Introduced by: Mayor John Eberhart
Introduced: June 23, 2014

RESOLUTION NO. 4637, AS AMENDED

A RESOLUTION ADOPTING THE FAIRBANKS NORTH STAR BOROUGH MULTI- HAZARD, MULTI-JURISDICTIONAL MITIGATION PLAN

WHEREAS, the City of Fairbanks recognizes that natural hazards such as wildfire, earthquakes, severe weather, volcanic ash, and flooding pose a threat to people and property; and

WHEREAS, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future occurrences of natural hazards; and

WHEREAS, adoption of a hazard mitigation plan is required as a condition for funding of mitigation projects under Federal Hazard Mitigation Assistance grant programs; and

WHEREAS, the City of Fairbanks is located within the Fairbanks North Star Borough and assisted with preparation of the Multi-Hazard, Multi-Jurisdictional Mitigation Plan; and

WHEREAS, the Fairbanks North Star Borough Multi-Hazard, Multi-Jurisdictional Mitigation Plan was reviewed and approved by the State of Alaska Division of Homeland Security & Emergency Management and Federal Emergency Management Agency, pending adoption by the Fairbanks North Star Borough Assembly, Fairbanks City Council, and North Pole City Council;

NOW, THEREFORE, BE IT RESOLVED by the City Council that the Fairbanks North Star Borough Multi-Hazard, Multi-Jurisdictional Mitigation Plan is hereby adopted as an official plan of the City of Fairbanks.

PASSED, APPROVED and EFFECTIVE this 23rd day of June, 2014.

Jim O. Wilson for Mayor Eberhart

John Eberhart, City Mayor

AYES: Gatewood, Walley, Anderson, Matherly, Hilling
NAYS: None
ABSENT: Staley
APPROVED: June 23, 2014

ATTEST:

Janey Hovenden, MMC, City Clerk

APPROVED AS TO FORM:

Paul Ewers, City Attorney

U.S. Department of Homeland Security
FEMA Region X
Federal Regional Center
130 228th Street, SW
Bothell, WA 98021-8627

FEMA

June 5, 2014

Ms. Ann Gravier
State Hazard Mitigation Planner
Alaska Division of Homeland Security
and Emergency Management
P.O. Box 5750
Fort Richardson, Alaska 99505-5750

Dear Ms. Gravier:

As requested, the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) has completed a pre-adoption review of the ***Fairbanks North Star Borough Hazard Mitigation Plan***. The plan successfully contains the required criteria, excluding the adoption, for hazard mitigation plans, as outlined in 44 CFR Part 201. This letter serves as Region 10's commitment to approve the plan upon receiving documentation of its adoption by the Community.

The plan will not be formally approved by FEMA until it is adopted. The Community is not eligible for mitigation project grants until the plan is formally approved by FEMA.

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

Sincerely,

Tamra Biasco
Chief, Risk Analysis Branch
Mitigation Division

BH:bb

Hazard Mitigation Plan

A Multi-Hazard, Multi-Jurisdictional Plan for the Fairbanks North Star Borough and its Communities

Prepared by the FNSB Community Planning Department:

Bernardo Hernandez, Director

Jae Hill, Deputy Director

Doug Sims, Floodplain Administrator

Melissa Kellner, Planner III

Cristina Haworth, Planner II

Kathy Marx, Planner III

Prepared: January 27, 2014

This study was prepared by the Fairbanks North Star Borough, Alaska, and reviewed by the Alaska State DHS&EM and the US Federal Emergency Management Agency.

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Insert resolutions from each jurisdiction

City of Fairbanks Enabling Resolution

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Insert resolutions from each jurisdiction

DRAFT

Acronyms

AEIC	Alaska Earthquake Information Center
AFB	(Eielson) Air Force Base
AICC	Alaska Interagency Coordination Center
AEIC	Alaska Earthquake Information Center
AFS	Bureau of Land Management Alaska Fire Service
AIWFMP	Alaska Interagency Wildland Fire Management Plan
AMAC	Alaska Multi-Agency Coordination Group
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
ARSC	Arctic Region Supercomputing Center
ARR	Alaska Railroad
AVO	Alaska Volcano Observatory
AWFCG	Alaska Wildland Fire Coordinating Group
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Review
BFE	Base Flood Elevation (100-year flood)
BLM	(US – Dept. of the Interior) Bureau of Land Management
CCHRC	Cold Climate Housing Research Center
CDBG	Community Development Block Grant
CDP	Census Designated Places
CFR	Code of Federal Regulations
Committee	Multi-Hazard Mitigation Plan Steering Committee
CWPP	Community Wildfire Protection Plan
DCCED	(Alaska) Department of commerce, Community and Economic Development
DCRA	(DCCED) Division of Community and Regional Affairs
DHS&EM	(Alaska) Division of Homeland Security and Emergency Management
DMA	Disaster Mitigation Act
DNR	(Alaska) Department of Natural Resources
DOF	(Alaska) Division of Forestry
DOT	(Alaska) Department of Transportation and Public Facilities
EPA	Environmental Protection Agency
FDIC	Federal Deposit Insurance Corporation
FEMA	Federal Emergency Management Agency
FHLBB	Federal Home Loan Bank Board
FIA	Fairbanks International Airport
FIRM	Flood Insurance Rate Maps
FLD	Flood Projects
FMA	Flood Mitigation Act
FNG	Fairbanks Natural Gas
FNSB	Fairbanks North Star Borough
FWS	(US) Department of Interior Fish and Wildlife Service
FY	Fiscal Year
GVEA	Golden Valley Electric Association
HMGP	Hazard Mitigation Grant Program
HMP	Multi-Jurisdiction Multi-Hazard Mitigation Plan
MSA	Metropolitan Statistical Area

NFIP	National Flood Insurance Program
NOAA	National Oceanographic and Atmospheric Administration
NPS	(US) Department of Interior National Park Service
OIPC	Office of Intellectual Property and Commercialization
PDM	Pre-disaster Mitigation
REAA	Regional Educational Attendance Area
RFC	Repetitive Flood Claim
RL	Repetitive Loss
SBA	Small Business Administration
SRL	Severe Repetitive Loss
STIP	Statewide Transportation Improvement Program
TAPS	Trans Alaska Pipeline System
TBD	To be determined
TCF	Trillion Cubic Feet
UAF	University of Alaska, Fairbanks
USACE	United States Army Corps of Engineers
USFS	United States Forest Service
USGS	United States Geological Survey
WUI	Wildland Urban Interface

1. Executive Summary

The intent of this plan is to meet the requirements of the Federal Emergency Management Agency (FEMA), as well as the State of Alaska Division of Homeland Security & Emergency Management (DHS&EM), in preparing the community for natural hazards and establishing area-wide pre-and post-disaster mitigation priorities.

1.01. Overview

There have been several iterations of a Multi-Jurisdictional Multi-Hazard Mitigation Plan (HMP) since 2004, but no final draft has ever materialized. In 2012, a renewed interest in obtaining hazard mitigation grant funding to prepare the community for hazard events led to a new push towards completion. A series of meetings of the project steering committee – comprised of representatives of the City of Fairbanks, City of North Pole, and the Fairbanks North Star Borough – has provided guidance and direction to staff preparing the HMP. Coordination then occurred between the HMP committee and the local public safety agencies, public utility providers, and other major stakeholders for review of the plan and inclusion of local non-governmental priorities.

The overall goals of the HMP are to:

1. Eliminate and/or Reduce Loss of Life and Injuries
2. Prevent and/or Reduce Property Damage
3. Reduce Economic Impact
4. Preserve Natural Systems
5. Promote Outreach and Education
6. Increase and Enhance Collaboration
7. Enhance Coordination of Emergency Response

The HMP begins with a baseline community profile and risk assessment methodology. This is followed by individual chapters that detail a specific hazard's characteristics, occurrence history and probability, and Action Matrices which identify mitigation projects for each hazard. The document concludes with a multi-hazard chapter, detailing efforts which are necessary for general disaster preparation and the possibility of combined events, such as an earthquake at forty below zero.

The plan was reviewed at each of the local, state and federal levels. The first review was completed by the Alaska DHS&EM who then forwarded the plan to FEMA for pre-approval pending adoption by Resolution by the FNSB Assembly, Fairbanks City Council, and North Pole City Council. The final plan approval was issued by FEMA on Month XX, 201X.

1.02. Planning Process

The Fairbanks North Star Borough (FNSB) Department of Community Planning has taken the lead role in preparing the HMP for the Borough with support from the Cities of Fairbanks and North Pole. Other stakeholders who provided input for the plan include representatives from local fire departments, utilities, resource management agencies, social service providers, and other state and local agencies. **Requirement §201.6(c)(1) and §201.6(b)(2)... See Planning Process and Methodology, page 2-1.**

At the early stages of plan development, the HMP concept was presented to the public at the Disaster Preparedness Expo on September 28, 2013 where over 140 people learned about the hazards facing their properties and understood the need for such a plan. After a draft plan was prepared by the Steering Committee and Borough staff, the plan was then placed on a dedicated website at http://hazplan.fnsb.us for public review and comment. The plan was further presented during work sessions at the city councils of both Fairbanks and North Pole, as well as to the Borough Planning Commission and the Borough Assembly, prior to submittal to the state and federal authorities. **Requirement §201.6(b)(1)... see Public Involvement, page 2-5.**

The plan incorporated a variety of previous planning efforts and required obtaining new and updated data from state, local, and private sources. **Requirement §201.6(b)(3) ... see** Plan Development Resources, **page** Error! Bookmark not defined..

The document is expected to be updated regularly as new information is made available and will also be thoroughly revised on a five-year cycle. Representatives from the Steering Committee, or their appointees and successors, will continue to meet regularly to keep the document useful and relevant. **Requirement §201.6(c)(4)(i) and §201.6(c)(4)(iii) ... see Plan Monitoring, Evaluation and Updating, page 2-7.**

1.03. Hazard Identification and Risk Assessment

In 2004, the Fairbanks Local Emergency Planning Committee (LEPC) determined that the Fairbanks North Star Borough was particularly susceptible to five natural hazards: floods, wildfires, severe weather, seismic events, and volcanic ash fall. Various parts of the community experience flood and wildfire hazards on a regular basis, and the occurrence of severe weather events has the possibility of causing area-wide shortages of supplies and outages of public utilities. While there is lesser seismic and volcanic activity in the immediate area around Fairbanks, the potential for regional events to disrupt air and rail traffic could have a strong effect on the transportation of critical supplies to Fairbanks: 100% of the state's gasoline and 97% of all foodstuffs are shipped in from outside of Alaska. The vulnerability of the community to these hazard events, coupled with its relative isolation from other major population centers, underscores the need for methodical and well-organized planning and hazard mitigation efforts. **Requirement §201.6(c)(2)(i) ... see Risk Assessment and Hazard Identification, page 9.**

The plan further identifies the historic occurrence and scale of previous events in each individual chapter. Estimations of the probability and location of future events include the vulnerability of each community to those events. **Requirement §201.6(c)(2)(i) and §201.6(c)(2)(ii) ... see Wildfire Hazard Profile, page 7-1; Seismic Event Hazard Profile, page 8-1; Severe Weather Hazard Profile, page 8-1; Severe Weather Hazard Profile, page 9-1; Volcanic Ash Hazard Profile, page 10-1; and Flood Hazard Profile, page 11-1.**

An inventory of the Borough's repetitive loss properties and current flood hazard mitigation efforts through the National Flood Insurance Program (NFIP) can be found in the Flood Hazard Profile. **Requirement §201.6(c)(2)(ii) ... see Continued Participation in the NFIP, page 11-7.**

1.04. Mitigation Strategies

The HMP inventories the abilities of the local municipalities, the Borough, and the emergency services providers to make policies and laws, to plan and program projects and funding, and to respond to **hazard events. Requirement §201.6(c)(3) ... see Community Profile, page 3-1.**

The FNSB is the sole entity participating in the National Flood Insurance Program in the region, and the authority of the Borough extends over the communities contained therein. **Requirement §201.6(c)(3)(ii) ... see Continued Participation in the NFIP, page 11-6.**

Through this process, the project team and the associated stakeholders have developed 7 goals to mitigate hazards and 31 actions to meet those goals, including actions and projects for new and existing construction and infrastructure. These are contained within each individual chapter. **Requirement §201.6(c)(3)(i) ... see Wildfire Hazard Profile, page 7-1; Seismic Event Hazard Profile, page 8-1; Severe Weather Hazard Profile, page 9-1; Volcanic Ash Hazard Profile, page 10-1; and Flood Hazard Profile, page 11-1.**

The Steering Committee developed basic screening criteria to determine the priority and cost-benefit for each mitigation action and project, which are also contained in each specific hazard chapter. The authority to plan for the hazard events remains with the FNSB, but the ability to implement may rest in a variety of city or service area type governments. **Requirement §201.6(c)(3)(iii) and §201.6(c)(3)(iv) ... see Wildfire Hazard Profile, page 7-1; Seismic Event Hazard Profile, page 8-1; Severe Weather Hazard Profile, page 9-1; Volcanic Ash Hazard Profile, page 10-1; and Flood Hazard Profile, page 11-1.**

The HMP will be further implemented by integrating the mitigation planning efforts into capital improvement plans, the Regional Comprehensive Plan, the FNSB and City Code of Ordinances, area emergency response plans, and other mitigation planning efforts like the Community Wildfire Protection Plan. **Requirement §201.6(c)(4)(ii) ... see Plan Approval and Implementation, page 2-6.**

1.05. Plan Adoption

The plan is slated for adoption by the Assembly of the Fairbanks North Star Borough as the municipal entity given planning powers under Alaska Statute Sec. 29.35.180. While the Borough and its fire service areas have authority for emergency preparedness and response in the unincorporated areas, the Cities of North Pole and Fairbanks have authority for those actions within their limits. The adopting resolutions are included in this document for reference. **Requirement §201.6(c)(5) ... see Enabling Resolutions at the beginning of this document.**

2. Introduction

Hazard mitigation planning seeks to minimize the impacts of a natural disaster before it occurs by identifying and profiling local hazards, assessing vulnerability of communities and facilities, and identifying mitigation actions to reduce risk to life and property. Mitigation actions may include long term capital improvement projects, policy changes to ordinances or existing plans, and public education and outreach. The ultimate goal of any mitigation action is the long-term protection of people and property.

This Multi-Jurisdictional Multi-Hazard Mitigation Plan (HMP) is jointly prepared by multiple jurisdictions within the borders of the Fairbanks North Star Borough (FNSB). It profiles five natural hazards – **flood, wildfire, severe weather, seismic events, and volcanic ash,** - assesses community vulnerability and risk associated with these hazards, and presents mitigation strategies for each hazard in order to reduce or eliminate human and economic losses associated with natural disasters.

The primary goal and intent of this HMP is to **reduce loss of life and property due to natural hazards that occur in our community and to foster community resilience in the face of these disasters,**

2.01. Planning Process and Methodology

This HMP is the result of nearly a decade of discussion about hazard mitigation planning, goals, and strategies. Borough and City officials established a Hazard Mitigation Steering Committee in 2005, comprised of the FNSB Emergency Operations Director, FNSB Emergency Operations Manager, FNSB Health and Safety Officer, local fire chiefs, FNSB planning staff, and private consultants. An initial set of hazard mitigation goals and implementation strategies were developed with public input, but the plan was never adopted by the Borough Assembly nor was it ever presented to the Federal Emergency Management Agency (FEMA) for review. The plan was resurrected in 2010 by the FNSB Emergency Operations Department, which updated maps and hazard information, but this plan, too, was not adopted by the Borough.

