hold together and can flow downhill at very high speeds, taking vegetation and/or structures with it. Slide risks increase after an earthquake during a wet winter.

The severity of an earthquake can be expressed in terms of intensity and magnitude. Intensity is based on the damage and observed effects on people and the natural and built environment. It varies from place to place depending on the location with respect to the earthquake epicenter, which is the point on the earth's surface that is directly above where the earthquake occurred.

The severity of intensity generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. The scale most often used in the U.S. to measure intensity is the Modified Mercalli Intensity (MMI) Scale. As shown in Table 5-4, the MM Intensity Scale consists of 12 increasing levels of intensity that range from imperceptible to catastrophic destruction. Peak ground acceleration (PGA) is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location. PGA can be measured as acceleration due to gravity (g) (see Table 5-4). (MMI 2006)

Magnitude (M) is the measure of the earthquake strength. It is related to the amount of seismic energy released at the earthquake's hypocenter, the actual location of the energy released inside the earth. It is based on the amplitude of the earthquake waves recorded on instruments, known as the Richter magnitude test scales, which have a common calibration (see Table 5-4).

Table 5-4 Magnitude/Intensity/Ground-Shaking Comparisons

Magnitude	Intensity	PGA (% g)	Perceived Shaking
0 – 4.3	I	<0.17	Not Felt
	II-III	0.17 – 1.4	Weak
4.3 – 4.8	IV	1.4 – 3.9	Light
	V	3.9 – 9.2	Moderate
4.8 – 6.2	VI	9.2 – 18	Strong
	VII	18 – 34	Very Strong
6.2 – 7.3	VIII	34 – 65	Severe
	IX	65 – 124	Violent
	X	124 +	Extreme
7.3 – 8.9	XI		
	XII		

(MMI 2006)

5.3.1.2 History

The State of Alaska designates Bethel's location as in a Zone 1 of potential earthquake danger (on a scale of 0 being the lowest). The Planning Team stated in the 2008 HMP that there had been no reported incidences of earthquakes in Bethel.

From 1971 to 2017, 20 earthquakes with magnitudes over 2.5 have been recorded within a 100 mile radius of the City. The average magnitude of these earthquakes is 3.21; no earthquakes exceeded M 5.0. (USGS, 2017)

5.3.1.3 Location, Extent, Impact, and Probability of Future Events

Location

The entire geographic area of Alaska is prone to earthquake effects. Figure 5-1 shows the locations of active and potentially active faults in Alaska.

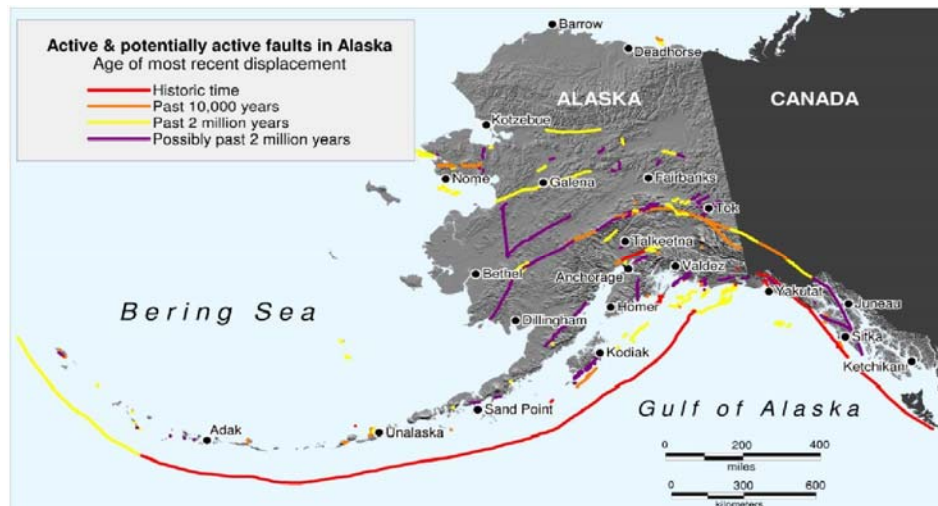


Figure 5-1 Active and Potentially Active Faults in Alaska

Extent

Earthquakes felt in the Bethel area have not exceeded M 5.0 in the past 46 years.

Based on historic earthquake events and the criteria identified in Table 5-3, the magnitude and severity of earthquake impacts in Bethel are considered negligible with injuries that can be treated with first aid, minor quality of life lost, critical facilities shutdown for less than 24 hours, and less than 10 percent of property severely damaged.

Impact

The City is located in an area that has not been active in recent history. Impacts to the community such as significant ground movement that may result in infrastructure damage are not expected. Intense shaking has not been felt based on past events. Impacts to future populations, residences, critical facilities, and infrastructure are anticipated to remain the same.

Probability of Future Events

While it is not possible to predict an earthquake, the United States Geological Survey (USGS) has developed Earthquake Probability Maps that use the most recent earthquake rate and probability models. These models are derived from the earthquake rate, location, and magnitude data from the USGS National Seismic Hazard Mapping Project. Figure 5-2 indicates the USGS earthquake probability model to place the probability of an earthquake with a likelihood of experiencing violent shaking (0.6 g to 0.8 g peak ground acceleration) with a 2% probability in 50 years.

This 2017 hazard probability map is the most current map available for this area. However, it is a viable representation to support probability inquiries.

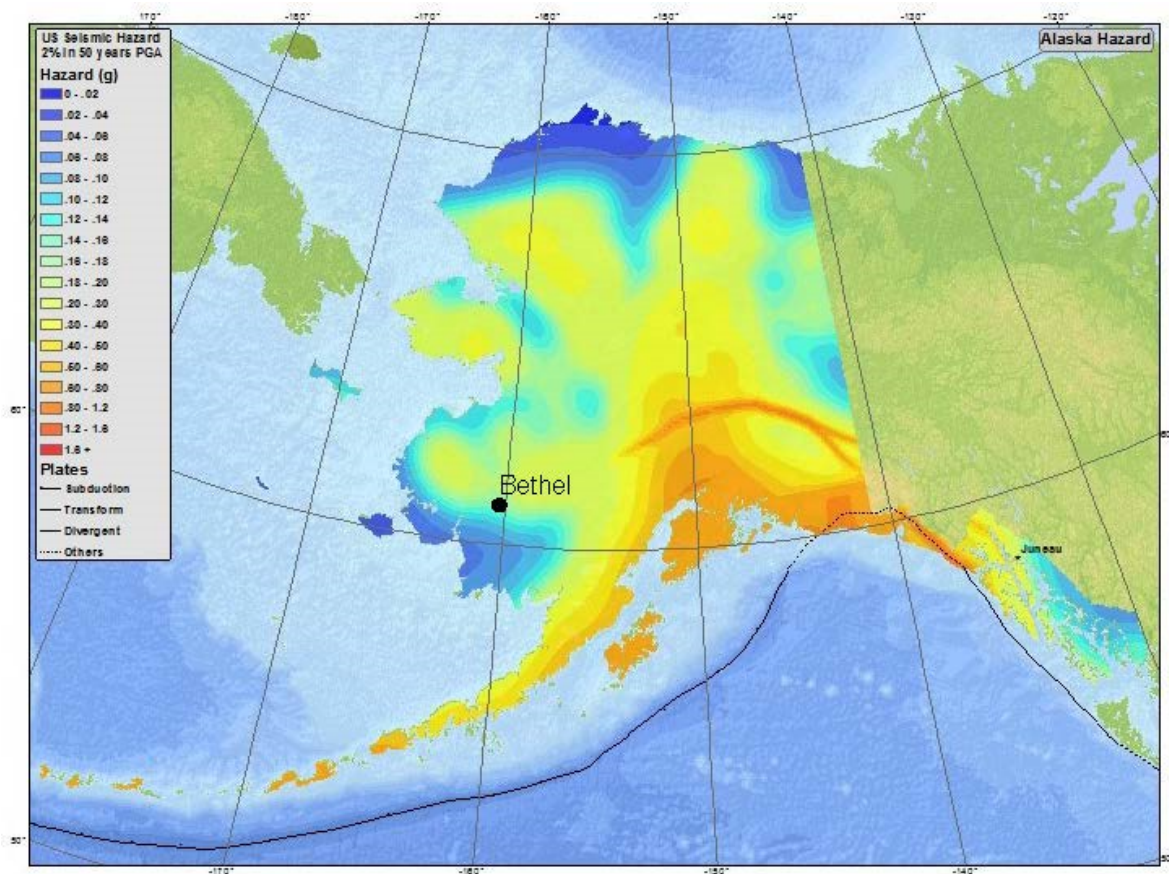


Figure 5-2 Bethel Earthquake Probability (USGS 2017)

5.3.2 Erosion

5.3.2.1 Nature

Because of its location on the largest oxbow curve in the Kuskokwim River, Bethel is highly susceptible to the river's erosive force. When it was founded, Bethel was protected from the river by several islands. By 1939, however, the river had eroded the islands and threatened the city. High velocity water eats away at the outside bend of the river. Erosion at Bethel is exacerbated by a number of other factors. Steep banks of unconsolidated silty sand or sandy silt material are easily eroded. Warm-water eddies and a south facing aspect melt the permafrost in the riverbank causing slumping of the steep material. Wave action from southerly storm winds exacerbates bank instability.

Documentation of the Bethel riverbank erosion began in 1939. The 2008 HMP stated that erosion averaged eight feet per year along the town front and 25 feet per year in front of the old Public Health Service hospital and the Chevron tank farm. From 1985 to 2007, the USACE has spent \$23,836,007 to install a 9,400 linear feet seawall (see Figure 5-3). This seawall has stabilized the Kuskokwim banks along Bethel and will continue to serve to protect the City Dock infrastructure, Bethel Small Boat Harbor, residential and commercial buildings north of the wall, and the public road and utility poles nearby. The Port of Bethel is in the process of formalizing its role as a Potential Place of Refuge with the Alaska Department of Environmental Conservation for stricken vessels in Western Alaska.

The USACE has received funding to replace the tiebacks of the seawall over a 2.15 acre area near the river. The tiebacks are corroded and in need of replacement. The USACE estimated that the service life of the seawall is 50 years once this second phase of construction has been completed.

David E. Trantham, Jr., 94 year old Alaskan with 51 years of residence in Bethel, stated in 2017 that the channel on the east side of the island in front of Bethel is becoming the main channel of the Kuskokwim River, and that the erosion rate should increase in the east channel and decrease in front of Bethel. The bank erosion process begins when wind and boat traffic drive waves into the bank, eroding the toe. The southeast exposure to the sun and rain along the high bank melts the permafrost and saturates the soil. The soil saturation combined with the toe erosion creates bank instability, which results in the bank sliding into the river. The eroded material is carried away by the river and exposes more of the bank to the erosion process. Mr. Trantham, Jr. further stated, "The seawall has essentially stopped erosion along the city side, but a new problem has occurred. The water moving downriver seemed to speed up which combined with a smooth seawall surface, created bottom scour on the river. At the same time, the river built up land on the opposite side of the river, thus causing approximately 110 feet of the riverbank to close on the opposite side". Mr. Trantham, Jr. predicts that "there will be no water flowing in the Kuskowim River in front of Bethel within six years as water will bypass the front of Bethel in favor of the east channel. The existing river on the city side will become an oxbow".

Peter Williams, former Port Director and current City Manager, stated in 2017, "What we have seen is that the river is getting narrower in front of town in certain places. It also has gotten deeper along the side of the river that the city sits on, as much as 65 feet in some places". There is a rock tow along the seawall, docks, and embankments that could be undermined if the

channel keeps moving toward the docks, seawall, and embankments. This is a real concern along, with the channel shoaling upriver outside the small boat harbor entrance”.

The primary cause of onshore erosion is improper construction of buildings and roads. Many buildings are constructed on sand pads, and in the past, water erosion and ponding problems have resulted from little consideration of natural drainage when siting buildings. Road construction has resulted in similar drainage problems. Road and building construction also often results in a large quantity of unconsolidated sand and silt. The sand and silt clogs culverts and drainage pipes and is picked up by the wind which aggravates the dusty air conditions common in Bethel during the summer.

5.3.2.2 History

The USACE Alaska Baseline Erosion Assessment, *Erosion Information Paper for the City of Bethel* dated 2009 states,

“Bethel experiences periodic flooding, mostly because of ice jams during the spring breakup of the Kuskokwim River. The spring ice breakup in 1995 caused such severe erosion that the governor of Alaska declared a state of emergency—scour created a cove 350 feet long and 200 feet inland and endangered several structures. The village’s main port is the only one on the western Alaska coast for oceangoing ships and serves as the supply center for villages in the Yukon-Kuskokwim Delta. In response to the 1995 emergency, the Corps placed rock along 600 linear feet of the riverbank and dock.

This was the beginning of a Corps 8,000-foot bank stabilization seawall project that cost \$24 million and was completed in 1997. This project included stabilization of the riverbank from the existing petroleum dock at the downstream end to the Bethel city dock at the upstream end. Although Bethel is not in imminent danger, it has experienced serious erosion and has undertaken various infrastructure-specific activities to resolve this problem. The Corps has a project underway to repair the seawall by placing more rock, by replacing a steel tieback system, and placing steel wall on the inland side of the pipe piles. The project will reinforce the seawall 1,200 feet so that it protects the entrance to Bethel’s small boat harbor. The initial cost estimate for this project in 2001 was over \$4.7 million. The project should be completed in 2006.

Erosion control efforts by the State of Alaska legislative grants and Department of Transportation and Planning Formulation (DOT&PF) funds, Corps, and Federal Aviation Association to date total more than \$57 million. It is expected that future erosion damages are expected to be minimal because of the existing bank stabilization seawall and the proposed erosion protection project at the east and west bank of the harbor.” (USACE 2009)

Previous occurrences according to the State of Alaska Disaster Cost Index are:

Bethel, July 10, 1985 High water accompanying breakup of the Kuskokwim River caused erosion damage at the city petroleum dock and washout of fill at the end of the seawall. Undercutting of riverbank also threatened eight private residences. The Governor's Proclamation of Disaster Emergency provided public assistance to replace fill at the petroleum dock and

seawall end. The State also provided funds to relocate the endangered homes, with the provision that the City of Bethel guarantee that the threatened property remain undeveloped.

Bethel, July 2, 1990 Abnormally high water in the Kuskokwim River during breakup and continuing for an extended period after breakup resulted in scouring of toe material along the Bethel bulkhead, dislocation of the pipe pilings that form the bulkhead, and loss of material behind these pilings. The disaster declaration supported repair of the bulkhead and placement of riprap material along the toe of affected sections.

Bethel Sinkhole Erosion On June 5, 1995, the Governor declared that a condition of disaster emergency existed in the City of Bethel, as a result of erosion during spring breakup. As a result of this disaster the face of the protective sea wall was damaged causing erosion under the City Dock to create and expand sinkholes on the dock.

00-191 Central Gulf Coast Storm declared February 4, 2000 by Governor Murkowski then FEMA declared (DR-1316) on February 17, 2000: On Feb 4 2000, the Governor declared a disaster due to high impact weather events throughout an extensive area of the state. The State began responding to the incident since the beginning of December 21, 1999. The declaration was expanded on February 8 to include City of Whittier, City of Valdez, Kenai Peninsula Borough, Matanuska-Susitna Borough and the Municipality of Anchorage. On February 17, 2000, President Bill Clinton determined the event disaster warranted a major disaster declaration under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288 as amended ("the Stafford Act). On March 17, 2000, the Governor again expanded the disaster area and declared that a condition of disaster exists in Aleutians East, Bristol Bay, Denali, Fairbanks North Star, Kodiak Island, and Lake and Peninsula Boroughs and the census areas of Dillingham, **Bethel**, Wade Hampton, and Southeast Fairbanks, which is of sufficient severity and magnitude to warrant a disaster declaration. Effective on April 4, 2000, Amendment No. 2 to the Notice of a Major Disaster Declaration, the Director of FEMA included the expanded area in the presidential declaration. Public Assistance, for 64 applicants with 251 PW's, totaled \$12.8 million. Hazard Mitigation totaled \$2 million. The total for this disaster is \$15.66 million.

Spring Floods, FEMA declared (DR-0832) on June 10, 1989 Presidential Declaration of Major Disaster, incorporated sixteen local declarations and applied to all communities on Yukon, **Kuskokwim** and Kobuk rivers and their tributaries. Provided public and individual assistance to repair damage.

'89 Spring Floods Hazard Mitigation, April 14, 1990 The Major Disaster Declaration by the President in response to **statewide flooding** in the Spring of 1989 authorized the commitment of federal funds to projects designed to mitigate flood damage in future years. Since the federal funding required a State-matching share, the Governor declared a disaster to provide these funds and authorize their expenditure.

Lower Kuskokwim, September 4, 1990 A severe storm compounded by high tides caused extensive flooding in coastal communities of the **Kuskokwim** and Bristol Bay areas and along the lower Kuskokwim River. The flooding caused damage to both public and private property. The disaster declaration authorized assistance to local governments, individuals and families affected by the flooding.

Central Gulf Coast Storm declared February 4, 2000 by Governor Murkowski then FEMA declared (DR-1316) on February 17, 2000: On Feb 4 2000, the Governor declared a disaster

due to high impact weather events throughout an extensive area of the state. The State began responding to the incident since the beginning of December 21, 1999. The declaration was expanded on February 8 to include City of Whittier, City of Valdez, Kenai Peninsula Borough, Matanuska-Susitna Borough and the Municipality of Anchorage. On February 17, 2000, President Bill Clinton determined the event disaster warranted a major disaster declaration under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288 as amended ("the Stafford Act). On March 17, 2000, the Governor again expanded the disaster area and declared that a condition of disaster exists in Aleutians East, Bristol Bay, Denali, Fairbanks North Star, Kodiak Island, and Lake and Peninsula Boroughs and the census areas of Dillingham, **Bethel**, Wade Hampton, and Southeast Fairbanks, which is of sufficient severity and magnitude to warrant a disaster declaration. Effective on April 4, 2000, Amendment No. 2 to the Notice of a Major Disaster Declaration, the Director of FEMA included the expanded area in the presidential declaration. Public Assistance, for 64 applicants with 251 PW's, totaled \$12.8 million. Hazard Mitigation totaled \$2 million. The total for this disaster is \$15.66 million.

5.3.2.3 Location, Extent, Impact, and Probability of Future Events

Location

Riverine erosion hazards have historically affected the City during flood events due to high water flow rates, spring break-up, ice scour, and melting permafrost. The City's riverbanks are essential to the lives of the residents and are susceptible to the effects of erosion.

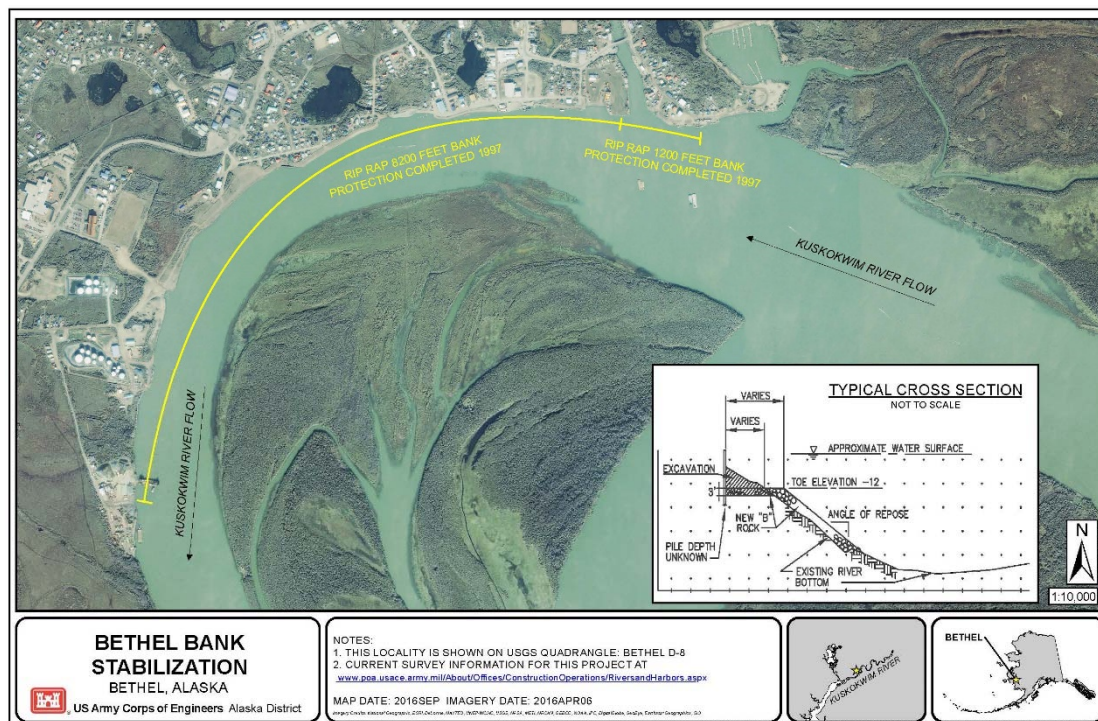


Figure 5-3 City of Bethel Seawall

Extent

A variety of natural and human-induced factors influence the erosion process within the community. River orientation and proximity to up and downstream river bends can influence erosion rates. Embankment composition also influences erosion rates, as sand and silt will erode easily, whereas boulders or large rocks are more erosion resistant. Other factors that may influence riverine erosion include:

- Geomorphology;
- Amount of encroachment in the high hazard zone;
- Proximity to erosion inducing structures;
- Nature of the topography;
- Density of development;
- Structure types along the embankment; and
- Embankment elevation.

Erosion in the City usually removes small areas at a time. The USACE *Alaska Baseline Erosion Assessment* for the City gave a “Monitor Conditions” classification to the City’s erosion threat.

Based on past events, the 2009 USACE *Alaska Erosion Assessment*, and the criteria identified in Table 5-3, the magnitude and severity of erosion impacts in the City are considered limited with the potential for critical facilities to be shutdown for 24 hours or less, and less than 10 percent of property or critical infrastructure being severely damaged.

Impact

Impacts from erosion include loss of land and any development on that land. Erosion can cause increased sedimentation of river deltas and hinder channel navigation—affecting marine transport. Other impacts include reduction in water quality due to high sediment loads, loss of native aquatic habitats, damage to public utilities (fuel headers and electric and water/wastewater utilities), and economic impacts associated with costs trying to prevent or control erosion sites.

The City of Bethel has not experienced severe flood events which bring high river flow rates and subsequent flooding and embankment erosion in the past decade. The seawall has minimized erosion with the exception that the upper bank above the seawall that reaches to First Avenue is still vulnerable to erosion. This bank was part of the USACE project when they started construction of the seawall in 1985. The City’s use of culverts to divert water from rain and snowmelt away from roads has helped maintain roads.

Probability of Future Events

Based on the Planning Team’s statements concerning previous occurrences, the USACE *Baseline Erosion Assessment*, and the criteria identified in Table 5-2, it is likely that erosion will occur in the next five years (event has up to 1 in 5 years chance of occurring) as the history of events is greater than 10 percent but less than or equal to 20 percent likely per year.

5.3.3 Flood

5.3.3.1 Nature

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

Primary types of flooding that occur in the Lower Kuskokwim REAA include: rainfall-runoff floods; snowmelt floods; ice jam floods.

Rainfall-Runoff Flood

Rainfall-runoff flooding occurs in late summer and early fall. The rainfall intensity, duration, distribution, and geomorphic characteristics of the watershed all play a role in determining the magnitude of the flood. Rainfall runoff flooding is the most common type of flood. This type of flood event generally results from weather systems that have associated prolonged rainfall.

Snowmelt Flood

Snowmelt floods typically occur in spring or early summer. The depths of the snowpack and spring weather patterns influence the magnitude of flooding.

Ice Jam Flood

Ice jam floods occur after an ice jam develops; thus, this type of flood can occur any time of the year that a river has ice on it. Ice jams restrict water flow on a river or stream and form during the following three situations:

- Fall freeze up;
- Midwinter when stream channels freeze forming anchor ice; and
- Spring break-up (i.e., when the existing ice cover is broken into pieces that block flowing water at bridges or other constrictions).

Ice jams commonly develop in areas where the channel slope decreases, becomes shallower, or where constrictions occur such as at bridges, bends in the river, headwaters, and reservoirs. Ice jams frequently impede water along big rivers during spring break-up.

Water levels increase upstream behind the location of the ice jam. The result is flooding of an area by creating a lake-like effect covering a large area. Little damage typically occurs from the water current upstream of the ice jam, but significant damage can result from flooding. However, the downstream effect is very different. As soon as the ice jam is breached, there is usually rapid draining of the dammed water. Downstream water levels rise substantially after the ice jam is breached and strong water currents are created, which can cause erosion and other significant damages. Additionally, the rising water causes the ice to float while increased velocities of water move the ice further downstream. The motion of large solid ice blocks is often destructive to natural and material property in the vicinities. When ice jams cause flood events during spring break-up, snowmelt can contribute to the flood. Notable large floods in recent years on the Kenai, Susitna, Kuskokwim, and Yukon rivers were all caused by ice jams and snowmelt.

5.3.3.2 History

The City has been an active participant in the NFIP since 1976 due to repeated flooding impacts.

The 2008 HMP stated,

“To some degree, flooding occurs in Bethel annually. The USACE has determined that a significant portion of Bethel is a Special Flood Hazard Zone. Bethel’s Special Flood Hazard Areas are those areas where the ground elevation is below 17.1 feet mean lower low water. Eighty percent of the residential and commercial areas have been flooded in the past. Areas such as Brown’s Slough are the most flood prone and contain a high density of the residential development. Flooding is typically caused by ice jams during breakup, but heavy rains in late summer and early fall can also flood Bethel. Poor drainage, frozen ground, permafrost, and low relief contribute to the flooding problems. Ice jams occur because of tight meander bends and islands downstream of Bethel create narrow channels where ice floes become blocked. Because the river flows at a shallow gradient near Bethel, it does not have enough force to free the blockage resulting in a backwater affect, causing flooding in Bethel. Similar ice jams, on a smaller scale, occur on sloughs. Frozen culverts have also caused flooding.

Low relief, permanently frozen ground, and a general lack of effective drainage throughout the developed area also contribute to flooding problems. Exclusive of when the Kuskokwim River overtops its banks, the City experiences localized flooding following winter rains and spring snowmelt. In general, drainage conditions in the community improve as elevation increases. The lowest, flattest areas of the community are also subject to the worst drainage problems. Areas such as Lousetown, Swanson’s business area, Elm Plant Dock area, and Alligator Acres experience localized flooding problems due to poor drainage. Higher areas, near the airport and west end of town are better drained because of higher elevations. Medium elevation areas (25-100 feet elevation) are typically better drained than the low areas, but may also be subject to localized areas of flooding due to drainage patterns.

The primary cause of flooding in Bethel is ice jams. The magnitude of the flood is influenced by several factors including snowmelt, winter and spring temperatures, precipitation, and ice thickness. The greatest flooding usually occurs in the spring when a thick river-ice buildup experiences rapid warming before breakup. Flooding is also common in late summer and early fall when Bethel experiences its heaviest rainfall of the year. A major flood can create a maximum river velocity of ten feet per second (fps), as compared to an average velocity of less than two fps. The highest discharge recorded during a flood is almost 580,000 cubic feet per second, (cfs) compared to the average discharge of 60,000 cfs. (City, 2008)

Previous occurrences according to the State of Alaska Disaster Cost Index are:

Bethel, July 10, 1985 High water accompanying breakup of the Kuskokwim River caused erosion damage at the city petroleum dock and washout of fill at the end of the seawall. Undercutting of riverbank also threatened eight private residences. The Governor's Proclamation

of Disaster Emergency provided public assistance to replace fill at the petroleum dock and seawall end. The State also provided funds to relocate the endangered homes, with the provision that the City of Bethel guarantee that the threatened property remain undeveloped.

Bethel, July 2, 1990 Abnormally high water in the Kuskokwim River during breakup and continuing for an extended period after breakup resulted in scouring of toe material along the Bethel bulkhead, dislocation of the pipe pilings that form the bulkhead, and loss of material behind these pilings. The disaster declaration supported repair of the bulkhead and placement of riprap material along the toe of affected sections.

Bethel Sinkhole Erosion On June 5, 1995, the Governor declared that a condition of disaster emergency existed in the City of Bethel, as a result of erosion during spring breakup. As a result of this disaster the face of the protective sea wall was damaged causing erosion under the City Dock to create and expand sinkholes on the dock.

00-191 Central Gulf Coast Storm declared February 4, 2000 by Governor Murkowski then FEMA declared (DR-1316) on February 17, 2000: On Feb 4 2000, the Governor declared a disaster due to high impact weather events throughout an extensive area of the state. The State began responding to the incident since the beginning of December 21, 1999. The declaration was expanded on February 8 to include City of Whittier, City of Valdez, Kenai Peninsula Borough, Matanuska-Susitna Borough and the Municipality of Anchorage. On February 17, 2000, President Bill Clinton determined the event disaster warranted a major disaster declaration under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288 as amended ("the Stafford Act). On March 17, 2000, the Governor again expanded the disaster area and declared that a condition of disaster exists in Aleutians East, Bristol Bay, Denali, Fairbanks North Star, Kodiak Island, and Lake and Peninsula Boroughs and the census areas of Dillingham, **Bethel**, Wade Hampton, and Southeast Fairbanks, which is of sufficient severity and magnitude to warrant a disaster declaration. Effective on April 4, 2000, Amendment No. 2 to the Notice of a Major Disaster Declaration, the Director of FEMA included the expanded area in the presidential declaration. Public Assistance, for 64 applicants with 251 PW's, totaled \$12.8 million. Hazard Mitigation totaled \$2 million. The total for this disaster is \$15.66 million.

Spring Floods, FEMA declared (DR-0832) on June 10, 1989 Presidential Declaration of Major Disaster, incorporated sixteen local declarations and applied to all communities on Yukon, **Kuskokwim** and Kobuk rivers and their tributaries. Provided public and individual assistance to repair damage.

'89 Spring Floods Hazard Mitigation, April 14, 1990 The Major Disaster Declaration by the President in response to **statewide flooding** in the Spring of 1989 authorized the commitment of federal funds to projects designed to mitigate flood damage in future years. Since the federal funding required a State-matching share, the Governor declared a disaster to provide these funds and authorize their expenditure.

Lower Kuskokwim, September 4, 1990 A severe storm compounded by high tides caused extensive flooding in coastal communities of the **Kuskokwim** and Bristol Bay areas and along the lower Kuskokwim River. The flooding caused damage to both public and private property. The disaster declaration authorized assistance to local governments, individuals and families affected by the flooding.

Central Gulf Coast Storm declared February 4, 2000 by Governor Murkowski then FEMA declared (DR-1316) on February 17, 2000: On Feb 4 2000, the Governor declared a disaster due to high impact weather events throughout an extensive area of the state. The State began responding to the incident since the beginning of December 21, 1999. The declaration was expanded on February 8 to include City of Whittier, City of Valdez, Kenai Peninsula Borough, Matanuska-Susitna Borough and the Municipality of Anchorage. On February 17, 2000, President Bill Clinton determined the event disaster warranted a major disaster declaration under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288 as amended (“the Stafford Act). On March 17, 2000, the Governor again expanded the disaster area and declared that a condition of disaster exists in Aleutians East, Bristol Bay, Denali, Fairbanks North Star, Kodiak Island, and Lake and Peninsula Boroughs and the census areas of Dillingham, **Bethel**, Wade Hampton, and Southeast Fairbanks, which is of sufficient severity and magnitude to warrant a disaster declaration. Effective on April 4, 2000, Amendment No. 2 to the Notice of a Major Disaster Declaration, the Director of FEMA included the expanded area in the presidential declaration. Public Assistance, for 64 applicants with 251 PW’s, totaled \$12.8 million. Hazard Mitigation totaled \$2 million. The total for this disaster is \$15.66 million.

5.3.3.3 Location, Extent, Impact, and Probability of Future Events

Location

Figure 5-4 is a flood overlap map for the City of Bethel from the 2008 HMP. There have been no significant flooding events since June 26, 2002. (FEMA, 2016)

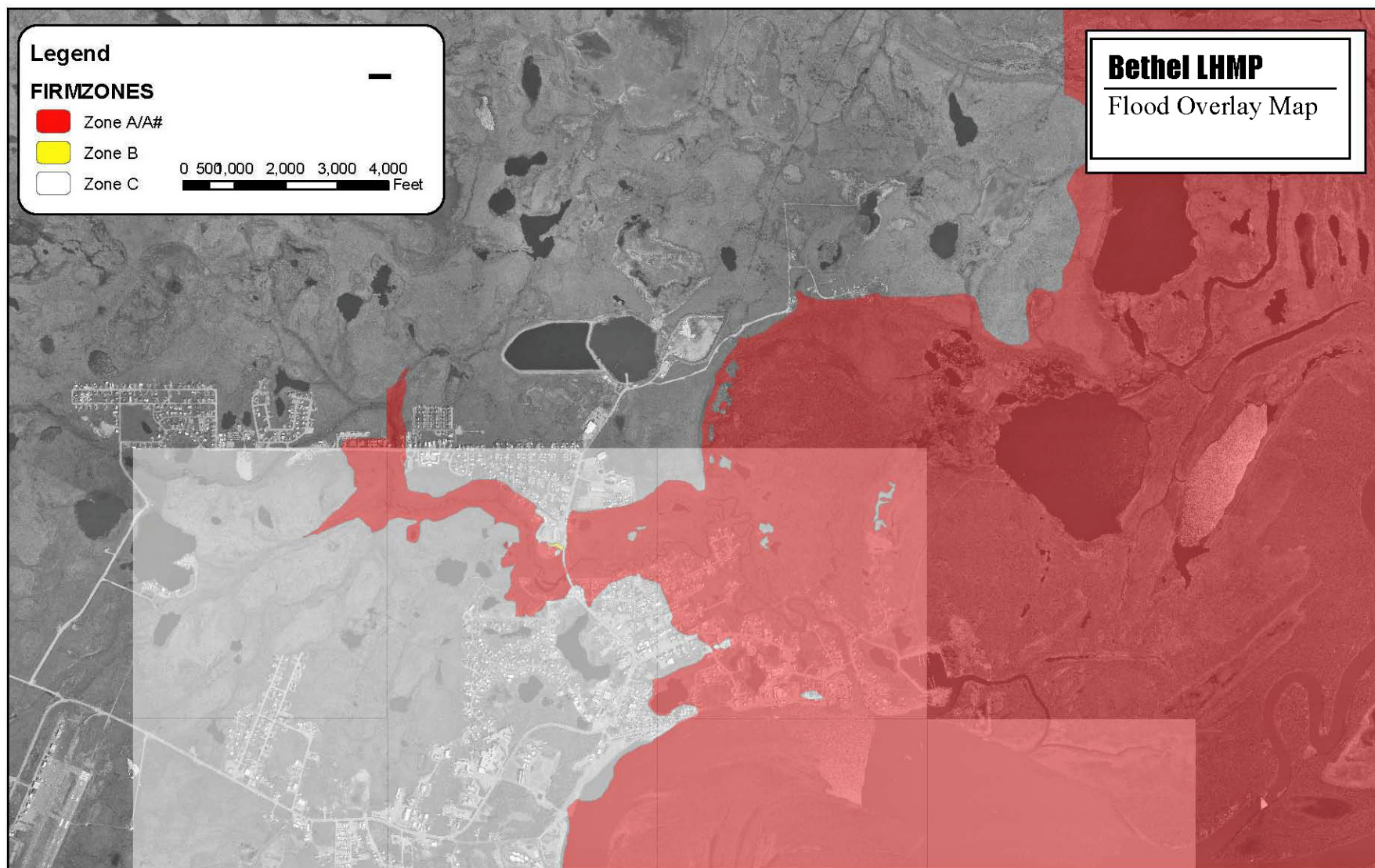
Extent

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

The following factors contribute to riverine flooding frequency and severity:

- Rainfall intensity and duration.
- Antecedent moisture conditions.
- Watershed conditions, including terrain steepness, soil types, amount, vegetation type, and development density.
- The attenuating feature existence in the watershed, including natural features such as swamps and lakes and human-built features such as dams.
- The flood control feature existence, such as levees and flood control channels.
- Flow velocity.
- Availability of sediment for transport, and the bed and embankment watercourse erodibility.
- City location related to the base flood elevation as indicated with their certified high water mark.

Figure 5-4. Bethel LHMP Flood Overlay Map



Based on past flood events and the criteria identified in Table 5-3, the extent of flood impacts in the City are considered limited with injuries and/or illnesses do not result in permanent disability, a complete shutdown of critical facilities for more than one week, and more than 10 percent of property is severely damaged.

Impact

Nationwide, floods result in more deaths than any other natural hazard. Physical damage from floods includes the following:

- Structure flood inundation, causing water damage to structural elements and contents.
- Erosion or scouring of stream banks, roadway embankments, foundations, footings for bridge piers, and other features.
- Damage to structures, roads, bridges, culverts, and other features from high-velocity flow and debris carried by floodwaters. Such debris may also accumulate on bridge piers and in culverts, increasing loads on these features or causing overtopping or backwater damages.
- Sewage and hazardous or toxic materials released as wastewater treatment plants or sewage lagoons are inundated, storage tanks are damaged, and pipelines are severed.

Floods also result in economic losses through business and government facility closure, communications, utility (such as water and sewer), and transportation services disruptions. Floods result in excessive expenditures for emergency response, and generally disrupt the normal function of a community.

Probability of Future Events

Based on previous occurrences and applying the criteria identified in Table 5-2, it is possible that a flood event could occur within the next five years (event has up to 1 in 5 years chance of occurring) as the history of events is greater than 10 percent but less than 20 percent likely per year.

Community Participation in the NFIP

The City of Bethel participates in the NFIP. The function of the NFIP is to provide flood insurance at a reasonable cost to homes and businesses located in floodplains. In trade, the City of Bethel agrees to regulate new development and substantial improvement to existing structures in the floodplain, or to build safely above flood heights to reduce future damage to new construction. The program is based upon mapping areas of flood risk, and requiring local implementation to reduce flood damage primarily through requiring the elevation of structures above the base (100-year) flood elevations.

Table 5-5 describes the Flood Insurance Rate Map (FIRM) zones.

Development permits for all new building construction, or substantial improvements, are required by the City in all A, AO, AH, A-numbered Zones. Flood insurance purchase may be required in flood zones A, AO, AH, A-numbered zones as a condition of loan or grant assistance. An Elevation Certificate is required as part of the development permit. The Elevation Certificate is a form published by FEMA required to be maintained by communities participating in the

NFIP. According to the NFIP, local governments maintain records of elevations for all new construction, or substantial improvements, in floodplains and to keep the certificates on file.

Elevation Certificates are used to:

1. Record the elevation of the lowest floor of all newly constructed buildings, or substantial improvement, located in the floodplain.
2. Determine the proper flood insurance rate for floodplain structures
3. Local governments must insure that elevation certificates are filled out correctly for structures built in floodplains. Certificates must include:
 - The location of the structure (tax parcel number, legal description and latitude and longitude) and use of the building.
 - The Flood Insurance Rate Map panel number and date, community name and source of base flood elevation date.
 - Information on the building's elevation.
 - Signature of a licensed surveyor or engineer.

Table 5-5 FIRM Zones

<i>Firm Zone</i>	<i>Explanation</i>
	Areas of 100-year flood; base flood elevations and flood hazard not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet, average depths of inundation are shown but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood.
C	Areas of minimal flooding.
D	Areas of undetermined, but possible, flood hazards.

The Bethel Floodplain Coordinator is City Planner, Ted Meyer. His contact information is: City of Bethel, P.O. 1388, Bethel, AK 99559; (907) 543-5306; and tmeyer@cityofbethel.net.

The State of Alaska Floodplain Management Program Coordinator is Jimmy C. Smith. His contact information is DCRA DCCED, 550 W. 7th Avenue, Suite 1640, Anchorage, AK 99501; (907) 269-4132; and jimmy.smith@alaska.gov.

Table 5-6 NFIP Statistics

Emergency Program Date Identified	Regular Program Entry Date	Map Revision Date	NFIP Community Number	CRS Rating Number	Total # of Current Policies (04/30/17)
6/28/1974	3/16/1976	9/25/2009	020104 A	N/A	72
Total Premiums (04/30/17)	Total Loss Dollars Paid	Average Value of Loss	AK State # of Current Policies	AK State Total Premiums	AK Total Loss Dollars Paid
\$124,733	\$67,009	\$4,786	2,561	\$2.3 million	\$9.7 million
Bethel Average Premium	AK State Average Premium	Repetitive Loss Claims	Date of Loss	Total Rep. Loss	Average Rep. Loss
\$1,732	\$885	1 property – 3 losses	2005 1999 1995	\$21,040	\$7,013

(DCRA 2017)

5.3.4 Permafrost

5.3.4.1 Nature

Permafrost is defined as soil, sand, gravel, or bedrock that has remained below 32°F for two or more years. Permafrost can exist as massive ice wedges and lenses in poorly-drained soils or as relatively dry matrix in well-drained gravel or bedrock. During the summer, the surficial soil material thaws to a depth of a few feet, but the underlying frozen materials prevent drainage. The surficial material that is subject to annual freezing and thawing is referred to as the “active layer”.

Permafrost melting (or degradation) occurs naturally as a result of climate change, although this is usually a very gradual process. Human-induced ground warming can often degrade permafrost much faster than natural degradation caused by a warming climate. Permafrost degradation can be caused by constructing warm structures on the ground surface allowing heat transfer to the underlying ground. Under this scenario, improperly designed and constructed structures can settle as the ground subsides, resulting in loss of the structure or expensive repairs. Permafrost is also degraded by damaging the insulating vegetative ground cover, allowing the summer thaw to extend deeper into the soil causing subsidence of ice-rich permafrost, often leading to creation of thermokarst water bodies. Evidence of this type of degradation can be seen where thermokarst water bodies are abundant in the ruts of an old trail used by heavy equipment (cat trails) or where roads or railroads constructed by clearing and grubbing have settled unevenly.

A task force commissioned by the U.S. Arctic Research Commission (USARC) in 2002 found that permafrost plays three key roles in the context of climate changes as a record keeper (temperature archive); as a translator of climatic change (subsidence and related impacts); and as a facilitator of climatic change (impact on the global carbon cycle). The potential for melting of ice-rich permafrost constitutes a significant environmental hazard in high-latitude regions.