Despite these previous efforts to draft and adopt a hazard mitigation plan, as of January 2013, the Borough did not have an official HMP. Because FNSB, the City of Fairbanks, the City of North Pole, and the unincorporated communities within the Borough are at risk for natural hazards, a new Hazard Mitigation Steering Committee comprised of representatives from the Borough, the City of Fairbanks, the City of North Pole, and emergency response personnel (see Table 2-1) formed to finalize and adopt a plan. An approved hazard mitigation plan enables the Borough and its communities to access financial and technical assistance from Federal and State resources, thereby preventing human and economic losses before they occur and increasing response capabilities in the event of a natural disaster.

Table 2-1: 2013 FNSB Hazard Mitigation Steering Committee

Name	Organization
Jae Hill, Chair	FNSB – Deputy Director, Community Planning
David Gibbs	FNSB – Director, Emergency Operations
Warren Cummings	City of Fairbanks – Fire Chief
Ernie Misewicz	City of Fairbanks – Deputy Fire Chief
Michael Schmetzer	City of Fairbanks – Director of Public Works and City Engineer
Jackson C. Fox	City of Fairbanks – Planning & Permitting Manager
Bill Butler	City of North Pole – Director of City Services
Doug Sims	FNSB – Floodplain Administrator

The benefits of developing a multi-jurisdictional plan are:

- Improved communication and coordination among jurisdictions and other regional entities;
- Comprehensive mitigation approaches to reduce risks affecting multiple jurisdictions;
- Resource- and cost-sharing that increase efficiency and reduce duplication of efforts; and
- Clear organizational structure assigning responsibilities among jurisdictions, creating opportunities for increased participation by local governments, non-profits, and members of the public.

In compliance with Multi-Jurisdictional Hazard Mitigation Plan regulations,[1] this Plan coordinates with the Cities of Fairbanks and North Pole, and seeks to include the fifteen unincorporated Census Designated Places (CDP) within the Borough. The HMP incorporates information and strategies from existing Federal, State, and local guidelines and plans, as well as scientific reports and studies from the University of Alaska – Fairbanks, various State departments, and the USGS. A full list of resources can be found in Section 2.05.

The HMP addresses the Borough and unincorporated communities; any information and strategies specific to the Cities of Fairbanks and North Pole are included within community profile descriptions, hazard profiles, and suggested projects sections.

2.02. Hazard Mitigation Planning Requirements

This plan has been prepared in coordination with the Alaska Division of Homeland Security & Emergency Management (DHS&EM) to fulfill grant funding requirements in the Disaster Mitigation Act of 2000 (DMA). This Federal law, passed on October 30, 2000, provides the legal basis for FEMA mitigation plan requirements for grant assistance from Federal Hazard Mitigation Assistance (HMA) programs.

[1] 44CFR § 201.6

The HMA grant programs present important opportunities to protect individuals and property from natural hazards by implementing the actions and projects identified in this plan while reducing reliance on Federal Disaster Funds. When drafting HMA, Congress defined a mitigation planning process that can reduce a community's exposure to natural hazard risk, therefore decreasing dependence on Federal Disaster Funds. The HMA program within FEMA provides pre-disaster mitigation grants annually to States, Territories, Tribes and local communities that have adopted a FEMA-approved hazard mitigation plan.

In addition to meeting the DMA requirements, this plan also addresses the Local Flood Mitigation Plan requirements of the Flood Mitigation Assistance (FMA) grant program.[2] The goal of the FMA grant program is to reduce or eliminate flood insurance claims under the National Flood Insurance Program (NFIP), particularly by mitigating repetitive loss (RL) and severe repetitive loss (SRL) properties.

2.03. Grant Programs with Mitigation Plan Requirements

Five FEMA grant programs provide funding to local communities that have a FEMA approved State and local hazard mitigation plan. Two of the grants are authorized under the Stafford Act and DMA, and three are authorized under the National Flood Insurance Program (NFIP) and Flood Insurance Reform Act.

Hazard Mitigation Grant Program (HMGP) provides grants to States, Tribes, and local entities to implement long-term hazard mitigation measures during the immediate recovery period after a disaster declaration. Projects seeking funding must demonstrate long-term reductions in hazard exposure, and can be used to protect either private or public property. This funding is awarded on a 75% Federal/25% non-Federal cost share basis.

Pre-Disaster Mitigation (PDM) provides funding to State, Tribes and local entities, including universities, for hazard mitigation planning and project implementation prior to a disaster event. PDM raises awareness of natural hazards and risks, while reducing the nation's disaster losses by encouraging long-term planning and the implementation of cost-effective mitigation measures. Grants under the PDM program are competitive, and are awarded on a 75% Federal/25% non-Federal cost share basis.

Flood Mitigation Assistance (FMA) provides funding from the National Flood Insurance Fund to States, Tribes and local entities to apply mitigation measures in reducing flood losses to properties insured under the NFIP. FMA grants fund technical studies, planning, and short- and long-term mitigation projects that reduce or eliminate flood insurance claims under the NFIP for repetitive loss and severe repetitive loss properties. Grants are typically awarded on a 75% Federal/25% non-Federal cost share basis.

Severe Repetitive Loss (SRL) provides grants to reduce or eliminate long term risk of flood damage to residential structures insured under the NFIP. To qualify for SRL mitigation project funding, a structure

2 National Flood Insurance Act of 1968 (42 USC 4101c §1366, as amended by Public Law 108-204 must have at least four NFIP claim payments over $5,000 each, when at least two such claims occur within any 10 year period and the cumulative amount of claim payments exceeds $20,000. SRL grants are typically awarded on a 75% Federal/25% non-Federal cost share basis.

Repetitive Flood Claim (RFC) provides funding to reduce or eliminate long term risk of recurring flood damage to residential and non-residential structures insured under the NFIP. Funding is made available annually to State and local governments to reduce flood damage to structures that have had one or more insurance claim payments for flood damages. Projects funded under the RFC program are eligible for up to 100% Federal assistance. This grant program has been used in the FNSB to elevate a residential structure in Salcha that was subject to repetitive flood damages and insurance claims.

2.04. Organization of the Multi-Jurisdiction Multi-Hazard Mitigation Plan

The Steering Committee decided to organize the plan by using standalone chapters related to the various hazards; in this manner, each chapter can be utilized as a separate resource and revised independently from other chapters in the document. As applications are made for various grants, each chapter may be included separately as attachments relating to purpose, need, and authority. The final benefit of this structure is that as more complete and rigorous plans are adopted, such as a Community Wildfire Protection Plan (CWPP), the Committee can incorporate that document as a full replacement for the appropriate chapter.

2.05. Plan Development Resources

1. *State of Alaska Hazard Mitigation Plan,* October 2013, DHS&EM
2. FEMA Guides:
    a. *Local Mitigation Planning Handbook*, March 2013, FEMA http://www.ready.alaska.gov/plans/documents/2013%20State%20Mitigation%20Plan%20Draft.pdf
    b. *Local Mitigation Plan Review Guide*, Oct. 1, 2011, FEMA: http://www.fema.gov/library/viewRecord.do?id=4859
    c. *Understanding Your Risks: Identifying Hazards and Estimating Losses*, August 2001, FEMA 386-2: https://s3-us-gov-west-1.amazonaws.com/dam-production/uploads/20130726-1521-20490-4917/howto2.pdf
    Worksheets, Appendix C, Mitigation Planning How-To Series: https://s3-us-gov-west-1.amazonaws.com/dam-production/uploads/20130726-1521-20490-0929/6howto2appc.pdf
3. *Community Wildfire Protection Plan for At-Risk Communities in the Fairbanks North Star Borough, Phase I*, October 30, 2006, State of Alaska, Division of Forestry, Fairbanks Area Office.
    Alaska Interagency Wildland Fire Management Plan, 2010: http://fire.ak.blm.gov/content/admin/awfcg/C.%20Documents/Alaska%20Interagency%20Wildland%20Fire%20Management%20Plan/Alaska%20Interagency%20Wildland%20Fire%20Managment%20Plan%202010.pdf
4. Alaska Climate Research Center: http://akclimate.org
5. *The Arctic: All About Arctic Climatology and Meteorology,* The National Snow and Ice Data Center: http://nsidc.org/cryosphere/arctic-meteorology/climate_vs_weather.html
6. *Actions to take for ash fall?,* U.S. Geological Survey, Volcanic Ash: Effects & Strategies: http://volcanoes.usgs.gov/ash/todo.html
7. Alaska Earthquake Information Center, University of Alaska, Geophysical Institute: www.gi.alaska.edu/research/seismo
8. USGS Earthquake Probability Mapping, 2013: https://geohazards.usgs.gov/eqprob/2009/index.phphttps://geohazards.usgs.gov/eqprob/2009/index.php
9. *Fairbanks North Star Borough Regional Comprehensive Plan*, September 13, 2005: ftp://co.fairbanks.ak.us/maps/maps/comprehensive_road_plan.pdf

10. *North Pole Land Use Plan*, January 28, 2010: http://www.co.fairbanks.ak.us/communityplanning/NP%20Land%20Use%20Plan.pdf
11. *Multiyear Training and Exercise Plan, 2012 – 2014,* April 9, 2012, Fairbanks North Star Borough Emergency Management: http://www.co.fairbanks.ak.us/EmergencyOperations/DisasterPreparedness/FNSBTrainExcercisePlan.pdfhttp://www.co.fairbanks.ak.us/EmergencyOperations/DisasterPreparedness/FNSBTrainExcercisePlan.pdf
12. Alaska Department of Commerce, Community and Economic Development, Community and Regional Affairs: http://commerce.alaska.gov/cra/DCRAExternal/
13. FNSB Flood Insurance Study; January 2, 1992; Federal Emergency Management Agency
14. FNSB Community Economic Development Strategy (CEDS); April 14, 2011.
15. Mitigation Ideas; a Resource for Reducing Risk to Natural Hazard; January 2013; FEMA

2.06. Public Involvement

The Committee initially met on February 13, 2013 to review previous hazard mitigation planning efforts and determine a timeline for this HMP. The Committee proposed that a draft plan, complete with hazard profiles, vulnerability analyses, and a review and update process, be completed by September 2013. After review, the draft plan would be circulated for public comment.

On September 28, 2013, the Committee manned a booth at the 2013 Fairbanks Area Preparedness Expo to distribute information and gather feedback from the public relating to prioritization of risk, vulnerability, and mitigation ideas. Eight hundred and thirty-eight residents attended the Expo, and 132 participated in activities at the HMP booth. Participants were encouraged to locate their homes on a map of the Borough indicating wildfire, subsidence, and flood hazard zones. Upon identifying their residences, planning staff engaged participants in a dialogue about the spatial relationship of their homes to potential hazard areas and the intent of the HMP. All participants were encouraged to provide feedback with concerns or ideas related to the plan. One hundred and thirty-two residents of the Borough identified their residential locations on the map provided: 32 within the City of Fairbanks, 7 within the City of North Pole and 93 within the unincorporated areas of the FNSB.

In addition to the booth, the Committee gave a 30 minute public presentation about the HMP. Interested Expo attendees unable to participate at the booth or watch the presentation were provided a newsletter describing the purpose and benefits of a hazard mitigation plan, with requests for input. The newsletter was also distributed at the Fox Store, Chatanika Lodge, and Ester and Goldstream fire stations.

On November 21, 2013, the Steering Committee hosted a stakeholders' meeting. Invitees included local business leaders, representatives from utilities companies, and other special interest groups with ownership of critical facilities and infrastructure in the FNSB and Cities of Fairbanks and North Pole. The attendees voiced concerns about hazard risks and provided ideas for potential future mitigation projects addressing those concerns.

A series of work sessions were also conducted with the lawmaking bodies of the local municipalities: the City of Fairbanks on January 6, 2014; the City of North Pole on January 6, 2014, and the FNSB Assembly on January 23, 2014.

Other public meetings were held. A public involvement index consisting of the newsletter, presentations, minutes and sign in sheets are included (Appendix A, Public Involvement).

In January 2014, the draft HMP was finalized for submittal to DHS&EM and FEMA. Prior to submittal, a FNSB Hazard Mitigation Plan website was created with the HMP and tools encouraging public participation and comment. Announcements advertising this website and soliciting public comment were posted in local newspapers and newsletters, on the Borough website, and in public locations including the library, community centers, and public schools in the Borough, Cities of Fairbanks and North Pole, and unincorporated communities. A summary of the public outreach strategy and tools can be found in Appendix A: Public Involvement.

The Borough will continue to involve the public in the HMP process. A current copy of the adopted plan and subsequent annual review reports will be maintained online at the Borough website, at the Borough's Planning and Emergency Operations Departments, as well as the City Halls in Fairbanks and North Pole and the Noel Wien public library. Locations of the plan will also be listed online.

2.07. Plan Approval and Implementation

The process by which the plan was approved and adopted is outlined in the figure below. The plan was reviewed at each of the local, state, and federal levels. The first review was completed by the Alaska DHS&EM who then forwarded the plan to FEMA for pre-approval pending adoption by Resolution by the FNSB Assembly, Fairbanks City Council, and North Pole City Council. The final plan approval was issued by FEMA on Month XX, 201X. Copies of the FNSB and City Council Resolutions and FEMA approval letter are included at the beginning of this HMP document. These officials will receive annual reports and are responsible for review and approval of all future plan updates.

Figure 2-1: Hazard Mitigation Plan Approval & Adoption Process

The HMP will be incorporated into existing plans as applicable according to each plan's review schedule:

Table 2-2: Existing Plans

Fairbanks North Star Borough Documents	Completed	Next Review
FNSB Regional Comprehensive Plan	2005	As needed
FNSB Legislative Priorities	Annually	Annually
FNSB Comprehensive Road Plan	1991	As needed
North Pole Land Use Plan	2010	As needed
FNSB Comprehensive Economic Development Strategy	2011	Annual
FNSB Comprehensive Review of Emergency Medical Services	2011	
FNSB Subdivision Ordinance	2012	As needed
Comprehensive Emergency Management Plan	2013	Annually
City of Fairbanks Emergency Operations Plan	2014	Annually
City of North Pole Emergency Operations Plan	2014	Annually

2.08. Plan Monitoring, Evaluation and Updating

Disaster Mitigation Act planning regulations[3] require an explicit monitoring, evaluation, and updating process that includes:

- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle;
- A mechanism for participating jurisdictions to incorporate the requirements of the mitigation plan into other planning documents, when appropriate; And
- A public participation strategy for the plan maintenance process

Plan monitoring will be carried out by the FNSB Community Planning Department and representatives from the cities of Fairbanks and North Pole via an annual review questionnaire and progress report (see Appendix B, Plan Maintenance Documents) from agencies and departments in participating jurisdictions. Multi-jurisdictional plans require that implementation in each participating jurisdiction must be individually reviewed and documented; the review questionnaire and progress report will be submitted two months prior to the scheduled planning meeting date. A compiled report will be submitted to the Borough Assembly and Fairbanks and North Pole City Councils and noticed to the public.