Permafrost records temperature changes and other information about environmental changes; it has a memory of past temperatures. Temperature trends spanning a century or more can be recorded in thick permafrost. Analysis of data gathered from boreholes made by the USGS in northern Alaska show that the temperature of permafrost on the North Slope has generally risen by 2 to 4°F in the past century.

Thawing of ice-rich permafrost may result in settlement of the ground surface, which often has severe consequences for human infrastructure and natural ecosystems. The land in and around Bethel is nearly all “warm” permafrost, averaging 31.2° per City grant documents. As the active layer increases each year, permafrost continues to thaw, making buildings less stable. Financial resources are needed to haul in fill and raise (level) houses which increases living costs. Pilings for new construction are driven deeper and deeper, and fill continues to sink and get washed away from pads. Additionally, permafrost jacks fence poles out of the ground which in turn requires financial resources to fix; otherwise the fences do not keep out all who they are designed to keep out. Also, melting permafrost has impacted a local farmer who resorted to adding an electric cooler to his root cellar because it wasn’t cold enough after many years of use. He lost over 2,000 pounds of vegetables because of his warming root cellar.

Melting of glaciers in Alaska and elsewhere will increase the rates of coastal erosion in areas of ice-rich permafrost, already among the highest in the world. Sediment input to the Arctic shelf derived from coastal erosion may exceed that from river discharge. Thawing effects to the active layer of permafrost may alter the activities and functions of the permafrost. Soil moisture content has an important effect on its thermal qualities, soil heat flow, and the vegetation it supports.

Permafrost can facilitate further climate change through the release of greenhouse gases. Considerable amounts of carbon are trapped in the upper layers of permafrost; an increase in the thickness of the thawed layer of permafrost could release large quantities of carbon dioxide and methane to the atmosphere. This could amplify regional and global warming. A further problem in some areas in the Alaskan arctic is the presence of a significant number of sites where contaminants were buried in previous decades. Contaminants are mobile in the active layer of permafrost and some can be mobile within frozen ground. When permafrost thaws, the ground becomes permeable, allowing contaminants to spread laterally and reach other layers.

The thawing of permafrost will cause changes in hydrology. Where it has a high ice content, thawing can result in severe, uneven subsidence of the surface, called thermokarst, which has been observed to exceed 16 feet. Flooding or draining of an area may result from permafrost melt, affecting the uses of the surface.

5.3.4.2 History

The Alaska Dispatch News published a story on July 9, 2017 entitled “The Permafrost is Dying: Bethel’s Roads, Buildings Shifting.” The article summarized how 35 years ago, building crews used to find permafrost four to six feet below the ground surface and are now finding permafrost at eight to twelve feet down. Permafrost in and around Bethel is deteriorating and shrinking, even more quickly than most places in Alaska. (ADN 2017) The article states:

“...In the wild, boggy lands of the Yukon-Kuskokwim Delta, a tundra blanket naturally insulates ice-rich permafrost. But in much of Bethel and surrounding villages, that blanket is long gone...Permafrost here is considered “warm”, maybe a fraction of a degree below freezing, so it’s sensitive to just a slight warming of the air, said Vladimir Romanovsky, geophysics professor and permafrost researcher at the University of Alaska Fairbanks.

Above the permafrost in Southwest, Alaska, an active layer of soil, often peat, freezes and thaws each year. With air temperatures warming too, the active layer is growing bigger, consuming what had been thought of as permanently frozen. Between the active freeze-thaw layer and the permafrost, there used to be another section that didn’t freeze each winter. In recent years with little snow that layer freezes, too, heaving what is above.

The most visible sign of disrupted infrastructure in Bethel is the roller coaster of a ride that is Chief Eddie Hoffman Highway, the busiest road in town. DOT&PF is planning extensive repairs estimated to cost almost \$9 million.” (ADN 20017)

The Planning Team did note that the article consisted mostly of anecdotes and did not contain any scientific information. There is no written record defining permafrost impacts for the City. The Chief Eddie Hoffman Highway is covered with asphalt through which radiant heat can melt the permafrost within one foot of the surface. DOT&PF typically repairs the Highway every ten years when funding is available.

5.3.4.3 Location, Extent, Impact, and Probability of Future Events

Location

The State's *Permafrost Risk Analysis Map*, completed by the Division of Geological and Geophysical Survey (DGGS) contained in the 2007 *All-State HMP*, indicates the City is underlain by isolated and discontinuous permafrost areas (Figure 5-5).

Extent

The damage magnitude could range from minor with some repairs required and little to no damage to transportation, infrastructure, or the economy to major if a critical facility (such as the airport) were damaged, and transportation was affected. Areas that are most likely impacted surround the airport as required vegetation removal has exposed soils. The airport runway was subsequently covered with asphalt through which radiant heat has melted the shallow permafrost layer (within one foot of the surface). This caused settling or sink holes which required periodic short runway closure for repairs.

Based on the City's soils surveys, the Planning Team's knowledge of past permafrost degradation events, and the criteria identified in Table 5-3, the extent of permafrost degradation impacts in the City are considered critical where critical facilities and services could be shutdown for at least two weeks, and more than 25 percent of property is severely damaged.

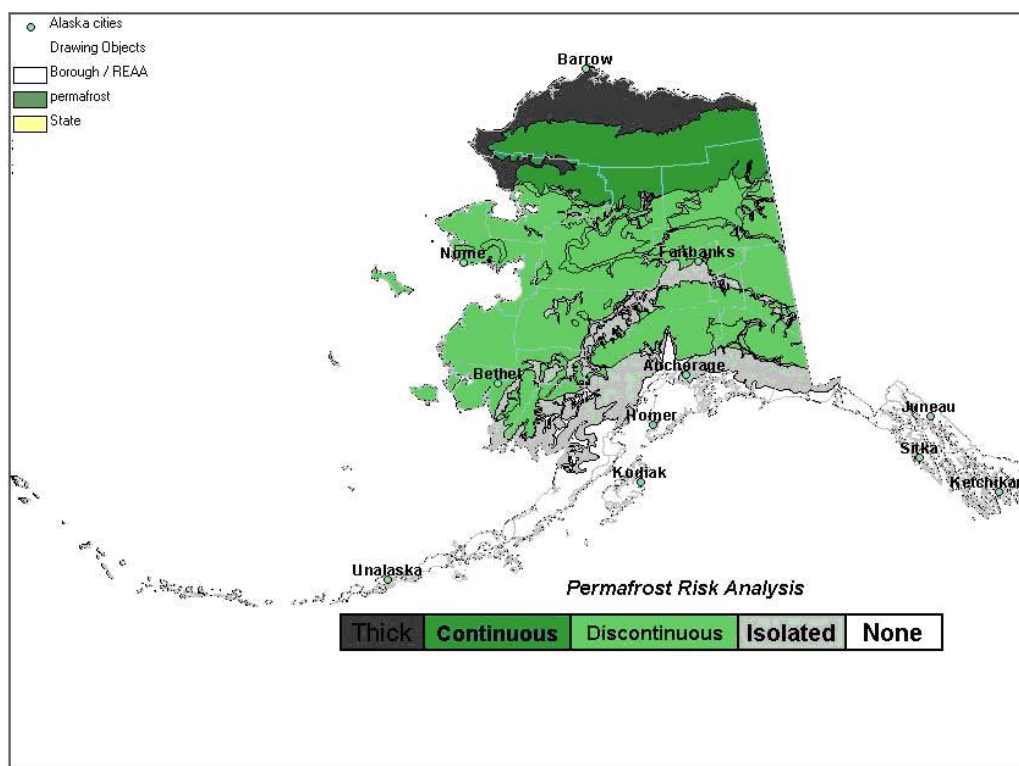


Figure 5-5 USGS Permafrost Map of Alaska (DHS&EM 2007)

Impact

Impacts associated with degrading permafrost within the City include surface subsidence. Permafrost does not pose a sudden and catastrophic hazard, but improperly designed and constructed structures can settle as the ground subsides, resulting in loss of the structure or expensive repairs. Permafrost restricts use of the ground surface, and affects the location and design of roads, buildings, communities, pipelines, airfields, and bridges. Per ADN 2017, permafrost degradation is already impacting Bethel, resulting in costly projects to repair damage.

Probability of Future Events

The probability of future damage resulting from permafrost is highly likely where the event is probable within the calendar year, has up to 1 in 1 year chance of occurring (1/1=100 percent), and the history of events is greater than 33 percent likely per year.

5.3.5 Weather (Severe)

5.3.5.1 Nature

Severe weather throughout Alaska includes thunderstorms, lightning, hail, heavy and drifting snow, freezing rain/ice storm, extreme cold, and high winds. The City of Bethel experiences periodic severe weather events such as the following:

Heavy and Drifting Snow

Heavy snow generally means snowfall accumulating to four inches or more in depth in 12 hours or less or six inches or more in depth in 24 hours or less. Drifting is the uneven distribution of snowfall and snow depth caused by strong surface winds. Drifting snow may occur during or after a snowfall.

Freezing Rain/Ice Storm

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

Extreme Cold

The definition of extreme cold varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered “extreme”. In Alaska, extreme cold usually involves temperatures between -20 to -50°F. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold accompanied by wind exacerbates exposure injuries such as frostbite and hypothermia.

High Winds

High winds occur in Alaska when there are winter low-pressure systems in the North Pacific Ocean and the Gulf of Alaska. Alaska’s high wind can equal hurricane force but fall under a different classification because they are not cyclonic nor possess other characteristics of hurricanes. High winds (winds in excess of 60 mph) occur rather frequently throughout Alaska.

5.3.5.2 History

There is one event in the Alaska Disaster Index for Bethel.

00-191 Central Gulf Coast Storm declared February 4, 2000 by Governor Murkowski then FEMA declared (DR-1316) on February 17, 2000: On Feb 4 2000, the Governor declared a disaster due to high impact weather events throughout an extensive area of the state. The State began responding to the incident since the beginning of December 21, 1999. The declaration was expanded on February 8 to include City of Whittier, City of Valdez, Kenai Peninsula Borough, Matanuska-Susitna Borough and the Municipality of Anchorage. On February 17, 2000, President Bill Clinton determined the event disaster warranted a major disaster declaration under the Robert T. Stafford Disaster Relief and Emergency Assistance Act, P.L. 93-288 as amended (“the Stafford Act). On March 17, 2000, the Governor again expanded the disaster area and declared that a condition of disaster exists in Aleutians East, Bristol Bay, Denali, Fairbanks North Star, Kodiak Island, and Lake and Peninsula Boroughs and the census areas of Dillingham, **Bethel**, Wade Hampton, and Southeast Fairbanks, which is of sufficient severity and

magnitude to warrant a disaster declaration. Effective on April 4, 2000, Amendment No. 2 to the Notice of a Major Disaster Declaration, the Director of FEMA included the expanded area in the presidential declaration. Public Assistance, for 64 applicants with 251 PW's, totaled \$12.8 million. Hazard Mitigation totaled \$2 million. The total for this disaster is \$15.66 million.

5.3.5.3 Location, Extent, Impact, and Probability of Future Events

Location

The City of Bethel has experienced periodic severe weather impacts.

Extent

Based on past severe weather events and the criteria identified in Table 5-3, the extent of severe weather in the City is considered limited where injuries do not result in permanent disability, complete shutdown of critical facilities occurs for more than one week, and more than 10 percent of property is severely damaged.

Impact

The intensity, location, and the land's topography influence the impact of severe weather conditions on a community.

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

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

Bethel has a homeless population. Severe weather impacts them. The community has a sleep-off center, but it doesn't have capacity to house everyone who needs shelter.

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

Extreme cold also interferes with the proper functioning of a community's infrastructure by causing fuel to congeal in storage tanks and supply lines, stopping electric generation. Without electricity, heaters and furnaces do not work, causing water and sewer pipes to freeze or rupture. If extreme cold conditions are combined with low or no snow cover, the ground's frost depth can increase, disturbing buried pipes. The greatest danger from extreme cold is its effect on people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible. The risk of hypothermia due to exposure greatly increases during episodes of extreme cold, and carbon monoxide poisoning is possible as people use supplemental heating devices.

Probability of Future Events

Based on previous occurrences and the criteria identified in Table 5-2, it is likely a severe storm event will occur in the next three years (event has up to 1 in 3 years chance of occurring) as the history of events is greater than 20 percent but less than or equal to 33 percent likely per year.

5.3.6 Fire

5.3.6.1 Nature

There are three different types of fires in the Bethel area: wildland fire, tundra fire, and steamhouse fires.

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

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

- **Topography:** As slope increases, the rate of wildland fire spread increases. South-facing slopes are also subject to more solar radiation, making them drier and thereby intensifying wildland fire behavior. However, ridgetops may mark the end of wildland fire spread since fire spreads more slowly or may even be unable to spread downhill.
- **Fuel:** The type and condition of vegetation plays a significant role in the occurrence and spread of wildland fires. Certain types of plants are more susceptible to burning or will burn with greater intensity. Dense or overgrown vegetation increases the amount of combustible material available to fuel the fire (referred to as the “fuel load”). The ratio of living to dead plant matter is also important. The risk of fire is increased significantly during periods of prolonged drought as the moisture content of both living and dead plant matter decreases. The fuel load continuity, both horizontally and vertically, is also an important factor.
- **Weather:** The most variable factor affecting wildland fire behavior is weather. Temperature, humidity, wind, and lightning can affect chances for ignition and spread of fire. Extreme weather, such as high temperatures and low humidity, can lead to extreme wildland fire activity. By contrast, cooling and higher humidity often signal reduced wildland fire occurrence and easier containment.

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

Tundra fires are a unique type of fire situation and move slower than wildland fires as their fuel source is different. Tundra fires can burn underground, undetected from above, and then pop up and continue burning. Their fuel source is roots, caribou moss, peat, and grass. They are difficult to extinguish. The volunteer fire department responds to many tundra fires adjacent to town, usually started by kids playing with matches.

Many of Bethel's fires start in steamhouses and consume the whole steamhouse, which could jump to a house, if one is nearby.

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

5.3.6.2 History

Wildland fires have not been documented within the boundaries of the City; however, wildland fires have occurred in the City's vicinity. The Alaska Interagency Coordination Center (AICC) provided the City's wildland fire information contained in Table 5-7 and Figure 5-6.

Approximately 95 wildland fires occurred within 50 miles of the City from 1939 to 2017. Table 5-7 is a select summary of fires greater than 1,000 acres, and Figure 5-6 shows this information.

Table 5-7 City of Bethel Historical Wildfire Events

Fire Name	Fire	Estimated	Latitude	Longitude	Specific
Gweek River	2016	1,320	61.0588333	-	Lightning
Israthorak Creek	2016	6,042.1	61.356	-	Lightning
Fog River	2015	35,580	60.893889	-160.758333	Lightning
Kuka Creek 3	2015	13,932	61.3533333	-	Lightning
Kuka Creek 4	2015	41,628	61.3369445	-	Lightning
Kwethluk River # 2	2015	23,241.5	60.784167	-161.292778	Lightning
Hawk River	2010	10,766	60.4833336	-	Lightning
Takslekluk North	2006	4,016.7	61.16667	-162.7	Lightning
Bet E 11	1984	1,500	60.7666664	-161.5	Human
Ahkuta	1974	10,025	60.1833344	-	Lightning
Long Lake	1972	1,800	61.3333321	-	Lightning
Water	1971	2,000	61.3166656	-162.75	Lightning
Hunker	1971	3,200	61.2333336	-	Lightning
Bethel 30-E	1957	1,000	60.8333321	-	Lightning
Bethel 1/2S	1957	2,491	60.75	-161.75	Debris
Nunipitchuk	1941	1,500	60.9333344	-	Lightning
Nunipitchuk #2	1941	1,500	60.9166679	-	Lightning
Tuluksak	1940	102,400	61.0999985	-	Unknown
Akiak	1940	204,800	60.9333344	-161.25	Unknown
Lomavik	1940	16,000	60.5833321	-	Unknown
Napaishak	1940	20,000	60.6666679	-	Unknown

(AICC 2017)

5.3.6.3 *Location, Extent, Impact, and Probability of Future Events*

Location

Figure 5-6 depicts the City's wildland fire threat. It is important to note that the fuel profile within the community is changing. There is an overgrowth of brush growing up around Bethel that has a higher moisture content (willows and cottonwoods). At this point, the Fire Department does not see a significant need to change tactics or strategy.

Due to development trends, the City will receive a new ladder truck in the near future that will be capable of reaching the new Primary Care Center that is currently being constructed. Funding is complete for the new ladder truck. The Fire Department would need a new 3,500-gallon water tanker and brush mover with an arm. The brush mower would be beneficial to reduce fuel loads right up against community roads. Funding sources are needed for the water tanker and brush mower.

Extent

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

Fuel, weather, and topography influence fire behavior. Fuel determines how much energy the fire releases, how quickly the fire spreads, and how much effort is needed to contain the fire. Weather is the most variable factor. High temperatures and low humidity encourage fire activity while low temperatures and high humidity retard fire spread. Wind affects the speed and direction of fire spread. Topography directs the movement of air, which also affects fire behavior. When the terrain funnels air, as happens in a canyon, it can lead to faster spreading. Fire also spreads up slope faster than down slope.

Based on past fire events and the criteria identified in Table 5-3, the magnitude and severity of potential impacts to the City are considered critical where injuries could result in permanent disability, complete shutdown of critical facilities could last for at least two weeks, and more than 25 percent of property could potentially be severely damaged, which would severely impact infrastructure or the economy.

Impact

Impacts of a fire that interfaces with the population center of the City could grow into an emergency or disaster if not properly controlled. A small fire can threaten lives and resources and destroy property. In addition to impacting people, fires may severely impact livestock and pets. Such events may require emergency watering and feeding, evacuation, and alternative shelter.

Indirect impacts of fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance siltation of rivers and streams, thus increasing flood potential, harming aquatic life, and degrading water quality.

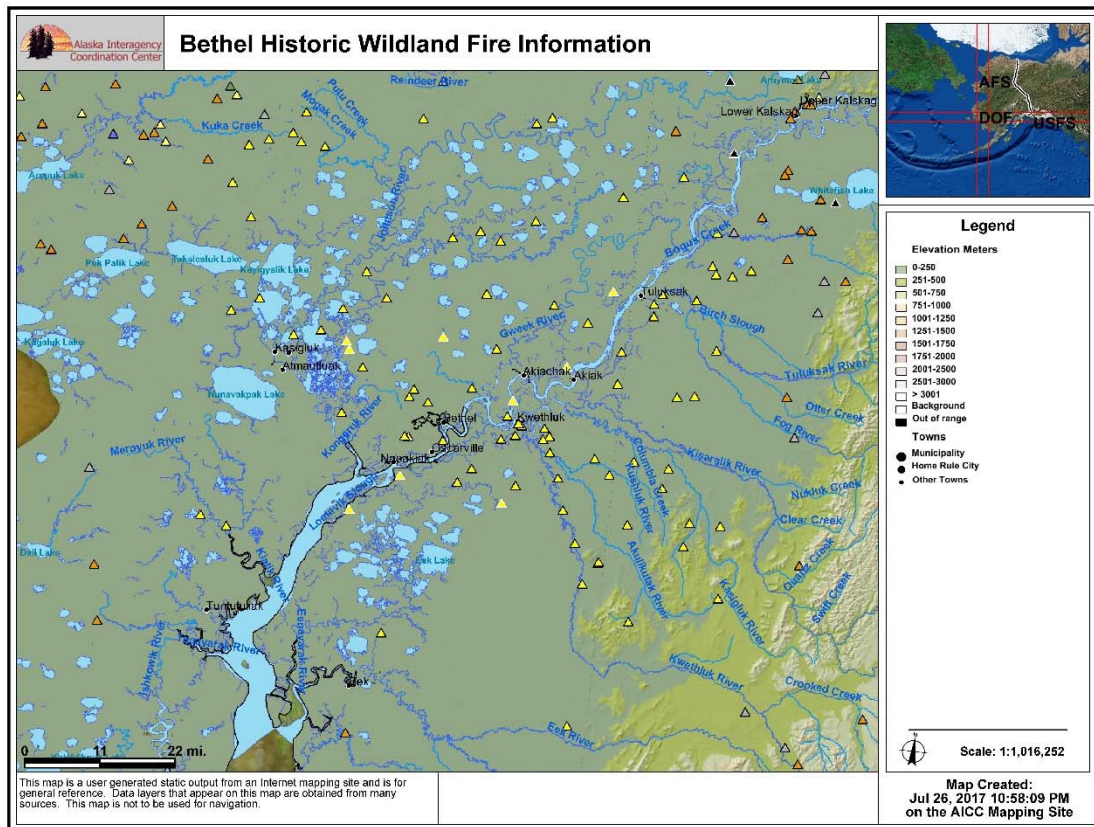


Figure 5-6 Wildfire History (AICC 2017)

Wildfires do occur but have a low probability and rarely cause significant damage per the Fire Chief. The City's response capabilities exceed the minimums required to handle fires. Bethel Fire Department has over 20 portable radios and two ATVs specifically outfitted with four water pump bags each, hand tools, saws, water pumps and hose. Also, there is a forestry cache of supplies kept in Bethel that the Fire Department has access to. This cache supports a 20 person team.

Bethel serves as an evacuation center for regional villages. Elderly and disabled people from upriver with asthma, COPD, and smoke sensitivities evaluate to Bethel when smoke in their communities are irritants.

Probability of Future Events

Fire is recognized as a critical feature of the natural history of many ecosystems. It is essential to maintain the biodiversity and long-term ecological health of the land. The role of land fire as an essential ecological process and natural change agent has been incorporated into the fire management planning process. The full range of fire management activities is exercised in Alaska, to help achieve ecosystem sustainability, including its interrelated ecological, economic,

and social consequences on firefighters, public safety and welfare; natural and cultural resources threatened; and the other values to be protected dictate the appropriate management response to the fire.

Based on the history of fires in the Bethel areas, applying the criteria identified in Table 5-2, it is likely a wildland fire event will occur within the next 10 years (10 % change).

5.3.7 Volcanoes

5.3.7.1 Hazard Description

Alaska is home to more than 80 major volcanic centers, 41 of which have been active in the last 250 years. On average, there are one or two eruptions or reports of volcanic unrest each year. Over half of the State's population lives within 100 miles of an active volcano.

A volcano is a vent at the Earth's surface through which magma (molten rock) and associated gases erupt, and also the landform built by effusive and explosive eruptions. Volcanoes display a wide variety of shapes, sizes, and behavior; however, they are commonly classified among three main types: cinder cone, composite, and shield.

5.3.7.2 Cinder Cones

A cinder cone is the simplest type of volcano. They are built from particles and blobs or congealed lava ejected from a single vent. As the lava is blown into the air, it breaks into small fragments that solidify and fall as cinders and bombs around the vent to form a circular or oval cone.

5.3.7.3 Composite Volcanoes

Composite volcanoes, sometimes called stratovolcanoes, are typically steep-sided, symmetrical cones of large dimension built of alternating layers of lava flows, volcanic ash, blocks, and bombs, and may rise as much as 8,000 feet above their bases.

5.3.7.4 Shield Volcanoes

Shield volcanoes are formed by lava flowing in all directions from a central summit vent, or group of vents, or rift zones building a broad, gently sloping cone with a dome shape. They are built up slowly by the accumulation of thousands of highly fluid lava flows that spread widely over great distances, and then cool in thin layers. Some of the largest volcanoes in the world are shield volcanoes. Volcanic eruptions create several types of hazards:

- Lava flows
- Pyroclastic flows
- Pyroclastic surges
- Lava Domes
- Volcanic ash and bombs
- Volcanic gases
- Lateral blasts
- Debris avalanches
- Lahars and debris flows

The Alaska Volcano Observatory monitors the seismic activity at 23 of Alaska's 41 active volcanoes in real time. The Alaska Tsunami Warning Center also monitors volcanic and earthquake activity throughout the Pacific region.

5.3.7.5 Location

No active volcanoes exist in the immediate Bethel area. Active volcanoes nearest to Bethel are Mount Augustine, Mount Redoubt, and Mount Spurr.

5.3.7.6 Extent

The community is at moderate risk of planes not being able to fly certain directions. In 2009, Mount Redoubt volcano erupted. No ash fell in Bethel; however, for a week, no jets could land in Bethel due to a change in flight patterns. The City receives goods and supplies via air and barge, and if the no fly period had been extended, there could have been a shortage in supplies.

5.3.7.7 Impact

Heavy ash fall can reduce sunlight causing a peak electrical demand resulting in brown-outs. Ash can clog watercourses and sewage treatment facilities, and may affect electronic equipment and all kinds of machinery. A one-inch layer of ash weighs ten pounds per square foot – ash accumulation on structures may cause damage. Fresh ash is extremely slippery, especially when wet, and can hamper both driving and walking. Ash can damage the lungs of infants, the very old or infirm, and those already suffering from respiratory illness. Under most circumstances, Houston residents will be “sheltered in place” and be instructed in the use of alternative filtering materials.

5.3.7.8 Probability

The 2013 *Alaska All-State Hazard Mitigation Plan* states that the Lower Kuskokwim REAA has no probability of being affected by a volcano erupting.

5.3.7.9 Previous Occurrences

One week in 2009 has been the only time Bethel has been affected by an erupting volcano.

5.3.8 Climate Change

5.3.8.1 Nature

For this HMP update, 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. 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.

5.3.8.2 Location, Extent, Impact, and Probability of Future Events

Location

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

Extent

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

Local Impact

Climate change has the potential to aggravate natural disasters along the coastline and rivers, particularly flooding and permafrost degradation. Climate change will continue to exacerbate the issue.

David E. Trantham, Jr., 94 year old Alaskan with 51 years of residence in Bethel, stated in 2017 that he believes climate change is occurring in Bethel. He has observed less high water, thinner river ice, and fewer ice jams. Bethel has not had a flooding problem in over a decade. Additionally, this year's growth of brush was at an increased rate, and he has seen an influx of birds and insects in Bethel that have never existed there. A hummingbird, grasshopper, and carpenter ants have been sighted in Bethel in recent years.

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.

Probability

Given the Earth's history of mass extinctions attributed to climate change and the current observed changes in the atmosphere, 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.

5.3.8.3 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.

During Earth's history, there have been many mass extinction events, five of which are regarded as the most thorough:

End Ordovician (~443Ma): The second largest known mass extinction on record. 12% of all families and 65% of all species ceased to exist.

Late Devonian (~370 Ma): Sharks appeared in this mass extinction, some of which still exist today and are mostly unchanged. 14% of all families and 72% of all species became extinct.

End Permian (~250Ma): known as the Great Dying, this is the most thorough known mass extinction in history. 52% of all families and greater than 90% of all species perished.

End Triassic (~210Ma): 12% of all families and 65% of all life in the Triassic period perished.

End Cretaceous (~65Ma): 11% of all families and 62% of all species became extinct.

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This section provides an overview of the vulnerability analysis and describes the five specific steps: asset inventory, methodology, data limitations, and exposure analysis for current assets, and areas of future development.

6.1 OVERVIEW OF A VULNERABILITY ANALYSIS

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

1. Asset Inventory;
2. Methodology;
3. Data Limitations;
4. Exposure Analysis For Current Assets; and
5. Areas of Future Development.

The requirements for a vulnerability analysis, as stipulated in DMA 2000 and its implementing regulations, are described here.

- A summary of the community's vulnerability to each hazard that addresses the impact of each hazard on the community.

DMA 2000 Requirements: Risk Assessment, Assessing Vulnerability, Overview

Assessing Vulnerability: Overview

Requirement §201.6(c)(2)(ii): [The risk assessment shall include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

Element

- Does the new or updated plan include an overall summary description of the jurisdiction's vulnerability to each hazard?
- Does new or updated plan address the impact of each hazard on the jurisdiction?

Source: FEMA, July 2008.

- Identification of the types and numbers of RL properties in the identified hazard areas. An identification of the types and numbers of existing vulnerable buildings, infrastructure, and critical facilities and, *if possible*, the types and numbers of vulnerable future development.
- Estimate of potential dollar losses to vulnerable structures and the methodology used to prepare the estimate.

DMA 2000 Requirements: Risk Assessment, Assessing Vulnerability, Addressing Repetitive Loss Properties

Assessing Vulnerability: Addressing Repetitive Loss Properties

Requirement §201.6(c)(2)(ii): [The risk assessment] **must** also address NFIP insured structures that have been repetitively damaged floods.

Element

- Does the new or updated plan describe vulnerability in terms of the types and numbers of repetitive loss properties in the identified hazard areas?

DMA 2000 Recommendations: Risk Assessment, Assessing Vulnerability, Identifying Structures

Assessing Vulnerability: Identifying Structures

Requirement §201.6(c)(2)(ii)(A): The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard area.

Element

- Does the new or updated plan describe vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas?
- Does the new or updated plan describe vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas?

DMA 2000 Recommendations: Risk Assessment, Assessing Vulnerability, Estimating Potential Losses

Assessing Vulnerability: Estimating Potential Losses

Requirement §201.6(c)(2)(ii)(B): [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate.

Element

- Does the new or updated plan estimate potential dollar losses to vulnerable structures?
- Does the new or updated plan describe the methodology used to prepare the estimate?

Source: FEMA, July 2008.

6.2 VULNERABILITY ANALYSIS: SPECIFIC STEPS

6.2.1 Asset Inventory

Asset inventory is the first step of a vulnerability analysis. Assets that may be affected by hazard events include population (for community-wide hazards), residential buildings (where data is available), and critical facilities and infrastructure. The assets and associated values throughout the City are identified and discussed in detail in the following subsections.

6.2.1.1 Population and Building Stock

Population data for the City was obtained from the 2010 U.S. Census. The City's total population for 2010 was 6,080, and 2016 DOL data reported a population of 6,244 (Table 6-1). Estimated numbers of residential buildings and replacement values for those structures, as shown in Table 6-1, were obtained from the City, the 2010 U.S. Census, and DCCED/DCRA/DOL. A total of 2,364 single-family residential buildings were considered in this analysis.

Table 6-1 Estimated Population and Building Inventory

Population		Residential Buildings	
2010 Census	DOL 2016 Data	Total Building Count	Total Value of Buildings ¹
6,080	6,244	2,364	\$155,314,800

Sources: The City of Bethel, U.S. Census 2010, and 2016 DCCED/DCRA/DOL population data.

¹ Average structural value of all single-family residential buildings is \$65,700 per structure.

6.2.1.2 Repetitive Loss Properties

The City has participated in the NFIP since March 16, 1976 with a flood hazard map dated September 25, 2009. The City has not developed an inventory of properties that meet the RL or SRL criteria.

The City only lists the total repetitive property losses in Table 6-2. These losses occurred at one property in 1995, 1999, and 2005.

Table 6-2 Repetitive Loss Properties

Type (RL/SRL) Year(s)	Town	Occupancy	No. of Claims	Flood Insurance (Yes/No)	Average Claim Value (\$) ¹	Total Paid (\$) ²
RL	City of Bethel	Unknown	3 at one property	Y	\$7,013	\$21,040

Type includes: RL or SRL

¹Insured structural value n/a.

²Content and building claims.

6.2.1.3 Existing Critical Facilities and Infrastructure

A critical facility is defined as a facility that provides essential products and services to the general public, such as preserving the quality of life in the City and fulfilling important public safety, emergency response, and disaster recovery functions. The critical facilities profiled in this plan include the following:

- Government facilities, such as city and tribal administrative offices, departments, or agencies;
- Emergency response facilities, including police, and fire;

- Educational facilities, including K-12;
- Care facilities, such as medical clinics, congregate living health, residential and continuing care, and retirement facilities;
- Community gathering places, such as community and youth centers; and
- Utilities, such as electric generation, communications, water and waste water treatment, sewage lagoons, and landfills.

The total number of critical facilities is listed in Table 6-3. No HAZUS information exists for the City of Bethel, and Bethel is not included in the State of Alaska Critical Inventory Index. Bethel floodplain maps were updated in 2009 with detailed hydrology work. In 2016, FEMA completed a Risk MAP inventory and published a Kuskokwim Delta Watershed Discovery Report in November 2016. HAZUS will be available for the next HMP Update in 2023.

Replacement values are not readily accessible. According to a recent grant application, the City owns 32 buildings valued at over \$200 million, a City Dock facility, Petro Port facility, small boat harbor, and is responsible for maintaining 16 miles of road and the seawall.

Table 6-3 Critical Facilities

Facility Type	Facility Name	Address
Government Facilities	Bethel City Office	300 Chief Eddie Hoffman Highway (CEH)
	Courthouse	204 CEH
	KCC Correctional	1000 CEH
Emergency Response Facilities	Bethel Fire Dept	320 CEH
	Bethel Police Services	157 Salmonberry
	State Troopers Office	3200 CEH
Medical Facilities	Y-K Delta Regional Hospital	700 CEH
	Bethel Family Clinic	631 4 th Avenue
Transportation Facilities	Bethel Municipal Airport, Asphalt	
	Gravel runway,	
	Float pond and parking basins	
	Bethel Port Authority dry cargo loading and	1171 and 1201 2 nd Avenue

Facility Type	Facility Name	Address
	unloading facility	
Utility Facilities	AVEC	1340 Kwethluk Lane
	City of Bethel Subdivision Water Treatment Plant	235 Akiak Drive
	Bethel Heights Water Treatment Plant	
	Sewage Lagoon	
	City Shop	1155 Ridgecrest
	7 lift stations	
	Landfill	1290 Ridgecrest

(Bethel 2017)

6.2.1.4 Future Critical Facilities and Infrastructure

Construction is occurring at the present time in the City and includes:

- 300 million renovation of existing hospital;
- \$5 million institutional corridor piped water system (bid documents have been posted);
- Bethel Family Clinic is constructing a new facility;
- New Port Office;
- Timber wall replacement to Bethel Cargo Dock repair; and
- \$8 million Sewage Lagoon rehabilitation project.

Immediate plans for future development in the City include:

- \$A new hospital building to be called Primary Care Center;
- 54-unit housing complex on hospital grounds;
- USACE tieback project of seawall is funded and will occur in Summer 2018; and
- Construction of new subdivision.

6.2.2 Methodology

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

The majority of rural communities lack Alaska DCRA community profile maps or geo-referenced data. Consequently, the City's Planning Team determined critical facility locations in relation to potential hazard threat exposure and vulnerability.

Replacement structure and contents values were not readily available. A similar analysis was used to evaluate the proportion of the population at risk. However, the analysis simply represents the number of people at risk; no estimate of the number of potential injuries or deaths was prepared.

6.2.3 Data Limitations

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

It is also important to note that the quantitative vulnerability assessment results are limited to the exposure of people, buildings, and critical facilities and infrastructure to the identified hazards. It was beyond the scope of this HMP update to develop a more detailed or comprehensive assessment of risk (including annualized losses, people injured or killed, shelter requirements, loss of facility/system function, and economic losses).

6.2.4 Exposure Analysis

The results of the exposure analysis for loss estimations in the City are summarized in the following discussion.

Earthquake

Based on earthquake probability (PGA) maps produced by the USGS, the entire City area is at risk of experiencing earthquake impacts as this is a risk common to Alaska. See Section 5.3.1.3. Impacts to the community such as ground movement that may result in infrastructure damage are not expected as Bethel is in an extremely low risk area.

The City has critical facilities and infrastructure located within areas of severe shaking. Severe risk areas includes 6,244 people in 2,364 residences (worth \$155,314,800) and 32 City buildings valued at over \$200 million per a 2014 City grant narrative as well as a City Dock facility, Petro Port facility, small boat harbor, and 16 miles of road and the seawall.

Impacts to the community such as significant ground movement that may result in infrastructure damage are unlikely. Although all structures are exposed to earthquakes, buildings within the

City constructed with wood have slightly less vulnerability to the effects of earthquakes than those with masonry.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level as the City currently experiences.

Erosion

There are houses and a road at the top of the steep bank above the dirt road near the seawall. A lot of erosion would need to take place to affect these houses, but these houses are vulnerable to erosion impacts. This steep bank above the dirt road was part of the USACE's seawall construction project.

River scour under the seawall occurs. Armor rock was placed to stop it, but a report needs to be done to provide an update.

Impacts from erosion include loss of land and any development on that land. See Section 5.3.2.3. Erosion can cause increased sedimentation of harbors and river deltas and hinder channel navigation, reduction in water quality due to high sediment loads, loss of native aquatic habitats, damage to public utilities (docks, harbors, electric and water/wastewater utilities), and economic impacts associated with costs trying to prevent or control erosion sites. In the City, only the location of a building can lessen its vulnerability to erosion.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level.

Flood

According to the City's FEMA Flood Insurance Rate Map (FIRM), and the Planning Team, the entire City can potentially experience impacts by high-water, high-flow flood events primarily during the summer months.

Impacts associated with flooding in the City include water damage to structures and contents, roadbed erosion and damage, boat strandings, areas of standing water in roadways, and damage or displacement of fuel tanks, power lines, or other infrastructure. See Section 5.3.3.3. Buildings on slab foundations, not located on raised foundations, and/or not constructed with materials designed to withstand flooding events (e.g., cross vents to allow water to pass through an open area under the main floor of a building) are more vulnerable to the impacts of flooding.

The City is a NFIP participant; however, RL flood claim data relates to one property. Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same low impact level. Funding may be secured to elevate or relocate flood prone structures to mitigate future damages or losses.

Permafrost

According to mapping completed by the USGS, the entire City is underlain by isolated and discontinuous permafrost areas, with impacts from this hazard. See Section 5.3.4.3. This includes 6,244 people in 2,364 residences (worth \$155,314,800) and 32 City buildings valued at over

\$200 million per a 2014 City grant narrative as well as a City Dock facility, Petro Port facility, small boat harbor, and 16 miles of road and the seawall.

Impacts associated with degrading permafrost include surface subsidence, infrastructure, structure, and/or road damage. Most buildings are either built on post and pad or have pilings sunk into the ground. It is not reasonable for the City to stop building in permafrost areas because nearly the entire City is on top of permafrost. Homes require leveling more often, every two to four years.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level.

Weather (Severe)

Using information provided by the City and the National Weather Service, the entire existing and future City's population, residences, and critical facilities are equally exposed to the effects of a severe weather event. This includes 6,244 people in 2,364 residences (worth \$155,314,800) and 32 City buildings valued at over \$200 million per a 2014 City grant narrative as well as a City Dock facility, Petro Port facility, small boat harbor, and 16 miles of road and the seawall.

Impacts associated with severe weather events includes roof collapse, trees and power lines falling, damage to light aircraft and sinking small boats, injury and death resulting from snow machine or vehicle accidents, overexertion while shoveling all due to heavy snow. A quick thaw after a heavy snow can also cause substantial flooding. Impacts from extreme cold include hypothermia, halting transportation from fog and ice, congealed fuel, frozen pipes, disruption in utilities, and carbon monoxide poisoning. Section 5.3.5.3 provides additional detail regarding the impacts of severe weather. Buildings that are older and/or not constructed with materials designed to withstand heavy snow and wind (e.g., hurricane ties on crossbeams) are more vulnerable to the impacts of severe weather.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level.

Fire

Impacts associated with a wildland, tundra, or steamhouse fire events include loss of life and property. See Section 5.3.6.3. All City buildings and houses are not exposed to wildland fire risk. There are few trees in Bethel, and most trees that do exist are willows which are usually not that big or extensive. Right at the edge of the town on all four sides is tundra with no trees. Tundra fires could pose a danger, but are not as dangerous as tree-fueled fires. There are not enough trees to have a fire burn from one place to another across town.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level.

Volcano

Impacts associated with a volcano include a food and supply shortage. See Section 5.3.7.3. The entire population is at risk. Impacts to future populations are anticipated at the same impact level.

DMA 2000 Recommendations: Risk Assessment, Assessing Vulnerability, Analyzing Development Trends

Assessing Vulnerability: Analyzing Development Trends

Requirement §201.6(c)(2)(ii)(C): [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Element

- Does the new or updated plan describe land uses and development trends?

Source: FEMA, July 2008.

6.3 LAND USE AND DEVELOPMENT TRENDS

Bethel is the largest rural town in Alaska. The community population has grown 2.65% since 2010. Bethel’s population is likely to stabilize or increase as a result of recent improvements in the Alaskan economy coupled with the construction of a new Primary Care Center and hospital renovation estimated to cost \$200-\$300 million. Once completed, the facility will support 300 new jobs, and the population will grow per a 2014 grant application narrative.

The Bethel Comprehensive Plan 2035, prepared by AGNEW::BECK Consulting for the City in 2011 stated the following:

“Land use in Bethel reflects an ongoing response to human pressures for growth and change as shaped by the challenges of the western Alaska physical environment. The location of development in Bethel is dominated by the need to use the relatively few areas where soils offer few physical building constraints, and where road access is available. The result has been a community with a small central “downtown” with a gridded road system and relatively concentrated, mixed use development. Extending for miles west from the center are several major roads, which provide access to low density, mostly residential subdivisions, irregularly spaced commercial and public uses, and the airport.

Another factor influencing the location of development is the limited supply of private land. Bethel is embedded in the Yukon Delta National Wildlife Refuge. In addition, much of the private land that does exist is Native allotments, which present unique development challenges. The advantage of this land ownership pattern is that almost all the land surrounding Bethel is undeveloped public property, which supports the subsistence activities that are an essential part of Bethel residents’ way of life.”

Projects identified in Section 6.2.1.4 were sited in areas where soils offer few physical building constraints in Bethel.

The Land Use Map in Appendix B shows the various land use areas in Bethel.

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This section outlines the four-step process for preparing a mitigation strategy including:

1. Developing Mitigation Goals;
2. Identifying Mitigation Actions;
3. Evaluating Mitigation Actions; and
4. Implementing Mitigation Action Plans.

Within this section, the Planning Team updated the mitigation goals and potential mitigation actions developed for the 2008 HMP.

7.1 DEVELOPING MITIGATION GOALS

The requirements for the local hazard mitigation goals, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy – Local Hazard Mitigation Goals

Local Hazard Mitigation Goals

Requirement §201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

Element

- Does the new or updated plan include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards?

Source: FEMA, July 2008.

The exposure analysis results were used as a basis for developing the mitigation goals and actions. Mitigation goals are defined as general guidelines that describe what a community wants to achieve in terms of hazard and loss prevention. Goal statements are typically long-range, policy-oriented statements representing community-wide visions. As such, nine goals were developed to reduce or avoid long-term vulnerabilities to the identified hazards (Table 7-1).