The annual reports will be compiled by the FNSB Department of Community Planning and provided to the FNSB Emergency Operations Director and representatives from the cities of Fairbanks and North Pole for review of the following:

- Temporal compliance with mitigation requirements;
- Procedural efficiency;
- Public outreach during the implementation of mitigation actions;

3 DMA §201.6(c)(4)(I)

- Updates of hazard profiles and activity during the past five years;
- Updates to the vulnerability analysis regarding new critical facilities or infrastructure;
- Changes in development patterns;
- New resources available to implement mitigation planning;
- Present goal applicability;
- Progress of mitigation plan actions; and
- Prioritization of existing or additional mitigation measures revised as necessary.

While annual review and minor updates (as needed) occur on an annual basis, the HMP will undergo major revision, updates, and resubmission to FEMA every five years for continued grant eligibility. These five-year updates must demonstrate progress in hazard mitigation and risk reduction over time. A plan update is not an appendix to the previously approved plan and must stand alone on its own.

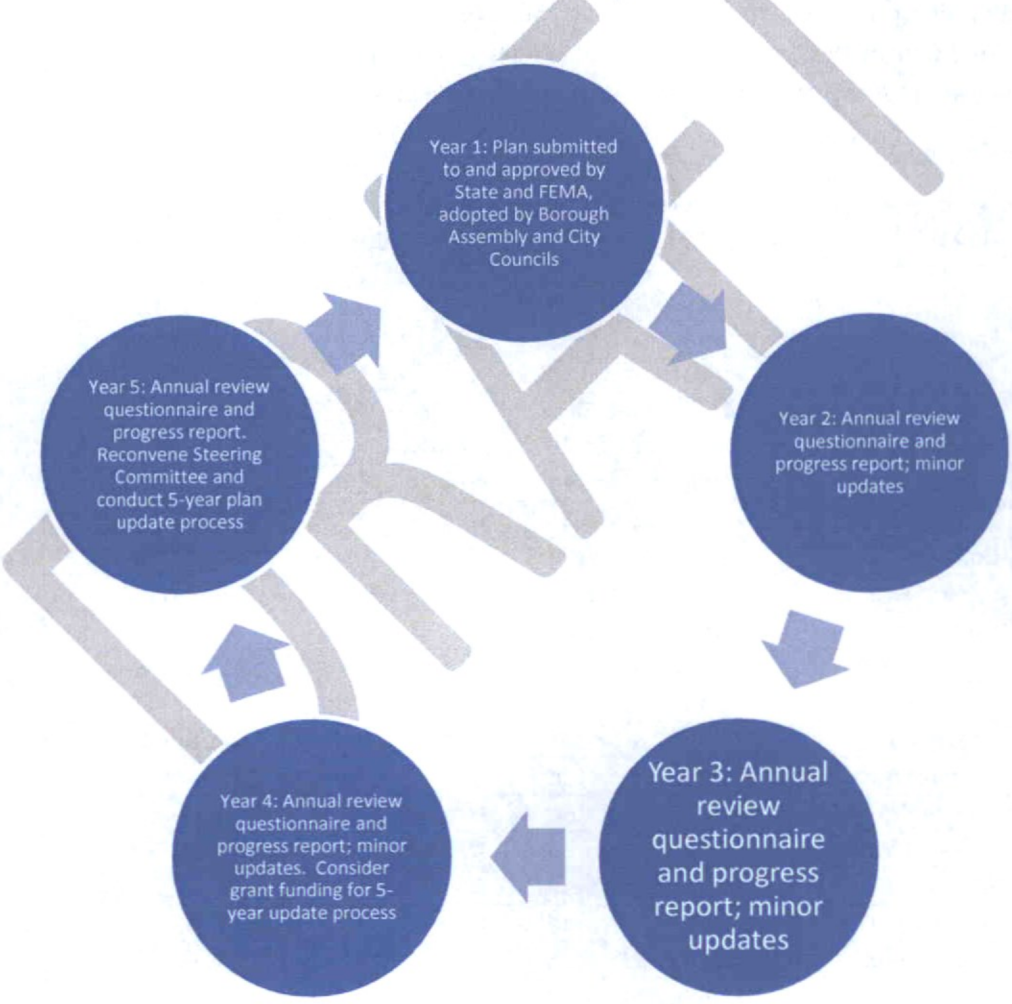


Figure 2-2: Five-Year Hazard Mitigation Planning Cycle

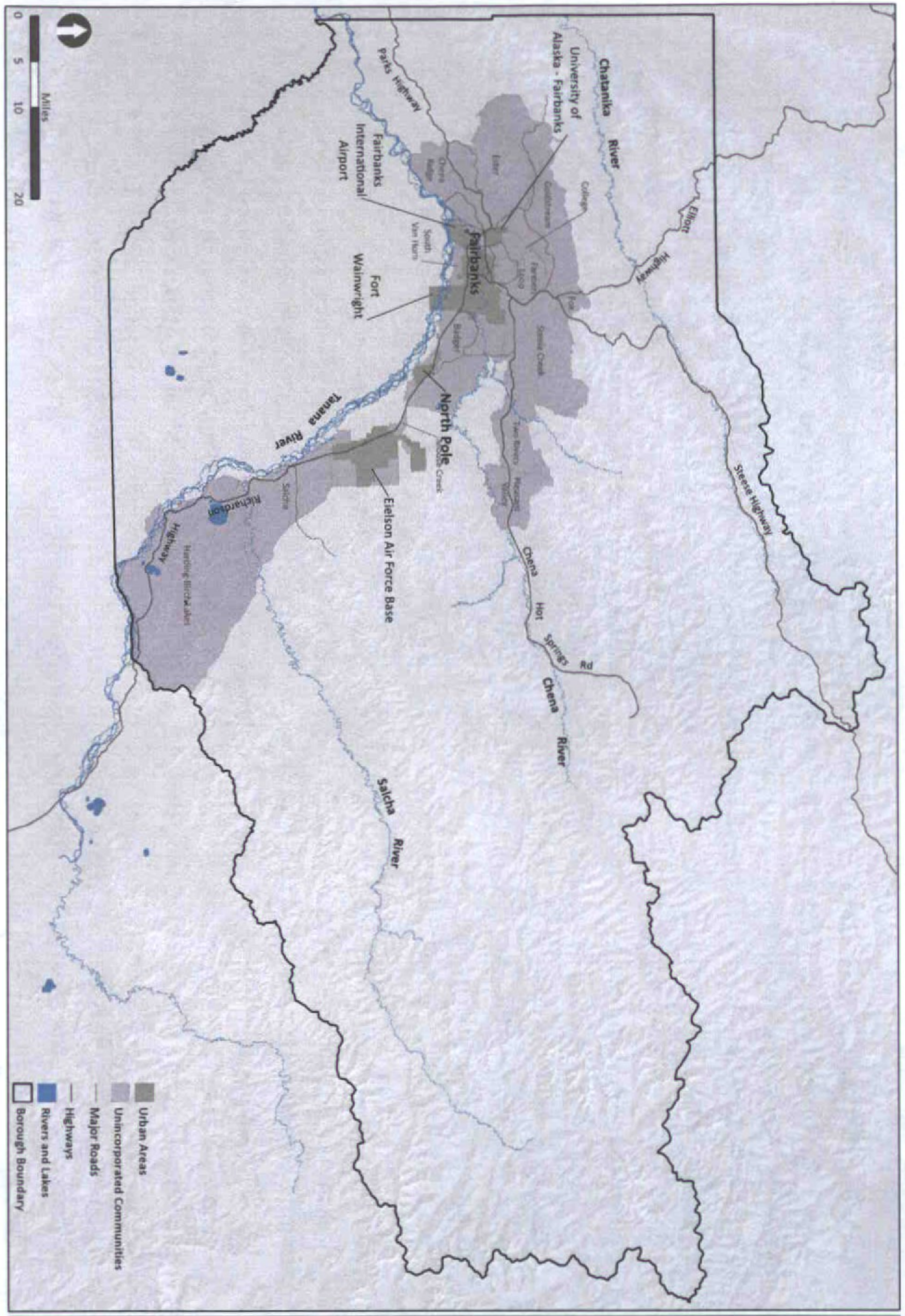
3. Community Profile

The Fairbanks North Star Borough is located in the heart of Interior Alaska and is the second-largest population center and fourth-largest borough in the state. The FNSB encompasses 7,361 square miles of land and 77.8 square miles of water. It serves as the hub for the Interior and northern half of the state with large regional hospitals, health centers and road, rail and air connections to the rest of Alaska and the Lower 48. It is also home to an Army base, Air Force base and the oldest and second-largest university campus in the state.

The Borough's two incorporated cities, Fairbanks and North Pole, are located about 14 miles apart in the west central portion of the FNSB, on the alluvial plain between the Chena and Tanana Rivers. The cities are situated at an elevation of approximately 440 feet above sea level and are surrounded by the Tanana Valley with rolling hills to the north, east, and west. Immediately surrounding the cities are 15 unincorporated Census-Designated Places (see Table 3-1) with strong community identities, as well as the Fort Wainwright Army Post and Eielson Air Force Base military installations.

Table 3-1: Census-Designated Places in the Fairbanks North Star Borough

Jurisdiction	Classification	Form of Government	Population
FNSB	2nd Class Borough, Incorporated 1964	Strong Mayor	97,581
Fairbanks	Home Rule City, Incorporated 1903	Strong Mayor	31,535
North Pole	Home Rule City, Incorporated 1953	Strong Mayor	2,117
Badger	Unincorporated	N/A	19,482
Chena Ridge	Unincorporated	N/A	5,791
College	Unincorporated	N/A	12,964
Eielson AFB	Unincorporated	N/A	2,647
Ester	Unincorporated	N/A	2,422
Farmers Loop	Unincorporated	N/A	4,853
Fox	Unincorporated	N/A	417
Goldstream	Unincorporated	N/A	3,557
Harding-Birch Lakes	Unincorporated	N/A	299
Moose Creek	Unincorporated	N/A	747
Pleasant Valley	Unincorporated	N/A	725
Salcha	Unincorporated	N/A	1,095
South Van Horn	Unincorporated	N/A	588
Steele Creek	Unincorporated	N/A	6,662
Two Rivers	Unincorporated	N/A	719



Map 3-1: Fairbanks North Star Borough Vicinity

Hazard Mitigation Plan, Chapter 3: Community Profile

3.01. History

In 1901, Captain E.T. Barnette established a trading post on the Chena River when he was stranded on his way to gold fields discovered in Tanacross. This trading post, initially home to a modest 5,600 individuals, grew into the modern-day City of Fairbanks. At the time, the population was primarily Native, but the 1902 gold discovery a mere 16 miles north of the post brought an influx of settlers from America and European countries. By 1903 Fairbanks had become well-established as a gold mining town and by the end of the year the City of Fairbanks had been incorporated. The gold discovery swelled the population to 13,064 by 1910. By World War I much of the easy-to-reach gold had been extracted, leading to economic and population decline in Fairbanks.

Early transportation of goods and supplies into and out of the settlement relied on sternwheeler river boats. The completion of Alaska Railroad in 1923 significantly decreased shipping on the river and hastened the development of Fairbanks by offering more efficient delivery of goods and supplies. World affairs in Europe and Russia, combined with the new accessibility of the Fairbanks area, led to the establishment of the US Army garrison Fort Wainwright (originally the Ladd Army Airfield) in 1939 and Eielson Air Force Base (originally the Mile 26 satellite airfield) in 1943, triggering new economic development and population growth. In 1944, the area between Fort Wainwright and Eielson Air Force Base was homesteaded by Bon V. and Bernice Davis, and shortly thereafter the Alaska Railroad built the Davis Siding along its spur line to Eielson at the homestead. In 1952, Dahl and Gaske Development Company purchased the Davis homestead, subdivided it, and renamed it North Pole in the hope of attracting a toy manufacturer to the area. The City of North Pole was incorporated on January 15, 1953, from portions of the original Davis homestead and an adjacent homestead owned by James Ford.

After President Dwight D. Eisenhower signed the State of Alaska into the United States in 1959, the Alaska Legislature passed the Mandatory Borough Act of 1963 requiring the state's most populous areas to form organized boroughs. This Act established the Fairbanks North Star Borough in 1964 and seated the Assembly in the City of Fairbanks. Statehood, an improved transportation system between Anchorage and Fairbanks, and the preservation of Denali National Park contributed to economic diversification and revitalization during the 1960's. The 1968 discovery of oil on Alaska's North Slope was another economic boon to the area as construction of the Trans-Alaska Pipeline began in 1974 When completed, the 800 mile pipeline transported crude oil from Prudhoe Bay on the northern shore of Alaska through the greater Fairbanks area before terminating at the port of Valdez for worldwide shipment via ocean going oil tankers. After the pipeline's completion, population abruptly declined within the Borough. Over the next forty years slow but steady population growth has contributed to a diverse and stable economy serving the approximately 100,000 people living in the Borough today.

The FNSB was established as a second-class borough on January 1, 1964, by the State of Alaska Mandatory Borough Act of 1963. The Borough is a unit of local government analogous to a county with school district powers. Its charter provided for the mandatory powers of property assessment and taxation, administration of public schools, and planning and zoning. Additional powers have been assumed by the voters or added by Alaska Statutes, including platting, parks and recreation, administration of a public library, operation of public transportation, operation of limited health and social services, animal control, emergency communication services (enhanced 911), solid waste disposal, flood control, air pollution control, and tourism & marketing funded by hotel-motel room taxes.

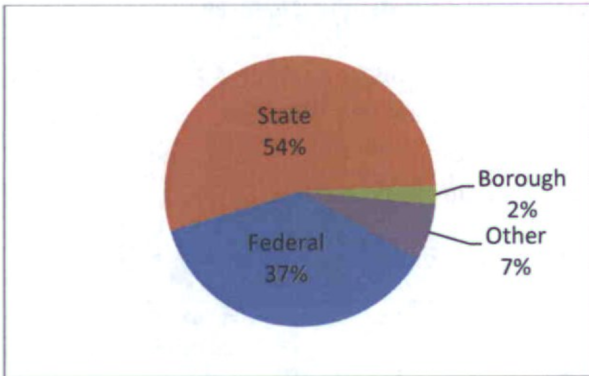


Figure 3-1: Land Ownership in the Fairbanks North Star Borough

Note: "Other" includes land owned by the Cities of North Pole and Fairbanks, educational institutions such as UAF, and Native corporations.

The Borough has a nine-person Assembly and a directly-elected mayor serving as the Chief Administrative Officer for a three-year term. The Mayor can introduce legislation, has veto power, and manages the everyday operations of the Borough. In addition to overseeing Borough administration, the Mayor is in charge of the budget and capital improvements within the FNSB. The Assembly members are elected at large, on a nonpartisan basis, for overlapping three-year terms. The Assembly approves the budget, sets the mill rate for taxation, and appropriates funds to provide for Borough services among other tasks.

A representative from the City of Fairbanks, City of North Pole, and the School Board is selected according to specific policies and serve a term provided by the respective city or school board. The representatives serve as delegates between their respective Councils and Board and the Borough Assembly, providing information about significant issues and activity. A delegate may participate in all deliberations on matters before the Assembly; however, they are not permitted to vote once a matter has been brought to question. The presiding officer may seat a city or school board delegate on any assembly committee.