Table 7-1 Mitigation Goals

No.	Goal Description
1	Promote recognition and mitigation of all natural hazards that affect the City of Bethel (City).
2	Cross-reference mitigation goals and actions with other City planning mechanisms and projects.
3	Reduce the probability of losses from all natural hazards that affect the City.
4	Reduce vulnerability of structures to earthquake damage.
5	Reduce the probability of damage and losses from erosion.
6	Reduce the probability of damage and losses from flooding.
7	Reduce the probability of damage and losses from permafrost.
8	Reduce vulnerability of structures to severe winter storm damage.
9	Reduce the probability of damage and losses from wildland fires.

7.2 IDENTIFYING MITIGATION ACTIONS

The requirements for the identification and analysis of mitigation actions, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy - Identification and Analysis of Mitigation Actions

Identification and Analysis of Mitigation Actions

Requirement §201.6(c)(3)(ii): [The mitigation strategy shall include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure.

Element

- Does the new or updated plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?
- Do the identified actions and projects address reducing the effects of hazards on new buildings and infrastructure?
- Do the identified actions and projects address reducing the effects of hazards on existing buildings and infrastructure?

Source: FEMA, July 2008.

DMA 2000 Requirements: Mitigation Strategy - Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance

Identification and Analysis of Mitigation Actions: NFIP Compliance

Requirement §201.6(c)(3)(ii): [The mitigation strategy] must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

Element

- Does the new or updated plan describe the jurisdiction(s) participation in the NFIP?
- Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?

Source: FEMA, July 2008.

After mitigation goals and actions were developed, the planning team assessed the potential mitigation actions to carry forward into the mitigation strategy. Mitigation actions are activities, measures, or projects that help achieve the goals of a mitigation plan. Mitigation actions are usually grouped into four broad categories: prevention, property protection, public education and awareness, and structural projects. In the development of the 2008 HMP, the Planning Team developed goals and actions for potential implantation during the five-year life cycle of the 2008 HMP. The Planning Team placed particular emphasis on projects and programs that reduced the effects of hazards on both new and existing buildings and infrastructure. These potential projects are listed in Table 7-2.

Table 7-2 Mitigation Goals and Potential Actions
(Bold ID items were selected for implantation by the Planning Team)

Goals		Actions	
No.	Description	ID	Description
1	Reduce Flood Damage.	A	Support elevation, flood proofing, buyout or relocation of structures that are in danger of flooding or eroding banks. Use culverts, drainage, and city road building practice to minimize flooding potential.
2	Prevent Future Flood Damage.	A	Continue enforcing NFIP regulations.
3	Increase Public Awareness.	A	Increase public knowledgeable about mitigation opportunities, floodplain functions, emergency service procedures, and potential hazards.
4	Reduce vulnerability of structures to earthquake damage.	A	Obtain funding to protect existing critical infrastructure from earthquake damage.
5	Reduce possibility of damage and losses from erosion.	A	Identify critical facilities potentially impacted, and develop mitigation initiatives such as bank stabilization or facility relocation to prevent or reduce the threat.
7	Reduce possibility of damage and losses from permafrost.	A	Identify and map existing permafrost areas to assist in new critical facility siting and existing facility relocation siting.
		B	Promote permafrost sensitive construction practices in permafrost areas.
8	Mitigate the effects of extreme weather by instituting programs that provide early warning and preparation.	A	Educate people about the dangers of extreme weather and how to prepare.
		B	Develop practical measures to warn in the event of a severe weather event.
9	Reduce possibility of damage and losses from wildland fires.	A	Many of Bethel's fires start in steamhouses and consume the whole steamhosue, which could jump to a house, if one is nearby. Build steamhouses farther apart.
		B	Conduct outreach activities to encourage the use of FireWise development techniques.
		C	Encourage the evaluation of emergency plans with respect to wildland fire assessment.
		D	Acquire information on the danger of wildland fires and how best to prepare.

Note: IDs, such as A, B, C, and D represent goals chosen to carry forward during development of the 2008 HMP.

7.3 EVALUATING AND PRIORITIZING MITIGATION ACTIONS

The requirements for the evaluation and implementation of mitigation actions, as stipulated in DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions

Implementation of Mitigation Actions

Requirement: §201.6(c)(3)(iii): [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) 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.

Element

- Does the new or updated mitigation strategy include how the actions are prioritized?
- Does the new or updated mitigation strategy address how the actions will be implemented and administered?
- Does the new or updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?
- Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred?

Source: FEMA, July 2008.

The Planning Team evaluated each of the mitigation actions on August 10, 2017 to determine which actions would be included in the updated Mitigation Action Plan. The Mitigation Action Plan contained in Table 7-2 represents mitigation projects and programs to be implemented through the cooperation of multiple entities in the City. The Planning Team added permafrost to Table 7-2 and determined that these actions did not need to be reprioritized from 2008 due to the last nine years of historical record within the community.

The Planning Team reviewed the simplified Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE) evaluation criteria (Table 7-3) and the Benefit-Cost Analysis Fact Sheet (Appendix D) to consider the opportunities and constraints of implementing each particular mitigation action. For each action considered for implementation, a qualitative statement is provided regarding the benefits and costs and where available the technical feasibility. A detailed cost-benefit analysis is anticipated as part of the application process for those projects the City chooses to implement.

On August 10, 2017, the hazard mitigation Planning Team reviewed each mitigation action from Table 7-4. The Planning Team considered each hazard's history, extent, and probability. A rating system based on *high*, *medium*, or *low* was used. *High* priorities are associated with actions for hazards that impact the community on an annual or near annual basis and generate impacts to critical facilities and/or people. *Medium* priorities are associated with actions for hazards that impact the community less frequently, and do not typically generate impacts to critical facilities and/or people. *Low* priorities are associated with actions for hazards that rarely

impact the community and have rarely generated documented impacts to critical facilities and/or people. Table 7-4 provides a summary of the mitigation action priorities.

The Planning Team updated Table 7-4 in 2017 and determined that descriptions in the 2008 HMP were too general.

Table 7-3 STAPLEE Evaluation Criteria for Mitigation Actions

Evaluation Category	Discussion "It is important to consider..."	Considerations
Social	The public support for the overall mitigation strategy and specific mitigation actions.	Community acceptance Adversely affects population
Technical	If the mitigation action is technically feasible and if it is the whole or partial solution.	Technical feasibility Long-term solutions Secondary impacts
Administrative	If the community has the personnel and administrative capabilities necessary to implement the action or whether outside help will be necessary.	Staffing Funding allocation Maintenance/operations
Political	What the community and its members feel about issues related to the environment, economic development, safety, and emergency management.	Political support Local champion Public support
Legal	Whether the community has the legal authority to implement the action, or whether the community must pass new regulations.	Local, State, and Federal authority Potential legal challenge
Economic	If the action can be funded with current or future internal and external sources, if the costs seem reasonable for the size of the project, and if enough information is available to complete a Federal Emergency Management Agency (FEMA) Benefit-Cost Analysis.	Benefit/cost of action Contributes to other economic goals Outside funding required FEMA Benefit-Cost Analysis
Environmental	The impact on the environment because of public desire for a sustainable and environmentally healthy community.	Effect on local flora and fauna Effect on fish from the Kuskokwim River Consistent with community environmental goals Consistent with local, state, and Federal laws

7.4 IMPLEMENTING A MITIGATION ACTION PLAN

Table 7-4 shows the City of Bethel's Mitigation Action Plan Matrix that shows how the mitigation actions were prioritized, how the overall benefit/costs were taken into consideration, and how each mitigation action will be implemented and administered by the Planning Team. This table has been updated from the 2008 HMP.

Table 7-4 Benefit Cost Review Listing

* Priorities: High = Clearly a life/safety project, or benefits clearly exceed the cost or can be implemented, 0 – 1 year.

Medium = More study required to designate as a life/safety project, or benefits may exceed the cost, or can be implemented in 1 – 5 years.

Mitigation Strategy

Low = More study required to designate as a life/safety project, or not known if benefits exceed the costs, or long-term project, implementation will not occur for over 5 years.

- ** PDMG Pre-Disaster Mitigation Grant
 *** HMGP Hazard Mitigation Grant Program
 ****FMA Flood Mitigation Assistance (Program)

Mitigation Projects	Benefits (pros)	Costs (cons)	High
Flood/Erosion (FLD)			
FLD-1. Updated FIRM Bethel Maps Status as of 2017: Floodplain maps were updated with detailed hydrology work in 2009. This project is considered complete and can be removed in the next HMP Update.	FEMA, PDMG**, HMGP*** and State DCRA funding available. USACE facilitated project. Can be started immediately.	Expensive, at least \$100,000	High
FLD-2. Pursue obtaining a CRS rating to lower flood insurance rates. Status as of 2017: This action has not been implemented.	High capability by city to do on an annual basis. Will reduce NFIP insurance for entire community.	\$1,000/year	High
FLD-3. Continue compliance with NFIP. Status as of 2017: Ongoing.	High capability by city to do on an annual basis. Public benefit to have public buildings insured through NFIP.	\$3,000/year	High
FLD-4. Bethel Small Boat Harbor Bank Stabilization Status as of 2017:FY2018 State of Alaska Capital Budget Request	Property Damage Reduction during flooding. Benefit to public and private properties. Potential PDMG. Ongoing project.	\$4 million	High
FLD-5. Improvements to Small Boat Harbor Status as of 2017:FY2018 State of Alaska Capital Budget Request	Benefit to entire community. Life/Safety issue Funding potential from PDMG or HMGP. Ongoing Project.	\$2.5 million	High

Mitigation Strategy

FLD-6. Tie-back Replacement on Seawall Status as of 2017: Funding is secured. Work will begin in 2018.	Benefit to entire community. Life/Safety issue Funding potential from PDMG or HMGP. Annual responsibility.	\$4 Million	High
Tundra/Wildland Fire (WF)			
WF-1. Continue to support the local fire department with adequate firefighting equipment and training. Status as of 2017: New equipment needs have been identified per development within the City.	Life/Safety issue Risk reduction Benefit to entire community State assistance available Annual project.	\$411,0000	High
Earthquake			
EQ-1. Perform an engineering assessment of the earthquake vulnerability of identified critical infrastructure owned by the City. New action identified in 2017	Life/Safety issue Risk reduction Benefit to entire community	\$25,000	Low
EQ-2. Install non-structural seismic restraints for large furniture such as bookcases, filing cabinets, heavy televisions, and appliances to prevent toppling damage and resultant injuries to small children, the elderly, and pets. New action identified in 2017	Life/Safety issue Risk reduction Benefit to entire community	\$5,000	Low
Volcano			
V-1. Purchase a local supply of ash masks and store at shelter. Supply should be sufficient for elderly, children, and those with known respiratory ailments. New action identified in 2017	Life/Safety issue Risk reduction Benefit to vulnerable populations. State assistance available	\$2,000	Medium
Permafrost			
P-1. Perform a permafrost assessment of areas within Bethel that are thawing and analyze study results with proposed future development plans. New action identified in 2017	Life/Safety issue Risk reduction Benefit to entire community	\$25,000	High

Severe Weather			
SW-1. Perform a severe winter storm assessment/analysis. New action identified in 2017	Life/Safety issue Risk reduction Benefit to entire community	\$10,000	High
SW-2. Install a siren to warn people of a severe weather event. New action identified in 2017	Life/Safety issue Risk reduction Benefit to entire community State funding is likely available	\$5,000	High
SW-3. Expand public awareness about NOAA Weather Radio for continuous weather broadcasting and warning tone alert capability. New action identified in 2017	Life/Safety issue Risk reduction Benefit to entire community	Staff time	High

7.5 MITIGATION PROJECT PLAN TABLE

Table 7-5 Mitigation Strategy Plan Table

* Priorities: High = Clearly a life/safety project, or benefits clearly exceed the cost or can be implemented, 0 – 1 year.

Medium = More study required to designate as a life/safety project, or benefits may exceed the cost, or can be implemented in 1 – 5 years.

Low = More study required to designate as a life/safety project, or not known if benefits exceed the costs, or long-term project, implementation will not occur for over 5 years.

** PDMG Pre-Disaster Mitigation Grant

*** HMGP Hazard Mitigation Grant Program

****FMA Flood Mitigation Assistance (Program)

Mitigation Projects	Responsible Agency	Cost	Funding Sources Possible	Priority*
Community-Wide				
COM 1. Develop a Continued Operations Plans and conduct yearly exercises	FEMA DHS&EM	\$35,000	DHS&EM State Homeland Security Program	High

Flood and Erosion Projects				
Project FLD 1. Update Bethel FIRM Maps. Note in 2017: This project is complete and can be deleted in the next HMP update.	FEMA USACE	\$100,000	PDMG** HMGP*** FMA****	High
FLD-2. Pursue obtaining a CRS rating to lower flood insurance rates.	City	\$1,000	PDMG HMGP	Medium
FLD-3. Continue compliance with NFIP.	City DCRA	\$1,000	City	High
FLD-4. Bethel Small Boat Harbor Bank Stabilization	USACE FEMA City, DHS&EM, Municipal Harbor Facilities Grant, Alaska Designated Legislative Grant	\$4 million	City	High
FLD-5. Improvements to Small Boat Harbor	USACE FEMA City, DHS&EM, Municipal Harbor Facilities Grant, Alaska Designated Legislative Grant	\$2.5 million	PDMG USACE	High
FLD-6. Tie-back Replacement on Seawall	USACE FEMA City, DHS&EM	\$4 million	PDMG USACE	High
Tundra/Wildland Fire Projects				
Project FIRE 1. Acquire additional firefighting equipment and training for personnel.	City DHS&EM Volunteer Firefighter's Assistant Grant Rural Firefighter's Assistance Grant, Firefighter Assistant Grant	\$410,000 for 3,500-gallon water tanker and brush mower with arm	State Grant	High

Mitigation Strategy

Project FIRE 2. Purchase additional firefighting equipment and vehicles, such as a Fire Truck and fire extinguishers.	City State Div. of Forestry	\$150,000	State Grants	High
Project FIRE 3. Utility maintenance crews continue existing willow clearing programs.	City Maintenance Crews	Already accounted for in Budget	City	High
Earthquake Projects				
Project EQ1. Perform an engineering assessment of the earthquake vulnerability of identified critical infrastructure owned by the City.	Contractor	\$25,000	State Grants	Low
Project EQ-2. Install non-structural seismic restraints for large furniture such as bookcases, filing cabinets, heavy televisions, and appliances to prevent toppling damage and resultant injuries to small children, the elderly, and pets.	City Maintenance Crews	\$5,000	City	Low
Volcano Projects				
Project V-1. Purchase a local supply of ash masks and store at shelter. Supply should be sufficient for elderly, children, and those with known respiratory ailments.	City Maintenance Crews	\$2,000	City	Medium

Permafrost Projects				
Project P-1. Perform a permafrost assessment of areas within Bethel that are thawing and analyze study results with proposed future development plans.	Contractor	\$25,000	State Grants	High
Severe Weather Projects				
Project SW-1. Perform a severe winter storm assessment/analysis.	Contractor	\$10,000	State Grants	High
Project SW-2. Install a siren to warn people of a severe weather event.	City	\$5,000	State Grants	High
Project SW-3. Expand public awareness about NOAA Weather Radio for continuous weather broadcasting and warning tone alert capability.	City	Staff Time	City	High

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This section describes a formal plan maintenance process to ensure that the HMP remains an active and applicable document. It includes an explanation of how the City's Planning Team intends to organize their efforts to ensure that improvements and revisions to the HMP occur in a well-managed, efficient, and coordinated manner.

The following three process steps are addressed in detail here:

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

8.1 MONITORING, EVALUATING, AND UPDATING THE HMP

The requirements for monitoring, evaluating, and updating the HMP, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Monitoring, Evaluating, and Updating the Plan

Monitoring, Evaluating and Updating the Plan

Requirement §201.6(c)(4)(i): [The plan maintenance process shall include a] section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Element

- Does the new or updated plan describe the method and schedule for monitoring the plan, including the responsible department?
- Does the new or updated plan describe the method and schedule for evaluating the plan, including how, when and by whom (i.e., the responsible department)?
- Does the new or updated plan describe the method and schedule for updating the plan within the five-year cycle?

Source: FEMA, July 2008.

The HMP update was prepared as a collaborative effort among the Planning Team and LeMay Engineering & Consulting, Inc. To maintain momentum and build upon previous hazard mitigation planning efforts and successes, the City will use the Planning Team to monitor, evaluate, and update the HMP. Each authority identified in Table 7-5 will be responsible for implementing the Mitigation Action Plan. The City Planner (Planning Team Leader or designee), will serve as the primary point of contact and will coordinate local efforts to monitor, evaluate, and revise the HMP.

Each member of the Planning Team will conduct an annual review during the anniversary week of the plan's official FEMA approval date to monitor the progress in implementing the HMP, particularly the Mitigation Action Plan. As shown in Appendix E, the Annual Review Worksheet will provide the basis for possible changes in the HMP Mitigation Action Plan by refocusing on new or more threatening hazards, adjusting to changes to or increases in resource allocations, and engaging additional support for the HMP implementation. The Planning Team Leader will

initiate the annual review two months prior to the scheduled planning meeting date to ensure that all data is assembled for discussion with the Planning Team. The findings from these reviews will be presented at the annual Planning Team Meeting. Each review, as shown on the Annual Review Worksheet, will include an evaluation of the following:

- Participation of authorities and others in the HMP 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 HMP.

A system of reviewing the progress on achieving the mitigation goals and implementing the Mitigation Action Plan activities and projects will also be accomplished during the annual review process. During each annual review, each authority administering a mitigation project will submit a Progress Report to the Planning Team. As shown in Appendix E, 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 or not the project has helped achieved the appropriate goals identified in the plan.

In addition to the annual review, the Planning Team will update the HMP every five years. To ensure that this update occurs, in the fourth year following adoption of the HMP, the Planning Team will undertake the following activities:

- Request grant assistance for DHS&EM to update the HMP (this can take up to one year to obtain and one year to update the plan);
- 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 City (a contractor hired by DHS&EM typically does this update via a grant from FEMA);
- Prepare a new draft HMP;
- Submit an updated HMP to the DH&EM and FEMA for approval;
- Submit the FEMA approved plan for adoption by the City of Bethel; and
- Copy of adoption resolution returned to the State and FEMA to receive final HMP approval.

8.2 IMPLEMENTATION THROUGH EXISTING PLANNING MECHANISMS

The requirements for implementation through existing planning mechanisms, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Incorporation into Existing Planning Mechanisms

Incorporation into Existing Planning Mechanisms

Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Element

- Does the new or updated plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?
- Does the new or updated plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?
- Does the updated plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?

Source: FEMA, July 2008.

After the adoption of the HMP update, the Planning Team Leader or his/her designee will ensure that the HMP, in particular each Mitigation Action Project, is incorporated into existing planning mechanisms. The Planning Team Leader or his/her designee will achieve this incorporation on an annual basis 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 HMP update 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.

8.3 CITY CAPABILITY ASSESSMENT

The City's capability assessment reviews the technical and fiscal resources available to the community. This section outlines the resources available to the City for mitigation and mitigation related funding and training.

Table 8-1 City of Bethel Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing Yes/No	Comments (Year of most recent update; problems administering it)
Comprehensive Plan	Yes	2011
City Charter	Yes	Defines the City's governance, staffing, and financial capabilities
Building code	Yes	City

Table 8-1 City of Bethel Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Existing Yes/No	Comments (Year of most recent update; problems administering it)
Zoning ordinances	Yes	City
Subdivision ordinances or regulations	Yes	City
Land Use, Planning, and Platting	Yes	City
Erosion Study	Yes	U.S. Army Corps of Engineers, <i>Alaska Baseline Erosion Assessment, Erosion Information Paper – Bethel, Alaska</i> . 2009 defined the City's erosion threat
Flood Insurance Rate Map	Yes	<i>City of Bethel FIRM</i> , 2009
Floodplain Regulations	Yes	
Wildfire Protection Plan	No	
Emergency Response Plans	Yes	2005
Community Profile	Yes	<i>State of Alaska, Department of Commerce, Community and Economic Development Community Profile Map</i> provided historical and demographic information

Federal Resources

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

- FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from FEMA Publication Warehouse (1-800-480-2520) and are briefly described here:
 - How-to Guides. FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides describe the four major phases of hazard mitigation planning. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements (<http://www.fema.gov/fima/planhowto.shtm>).
 - Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments. FEMA DAP-12, September 1990. This handbook explains the 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. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.
- Mitigation Resources for Success compact disc (CD). FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for state and local government planners and other stakeholders in the mitigation process. It 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.
 - A Guide to Federal Aid in Disasters. FEMA 262, April 1995. When disasters exceed the capabilities of state and local governments, the President's disaster assistance programs (administered by FEMA) is the primary source of Federal assistance. This handbook discusses the procedures and process for obtaining this assistance, and provides a brief overview of each program.
 - The Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to a community's industries and businesses located in hazard prone areas.
 - The FEMA Hazard Mitigation Assistance (HMA Unified Guidance, June 1, 2009). The guidance introduces the five HMA grant programs, funding opportunities, award information, eligibility, application and submission information, application review process, administering the grant, contracts, additional program guidance, additional project guidance, and contains information and resource appendices (FEMA 2009).
 - Department of Agriculture (USDA). Assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.
 - Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program. This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks.
 - Department of Health and Human Services, Administration of Children & Families, Administration for Native Americans (ANA). The ANA awards funds through grants to American Indians, Native Americans, Native Alaskans, Native Hawaiians, and Pacific Islanders. These grants are awarded to individual organizations that successfully apply for discretionary funds. ANA publishes in the Federal Register an announcement of funds available, the primary areas of focus, review criteria, and the method of application. (<http://www.acf.hhs.gov/programs/ana/>)

- Department of Housing and Urban Development (HUD), Office of Homes and Communities, Section 108 Loan Guarantee Programs. This program provides loan guarantees as security for Federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing.
- Department of Housing and Urban Development, Community Development Block Grants (HUD/CDBG). Provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons.
- Department of Labor (DOL), 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. Member banks of Federal Deposit Insurance Corporation, Financial Reporting Standards or Federal Home Loan Bank Board may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.
- Internal Revenue Service (IRS), Tax Relief. Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous tax returns to reflect loss back to three years.
- U.S. Small Business Administration (SBA). May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. Requests for SBA loan assistance should be submitted to DHS&EM.
- USACE Alaska District's Civil Works Branch studies potential water resource projects in Alaska. These studies analyze and solve water resource issues of concern to the local communities. These issues may involve navigational improvements, flood control or ecosystem restoration. The agency also tracks flood hazard data for over 300 Alaskan communities on floodplains or the sea coast. These data help local communities assess the risk of floods to their communities and prepare for potential future floods. The USACE is a member and co-chair of the Alaska Climate Change Sub-Cabinet.
- USACE Funded Project List that goes to Congress for approval. Any planning projects in Bethel would need to be on that list prior to it going to Congress for approval.

State Resources

- State Homeland Security Grant Program
- State of Alaska Designated Legislative Grant
- DHS&EM is responsible for improving hazard mitigation technical assistance for local governments for the State of Alaska. Providing hazard mitigation training, current hazard information, and communication facilitation with other agencies will enhance local hazard mitigation efforts. DHS&EM administers FEMA mitigation grants to mitigate

future disaster damages such as those that may affect infrastructure including the elevation, relocation, or acquisition of hazard-prone properties. DHS&EM also provides mitigation funding resources for mitigation planning on their Web site at <http://www.ak-prepared.com/plans/mitigation/mitigati.htm>.

- Division of Senior Services (DSS): Provides special outreach services for seniors, including food, shelter and clothing.
- Division of Insurance (DOI): Provides assistance in obtaining copies of policies and provides information regarding filing claims.
- Department of Military and Veterans Affairs (DMVA): Provides damage appraisals and settlements for VA-insured homes, and assists with filing of survivor benefits.
- The Community Health and Emergency Medical Services (CHEMS) is a section within Division of Public Health within the Department of Health and Social Services (DHSS). DHSS is charged with promoting and protecting the public health and one of CHEMS' responsibilities is developing, implementing, and maintaining a statewide comprehensive emergency medical services system. The department's statutory mandate (Alaska Statute 18.08.010) requires it to:
 - Coordinate public and private agencies engaged in the planning and delivery of emergency medical services, including trauma care, to plan an emergency medical services system
 - Assist public and private agencies to deliver emergency medical services, including trauma care, through the award of grants in aid
 - Conduct, encourage, and approve programs of education and training designed to upgrade the knowledge and skills of health personnel involved in emergency medical services, including trauma care
 - Establish and maintain a process under which hospitals and clinics can represent themselves to be trauma centers because they voluntarily meet criteria adopted by the department which are based on an applicable national evaluation system
- DCRA within the DCCED. DCRA administers the HUD/CDBG, FMA Program, and the Climate Change Sub-Cabinet's Interagency Working Group's program funds and administers various flood and erosion mitigation projects, including the elevation, relocation, or acquisition of flood-prone homes and businesses throughout the State. This department also administers programs for State "distressed" and "targeted" communities.
- Division of Environmental Conservation (DEC). The DEC primary roles and responsibilities concerning hazards mitigation are ensuring safe food and safe water, and pollution prevention and pollution response. DEC ensures water treatment plants, landfills, and bulk fuel storage tank farms are safely constructed and operated in communities. Agency and facility response plans include hazards identification and pollution prevention and response strategies.
- Department of Transportation and Public Facilities (DOT/PF) personnel provide technical assistance to the various emergency management programs, to include mitigation. This assistance is addressed in the DHS&EM-DOT/PF Memorandum of

Agreement and includes but is not limited to: environmental reviews, archaeological surveys, and historic preservation reviews.

In addition, DOT/PF and DHS&EM coordinate buy-out projects to ensure that there are no potential right-of-way conflicts with future use of land for bridge and highway projects, and collaborate on earthquake mitigation.

Additionally, DOT/PF provides safe, efficient, economical, and effective operation of the State's highways, harbors, and airports. DOT/PF uses its Planning, Design and Engineering, Maintenance and Operations, and Intelligent Transportation Systems resources to identify the hazard, plan and initiate mitigation activities to meet the transportation needs of Alaskans and make Alaska a better place to live and work. DOT/PF budgets for the temporary replacement bridges and materials necessary to make the multi-modal transportation system operational following a natural disaster.

- DNR administers various projects designed to reduce stream bank erosion, reduce localized flooding, improve drainage, and improve discharge water quality through the stormwater grant program funds. Within DNR, the Division of Geological and Geophysical Survey (DGGS) is responsible for the use and development of Alaska's mineral, land, and water resources, and collaboration on earthquake mitigation.
 - DNR's Division of Geological and Geophysical Survey (DGGS). DGGS collects and distributes information about the State's geologic resources and hazards. Their geologists and support staff are leaders in researching Alaska's geology and implementing technological tools to most efficiently collect, interpret, publish, archive, and disseminate that information to the public
 - The DNR's DOF participates in a statewide wildfire control program in cooperation with the forest industry, rural fire departments and other agencies. Prescribed burning may increase the risks of fire hazards; however, prescribed burning reduces the availability of fire fuels and therefore the potential for future, more serious fires.
 - DOF also manages various wildland fire programs, activities, and grant programs such as the FireWise Program, the Community Forestry Program and the Volunteer Fire Assistance and Rural Fire Assistance Grant programs. Information can be found at <http://forestry.alaska.gov/fire/current.htm>.

Other Funding Sources and Resources

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

- FEMA, <http://www.fema.gov> - includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.
- American Planning Association (APA), <http://www.planning.org> - a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
- Institute for Business and Home Safety (IBHS), <http://ibhs.org> - an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters.

- American Red Cross (ARC). Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided.
- 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.

Local Resources

The City has a number of planning and land management tools that will allow it to implement hazard mitigation activities. The resources available in these areas have been assessed by the hazard mitigation Planning Team, and are summarized below.

Table 8-2 City of Bethel Staff Resources

Staff/Personnel Resources	Y/N	Department/Agency and Position
Planner or engineer with knowledge of land development and land management practices	Yes	Planning Department
Engineer or professional trained in construction practices related to buildings and/or infrastructure	No	Contract out as needed
Planner or engineer with an understanding of natural and/or human-caused hazards	Yes	Planning Department
Floodplain Manager	Yes	City Manager
Surveyors	Yes	City is in the process of hiring an engineering firm to provide surveying as part of their repertoire of services.
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards	Yes	Planning Department
Personnel skilled in Geographic Information System (GIS) and/or HAZUSUS-MH	No	Contract out as needed
Scientists familiar with the hazards of the jurisdiction	No	Contract out as needed
Emergency Operations Manager	Yes	Fire Chief Bill Howell
Administration Grant Writers	Yes	John Sargent
Public Information Officer	Yes	Lori Strickler

Table 8-3 City Financial Resources for Hazard Mitigation

Financial Resources	Y/N	Effect on Hazard Mitigation
General funds	Yes	Limited funding available, appropriated by City Council vote
Authority to levy taxes for specific purposes	Yes	Ratified by public vote
Incur debt through general obligation bonds	Yes	Ratified by public vote
Incur debt through special tax and revenue bonds	Yes	Ratified by public vote
Incur debt through private activity bonds	Yes	Ratified by public vote

Table 8-3 City Financial Resources for Hazard Mitigation

Financial Resources	Y/N	Effect on Hazard Mitigation
Community Development Block Grants	Yes	City Council decides to pursue the grant, and Administration carries out the Council's request.
Capital Improvement Projects Funding	Yes	City Council decides to pursue the funding, and Administration carries out the Council's request.
Hazard Mitigation Grant Program (HMGP)	Yes	FEMA funding which is available to local communities after a Presidentially-declared disaster. It can be used to fund both pre- and post-disaster mitigation plans and projects.
Pre-Disaster Mitigation (PDM) Grant Program	Yes	FEMA funding which available on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects only
Flood Mitigation Assistance (FMA) Grant Program	Yes	FEMA funding which is available on an annual basis. This grant can be used to mitigate repetitively flooded structures and infrastructure to protect repetitive flood structures.
State Homeland Security Program Grant Program	Yes	FEMA funding which supports the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal.
Volunteer Firefighter's Assistance Grant	Yes	FEMA funding to enhance the safety of the public and firefighters by providing direct financial assistance to nonaffiliated EMS organizations.
Rural Firefighter's Assistance Grant	Yes	Fire trucks, equipment, turnouts
State Designated Legislative Grants	Yes	State Capital Budget Grants
United State Fire Administration (USFA) Grants	Yes	The purpose of these grants is to assist state, regional, national or local organizations to address fire prevention and safety. The primary goal is to reach high-risk target groups including children, seniors and firefighters.
Fire Mitigation Fees	Yes	Finance future fire protection facilities and fire capital expenditures required because of new development within Special Districts.

8.4 CONTINUED PUBLIC INVOLVEMENT

The requirements for continued public involvement, as stipulated in the DMA 2000 and its implementing regulations, are described below.

DMA 2000 Requirements: Plan Maintenance Process - Continued Public Involvement

Continued Public Involvement

Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

Element

- Does the new or updated plan explain how continued public participation will be obtained?

Source: FEMA, July 2008.

The City is dedicated to involving the public directly in the continual reshaping and updating of the HMP. A paper copy of the HMP and its updates and any proposed changes will be available at the City Office. An address and phone number of the Planning Team Leader to whom people can direct their comments or concerns will also be available at the City Office.

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

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1. Alaska Economic Information System. DCRA, Bethel Census Bureau Regional Profile, www.dkra.state.ak.us/cbd/AEIS Online database, 2017.
2. *Alaska State Hazard Plan*. Prepared by and for DHS&EM. 2013
3. *Bethel Coastal Management Plan*. Conceptually Approved Draft. City of Bethel, June 1983.
4. *Bethel Coastal Management Plan*. Enforceable Policies. City of Bethel, January 1984.
5. *Bethel Coastal Management Plan Amendment*. City of Bethel, BP&D, January 2007.
6. *Bethel Comprehensive Plan*. City of Bethel, August 1997 and September 2011.
7. *Bethel Comprehensive Economic Development Strategy*. City of Bethel, May 2003.
8. *Bethel City website* <http://www.cityofbethel.org/>.
9. *Bethel Emergency Operations Plan*, 2005. City of Bethel, Alaska.
10. *Bethel Port Development Plan*. City of Bethel, January 1994.
11. *Climate change impacts, vulnerabilities, and adaptation in Northwest Alaska (No. 06-11)*. Gregory, R., Failing, L., & Leiserowitz, A. (2006). Eugene: Decision Research. http://www.decisionresearch.org/Projects/Climate_Change/
12. *FEMA Benefit-Cost Analysis Website*: <http://www.fema.gov/government/grant/bca>.

FEMA How to Guides
Getting Started: Building Support For Mitigation Planning (FEMA 386-1)
Understanding Your Risks: Identifying Hazards And Estimating Losses (FEMA 386-2)
Developing The Mitigation Plan: Identifying Mitigation Actions And Implementing Strategies (FEMA 386-3)
Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA 386-4)
Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)
13. *Potential Consequences of Climate Variability and Change for Alaska*. Parson, Edward A., et al. (1999) A Report of the Alaska Regional Assessment Group for the U.S. Global Change Program. Prepared for the Center for Global Change and Arctic Research. Fairbanks.
14. *Kuskokwim Delta Watershed, Alaska Discovery Report*, November 2016 was prepared by FEMA as a preparatory phase to begin development of a Risk MAP.

15. Alaska Dispatch News, July 9, 2017 article by Lisa Demer, “*The Permafrost is Dying: Bethel’s Roads, Buildings Shifting*”
16. MMI. 2006. Modified Mercalli Intensity Scale. Michigan Technical University. Available: <http://www.geo.mtu.edu/UPSeis/Mercalli.html>.

Appendix A
Public Involvement

Hazard Mitigation Plan Update for Bethel, Alaska

Newsletter #1: July 31, 2017



"Photo Credit: Department of Commerce, Community and Economic Development; Division of Community and Regional Affairs' Community Photo Library."

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from FEMA to update the 2008 hazard mitigation plan (HMP) for the City of Bethel. LeMay Engineering & Consulting, Inc. was contracted to assist the City with updating the HMP.

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

Attend the August 10, 2017, Zoning and Commissioning Meeting at 6:30 pm: One of the agenda items will be a summary of the HMP process by Jennifer LeMay. You're invited to provide input to the plan. Specifically, we'll be discussing what information has changed since the HMP was developed in 2008.

For more information, contact:

Ted Meyer, City Planner, (907) 543-5306

Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061

George Grady, DMVA, DHS&EM Project Manager, (907) 428-7055

Hazard Mitigation Plan Update for Bethel, Alaska

Newsletter #2: August 4, 2017



"Photo Credit: Department of Commerce, Community and Economic Development; Division of Community and Regional Affairs' Community Photo Library."

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from FEMA to update the 2008 hazard mitigation plan (HMP) for the City of Bethel. LeMay Engineering & Consulting, Inc. was contracted to assist the City with updating the HMP.

The goal of Newsletter #2 is to announce the availability of the working draft copy and to invite you to the August 10 meeting to provide comments, identify key issues or concerns, and improve mitigation ideas. Jennifer LeMay and the Planning Team have prepared a working draft copy of the plan. This plan has been posted at City Hall for your review. Comments or questions can be emailed to Jennifer LeMay at jlemay@lemayengineering.com or provided at the meeting.

Attend the August 10, 2017, Zoning and Commissioning Meeting at 6:30 pm: One of the agenda items will be a summary of the HMP process by Jennifer LeMay. You're invited to provide input to the plan. Specifically, we'll be discussing what information has changed since the HMP was developed in 2008.

For more information, contact:

Ted Meyer, City Planner, (907) 543-5306

Jennifer LeMay, PE, PMP, Lead Planner, (907) 350-6061

George Grady, DMVA, DHS&EM Project Manager, (907) 428-7055

Bethel Multi-Hazard Mitigation Plan Meeting

August 10, 2017

6:30 pm

Name	Organization	Contact Information (phone or email)
Alex Wasierski	Planning Commission	907-545-3499
Betsy Jumper	↑ Planning Dept. City of Bethel	907-543-5301
Larria Biedberg	Planning Commission	907-545-1945
John P. Guinn	PLANNING COMMISSION	907-545-4442
Kathy Hanson	Planning Commission	907 545 0905
Jon Cochran	Planning Commission	907-545-1210
TED MEYER	CITY OF BETHEL PLANNING DEPT	907-543-5306
Bill Howell	Bethel Fire	907 545 4998
JENNIFER LEMAY	LEMAH ENGINEERING + CONSULTING	907 350 6061
JOHN SARGENT	GRANT MANAGER	907 543-1386

City of Bethel, Alaska

Planning Commission

August 10, 2017

Regular Meeting

Bethel, Alaska

I. CALL TO ORDER

A regular meeting of the Planning Commission was held on August 10, 2017 at 6:30 pm in the City of Bethel Council Chambers room, in Bethel, Alaska. Chair Hanson called the meeting to order at 6:30 PM.

II. ROLL CALL

Compromising a quorum of the Commission, the following members were present for roll call: Kathy Hanson, John Guinn, Jon Cochrane, Alex Wasierski, and Lorin Bradbury. Also present was Ex-Officio City Planner Ted Meyer and Recorder Betsy Jumper.

Other people present were Ms. Jennifer LeMay, of LeMay Engineering, and Mr. John Sargent, Grant Manager of the City of Bethel, and Mr. Bill Howell, Fire Chief of the City of Bethel.

III. PEOPLE TO BE HEARD: *Nobody wished to be heard.*

IV. APPROVAL OF THE AGENDA

MOTION TO APPROVE THE AGENDA OF AUGUST 10, 2017

MOVED:	Jon Cochrane	To approve the agenda.
SECONDED:	Lorin Bradbury	
VOTE ON MOTION	All in favor 5 for and 0 opposed.	

V. APPROVAL OF THE MINUTES

MOTION TO APPROVE THE MINUTES OF THE JULY 13 REGULAR MEETING

MOVED:	Jon Cochrane	To approve the minutes.
SECONDED:	Lorin Bradbury	
VOTE ON MOTION	All in favor 5 yes and 0 opposed.	

VI. NEW BUSINESS

A. Hazard Mitigation Plan Update for Bethel.

MOTION TO GO INTO COMMISSION AS A WHOLE

MOVED:	Jon Cochrane	To go into commission as a whole.
SECONDED:	John Guinn	
VOTE ON MOTION	All in favor 5 yes and 0 opposed.	

Ms. Jennifer LaMay summarized the Hazard Mitigation Plan for Bethel (HMP) and gave a power point presentation. The Planning Commission as well as Mr. Sargent and Mr. Howell gave their input into identifying updates/natural hazards from the 2008 HMP and additional hazards that may occur in Bethel.

Ms. LaMay explained that after she prepares the draft with the publics' input, it will then go on to the State, and then after that, FEMA. Once that draft is finalized, it will go to the City Council and the City Council will do a resolution. Ms. LaMay estimated the time frame would be approximately November or December.

MOTION TO COME OUT OF THE COMMISSION AS A WHOLE

MOVED:	Jon Cochrane	To come out of commission as a whole.
SECONDED:	Lorin Bradbury	
VOTE ON MOTION	All in favor 5 yes and 0 opposed.	

VII. PLANNER'S REPORT: Ted went over the monthly happenings.

VIII. COMMISSIONER'S COMMENTS: **Lorin:** It's been a pleasure working with Ted, sorry to see you go. Thank you for all you have done. I think the water and sewer needs need to rise with development; it shouldn't be the other way around, that development is hindered by whether or not we have enough water and sewer trucks. I think the City needs to be thinking in terms of we are growing, and they need to rise to meet more development, more revenue to pay for that. The other thing we've talked about in the past was zoning. We did get one subdivision zoned, believe it was Larson; I'd like to see us get the rest of Bethel zoned, and then address land issues with abandoned buildings. What can we do? Also, abandoned cars are a concern. I'd like to see us address that as well. **John:** Thank you Ted, you did a heck of a great job, sorry to see you go. **Jon:** Thank you Ted, it was good having you while we had you, hope your replacement is at least as competent as you. **Alex:** Wish Ted wasn't leaving and also I agree with Lorin that water and sewer should not be hindering everything. **Kathy:** I already said Ted don't go because in my short time here, man, we got so much done!!! I had no idea that Planning Commission could do so much. I hope whatever the next act is will be as good as you. Good luck Ted. I also agree about the water and sewer—tail that's wagging the dog. I would encourage everyone to try to get to the public hearing about the AVEC wind turbine Wed. 23rd at 5:30 at the Cultural Center. They may want more towers--we want to make sure everything is done the right way.

VIII. ADJOURNMENT

MOVED:	Jon Cochrane	Motion to adjourn the meeting at 8.00 pm.
SECONDED:	John Guinn	
VOTE ON MOTION	5 yes and 0 opposed.	

The next meeting will be on September 14, 2017

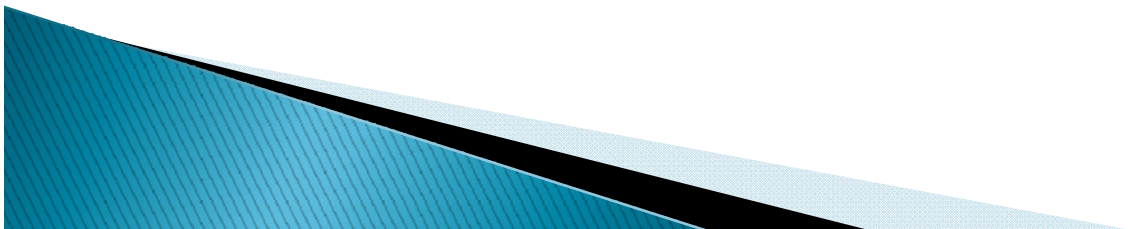
ATTEST: _____, Kathy Hanson, Chairperson
 _____, Betsy Jumper, Recorder

=====



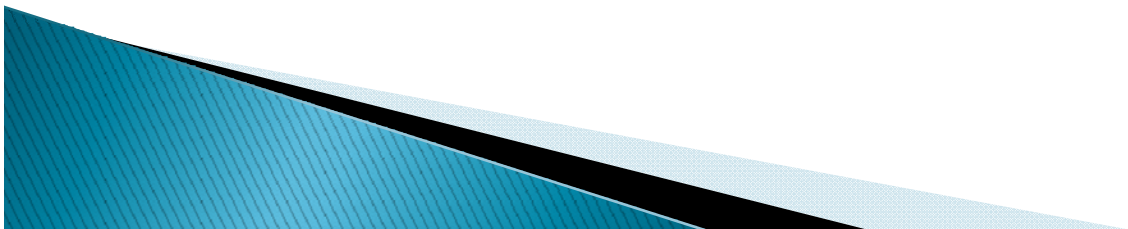
City of Bethel Hazard Mitigation Plan (HMP) Update

- ▶ The City developed a HMP in 2008.
- ▶ FEMA requires HMPs to be updated every 5 years.
- ▶ The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from FEMA to update the City of Bethel HMP.
- ▶ LeMay Engineering & Consulting, Inc. was contracted to assist the City with updating the HMP in 2017.