Non-areawide powers are exercised in the geographic area of the Borough, excluding the incorporated areas of Fairbanks and North Pole. Those powers are emergency disaster, emergency medical services, solid waste collection and economic development. In addition, the Borough is also responsible for more than one hundred active service areas. Service areas are smaller jurisdictions within the FNSB that provide certain specific services, such as road installation and maintenance, fire protection, sewer and water, or streetlights. The Borough Mayor appoints volunteer commissioners, who are confirmed by the Borough Assembly, to oversee the affairs of each service area.

Taxes levied on an areawide basis may only be expended on areawide functions. Likewise, taxes levied on a non-areawide basis or within a service area may only be expended on the geographic area that was taxed. However, in accordance with a statutory exception, the Borough expends some areawide taxes on economic development (a non-areawide power) in conformity with an agreement between the Borough and the Cities of Fairbanks and North Pole (Financial Services Dept. 2011).

The City of Fairbanks was incorporated on November 10, 1903, and the City of North Pole was incorporated on January 16, 1953. Both of their charters provide for a Council-Mayor form of government with City Councils, each comprised of the Mayor and six elected Council members, to enact laws, ordinances, resolutions and administrative orders.

Table 3-2: Community Administration Contacts

FNSB Luke Hopkins, Mayor 809 Pioneer Rd. PO Box 71267 Fairbanks, AK 99707 Phone: (907) 459-1000 Fax: (907) 459-1102 (Mayor's Office) Email: mayor@fnsb.us Web: http://www.co.fairbanks.ak.us	**City of Fairbanks** John Eberhart, Mayor 800 Cushman St. Fairbanks, AK 99701 Phone: (907) 459-6793 Fax: (907) 459-6787 Email: jeberhart@ci.fairbanks.ak.us Web: http://www.fairbanksalaska.us
City of North Pole Bryce Ward, Mayor 123 Snowman Lane North Pole, AK 99705 Phone: 907-488-8584 Fax: 907-488-3002 Email: bryce.ward@northpolealaska.org Web: http://www.northpolealaska.com	**FNSB School District** Peter Lewis, Superintendent 520 Fifth Avenue Fairbanks, AK 99701 Phone: 907-452-2000 Fax: 907-451-6008 (Human Resources) Email: web@k12northstar.org Web: http://www.k12northstar.org
Doyon, Limited Aaron M. Schutt, President and CEO 1 Doyon Place, Suite 300 Fairbanks, AK 99701 Phone: 907-459-2000 Fax: 907-459-2060 Email: info@doyon.com Web: http://www.doyon.com	**Tanana Chiefs Conference** Jerry Isaac, President 122 1st Avenue Fairbanks, AK 99701 Phone: 907-452-8251 Fax: 907-459-3850 (Administration) Email: info@tananachiefs.org Web: http://www.tananachiefs.org
Fairbanks Native Association Audrey Jones, Board President 605 Hughes Avenue, Suite 100 Fairbanks, Alaska 99701 (907) 452-1648 Web: http://www.fairbanksnative.org	

3.02. Alaska Native Corporations

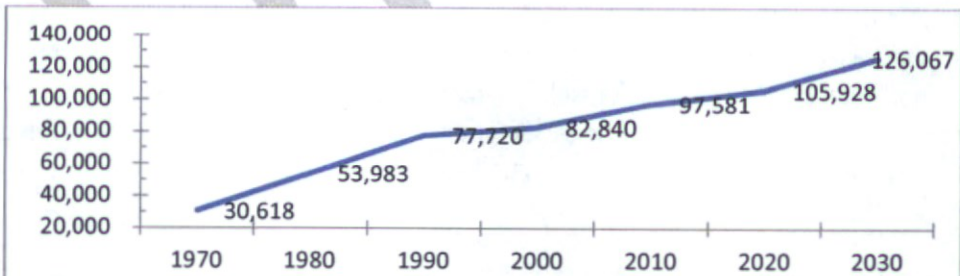
Alaska Native Corporations, created under the Alaska Native Claims Settlement Act of 1791 (ANCSA) to serve regions and villages and administer land entitlement and monetary compensation under the Act, play an important role in the FNSB economy. These corporations own, operate, and manage various development projects and businesses in the FNSB and statewide, and several Alaska Native Regional Corporations operate subsidiaries in the FNSB. There are 12 land-based regional corporations and 220 village corporations across the State. Regional and Village corporations serve their shareholders through dividends, workforce training, employment opportunities, charitable contributions, and social and cultural leadership.

Doyon, Limited, an Interior Regional Native Corporation, is headquartered in Fairbanks and is regularly listed as one of the state's top 49 Alaskan owned and operated businesses. Doyon is the largest private landowner in Alaska with 11.4 million acres of land in Interior Alaska and has over 18,000 shareholders. Under the provisions of ANCSA Doyon will receive approximately 1.1 million more acres across Interior Alaska.[4] Doyon is focused on protection of traditional use and responsible economic development of natural resources for the benefit of its shareholders. Doyon, Limited "operates a diverse family of companies in industries including oil and gas, natural resource development, government contract and tourism," (Doyon, Limited n.d.).

3.03. Socioeconomics

The FNSB is the second largest population center in the State of Alaska with 97,581 residents (approximately 13.7% of the total state population) according to the 2010 U.S. Census. Changes in the FNSB's population have typically followed the growth and decline of the regional economy. Rapid population growth between 1970 and 1980 was largely influenced by the construction of the 800-mile Trans-Alaska Pipeline system and the resulting economic expansion. The Borough's population has increased steadily over the past 10 years and is expected to continue into the future. Using a simple linear regression on the adjusted census data population estimates can be projected out to 2030.

Table 3-3: Population Projection - 2010-2030



SOURCE: US CENSUS, STATE OF ALASKA DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

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4 43 USC CHAPTER 33

The median age of a Borough resident is 31 years. Approximately 53% of the population is male. The housing stock consists of 41,783 units, with 36,441 occupied, 5,342 vacant (31% of which are vacant due to seasonal use). Of the total units of housing stock, 21,410 are owner-occupied. The average household size is 3 persons. This population and housing stock information is from the 2010 U.S. Census provided by the Alaska State Department of Commerce, Community and Economic Development.

3.03.1. Economy

The Borough serves as the economic hub for Interior and northern Alaska, including the oil-rich North Slope. Fairbanks has experienced only moderate effects of the national and global recession, based on employment data indicating 1.8% growth between 2009 and 2010. In 2010, 38,800 workers were employed within the Borough. Over the last five years, all industry sectors have remained at fairly constant rates of employment relative to total Borough employment. The government sector remains the largest with 31% employment share (9% Federal, 14% State, 8% local), followed by trade, transportation, and utilities at 20% employment, which includes Alyeska Pipeline Service Company's trans-Alaska pipeline operations. The Borough's largest employers are the Federal government (excluding uniformed military personnel) and the University of Alaska.

3.03.2. Military

The military has operated the Fort Wainwright Army Post and Eielson Air Force Base (AFB) since the 1940s. Fort Wainwright borders the City of Fairbanks to the east and is home to the 1st Stryker Brigade Combat Team and the 16th Combat Aviation Brigade, along with several smaller units, reserve component units, and tenant organizations including the Bureau of Land Management (BLM) and Alaska Fire Service. Eielson AFB, ten miles southeast of the City of North Pole, is home to the 354th Fighter Wing and hosts the 18th Aggressor Squadron, 353rd Combat Training Squadron, and 168th Air Refueling Wing of the Alaska Air National Guard. Fort Wainwright and Eielson AFB provide mission support, joint operations training, arctic operations training, and cold climate testing services for the US Army and Air force missions in Alaska and abroad. Fort Wainwright owns 1.5 million acres that allow for a variety of training and testing. Eielson AFB includes a large portion of the 67,000 square miles Pacific Alaska Range Complex, the world's largest fully instrumental training range.

The economic impact of these two bases to the FNSB and the State of Alaska is very significant; estimates from the Fairbanks Economic Development Corporation indicate that military personnel represent approximately 38% of all wages, salary, and benefit payments, and defense operations bring approximately $1.2 billion into the Fairbanks economy. This operational expenditure generates an additional $2.7 billion in sales revenue, totaling $3.9 billion (27% of all revenue) in the local economy.

3.03.3. Education

The FNSB School District operates 35 public schools, 18 elementary, six middle, six high and five charter schools, with approximately 14,300 students in attendance. Eight private elementary and secondary schools also operate within FNSB, along with several workforce training centers and technical schools for post-secondary students and workers. Because of its concentrated assets and services, Fairbanks serves residents of outlying villages and remote locations.

The University of Alaska - Fairbanks (UAF) was founded in 1917 as the Alaska Agricultural College and School of Mines. Today UAF is home to seven major research units: the Agricultural and Forestry Experiment Station; Arctic Region Supercomputing Center; Geophysical Institute; Institute of Marine Science; Institute of Arctic Biology; Institute of Northern Engineering; and International Arctic Research Center. UAF is a Land, Sea, and Space Grant institution, and operates the Poker Flat Research Range, the only university-owned scientific rocket launching facility in the nation. The Alaska Native Language Center and the UAF Museum of the North are also located on the UAF campus. Between the fall semesters of 2004 and 2010, total enrollment at all UAF facilities increased 7.9% to 9,855 students; enrollment at UAF's main campus in Fairbanks also increased 4.4% to 5,504 students (Janet R. Davison Spring 2013).

3.03.4. Research and Development

The research energy, engineering, climate change, and biomedicine conducted at UAF is of great importance to the FNSB as well as the State of Alaska. These research areas combined with UAF's traditional research strengths in geophysics, oceans and fisheries sciences, and natural hazards contribute to Forbes' ranking UAF number 139 in research institutions and number 63 in the West region. For every dollar UAF receives from the state, the University secures an additional five dollars in research funding, yielding approximately $120 million per year in research funding. The revenue generated by research at UAF creates jobs and boosts the local, regional and state's economy.

In 2010, UAF revitalized the Office of Intellectual Property and Commercialization (OIPC) to protect and promote UAF research and technologies. OIPC engages researchers and investors to facilitate the commercialization of promising early-stage technologies, fostering economic development by placing new knowledge and technologies developed at UAF on a critical path to licensing. The University received 32 Invention Disclosures at the start of Fiscal Year (FY) 2012, indicating a rapid increase in intellectual property activity since 2005 (Fairbanks 2012).

The Cold Climate Housing Research Center (CCHRC) is a privately owned nonprofit operating within the Borough researching and developing energy-efficient, durable, and healthy building technologies for the Circumpolar North. The research center was formed by the Alaska State Home Builders Association to address the challenges of building in Alaska's extreme environments. In September 2006, the CCHRC finished construction of a cold weather research test facility and demonstration project on a 2.5 acre section of a 30 acre parcel UAF has identified for a research park and created a four-home Sustainable Village as a training tool for students.

The Arctic Region Supercomputing Center (ARSC) also operates within the UAF campus as the high-performance computing unit for UAF and is a top-level research center.

3.03.5. Agriculture

In the last decade, the Tanana Valley has produced 31.8% of Alaska's agricultural products. Local farmers harvested 54.7% of the total acreage farmed, accounting for 31.8% of the State's average total crop production and 10.3% of the State's vegetable production. Grass, hay, barley, oats, vegetables (lettuce, carrots, cabbage and other vegetables) and potatoes are typical crops. Animal products from livestock includes beef, pork, mutton, milk and wool. Greenhouse operations producing ornamental plants and vegetables operate year-round.

The market value of FNSB agricultural products sold increased by 29.2%. During this same period, the statewide market value of agricultural products sold increased 14.7%. Average market value of production per farm in the FNSB increased 33.9% compared with a 23.6% increase statewide.

3.03.6. Forestry

The Tanana Valley State Forest covers approximately 1.8 million acres and extends about 450 miles east from the town of Tanana at the confluence of the Tanana and Yukon Rivers to the Canadian border. Approximately 578,000 acres of this forest are within the FNSB's boundaries.

The FNSB is an important market for wood products, consuming an annual average of seven million board feet of graded dimensional lumber. Local mills supply a fraction of this product and typically produce rough, ungraded lumber such as house logs. Local secondary processors produce artisanal products, paneling, and flooring.

The Alaska Department of Natural Resources Division of Forestry (DOF) projects timber harvests in Fairbanks Region in an effort to assure a sustained annual yield of renewable forest resources and the integrated use of forest land. The current schedule will total approximately 600,000 to 1.2 million cubic feet of saw timber from 2010 and 2014. During this same period 700,000 to 1.3 million cubic feet of wood fiber will be harvested.

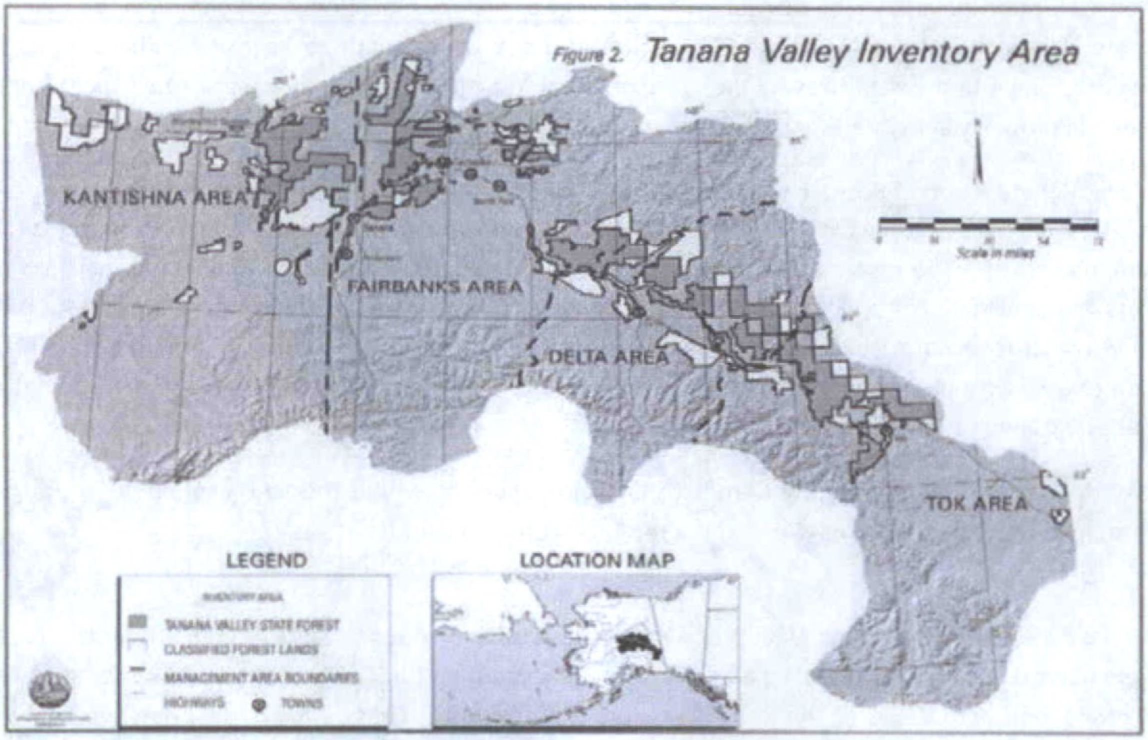


Figure 3-2: Tanana Valley Forest

The cost of heating fuel in the Interior has created a high demand for firewood. Commercial and personal harvesting permits are available through DOF. The FNSB Department of Land Management also offers firewood cutting permits on FNSB property. Over 200 firewood cutting permits are issued annually through FNSB.

3.03.7. Mining

The FNSB serves as a staging area for much of the State's mineral exploration and development. Usibelli, Fort Knox, and Pogo, the state's largest mining operations, lie within 150 miles of the Borough. Improvements to the Interior's transportation systems greatly increase the productivity of these mineral resources and accessibility to more remote resources. As Interior Alaska's mineral deposits are discovered and developed, the FNSB will provide labor expertise, construction equipment and support services for these operations.

In 1997, Alaskan gold production by hard rock mines exceeded production of placer mines for the first time in over fifty years. The Fort Knox Gold Mine, the largest producer of gold in Alaskan history, was constructed in 1995 and purchased in 1998 by the Kinross Corporation. It is located 25 miles northwest of Fairbanks and produces about 330,000 ounces of gold per year. The Pogo Mine, owned by Sumitomo Metal Mining Co., Ltd., is located 115 miles east of Fairbanks, and began operating in early 2006. The current annual production level is approximately 315,000 ounces of gold per year.

Usibelli Coal Mine, headquartered in Fairbanks and operating in the Denali Borough, has been in production for more than 60 years. Since 1943, Usibelli's annual mine production has grown from 10,000 tons to an average of 1.5 million tons of coal, approximately half of which is transported by Alaska Railroad Corporation to the Seward Coal Terminal at the Port of Seward for export.

About five percent, or $1.5 billion, of the state's gross economic product is directly attributable to mineral development and mining activities. Within the Borough, the Alaska Department of Labor reports that during the second quarter of 2012 there were 1,436 employees in the mining industry with average monthly wages of $7,565.

Increased global mineral demand and resulting high minerals prices have led to expanded exploration and development statewide, particularly in the mineral rich Eastern Interior/Fairbanks District. Much of this exploration and development activity is occurring within or in close proximity to the Fairbanks District.

3.03.8. Oil & Gas Development

At the forefront of almost all economic endeavors in the FNSB is the need for a reasonably priced energy source. Oil and gas development plays a significant part in the Borough's tax base providing a large variety of benefits to FNSB residents. Unfortunately the high cost of home heating fuels and transportation's gas/diesel products overshadows those benefits in many residents' minds.

Therefore, with continued decline in production of oil from the large fields on the North Slope, there is significant interest in developing and marketing the state's natural gas reserves. There are currently 35 trillion cubic feet (tcf) of known reserves of natural gas in the Prudhoe Bay and Point Thompson area with much of current production being re-injected into the ground to maximize the recovery of oil from existing fields. Some gas is used by oil producer lease operations or sold locally. The federal government estimates that more than 240 tcf of technically recoverable natural gas is present beneath onshore and offshore areas of Alaska's Arctic in undiscovered conventional reservoirs. These estimates do not include unconventional reservoirs such as shale gas and natural gas hydrates, which likely contain hundreds of additional tcf of gas.

Sustained high demand for natural gas will continue to provide economic incentive for pipeline construction.

Currently the Trans-Alaska Pipeline (TAPS) supplies two refineries located in the FNSB with Alaska North Slope crude oil: Flint Hills and Petro Star. Flint Hills currently has a crude oil processing capacity of about 85,000 barrels per day. It processes North Slope crude oil and supplies gasoline, jet fuel, heating oil, diesel, gasoil and asphalt to Alaska markets. About 60 percent of the refinery's production is destined for the aviation market. Flint Hills Refinery provides all the gasoline in the FNSB (all grades: regular, mid-grade and premium). Petro Star has a processing capacity of 22,000 barrels per day producing kerosene, diesel and jet fuels. Petro Star's products are distributed throughout the Interior and Northern Alaska to such remote communities as Anaktuvuk Pass and Wiseman; military customers; and commercial customers such as Ft. Knox Gold Mine, Alyeska Pipeline and the other North Slope companies.

3.03.9. Tourism

Fairbanks is a gateway for travelers from Asia, Europe, and the continental United States with approximately 325,000 visitors each year. The proximity of Denali National Park has made Fairbanks a popular overnight destination for many cruise and tour companies Alaskan. These tours typically include a combination of travel options to Fairbanks including air, rail, and motor coach transportation. Additionally, Fairbanks is a popular gateway for tours into Alaska's Northern Region. Visitors to Fairbanks can take a tour of a rural Alaskan community and experience firsthand the region's rich cultural heritage and tradition.

While the majority of visitors arrive during the summer months, Fairbanks is succeeding in developing itself as a popular destination for winter tourism. Winter tourism in Fairbanks has benefited from the proximity of world-class cross-country skiing, snowmobiling, dog-mushing, winter festivals and numerous hot springs. The World Ice Art Championships, held annually in March, draw artists and visitors from around the globe. Additionally, Fairbanks is one of the premier locations in Alaska for visitors viewing the aurora borealis (a.k.a. "Northern Lights").

The role of the visitor industry in the FNSB's economy continues to grow as a tourist and business destination.

3.04. Transportation

3.04.1. Air Transportation

Air transportation is central to the Alaskan economy. Due to the limited reach of other transportation systems, air transportation is integral, and has a much larger economic impact on the state of Alaska than most other states in the U.S. International and domestic air cargo and passenger service are the main components of air transportation's role in the FNSB's economy. FIA also serves as a hub for many communities in Interior and Northern Alaska that rely upon air freight and commuter services. Air transportation provides these rural and remote communities with regular access to health and dental care as well as mail delivery.

Total FIA passenger volumes through Fairbanks remained relatively constant between 2007 and 2012. However, freight volumes declined.

From the FIA, it is 50 minutes by air to Anchorage, four hours to Seattle, eight hours to Tokyo, eight and a half hours to New York, and nine and a half hours to London.

3.04.2. Rail Transportation

The Alaska Railroad (ARR) was acquired from the Federal government on January 5, 1985 and is presently an independently managed corporation owned by the State of Alaska. The ARR mainline extends 470 miles from the all-season, deep-water port of Seward to its northern terminus in Fairbanks. From Fairbanks the railroad extends 28 miles east of Fairbanks to the oil refineries in North Pole and then to Eielson AFB.

ARR provides both passenger and freight service to the FNSB. Passenger service is primarily a summer operation serving the visitor industry. Coal is transported from the Usibelli Coal Mine, in Healy, Alaska to power generation plants in Fairbanks, Fort Wainwright Army Post and Eielson AFB. ARR also transports jet fuel from North Pole refineries to Anchorage International Airport.

Phase I of the proposed northern rail extension project, including construction of a new $188 million bridge over the Tanana River, began in the summer of 2012. The project is scheduled for completion in the summer of 2014. The northern rail extension project will involve the completion of 80 miles on new rail line connecting the existing Eielson Branch rail line to a point near Delta Junction.

3.04.3. Road Transportation

All major highways in interior Alaska converge at Fairbanks. The Alaska Highway connects Fairbanks to Canada and the Continental U.S. The Alaska Highway's northern terminus is Delta Junction where it meets the Richardson Highway, which continues on to Fairbanks. The Richardson highway, originally a historic trail used during the gold rush era, connects Fairbanks to Valdez. The George Parks Highway extends 300 miles south from Fairbanks to Wasilla where it connects with the Glenn Highway to Anchorage and Glennallen. The Parks Highway was constructed in the late 1960s to shorten road travel time between Fairbanks and Anchorage and to provide access to Denali National Park. The Steese Highway leads north from Fairbanks to Circle and the Yukon River. North of Fairbanks, the Chena Hot Springs Road branches east from the Steese Highway. The junction of the Elliott and Steese Highways is at Fox, north of Fairbanks. The Elliott Highway extends west to Livengood, Minto and Manley Hot Springs connecting up with the Dalton Highway at Livengood and continuing north to the Prudhoe Bay oil fields. There is a total of 568 miles of State of Alaska Department of Transportation and Public Facilities (DOT) managed roads within the FNSB.

Table 3-4 represents the segment lengths of all State roads within the Borough provided by Andrew Heist, DOT Division of Program Development Transportation Data Programs Planner.

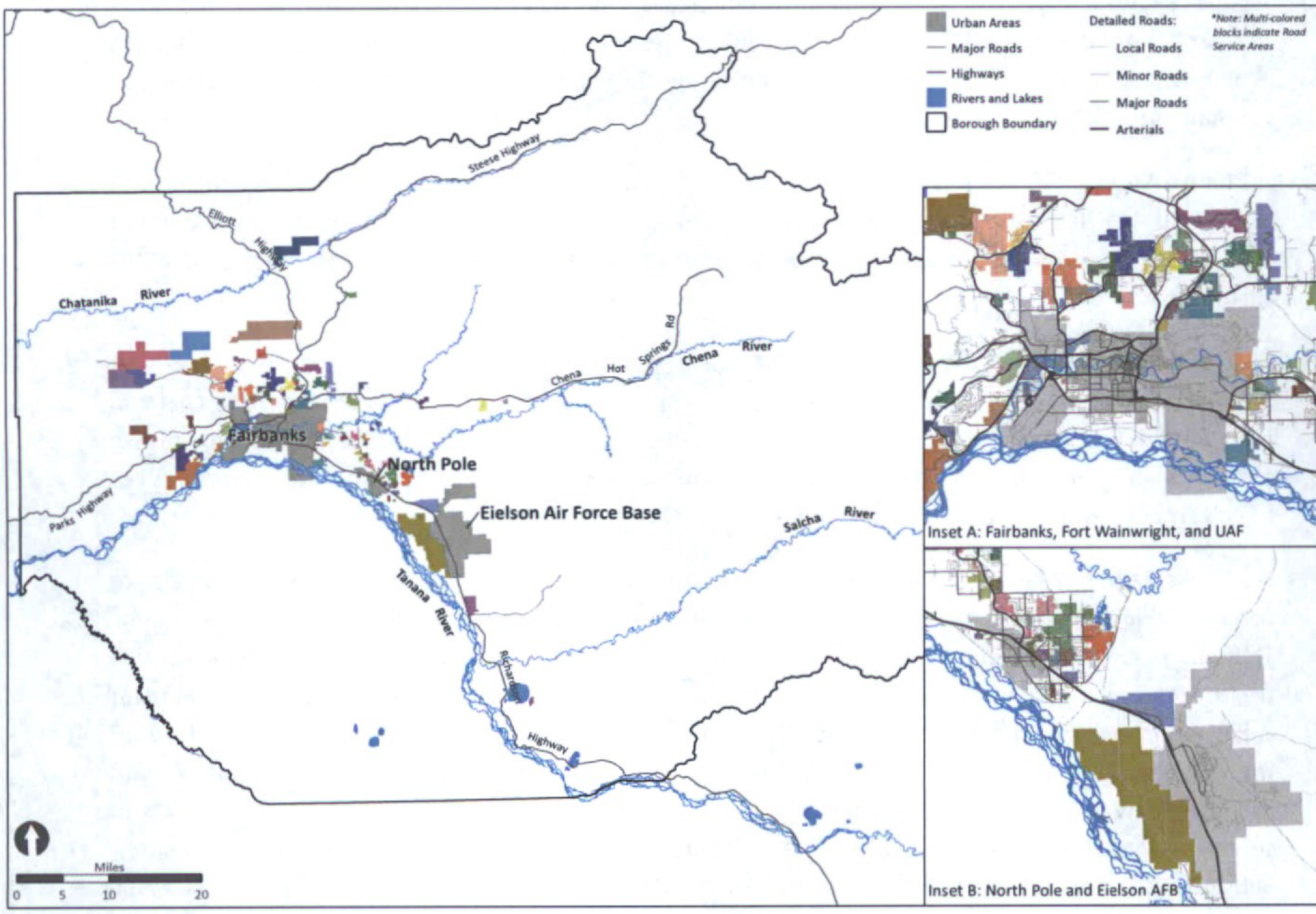
As a Second Class Borough, the FNSB is limited to road powers only in areas where a road service area has been established. Road powers within the FNSB are limited to ownership and maintenance. Within the Borough there are currently 105 established road service areas maintaining approximately 485 miles of roadway varying from major collectors to local roadways.

Table 3-4: FNSB Roads by Class

FNSB Roads	Segment Lengths (mi)
Arterial	697.5
Arterial Controlled Access	137.3
Major	300.2
Minor	430.4
Local	1,299.4
Alley	23.8
Grand Total	2,888.6

The City of Fairbanks owns and maintains 116 miles of local roads within their city limits. The City of North Pole also owns and maintains 18 miles of local roads within their city limits. Maintenance within the boundaries of Eielson AFB and Fort Wainwright are the responsibilities of the Air Force and the Army, respectively. UAF has maintenance authority over 8 miles of local roadways on the campus.

In addition to the roadway maintenance authorities, there are many public and private roadways that have been established in the FNSB with no maintenance commitment from a governmental organization. It is estimated that there are approximately 730 miles of constructed roadways, primarily local type roadways, within the Borough that are not publicly maintained. The conditions on these roadways vary and certain roadways can be seasonally inaccessible.



Map 3-2: Roads and Road Service Areas

Hazard Mitigation Plan, Chapter 3: Community Profile

Appendix C provides a reference map of all roads serviced by FNSB and the cities of Fairbanks and North Pole.

3.05. Electric and Utilities

Incorporated in 1946 in Fairbanks, **Golden Valley Electric Association** (GVEA) distributes power to service locations in Fairbanks, Delta, Nenana, Healy and Cantwell with over 3,100 miles of transmission and distribution lines and 34 substations. GVEA operates coal, oil, natural gas, and hydroelectric generation facilities, and has begun diversifying its portfolio with renewable sources. The Sustainable Natural Alternative Power program (SNAP) now has 39 local renewable energy producers. Over the last decade, kilowatt-hour purchases more than doubled as the number of large commercial customers increased. Additionally, GVEA owns the world's largest rechargeable battery energy storage system (BESS), which helps provide continuous power during short power outages. It can provide power for seven minutes to approximately 12,000 homes.

Fairbanks Natural Gas LLC (FNG) provides over 1,100 customers, both residential and commercial, with natural gas, which is estimated to save 20% over fuel oil. FNG is moving forward with the development of a liquefied natural gas storage expansion in order to increase the availability of natural gas to FNG customers.

Aurora Energy LLC, which owns and operates a power plant located in downtown Fairbanks that produces electricity, hot water and steam heat. The plant has four steam turbines fueled by coal and one oil-fired electrical generator. The steam heat serves approximately 165 buildings in the downtown area through an underground district system comprised of 15 miles of supply and return pipes. All of the electricity generated is provided to GVEA.

Fairbanks Sewer & Water is the parent company for five closely held subsidiaries, two of which are privately held, publicly regulated water and wastewater utility companies in the greater Fairbanks area. The water treatment plan is located in downtown Fairbanks and produces nearly 1.3 billion gallons of treated water annually from four wells along the Chena River. The regional wastewater treatment plant is located in south Fairbanks and accepts approximately 1.8 billion gallons of wastewater annually from the university, army base, and commercial septage haulers. Connected to each of these plants are approximately 150 miles of water mains and 113 miles of sewer mains buried beneath the roads to serve residential, commercial, industrial, and institutional customers in the Fairbanks urban center. Subsidiaries College Utilities Corporation and Golden Heart Utilities provide service to more than 8,500 combined customer accounts representing a population of over 55,000 people.