2017 Planning Team

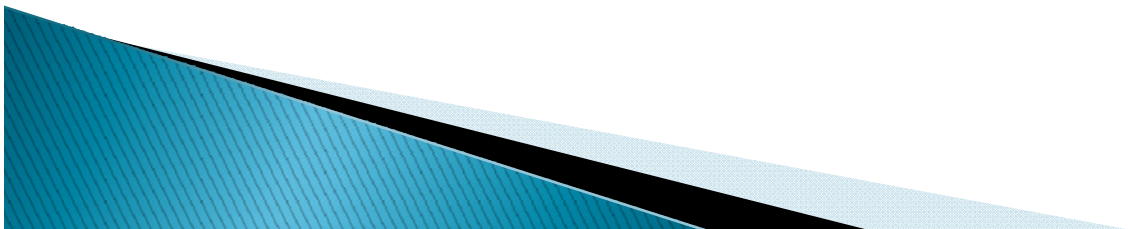
- ▶ Ted Meyer, City Planner
- ▶ Betsy Jumper, Planning Technician
- ▶ John Sargent, Grant Writer
- ▶ Peter Williams, City Manager
- ▶ Bill Howell, Fire Chief
- ▶ Jennifer LeMay, PE, PMP, Planning Consultant
- ▶ George Grady, State Hazard Planner
- ▶ Brent Nichols, State Hazard Mitigation Officer



Hazard Mitigation Plan Process

The Planning Team worked through the following HMP update process.

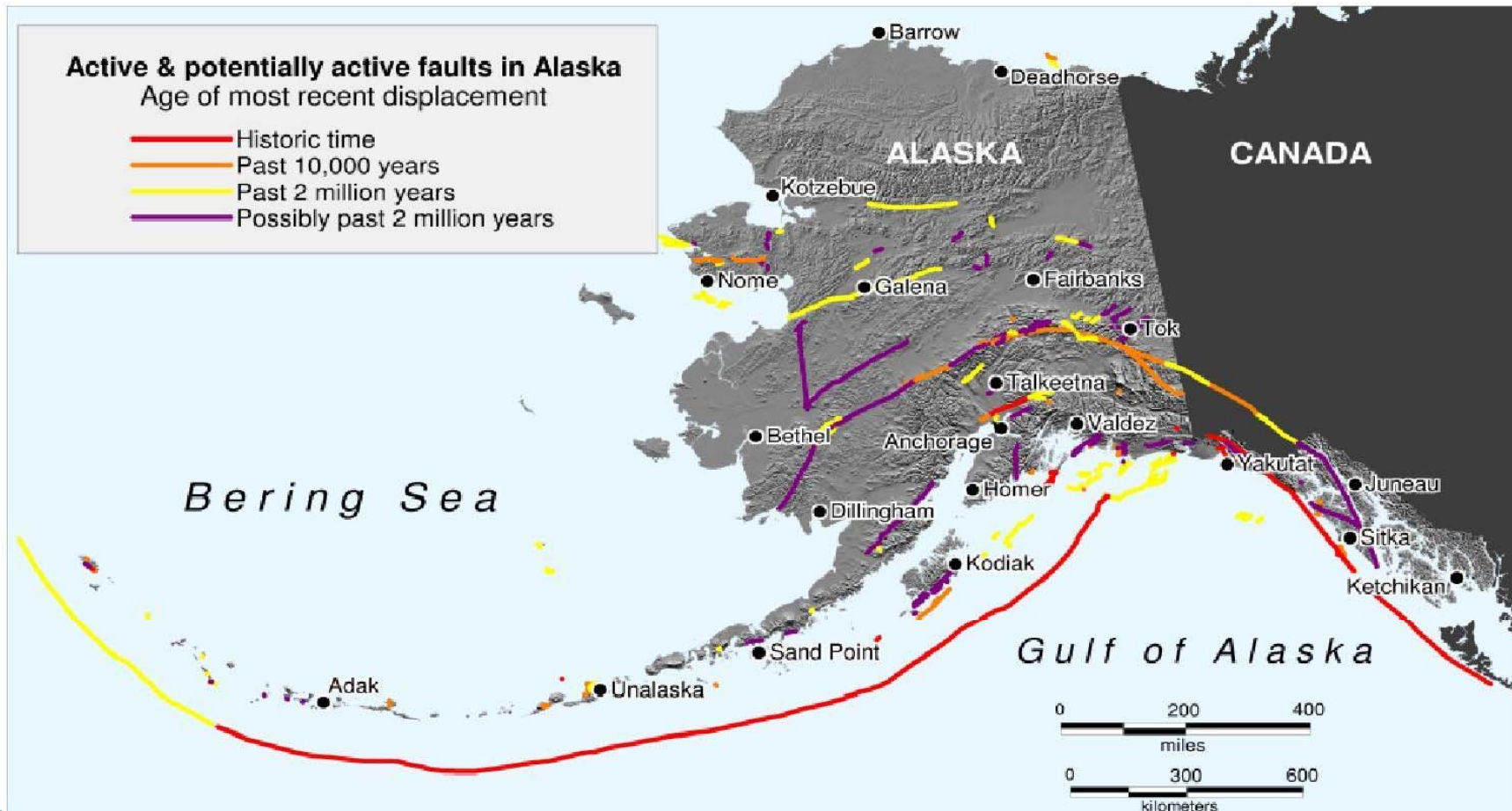
1. Evaluated the 11 possible hazards that could affect the Lower Kuskokwim Regional Education Attendance Area (REAA) from the 2013 State of Alaska All-Hazards Mitigation Plan.
2. Developed hazard profiles for the 7 identified hazards that could potentially affect Bethel. Hazard profiles are based on the following factors: nature, history, location, extent (magnitude and severity), impact, and probability of future events.



Identification and Screening of Hazards

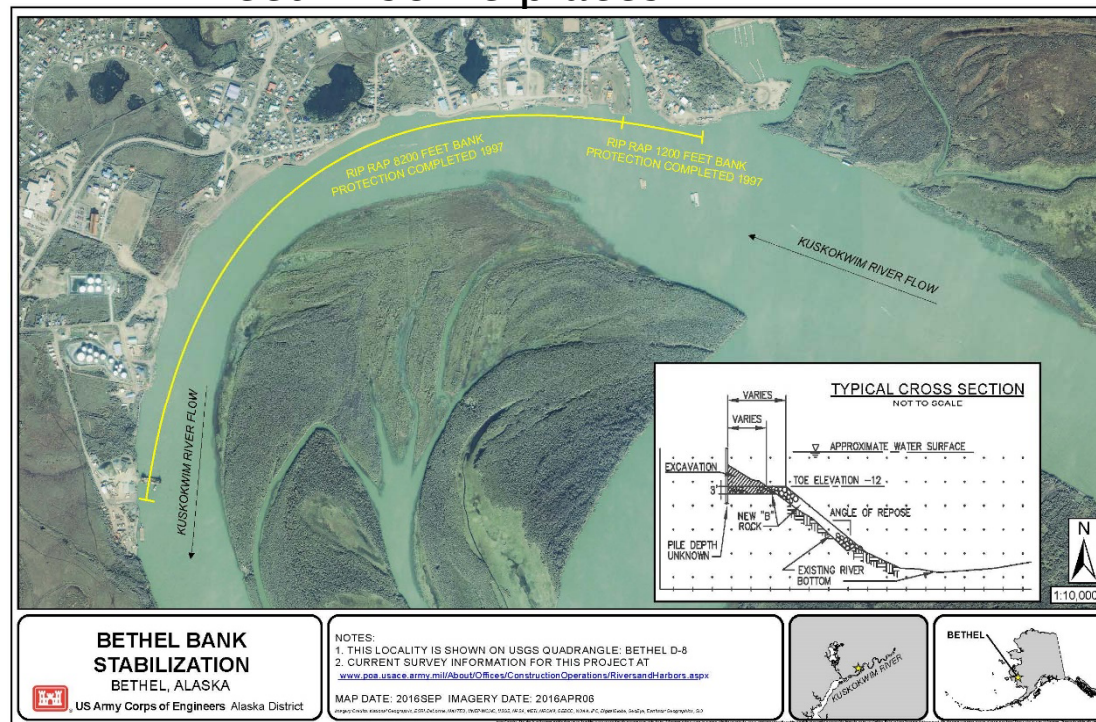
- ▶ The 11 Possible Hazards in the State of Alaska
 - ▶ 1. Avalanche
 - ▶ 2. Earthquake
 - ▶ 3. Erosion
 - ▶ 4. Flood
 - ▶ 5. Landslide
 - ▶ 6. Permafrost
 - ▶ 7. Tsunami & Seiche
 - ▶ 8. Volcano
 - ▶ 9. Severe Weather
 - ▶ 10. Fires
 - ▶ 11. Climate Change
- ▶ 2007 HMP identified the following hazards as impacting Bethel: Earthquake, Erosion, Flood, Severe Weather, Fires, and Climate Change
- ▶ In 2017, Planning Team kept the 6 hazards from 2007 and added Permafrost

Earthquakes felt in the Bethel area have not exceeded M 5.0 in the past 46 years.



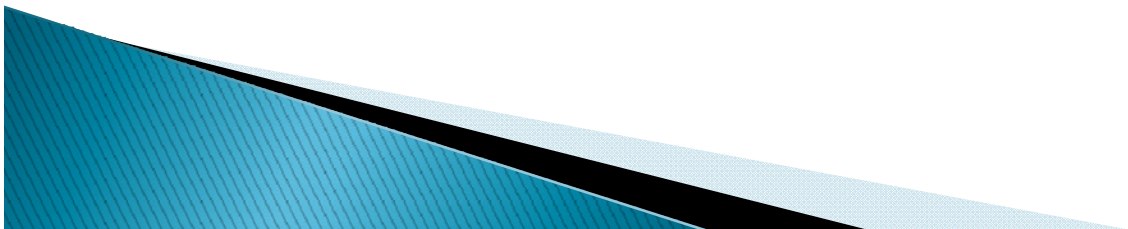
Erosion

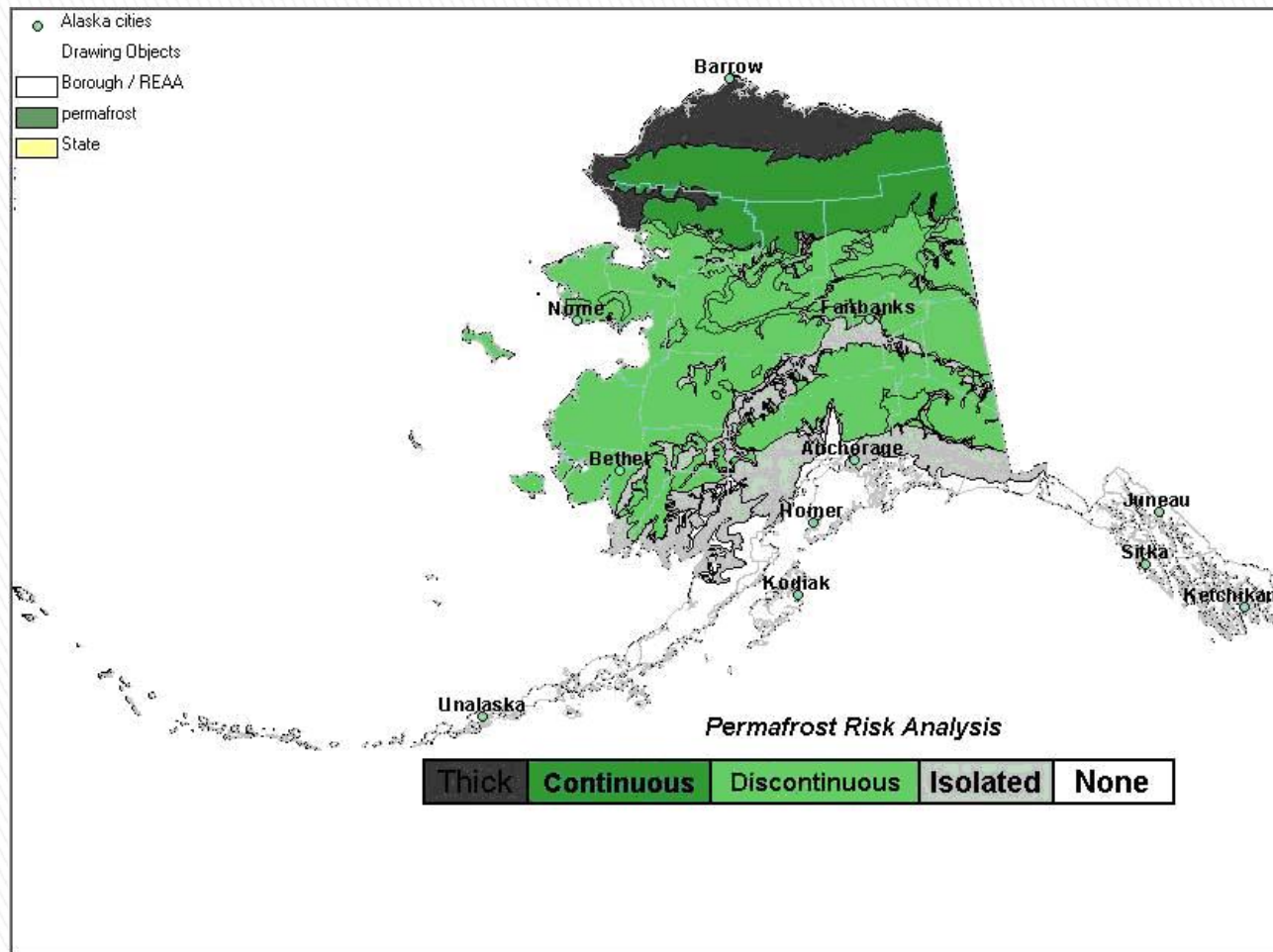
Peter Williams, former Port Director and current City Manager, stated in 2017, “What we have seen is that the river is getting narrower in front of town in certain places. It also has gotten deeper along the side of the river that the city sits on, as much as 65 feet in some places”.



Flooding

- ▶ Bethel entered the National Flood Insurance Program in 1976
- ▶ Bethel has only one repetitive loss property (3 losses: 2005, 1999, 1995 for a total repetitive loss of \$21,040)
- ▶ In 2016, FEMA completed a Risk MAP inventory and published a Kuskokwim Delta Watershed Discovery Report in November 2016. FEMA will use this information obtained in the future with the LiDAR and building inventory to create updated FIRM maps for the Bethel area. The last FIRMs were completed in 2009.



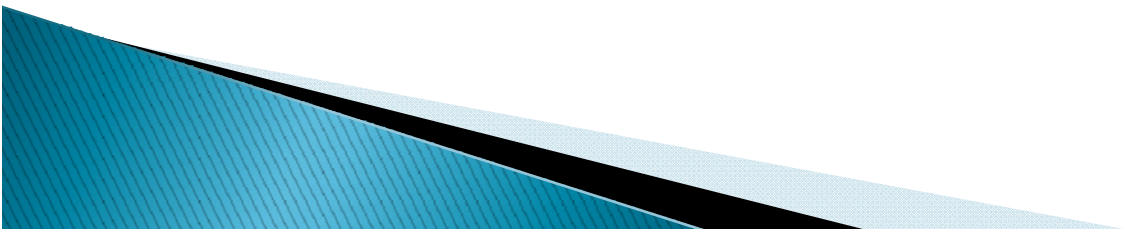


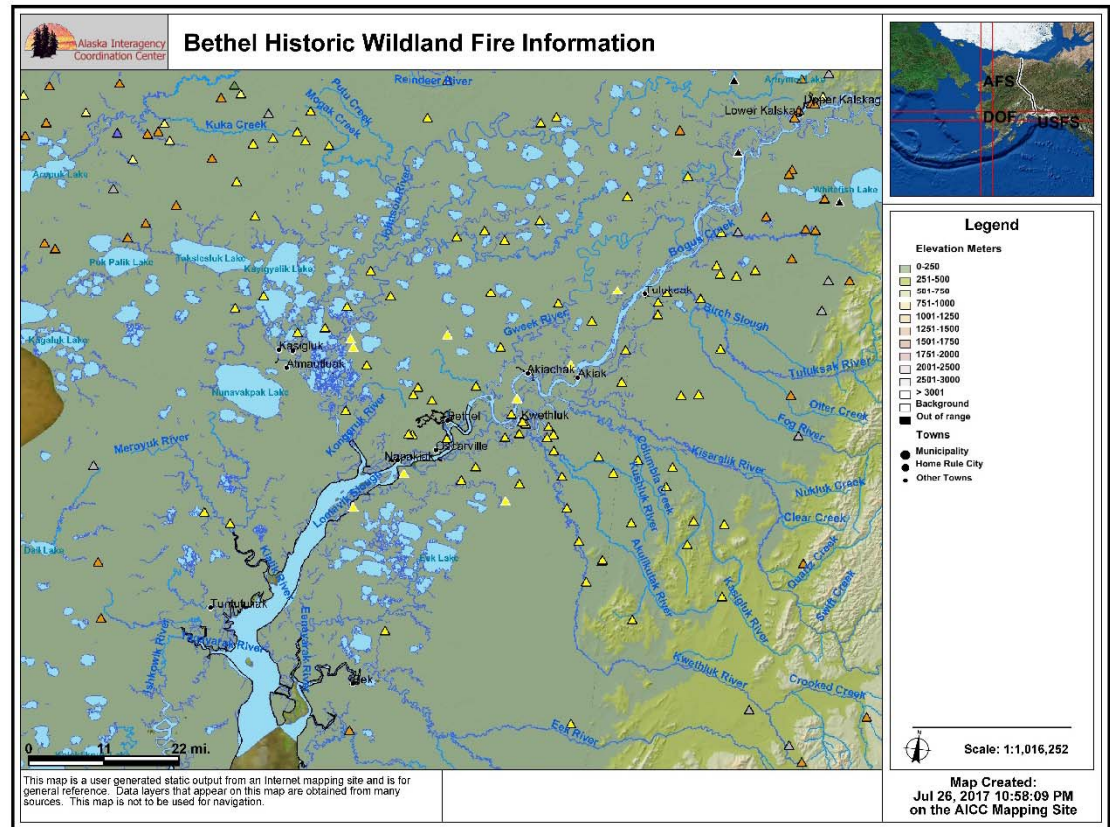
Permafrost

The Alaska Dispatch News published a story on July 9, 2017 entitled "The Permafrost is Dying: Bethel's Roads, Buildings Shifting." The article summarized how 35 years ago, building crews used to find permafrost four to six feet below the ground surface and are now finding permafrost at eight to twelve feet down. Permafrost in and around Bethel is deteriorating and shrinking, even more quickly than most places in Alaska. (ADN 2017)

Severe Weather

- Heavy Drifting Snow
- Freezing Rain/Ice Storm
- Extreme Cold
- High Winds





Wildland Fire History

- ▶ Wildland fires have not been documented within the boundaries of the City; however, wildland fires have occurred in the City's vicinity. The Alaska Interagency Coordination Center (AICC) provided the City's wildland fire information contained in the figure. Approximately 95 wildland fires occurred within 50 miles of the City from 1939 to 2017.

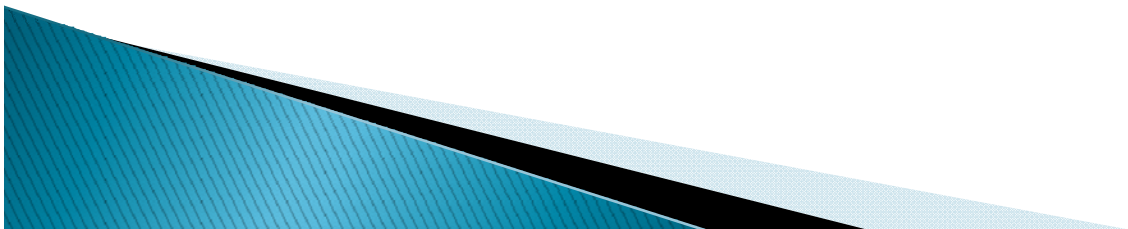
Local Impacts of Climate Change

- ▶ Climate change has the potential to aggravate natural disasters along the coastline and rivers, particularly flooding and permafrost degradation. Climate change will continue to exacerbate the issue.
- ▶ David E. Trantham, Jr., 94 year old Alaskan with 51 years of residence in Bethel, stated in 2017 that he believes climate change is occurring in Bethel. He has observed:
 - Less high water
 - Thinner river ice
 - Fewer ice jams
 - This year's growth of brush was at an increased rate, and he has seen an influx of birds and insects in Bethel that have never existed there.



Hazard Mitigation Plan Process

3. Conducted a vulnerability analysis (risk assessment) that predicts the extent of exposure that may result from a hazard event of a given intensity to a specific area.
4. Developed a mitigation strategy.