The FNSB began operating the **Solid Waste Facility** after acquiring the South Cushman landfill in 1973 by a transfer of power from the City of Fairbanks. The Borough's current operations include the original South Cushman landfill now primarily used for construction debris, and additional expansion for active use and a recycling and household hazardous waste program.

Wireline telephone services are provided by two companies, **Alaska Communication Services** (ACS) and **General Communication Inc** (GCI). In 2012 there were 38,211 residential accounts and 19,907 commercial accounts total between both providers within the Borough. Cellular service in the FNSB is provided by **AT&T, Verizon, GCI** and **ACS**.

4. Capability Assessment

Typically, mitigation projects within the Borough will depend on cooperative efforts between the Borough, cities of Fairbanks and North Pole, State and Federal agencies.

This section outlines the resources available to the FNSB and its communities for mitigation and mitigation-related activities.

4.01. Local Resources

The resources available to the FNSB are provided by the Borough, cities of Fairbanks and North Pole and volunteer organizations within the unincorporated CDPs.

The Borough is responsible by Alaska Statutes (AS 29.35 and 29.40) for planning and zoning authority for the entire Borough. Both cities, Fairbanks and North Pole, have additional regulatory tools within their purview that assist in the capability of the FNSB to mitigate hazards. Tables 4-1, 4-2 and 4-3 outline the regulatory tools available, administrative and technical capability and financial resources. The ability to utilize financial resources is jurisdiction specific.

Table 4-1: Regulatory Tools

Regulatory Tools (ordinances, codes, plans) and process for implementation/amendment	Local Authority	Comments	Amendment timeframe
Building and fire codes: Codes are introduced to the City Council by the Building Official for adoption by Ordinance; Ordinances may be amended at subsequent Council Meetings to include new and updated codes and/or more stringent requirements of those codes.	Yes	Cities of Fairbanks and North Pole, UAF, In FNSB through DPS/Fire Marshall	1-2 months
Zoning ordinance: Ordinance introduced by mayor or assembly member; Work session and public hearing at Planning Commission; public hearing and adoption by FNSB Assembly.	Yes	FNSB	2-4 months
Subdivision ordinance or regulations: Ordinance introduced by mayor or assembly member; work session and public hearing at Platting Board and Planning Commission; public hearing and adoption by FNSB Assembly.	Yes	FNSB	2-4 months
Special purpose ordinances (floodplain management, stormwater management, hillside or steep slope ordinances, wildfire ordinance, hazard setback requirements): FNSB Ordinances are introduced by mayor or assembly member; at a minimum, a work session and a public hearing are held at Planning Commission and/or Platting Board; public hearing and adoption by FNSB Assembly. In the City of Fairbanks, Special Purpose Ordinances are introduced to the City Council by the City Engineer for adoption by Ordinance; Ordinances may be amended at subsequent Council Meetings.	Yes	FNSB, Cities of Fairbanks and North Pole	2-4 months
Growth management ordinances (also called "smart growth" or anti-sprawl programs): FNSB Ordinances are introduced by mayor or assembly member; at a minimum, a work session and a public hearing are held at Planning Commission and/or Platting Board; public hearing and adoption by FNSB Assembly.	Varies	Nothing like this is currently in place; could be implemented through zoning (FNSB) or other regulations	
Site plan review requirements: Generally determined internally as department procedures. Can be adjusted by City Engineer, department director, etc.	Yes	FNSB Community Planning and City of Fairbanks	Varies
Comprehensive plan: At a minimum, work session and public hearing at Planning Commission; public hearing and adoption by FNSB Assembly. Reviewed every 5 years and revised every 20 years or with 20% population growth.	Yes	FNSB	2-4 months
Land use plan: At a minimum, work session and public hearing at Planning Commission; public hearing and adoption by FNSB Assembly.	Yes	City of North Pole	2-4 months
Capital improvements plan: In the City of Fairbanks, individual projects may be added to the City's Capital Improvements Plan by the Mayor at any Council Meeting with the passage of a Resolution by Council.	Yes	FNSB, Cities of Fairbanks and North Pole	2 weeks

Economic development plan: FNSB Comprehensive Economic Development Strategy (CEDS) is reviewed annually and revised every 5 years. At a minimum, work session and public hearing at Planning Commission; public hearing and adoption by FNSB Assembly.	Yes	FNSB	2-4 months
Emergency response plan: Work session, public hearing and adoption by Assembly. Review annually and/or after significant events and major exercises.	Yes	FNSB, Cities of Fairbanks and North Pole, CDPs	1-2 months
Post-disaster recovery plan	No		
Real estate disclosure requirements	No		

Table 4-2: Administrative and Technical Capability

Department/Agency/Position	Yes/No	Staff/Personnel
BOROUGH Administrator	Yes	Mayor Luke Hopkins
Clerk	Yes	Nancy Ashford Bingham
Planning Director	Yes	Bernardo Hernandez
Public Works Director	Yes	Scott Johnson
Emergency Operations Director	Yes	David Gibbs
Emergency Operations Manager	Yes	Craig Malloy
Library Director	Yes	
Engineers or professionals trained in construction practices related to buildings or infrastructure	Yes	Bill Gryder, Public Works
Planners with an understanding of natural and/or human-caused hazards	Yes	Jae Hill, Deputy Director, Community Planning
Floodplain Manager	Yes	Doug Sims
Staff with education or expertise to assess the community's vulnerability to hazards	Yes	David Gibbs, Emergency Op Director
Personnel skilled in GIS	Yes	Tom Duncan, Computer Services
CITY OF FAIRBANKS Administrator	Yes	Mayor John Eberhart
City Clerk	Yes	Janey Hovenden
Fire Chief	Yes	Warren B. Cummings
Public Works Director and City Engineer	Yes	Michael J. Schmetzer
Building Official	Yes	Clem Cooten

Chief of Police	Yes	Laren Zager
Engineers or professionals trained in construction practices related to buildings or infrastructure		Building Department Public Works Engineering Division
Staff with education or expertise to assess the community's vulnerability to hazards		Warren Cummings
CITY OF NORTH POLE Administrator	Yes	Mayor Bryce Ward
City Clerk	Yes	Kathy Weber
Fire Chief	Yes	Buddy Lane
Director of City Services	Yes	Bill Butler
Police Chief	Yes	Steve Dutra

Table 4-3: Fiscal Capability

Financial Resources	Accessible or Eligible to Use
Community Development Block Grants	Yes
Capital improvements project funding	Yes
Authority to levy taxes for specific purposes	Yes
Fees for sewer	Yes
Impact fees for homebuyers or developers for new developments/homes	No
Incur debt through general obligation bonds	Yes
Incur debt through special tax and revenue bonds	Yes
Incur debt through private activity bonds	Yes
Withhold spending in hazard-prone areas	No

4.02. State Resources

- Alaska DHS&EM is responsible for coordinating all aspects of emergency management for the State of Alaska. Public education is one of its identified main categories for mitigation efforts. Improving hazard mitigation technical assistance for local governments is a high priority item for the State of Alaska. Providing hazard mitigation training, current hazard information, and the facilitation of communication with other agencies would encourage local hazard mitigation efforts. DHS&EM provides resources for mitigation planning on their website at http://www.ak-prepared.com.

- Alaska Department of Commerce, Community, and Economic Development, Division of Community and Regional Affairs (DCCED DCRA): Provides training and technical assistance on all aspects of the National Flood Insurance Program (NFIP) and flood mitigation.
- Division of Senior Services: Provides special outreach services for seniors, including food, shelter and clothing.
- Division of Insurance: Provides assistance in obtaining copies of policies and provides information regarding filing claims.
- Department of Military and Veteran's Affairs: Provides damage appraisals and settlements for Veterans Administration insured homes, and assists with filing for survivor benefits.

4.03. Federal Resources

The federal government requires local governments to have a hazard mitigation plan in place to be eligible for funding opportunities through FEMA. Mitigation Technical Assistance Programs are also available to local governments from FEMA. Training is available through FEMA's Emergency Management Institute relating to emergency management and hazard mitigation.

The following represent some of the resource documents available through FEMA utilized in the multi-hazard multi-jurisdictional planning effort at the FNSB.

- How-to Guides. Within this series of how-to guides, developed to assist state, communities and tribes in enhancing their hazard mitigation planning efforts, there are four guides that mirror the four major phases of hazard mitigation planning and five following guides that address special topics. One of the special topics guide addresses preparing multi-hazard mitigation plans. FEMA also published the *Local Mitigation Planning Handbook* in March 2013, an all-comprehensive guide to hazard mitigation planning.
- Fact Sheets. The fact sheet series gives hands-on examples of integrating hazard mitigation into local planning. This 5 fact sheet series provides practical guidance on how to incorporate risk reduction into existing local plans, policies, codes and programs that guide community development and redevelopment. This series was also developed in 2013 providing a fresh and updated hazard mitigation planning resource.
- Integrating Hazard Mitigation Into Local Planning. This guide provides case studies and tools for community officials in order to provide an integrated approach to hazard mitigation planning for a stronger and more sustainable hazard mitigation plan.
- Mitigation Ideas. This FEMA guide acts as a resource for reducing risk to natural hazards utilizing the format of dividing the guide by natural hazards and ideas towards mitigating vulnerability to each hazard. It, too, is a very hands-on and a practical working guide.

4.04. Health Care

Fairbanks is a regional hub for medical services for the Interior and northern half of the state. Local hospitals and health clinics within the FNSB include Fairbanks Memorial Hospital, Bassett Army Community Hospital at Ft. Wainwright, Chief Andrew Isaac Health Center, Tanana Valley Health Clinic and Interior Community Health Center. Additionally they are many smaller clinics, urgent care and health care practices within the Borough.

Fairbanks Memorial Hospital is a 152-bed facility, acute care hospital. It is linked to a 90-bed extended care facility, Denali Center. The hospital's Harry & Sally Porter Heart Center came on line in 2010 and is the sole full-time cardiology unit from Denali National Park to the North Slope and the Canadian Border. The hospital also has a cancer treatment center, imaging center, diabetes center and emergency care center among a multitude of other health care services. In 2011 the hospital has 1,364 employees; 6,643 people who came in as inpatients, and 151,770 visits from outpatients.

Bassett Army Community Hospital on Fort Wainwright is the U.S. military's northernmost hospital and serves the area's military population. The new 32-bed facility opened in 2006, providing primary care services and emergency services.

The Tanana Valley Clinic is a multi-specialty clinic with a large variety of primary care services.

The newest medical facility within the Borough is the Chief Andrew Isaac Health Center completed in 2012, serving as a medical health clinic providing out-patient services for the Tanana Chiefs Conference tribal consortium of 42 villages of interior Alaska. In addition the Tanana Chiefs Conference health services include a residential patient hostel, residential recovery house and residential treatment facility.

The Interior Community Health Center was established in 1993, providing medical, dental, preventative, and educational services for people in Alaska's Interior. In 2012 the clinic served 7,700 people with 23,273 visits.

4.05. Emergency Services

The FNSB completed a *Comprehensive Review of Emergency Medical Services* in 2011 (TriData Division, System Planning Corporation August 2011). Emergency services within the FNSB currently are provided mainly by fire-based contractors. Emergency medical services terminology follows:

- Areawide Emergency Medical Service District: This designation is given to boroughs that include all emergency medical service agencies within borough oversight, even incorporated cities.
- Non-areawide Emergency Medical Service District –A borough emergency medical service district that does not include incorporated cities or military facilities. The FNSB is a non-areawide emergency medical service district. The cities of Fairbanks and North Pole, and the two military bases, Fort Wainwright and Eielson AFB are not part of the district.
- Fire Service Area: A designated area, under the oversight of mayoral appointed commissioners, responsible for the provision of fire services. Residents and businesses must pay taxes (mil assessment) to the area to receive fire service. Parts of the Borough that do not agree to join a fire service area do not receive fire service other than wildland firefighting.
- Emergency Services Contractor: The emergency services provider that is contracted by the Borough to perform emergency services in a designated area, as part of the non-areawide emergency medical service district.

The local emergency services community is comprised of:

- City of Fairbanks Fire Department
- City of Fairbanks Police Department
- University Fire Department
- University Police Department

- City of North Pole Fire Department
- City of North Pole Police Department
- Alaska State Troopers
- Alaska Department of Fish and Wildlife
- Steese Area Volunteer Fire Department
- Chena-Goldstream Fire and Rescue
- Salcha Fire and Rescue
- Fairbanks International Airport Police & Fire Department
- North Star Volunteer Fire Department
- Ester Volunteer Fire Department
- FNSB Emergency Operations Department
- FNSB Hazmat Response Team

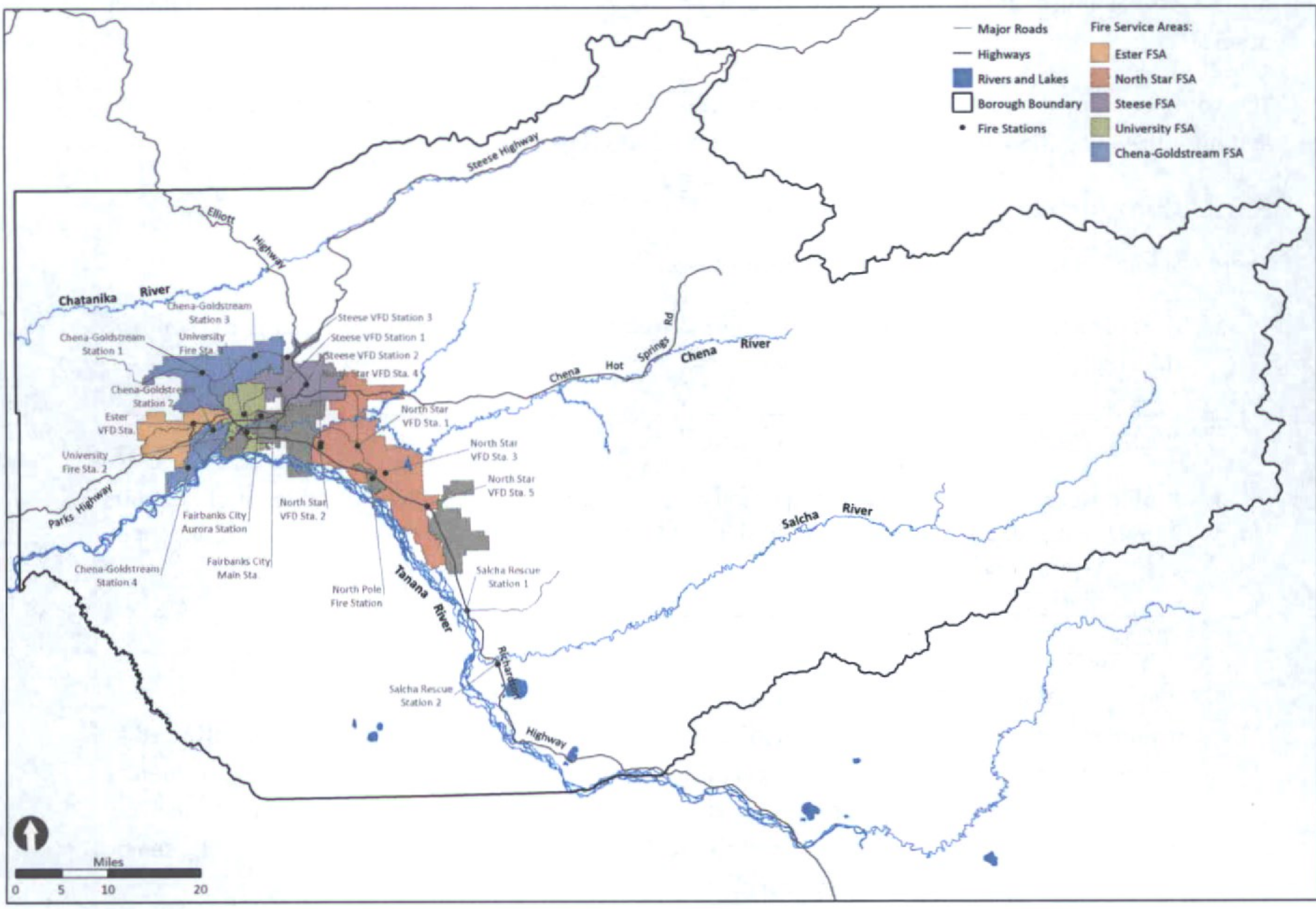
Emergency personnel from Fort Wainwright regularly respond on mutual aid requests within the local area, and during large events, the EAFB personnel will likely respond. National Guard units may be called out to provide assistance during declared disasters by order of the President or the Governor.

Throughout the Borough, as in most of Alaska, the majority of Fire and EMS response is provided by volunteers who are members of community-based services that serve a small political subdivision, a rural area, or are provided on some other basis. Until the 1990's, most communities were well-protected, and coverage was rarely as issue. Social change has challenged communities, rendering volunteer organizations vulnerable to new organizational dynamics. The Borough is no exception to this national trend but is working towards rectifying this issue.

To better address the emergency services provided in the Borough, in 2010 the Assembly re-established by Ordinance 2010-43 the Emergency Services Commission, which had last met in 1999. According to Borough code, the Commission is tasked with evaluating all service districts, areawide, and non-areawide (areas outside city limits) services provided by the Borough regarding communication, ambulance, rescue and related medical services, fire service, emergency management, disaster planning and response, civil defense and hazardous material response. A major task is to formulate a long-term plan to guide efficient and economical delivery of quality services in the Borough. The Commission will hold public meetings throughout the Borough to elicit input from citizens concerning the desired levels of services and costs for delivery of all emergency services and concerns of equity to remote areas of the Borough. This Commission is up for reauthorization every six years and was reauthorized in 2010. The Borough also has an EMS advisory Council that consists of the EMS chiefs from each provider organization.

There are two public safety answering points (911 centers) in the FNSB.

- Alaska State Troopers
- Fairbanks Emergency Communications Center



Map 4-1: Fire Response Capability

Hazard Mitigation Plan, Chapter 4: Capability Assessment

5. Risk Assessment and Hazard Identification

FEMA regulation 44 CFR §201.6(c)(2)(i) defines the process of risk assessment as:

"...providing the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessment must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. The risk assessment shall include a description of the type, location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events and on the probability of future hazard events [among others]."

The completion of the HMP the risk assessment requirement will have helped the community identify and prioritize mitigation activities that will prevent or reduce losses from the identified hazards.

5.01. Components of Risk Assessment

There are four components of analyzing risk for an HMP:

1. **Hazards Identification** – The first step in risk assessment is to identify the hazards that impact the FNSB.

   What kind of natural hazards can affect our planning area?

2. **Profile Hazard Events** – The second step of profiling the hazards include the location, extent, impact and probability for each natural hazard identified. It also includes previous occurrences of the hazard events.

   How bad can it get?

3. **Inventory Assets** – The third step is to identify the Borough's vulnerability to a hazard. This includes an inventory of the people, infrastructure and property that would likely be affected in the event of a hazard. It includes everyone who enters the jurisdiction including residents, employees, commuters, shoppers, tourists and others. Special needs populations, such as children, seniors and the disabled and the facilities they could occupy such as schools, senior housing and health clinics should be included, also.

   What can be affected by the different hazard events?

   Inventory of the FNSB's and the associated cities' assets are a critical component of the analyzing the Borough's vulnerability to hazard. For a multi-jurisdictional plan such as the HMP, the risk assessment must assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

4. **Estimate Losses** – This fourth step brings together all the above information that has been gathered in order to estimate the potential losses that might be incurred from a hazard event. Such an estimate or risk assessment takes into account all of the potential hazard events rather than just a single event.

How will the Borough's and/or Cities' assets be affected by the hazard event?

These four steps of the assessment of risk will be presented in the following chapters.

5.02. Hazard Identification

The first step in conducting a risk assessment it is to identify the natural hazards that can occur within the Borough. A natural hazard is a source of harm or difficulty created by a meteorological, environmental, or geological event. The Borough has followed FEMA guidelines regarding listing hazards that may occur by researching newspapers, reviewing existing plans and reports, talking to experts within the Borough and gathering information on Internet Websites. A list of hazards was put together after conducting research. The Committee then narrowed the focus by determining whether the Borough was in a high-risk area for each hazard and a list of hazards that pose a significant threat were identified.

For the initial step of the hazard risk analysis, the Committee considered the natural hazard risks of dam failure, earthquake, flood, land subsidence, avalanche, severe weather, wildfire and volcanic ash. The Committee evaluated and screened the list of potential hazards focusing on the most prevalent hazards in the Borough.

The final basis of the Committee's decision was predicated on both local knowledge and public input of the risk and State and Federal agency risk maps. The five hazards that will be included were determined to be: **Wildfires, Flood, Severe Weather, Volcanic Ash and Earthquake**. All the hazards chosen to be profiled could occur within all areas of the Borough with the exception of flood, which is location specific.

Table 5-1 represents the identification and screening of hazards within the FNSB.

As identified in FEMA's planning guides, when describing natural hazards it is important to identify the nature of the hazard, the historical occurrences and impact from the hazard, the potential hazard location and extent (magnitude and severity) of the hazard event, the potential impact, and the probability of future events. (U. D. FEMA March 2013) This section profiles the hazards that could affect the FNSB. At the end of the each hazard profile chapter, the extent of severity and probability of future occurrences is delineated.

Table 5-1: Hazard Identification and Profile Decision

Hazard Type	Should it be profiled?	Explanation
Wildfire	Yes	There have been multiple significant wildland fire events within the FNSB. State agency risk mapping also characterizes many areas within the FNSB as critical risk.
Earthquake	Yes	FNSB is within known fault zones, the Kaltag and Tintina faults among many unnamed faults. USGS recognizes three seismic zones in the Borough: Minto Flats, Fairbanks, and Salcha.
Severe Weather	Yes	Severe winter weather and summer weather is an ever present annual threat impacting the FNSB significantly.
Flood	Yes	FNSB participates in the NFIP and has experienced multiple significant flood events in past history.
Volcanic Ash	Yes	The risk of high altitude movement of volcanic ash across the FNSB is high and has been experienced multiple times in prior years.
Dam/Dike/Levee Failure Water Impoundment Failure	No	The Army Corps. of Engineers is currently evaluating the Moose Creek Dam, a federal dam, for safety. The study is not complete. Therefore, there is not enough documentation to determine the extent of potential hazard. It's more likely the dike or one of its levees will fail before the dam itself.
Snow Avalanche	No	State HMP lists FNSB as having Low Snow Avalanche hazard vulnerability. Local knowledge and no known historical occurrences do not concur with that significance.
Land Subsidence	No	State HMP lists FNSB as highly impacted by discontinuous permafrost. Local knowledge validates the discontinuous nature of permafrost in the area but modern construction and engineering methods compensate for such risk relative to commercial construction. Residential construction techniques are variable and could be susceptible to subsidence if located in an area of permafrost soil conditions.

The probability of a multiple-hazard event exists but cannot be ranked. As an example, such a situation could result when an earthquake would cause a dam breach consequently causing a large scale flood event. In order to acknowledge and mitigate for such multiple-hazards the mitigation action plan matrices (see Chapter 12) cross-reference potential mitigation actions that could apply to multiple hazards.

Table 5-2 establishes the criteria for probability. The criteria reference the Hazard and Vulnerability Matrix from the State of Alaska All-Hazard Plan 2013.

Table 5-2: Hazard Probability Criteria

Probability Key	Criteria
Y-Yes	The event occurs within that jurisdiction.
N-No	Hazard is not present

	No known record or expectation of occurrence in that jurisdiction.
Y-V Yes-Very Low	Hazard is present with a very low probability of occurrence Event is possible within the next 10 yrs. Event has up to 1 in 10 years chance of occurring (1/10-10%) History of events is less than or equal to 10% likely per year Event is "Unlikely" but is possible it will occur
Y-L Yes-Low	Hazard is present with a low probability of occurrence Event is probable within the next 5 years. Event has up to 1 in 5 chance of occurring (1/5=20%) History of events is greater than 10% but less than or equal to 20% likely per year Event could "possibly" occur
Y-M Yes-Moderate	Hazard is present with a moderate probability of occurrence Event is probable within the next 3 years. Event has up to 1 in 3 chance of occurring (1/3=33%) History of events is greater than 20% but less than or equal to 33% likely per year. Event is "Likely" to occur.
Y-H Yes- High	Hazard is present with a high probability of occurrence Event is probable within the calendar year. Event has up to 1 in 1 year chance of occurring (1/1=100%) History of events is greater than 33% likely per year. Event is "Highly Likely" to occur.

State of Alaska Hazard Mitigation Plan, 2013.

The criteria were applied to the disaster extents and historical record of each jurisdiction. The following matrix resulted from this process and represents the probability of occurrence within the FNSB, City of Fairbanks and the City of North Pole.

Table 5-3: Hazard Occurrence Probability

	Flood	Wildland Fire	Earthquake	Volcano (Volcanic Ash)	Severe Weather	Technological (Hazardous materials)	Erosion	Snow Avalanche	Tsunami & Seiche	Landslides
Fairbanks North Star Borough	Y-H	Y-M	Y-M	Y-L	Y-H	Y-M	Y-M	N	N	N
City of Fairbanks	Y-M	Y-L	Y-M	Y-L	Y-H	Y-M	Y-L	N	N	N
City of North Pole	Y-M	Y-M	Y-M	Y-L	Y-H	Y-H	Y-L	N	N	N

Extent/Magnitude Description

The following criteria will be used to rank the magnitude of each hazard. Similar to probability, the magnitude references the historical record of each jurisdiction.

Table 5-4: Magnitude Criteria

Magnitude/Severity	Criteria to Determine Magnitude
Catastrophic	Multiple deaths Complete shutdown of facilities for 30+ days More than 50% of property severely damaged
Critical	Injuries and/or illnesses result in permanent disability Complete shutdown of critical facilities for at least 2 weeks More than 25% of property is severely damaged
Limited	Injuries and/or illnesses do not result in permanent disability Complete shutdown of critical facilities for more than one week More than 10% of property is severely damaged
Negligible	Injuries and/or illnesses are treatable with first aid Minor quality of life lost Shutdown of critical facilities and services for 24 hours or more Less than 10% of property is severely damaged.

5.03. Critical Facilities

FNSB is home to multiple critical facilities: schools, fire stations, transportation infrastructure, technological centers, communication infrastructure, hospitals, utilities, Federal, State and local government agencies, public safety agencies and military installations et al. As a multi-jurisdiction and multi-hazard mitigation plan it is imperative that the HMP cover all of these facilities that could be highly vulnerable from the impacts of a potential disaster. A comprehensive list is included in the vulnerability analysis (Appendix C).

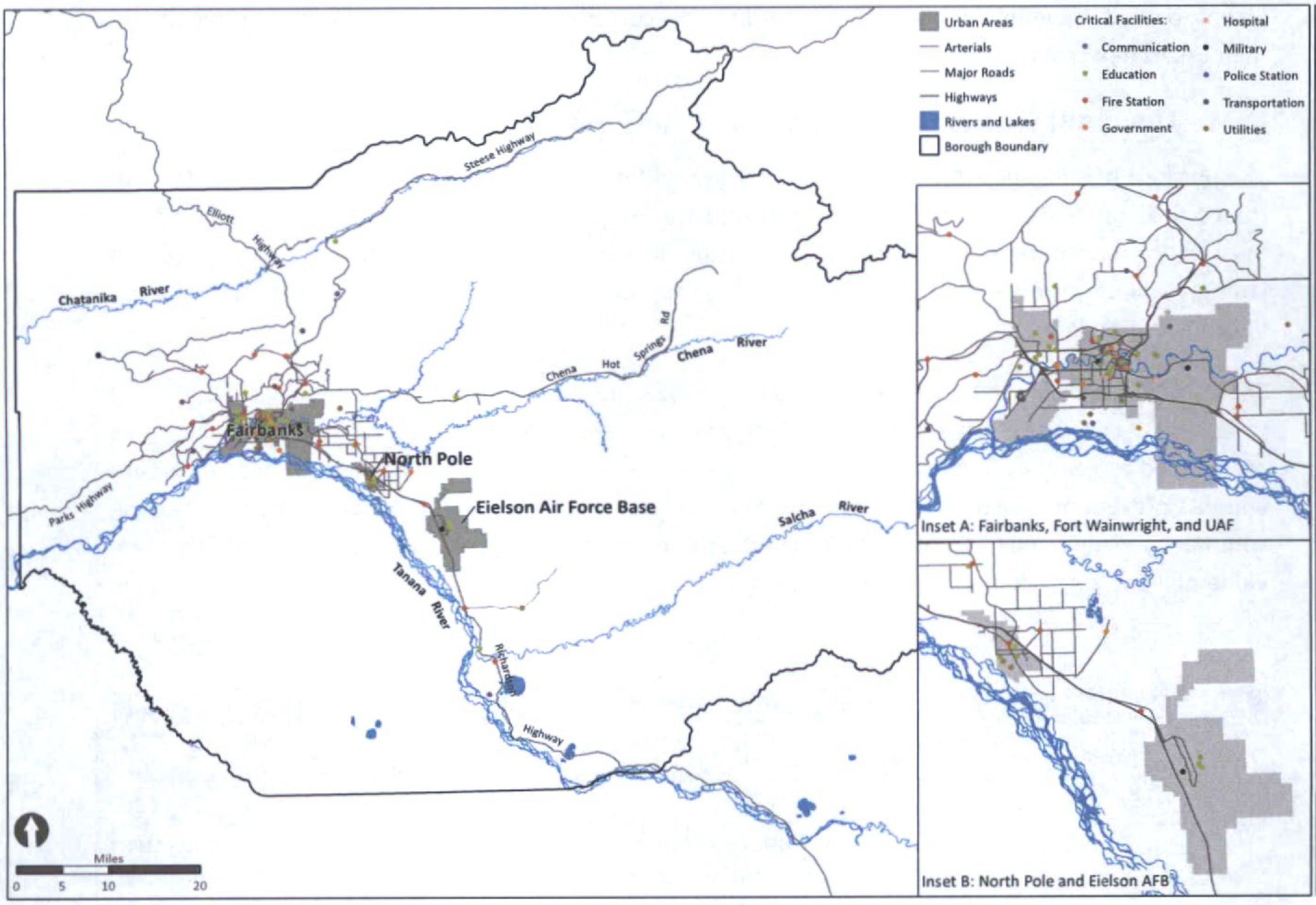
Federal agencies operating within the Borough include:

- US Postal Service
- US Army Corps of Engineers
- US Fish and Wildlife Service
- US Department of Defense
- US Department of Justice
- US Department of the Interior - Bureau of Land Management
- US Department of the Interior – Bureau of Indian Affairs
- US Department of Commerce - National Oceanic and Atmospheric Administration and National Weather Service

* US Department of Transportation - Federal Aviation Administration
* US Department of the Treasury
* US Department of Agriculture – Natural Resources Conservation Service
* Alaska Volcanic Observatory (cooperative between US Geological Service, UAF Geophysical Institute and the State Division of Geological and Geophysical Surveys)

State agencies operating within the Borough include:

* Alaska Railroad
* Department of Fish & Game
* Department of Natural Resources - Divisions of Forestry, and Geological and Geophysical Surveys
* Department of Homeland Security and Emergency Management
* Department of Public Safety (providing Alaska State Troopers, fish and wildlife protection officers and the State Fire Marshall)
* Department of Environmental Conservation
* Department of Transportation and Public Facilities



Map 5-1: Critical Facilities

Hazard Mitigation Plan, Chapter 5: Risk Assessment and Hazard Identification

6. Mitigation Strategy and Goals

The following section presents the FNSB, City of Fairbanks and City of North Pole's strategy for reducing risk and preventing loss during future disasters. It provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools. This includes the jurisdictions' current mitigation actions and authorities for implementation; gives examples of prior mitigation successes; establishes goals and objectives for each hazard profiled with particular emphasis on new and existing buildings and infrastructure; and prioritizes the goals and objectives with an emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

6.01. Development of Mitigation Goals, Actions, Benefit-Cost Analysis

The purpose of mitigation is to reduce the Borough and its communities' vulnerability to the effects of the hazards profiled. Currently the planning effort is limited to the hazards determined to be of the most concern: wildfire, earthquake, severe weather, volcanic ash and flood. However, the mitigation strategy will be reviewed and updated annually as hazard information is added and new information becomes available.

The HMP Committee reconvened October 24, 2013, to review the HMP preliminary draft and vulnerability analysis results 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, the Committee developed seven goals to reduce or avoid long-term vulnerabilities to the identified hazards as presented in Table 11-1.

Table 6-1: Mitigation Goals

Goal Number	Goal Description
1	Eliminate and/or Reduce Loss of Life and Injuries – Eliminate and Reduce the Loss of Life, Injuries and Property by developing and implementing programs that improve public safety.
2	Prevent and/or Reduce Property Damage – Ensure that hazard mitigation practices are incorporated into all new construction occurring in known hazard areas in order to prevent and reduce property damage.
3	Reduce Economic Impact – Minimize negative economic disruptions during a disaster by promoting appropriate hazard insurance coverages and implementation of sustainable mitigation projects.
4	Preserve Natural Systems – Avoid development of known high hazard areas when possible and where unavoidable, recognize natural systems values and open space in order to reduce hazard risk.
5	Promote Outreach and Education – Increase overall natural hazard awareness in the FNSB with well-directed public information campaigns on a year round basis.

6	Collaboration – Promote partnerships and cooperation with public and private sector agencies, businesses, non-governmental agencies and volunteer organizations in reducing or eliminating hazard risks in the FNSB.
7	Enhance Coordination of Emergency Response – Continually monitor, maintain and strengthen emergency response capabilities within the FNSB through collaboration and coordination with responding agencies.

After establishing the mitigation goals, the Committee assessed and revised a list of potential mitigation actions at the November 7, 2013 meeting. Mitigation actions are activities, measures or projects that help achieve the goals of the HMP. It was also determined by the Committee that the probability of a multiple-hazard event exists. As an example, such a situation could result when an earthquake would cause a dam breach consequently causing a large scale flood event. In order to acknowledge and mitigate for such multiple-hazards the mitigation action plan matrices cross-reference potential mitigation actions that could apply to multiple hazards.

After determining the list of potential mitigation actions, the benefit-cost review component of the mitigation strategy was accomplished by reviewing the following factors:

- Extent to which benefits are maximized when compared to the costs of the projects.
- Extent to which the project reduces risk to life-safety.
- Project protects critical facilities or critical city functionality.
- Hazard probability.
- Hazard severity.

The benefit-cost review presented in the HMP is a review and overview and not intended for an actual benefit-cost analysis as would be required as part of grant applications for specific projects. The emphasis within this review is that the process used demonstrates a maximization of benefits over costs.

Projects that demonstrate benefits over costs and that can start immediately were given the highest priority. Projects that the costs somewhat exceed immediate benefit and that can start within five years (or before the new update) were given a description of medium priority, with a timeframe of one to five years. Projects that are very costly without known benefits, probably cannot be pursued during this plan cycle, but are important to keep as an action were given the lowest priority and designated as long term.

After the HMP has been approved, specific projects must be evaluated using a Benefit-Cost Analysis during the funding cycle for disaster mitigation funds from DHS&EM and FEMA.

7. Wildfire Hazard Profile

"Back in Fairbanks, people who fled the flames are trying to cope as best they can. Iditarod Sled Dog Race runner-up Aliy Zirkle left Two Rivers with her 59 dogs yesterday afternoon when the evacuation call went out. 'We actually had a very good view of the fire,' she said. 'We could see flames, so we thought it was probably time to go.' She and her husband, Yukon Quest champion Allen Moore, loaded all the dogs into two trucks and a trailer, along with 'a ton of dog food,' medicine, 60 dog bowls, and other supplies. Among them were 15-year-olds and a pregnant dog due at the end of July. In terms of belongings, 'we forgot some of the human stuff', but the dogs are covered', Zirkle said." (Alaska Dispatch, Laurel Andrews, July 8, 2013)

Figure 7-1: Stuart Creek 2 Fire, 2013

7.01. Nature and Location

Fire has been a natural force in Alaska's Interior for thousands of years. It is a key environmental component in cold-dominated ecosystems. Without fire the Interior's boreal forest's black spruce becomes the predominant tree overtaking the birch, aspen and willow. Eventually the spruce creates a dense canopy that blocks out sunlight to the underlying vegetation. This lack of light diminishes the diversity of vegetative under story necessary to provide adequate food sources to wildlife that are dependent on it. This altered cycle becomes critical to wildfire analysis and planning. It is described in the Community Wildfire Protection Plan (Community Wildfire Protection Plan, Phase I and Phase II 2006) as follows:

With the start of fire fighting in 1950[5], the natural fire cycle and the creation of a diversity of forest age classes across the landscape was slowed. Occasional fires would escape suppression and large fires would result, but in the overall, the forest grew older as a whole. The forest tended to become one age with a lack of successional diversity. The overall forest health had diminished. Continuous fuel beds were created, leading to more difficult fire suppression. On unusually hot dry seasons, like 2004, the continuous fuel beds promoted and continue to promote very large fires. In the extreme years the ecosystem will rebalance itself.

[5] Fire-fighting efforts in Alaska actually started in 1939 with the Alaska Fire Control Service (AFCS) when Alaska was still a territory. A Federal Administrative Order abolished the AFCS in favor of a new Division of Forestry under the BLM Branch of Timber and Resource Management January 19, 1947. Susan K. Todd, PhD. And Holly Ann Jewkes, M.S., Wildland Fire In Alaska: A History of Organized Fire Suppression and Management in the Last Frontier, (Agricultural and Forestry Experiment Station Bulletin No. 114, University of Alaska Fairbanks March 2006): 16

Unfortunately, these large fires create large areas of single age classes, instead of the mosaic of age classes that had existed prior to fire suppression [that created natural fire breaks]. In about 80 years after succession...the forest [has returned] back to black spruce [creating] large continuous fuel beds...and very large extreme fires occur.

Figure 7-2: Willow Creek Fire

PHOTO CREDIT: JOYCE KELSO, AUGUST 3, 2010

Additionally, other natural resources can be severely damaged by intense wildfire resulting in an inability of the soil to absorb moisture effectively and support vegetation. The consequences of this include increased erosion and siltation of rivers and streams, which increases flood potential, degradation of water quality and destruction of aquatic life.

If a wildfire reaches an urban or populated area the consequences become extremely grave with the potential to threaten lives and destroy property and associated resources such as water or electricity availability.

The essential role of fire as a positive force in the environment must be weighed against the necessity of protecting human life, property and valued natural and cultural resources, making the process of fire management very difficult.

Multiple environmental characteristics relate to the nature of wildfire. Topographically the Fairbanks area, located in the northern Interior below the Arctic Circle, is a combination of rolling hills, low mountains and tundra flats. The flats dominate the southern and western parts. Hills and low mountains are in the north and east. Elevations range from 436 feet at Fairbanks to 3,000 feet in the hills. The predominant forest ecosystem is boreal forest. Boreal forest is characterized by large patches of black spruce growing on poorly drained and permafrost soils, whereas the riverbanks and south-facing slopes are patchworks of birch, quaking aspen, balsam poplar and white spruce. A very unique characteristic of the boreal forest and tundra or barren plain of the Interior is the deep moss just beneath the surface that occurs in many locations. The climate of the subarctic forest is characterized by low precipitation, long, cold winters and short, warm summers. The general maximum wind speed is observed in the spring and averages 7 mph (Shulski, A Century of Climate Change in Fairbanks, Alaska 2009). Dry lightning (lightning strikes reaching ground level with the associated precipitation evaporating before reaching the ground) storms are common in the summer months.

The State of Alaska Hazard Mitigation Plan of 2013 indicates that the most active thunderstorm area for lightning strikes is the White Mountains, north of Fairbanks. Overall on very active thunderstorm days within the Interior there may be 8,000 to 12,000 lightning strikes usually occurring in the late afternoon hours from the end of June to the beginning of July. An air mass is defined as any widespread body of air that is approximately homogeneous in its horizontal and vertical extent. Conversely, synoptic thunderstorms feature widespread and intense activity over larges areas, triggered by large-scale weather systems that are often tied to effect of the jet stream.

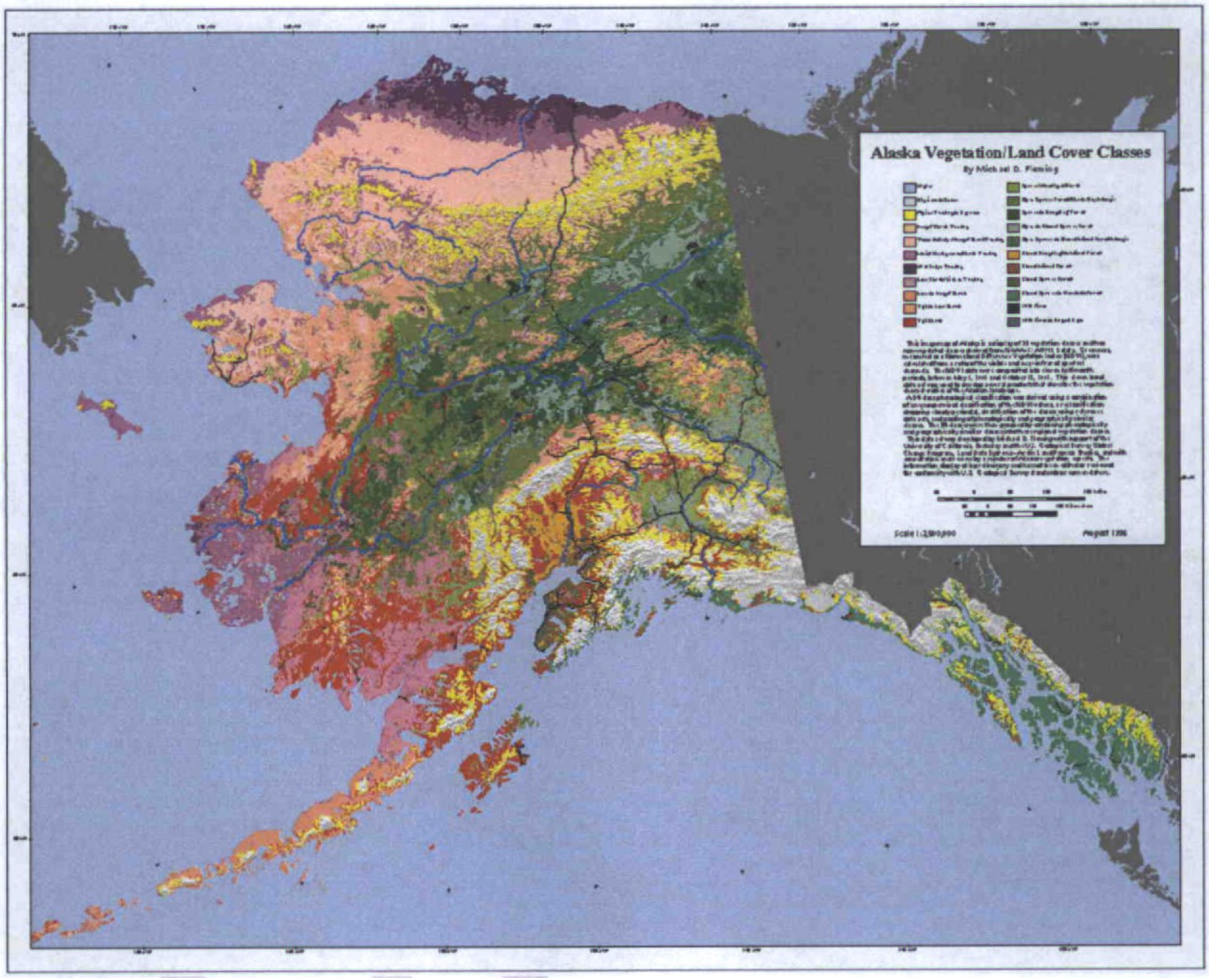
Wildfire characteristics relative to the environment are such that fire normally will burn up slope. Spruce are typically a much more highly combustible fuel source than the fast-growing herbaceous plants such as willow, aspen and birch. The deep moss of the boreal forest and tundra environments can act as a source for smoldering fires after suppression that can suddenly ignite again.

The distinction of black spruce boreal forests for spreading fire is explained in *Wildland Fire in Alaska: A History of Organized Fire Suppression and Management in the Last Frontier* (Todd 2006) as follows:

> *Black spruce forests are an ideal fuel for spreading fire. They have resinous needles, considerable pitch in their wood, and dense branches that go all the way to the ground. These branches serve as "ladder fuels" that allow fires to climb to the tops, or crowns, of the trees. Fires in black spruce can quickly become "crown fires" that reach the tops of the trees. Once in the crown, the fire intensifies and spreads rapidly. In contrast, deciduous trees such as birch and aspen do not have resinous needles or dense branches near the ground and are therefore not as prone to intense fires as black spruce. Even fires in white spruce often do not crown, because white spruce trees, unlike black spruce, often do not have many branches near the ground and the resin content in the needles is lower than black spruce.*

A map of statewide vegetation and land cover, using the phenology of a vegetation index collected by Michael Fleming, US Geological Service (USGS) during the growing season of 1991 follows. Figure 7-3 illustrates that the FNSB is predominately covered with three vegetation classes: Spruce and Broadleaf Forest, Open Spruce Forest/Shrub/Bog Mosaic and Spruce/Woodland Shrub.

Figure 7-3: Statewide Vegetation/Land Cover