Mitigation Strategy Plan

Mitigation Project	Responsible Agency	Estimated Cost	Funding Sources Possible	Priority
1. Develop a Continuity of Operations Plan (COOP)	City of Bethel	\$35,000	DHS&EM State Homeland Security Program	High
2. Update Bethel Flood Insurance Rate Maps	DCRA/FEMA	\$100,000	Ongoing now as part of RISKMAP program	High
3. Pursue obtaining a CRS rating to lower flood insurance rates	City	\$1,000	PDMG HMGP FEMA NFIP	Medium
4. Continue compliance with NFIP.	City	\$1,000	City	High

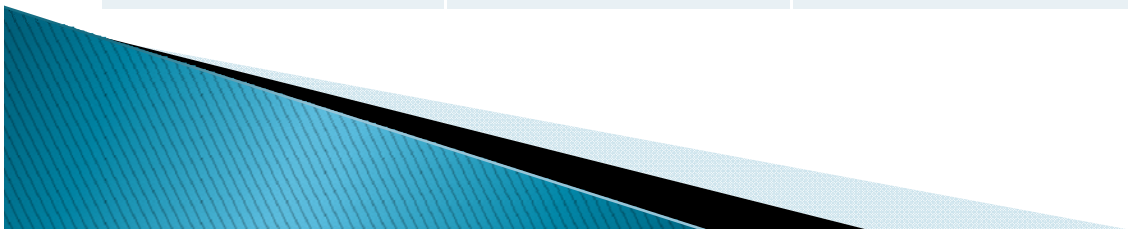


Mitigation Strategy Plan Continued

Mitigation Project	Responsible Agency	Estimated Cost	Funding Sources Possible	Priority
5. Bethel Small Boat Harbor Bank Stabilization	USACE, City	How much was capital budget request for?	Municipal Harbor Facilities Grant, Alaska Designated Legislative Grant	High
6. Improvements to Small Boat Harbor	USACE, City	\$2.5 million	USACE, City, Municipal Harbor Facilities Grant, Alaska Designated Legislative Grant	High
7. Tie-back Replacement on Seawall	USACE, City	\$4 million	USACE, City, Municipal Harbor Facilities Grant, Alaska Designated Legislative Grant	High

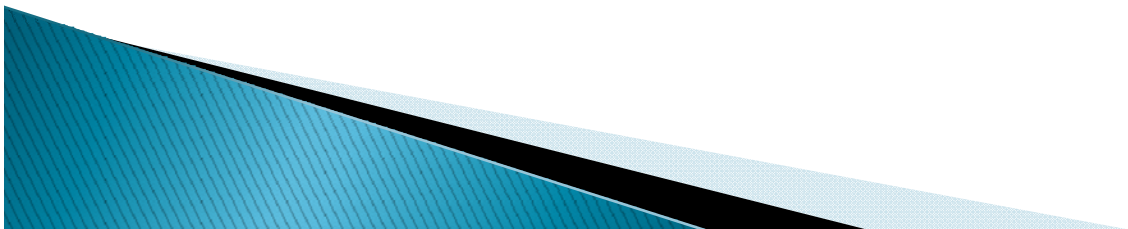
Mitigation Strategy Plan Continued

Mitigation Project	Responsible Agency	Estimated Cost	Funding Sources Possible	Priority
8. Acquire additional firefighting equipment and training for personnel	City	Chief Howell	City, Volunteer Firefighter's Assistant Grant, Rural Firefighter's Assistant Grant, Firefighter Assistant Grant	High
9. Purchase additional firefighting equipment and vehicles, such as a Fire Truck and fire extinguishers.	City	Chief Howell	City, Volunteer Firefighter's Assistant Grant, Rural Firefighter's Assistant Grant, Firefighter Assistant Grant	High



Steps to 2017 HMP Update Completion

- August 10: Planning Commission Meeting
 - Provide overview of Planning Team's progress in updating 2017 Bethel HMP
 - Announce availability of plan for review (plan is in packet posted on the City of Bethel's website)
 - Comment on plan
 - 1. Commenting at August 10 meeting
 - 2. Email your comments to jlemay@lemayengineering.com
 - 3. Call Jennifer LeMay with your comments-907-350-6061
- August 15 – September 30: State of Alaska reviews 2017 Bethel HMP Update
- October 1– November 15: FEMA reviews 2017 Bethel HMP Update
- End of Year: Bethel City Council adopts plan by resolution



Public Comments Received

1. Ms. Nikki Hoffman was unable to attend the August 10, 2017 meeting. She called Jennifer LeMay on August 14 to provide public comment. Ms. Hoffman's contact information is (907) 545-2554/2838 and nhoffman@nativecounsel.org. Ms. Hoffman would like to advocate for the elderly and disabled. She would like to go on record that evacuations of elderly and disabled residents of other villages to Bethel are an area of concern. Ms. LeMay suggested this information would be critical to include in either a Small Community Emergency Plan (plan recommended for villages with less than 2,000 residents) or an Emergency Operations Plan. Ms. Hoffman also stressed the importance of including elder knowledge in development of any plan. Ms. LeMay summarized her phone call earlier this month with Mr. David E. Trantham, Jr., a 94 year old man with 51 years of residence in Bethel. Mr. Trantham's knowledge and observations were very helpful and relevant to the HMP update, and many parts of their conversation were included in appropriate sections of this HMP update.

Appendix B
Land Use Maps



CITY OF BETHEL OFFICIAL LAND USE MAP

Legend

Open Space

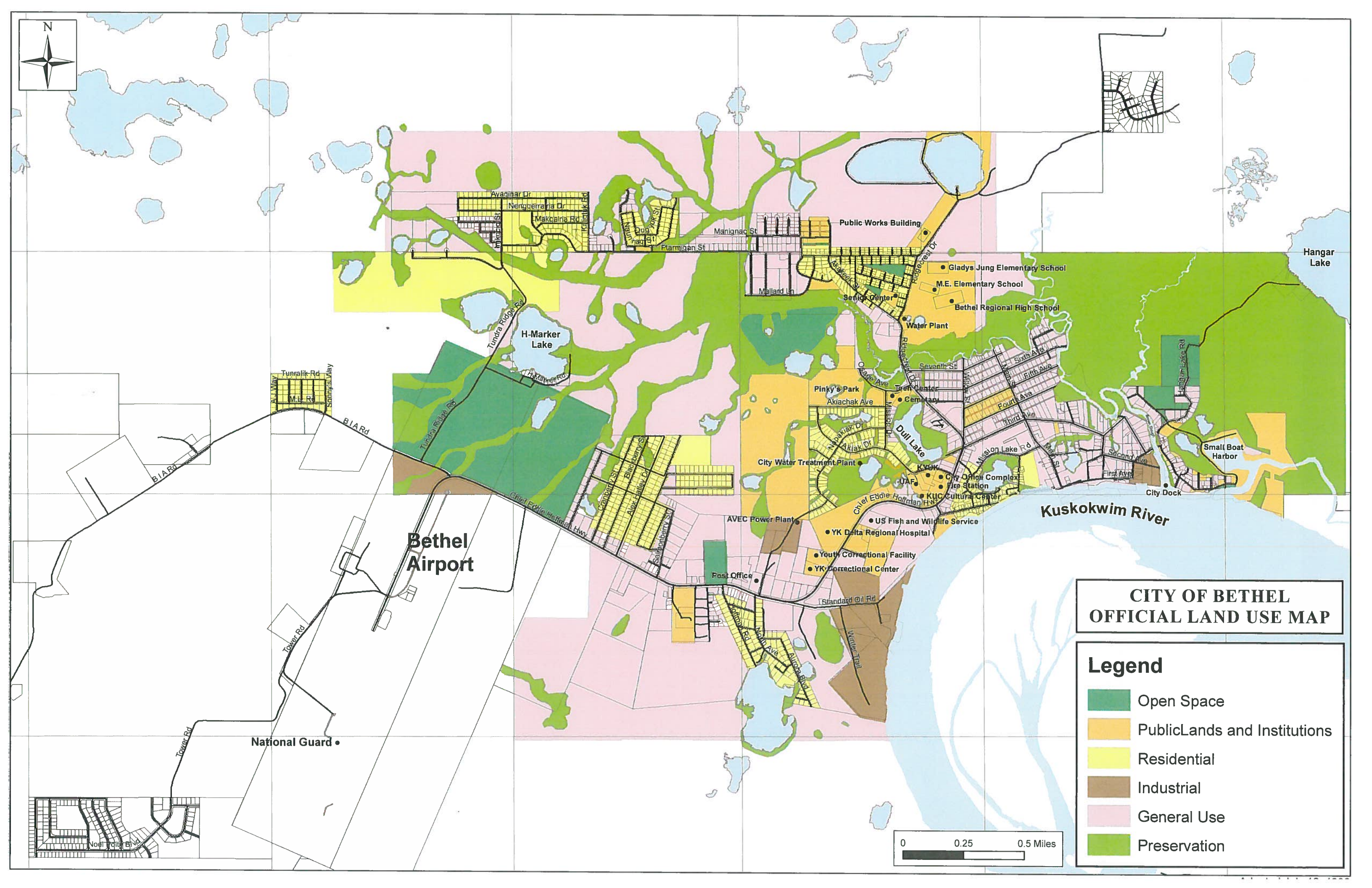
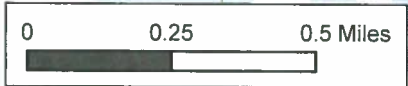
Public Lands and Institutions

Residential

Industrial

General Use

Preservation



Appendix C
FEMA REVIEW TOOL

APPENDIX A:

LOCAL MITIGATION PLAN REVIEW TOOL

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

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

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

Jurisdiction: Bethel, Alaska (Region 10)	Title of Plan: City of Bethel Local Hazard Mitigation Plan Update	Date of Plan: August 15, 2017
Local Point of Contact: Betsy Jumper	Address: P.O. Box 1388 Bethel, AK 99559	
Title: Planning Director		
Agency: City of Bethel		
Phone Number: (907) 543-5306	E-Mail: bjumper@cityofbethel.net	

State Reviewer: George Grady	Title: Hazard Mitigation Planner	Date:
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FEMA Reviewer: Amanda Siok Amanda.Siok@fema.dhs.gov	Title: Mitigation Planner	Date: 11/15/2017
Date Received in FEMA Region 10	10/02/2017; 01/08/2018	
Plan Not Approved		
Plan Approvable Pending Adoption	3/14/2018	
Plan Approved		

**SECTION 1:
REGULATION
CHECKLIST**

INSTRUCTIONS: The Regulation Checklist must be completed by FEMA. The purpose of the Checklist is to identify the location of relevant or applicable content in the Plan by Element/sub-element and to determine if each requirement has been 'Met' or 'Not Met.' The 'Required Revisions' summary at the bottom of each Element must be completed by FEMA to provide a clear explanation of the revisions that are required for plan approval. Required revisions must be explained for each plan sub-element that is 'Not Met.' Sub-elements should be referenced in each summary by using the appropriate numbers (A1, B3, etc.), where applicable. Requirements for each Element and sub-element are described in detail in this *Plan Review Guide* in Section 4, Regulation Checklist.

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT A. PLANNING PROCESS				
A1. Does the Plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))	Chapter 4, pages 4-1 thru 4-5, Appendix A PDF 24-26 and 101-104	X		
A2. Does the Plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))	Chapter 4, plan update will be uploaded to DHS&EM webpage for review PDF 24-26 and 101-104	X		
A3. Does the Plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))	Chapter 4, pages 4-1 thru 4-5, Appendix A PDF 24-26 and 101-104	X		
A4. Does the Plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement §201.6(b)(3))	Chapter 4, page 4-4/5 PDF 26-27, 111	X		
A5. Is there discussion of how the community(ies) will continue public participation in the plan maintenance process? (Requirement §201.6(c)(4)(iii))	Chapter 8, Appendix E PDF 94-95	X		
A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle)? (Requirement §201.6(c)(4)(i))	Chapter 8, Appendix E PDF 85-94	X		
<u>ELEMENT A: REQUIRED REVISIONS</u>				

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT B. HAZARD IDENTIFICATION AND RISK ASSESSMENT				
B1. Does the Plan include a description of the type, location, and extent of all natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))	Chapter 5, Section 5.3 and its subsections PDF 33-35, 38-41, 42, 45-47, 50, 52-53, 54-56, 57, 59, 62-63, 64	X		
B2. Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))	Chapter 5, Pages 5-6 to 5-8, 5-9 to 5-13, 5-15 to 5-19, 5-22 to 5-25, 5-26 to 5-28, 5-30 to 5-32, 5-33 to 5-35, 5-36 to 5-37 PDF 34-35, 38, 43-45, 51-53, 54, 58, 60, 63, 65	X		
B3. Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))	Chapter 5, Page 5-7, 5-13, 5-19, 5-25, 5-27, 5-31/32, 5-35, 5-36, 6-8 to 6-9 PDF 30, 35, 41, 47, 53, 55, 59, 63, 64. PDF 73 -75	X		
B4. Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))	Page 6-3 PDF 15, 47-49, 69	X		
<u>ELEMENT B: REQUIRED REVISIONS</u>				

ELEMENT C. MITIGATION STRATEGY			
C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement §201.6(c)(3))	Tables 8-1, 8-2, and 8-3 on pages 8-3/4, and 8-9/10 as well as Chapter 2 on page 2-1, Chapter 7 and Tables 7-4 and 7-5 PDF 87-94	X	
C2. Does the Plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement §201.6(c)(3)(ii))	Section 5.3.3 and page 6-3 PDF 83	X	
C3. Does the Plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))	Chapter 7, Tables 7-1 and 7-2 PDF 77	X	
C4. Does the Plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))	Chapter 7, Tables 7-4 and 7-5 PDF 82-84	X	
C5. Does the Plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))	Chapter 7, Tables 7-4 and 7-5 PDF 83-84	X	
C6. Does the Plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))	Pages 8-2 and 8-3, Appendix E PDF 86-94	X	
<u>ELEMENT C: REQUIRED REVISIONS</u>			

1. REGULATION CHECKLIST		Location in Plan (section and/or page number)	Met	Not Met
Regulation (44 CFR 201.6 Local Mitigation Plans)				
ELEMENT D. PLAN REVIEW, EVALUATION, AND IMPLEMENTATION (applicable to plan updates only)				
D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))	Section 6.3, Page 6-9 PDF 71-75	X		
D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))	PDF 24, PDF 81-84	X		
D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))	PDF 24	X		
<u>ELEMENT D: REQUIRED REVISIONS</u>				
ELEMENT E. PLAN ADOPTION				
E1. Does the Plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))	City Adoption Letter to be included on Page vii			X
E2. For multi-jurisdictional plans, has each jurisdiction requesting approval of the plan documented formal plan adoption? (Requirement §201.6(c)(5))	Not applicable - City Plan only	N/A		
<u>ELEMENT E: REQUIRED REVISIONS</u>				
ELEMENT F. ADDITIONAL STATE REQUIREMENTS (OPTIONAL FOR STATE REVIEWERS ONLY; NOT TO BE COMPLETED BY FEMA)				
F1.				
F2.				
<u>ELEMENT F: REQUIRED REVISIONS</u>				

SECTION 2:

PLAN ASSESSMENT

A. Plan Strengths and Opportunities for Improvement

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

Element A: Planning Process

Plan Strengths:

- The plan includes a thorough narrative describing the one comment received from the public.
- The plan reviewed and incorporated information from a wide array of existing plans and reports including the Bethel Comprehensive Plan, Permafrost research, and USACE bank erosion reports.
- The Plan describes a thorough process for reviewing mitigation actions annually and assigns roles to planning team members.

Opportunities for Improvement:

- Since the planning team chose to conduct the plan update over e-mail, consider adding documentation demonstrating each planning team member's contribution to the update.
- The planning team or plan stakeholders should have been more diverse to better represent the community such as the Port of Bethel, Schools, Prison, Air industry, Public health, etc.
- There should have been a better public outreach process that was targeted at tribal engagement and other local agencies that contribute to the well-being of the economy.
- The two newsletters were almost identical and should be improved to better engage the public in a meaningful way; consider asking the public's health to develop or vote on mitigation strategies rather than ask them to read the entire plan.
- The Plan should include an analysis of the public involvement process since the last plan's adoption including what worked, didn't work, and how it will be improved over the next planning cycle.
- The plan should describe in more how the jurisdiction will continue to seek public participation after the plan has been approved and during the plan's implementation, monitoring, and evaluation. Participation means engaged and given the chance to provide feedback. PDF 94-95 state that the Planning Team will identify opportunities to raise community awareness but doesn't provide information specific to the community. Bethel holds several annual community events which could be leveraged to showcase what Bethel is or wants to be doing to reduce risk. Consider events like the Kuskokwim 300, the Yup'ik dance festival, and the Bethel Fair.

Element B: Hazard Identification and Risk Assessment

Plan Strengths:

- The plan includes a detailed table of NFIP statistics of Bethel compared with the State as a whole.
- The plan included two new hazards to assess in this update, climate change and volcano.
- The plan created a quantitative probability based off of qualitative data.

Opportunities for Improvement:

- The previous occurrences section for volcano on PDF 63 should describe in more detail what happened during the 2009 event. Can Mt. Redoubt erupt again? If yes, the probability for risk in Bethel shouldn't be zero. Additionally, the summary for Extent for this hazard is actually the impact, extent would be based on winds and location of eruption. By better explaining Bethel's past impacts from a volcano, they can better plan for future eruptions and impacts caused by them. CHECK FOR MITIGATION STRATEGY.
- The erosion impact section in chapter six should be expanded to better describe experienced impacts of erosion in the community. Additionally, an analysis of erosion impacts resulting in the river bed from the seawall could be put into this section as well.
- The flood section does not thoroughly describe areas of local ponding that result from severe weather or snowmelt.

Element C: Mitigation Strategy

Plan Strengths:

- The capability assessment is thorough, it addresses city regulatory tools, federal resources, State resources, City of Bethel Staff resources, and City financial resources.
- The Mitigation Actions are selected based on priority and a demonstrated pro vs con and cost-based assessment.
- Mitigation goals and potential actions are in alignment with one another

Opportunities for Improvement:

- Consider making all mitigation actions measureable. For example, WF-1 “continue to support local fire department with adequate equipment and training”; how will this action be completed? By modifying the action to “Order new equipment X, Y, and Z by 2020” the action is now measureable with a defined task and specific timeframe.
- Mitigation Actions should be assigned to a specific position with the city; FEMA, the Forest Service, DHS&EM, and any other federal or state agency should never be identified as the responsible agency on any mitigation action.
- Mitigation funding sources are very general. Future plans should include more specifics on what funding will be pursued to fund proposed mitigation actions.

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

Plan Strengths:

- The plan addresses a growing population that could continue to grow as a result of the health care center.
- The Planning Team updated the Mitigation Action Plan to make project descriptions less general.

Opportunities for Improvement:

- Consider analyzing areas of growth in the City based on their exposure to hazards (permafrost, floodplain, etc.) and how building construction type in the areas of new growth is or can be modified to reduce vulnerability.
- Consider adding specific tasks to planning team members to better integrate the plan into community planning processes rather than suggesting reviews of regulatory tools ad hoc.

B. Resources for Implementing Your Approved Plan

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

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

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

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

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

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

The **Tribal Multi-Hazard Mitigation Planning Guidance**: This resource is specific to tribal governments developing or updating tribal mitigation plans. It covers all aspects of tribal planning requirements and the steps to developing tribal mitigation plans. You can find the document in the FEMA Library at <http://www.fema.gov/media-library/assets/documents/18355>

National Fire Adapted Communities Learning Network

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

The FEMA Region 10 **Risk Mapping, Analysis, and Planning program (Risk MAP)** releases a monthly newsletter that includes information about upcoming events and training opportunities, as well as hazard and risk related news from around the Region. Past newsletters can be viewed at <http://www.starr-team.com/starr/RegionalWorkspaces/RegionX/Pages/default.aspx>. If you would like to receive future newsletters, email rxnewsletter@starr-team.com and ask to be included.

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

Appendix D
Benefit–Cost Analysis Fact Sheet

Benefit-Cost Analysis Fact Sheet

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

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

All Benefit-Costs must be:

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

General Data Requirements:

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

Damage and Benefit Data

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

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

Building Data

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

Use Correct Occupancy Data

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

Questions to Be Answered

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

Common Shortcomings

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

Appendix E
Plan Maintenance Documents

Annual Review Questionnaire

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

Mitigation Action Progress Report

Page 1 of 3

Progress Report Period: _____ to _____
(date) (date)

Project Title: _____ Project ID# _____

Responsible Agency: _____

Address: _____

Contact Person: _____ Title: _____

Phone #(s): _____ email address: _____

List Supporting Agencies and Contacts:

Total Project Cost: _____

Anticipated Cost Overrun/Underrun: _____

Date of Project Approval: _____ Start date of the project: _____

Anticipated completion date: _____

Description of the Project (include a description of each phase, if applicable, and the time frame for completing each phase): _____

[illegible]

Plan Goal (s) Addressed:

Page 2 of 3

Goal: _____

Indicator of Success: _____

Project Status

Project Cost Status

☐ Project on schedule

☐ Cost unchanged

☐ Project completed

☐ Cost overrun*

☐ Project delayed*

*explain: _____

*explain: _____

☐ Cost underrun*

☐ Project canceled

*explain: _____

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

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

C. How was each problem resolved?

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

Other Comments:
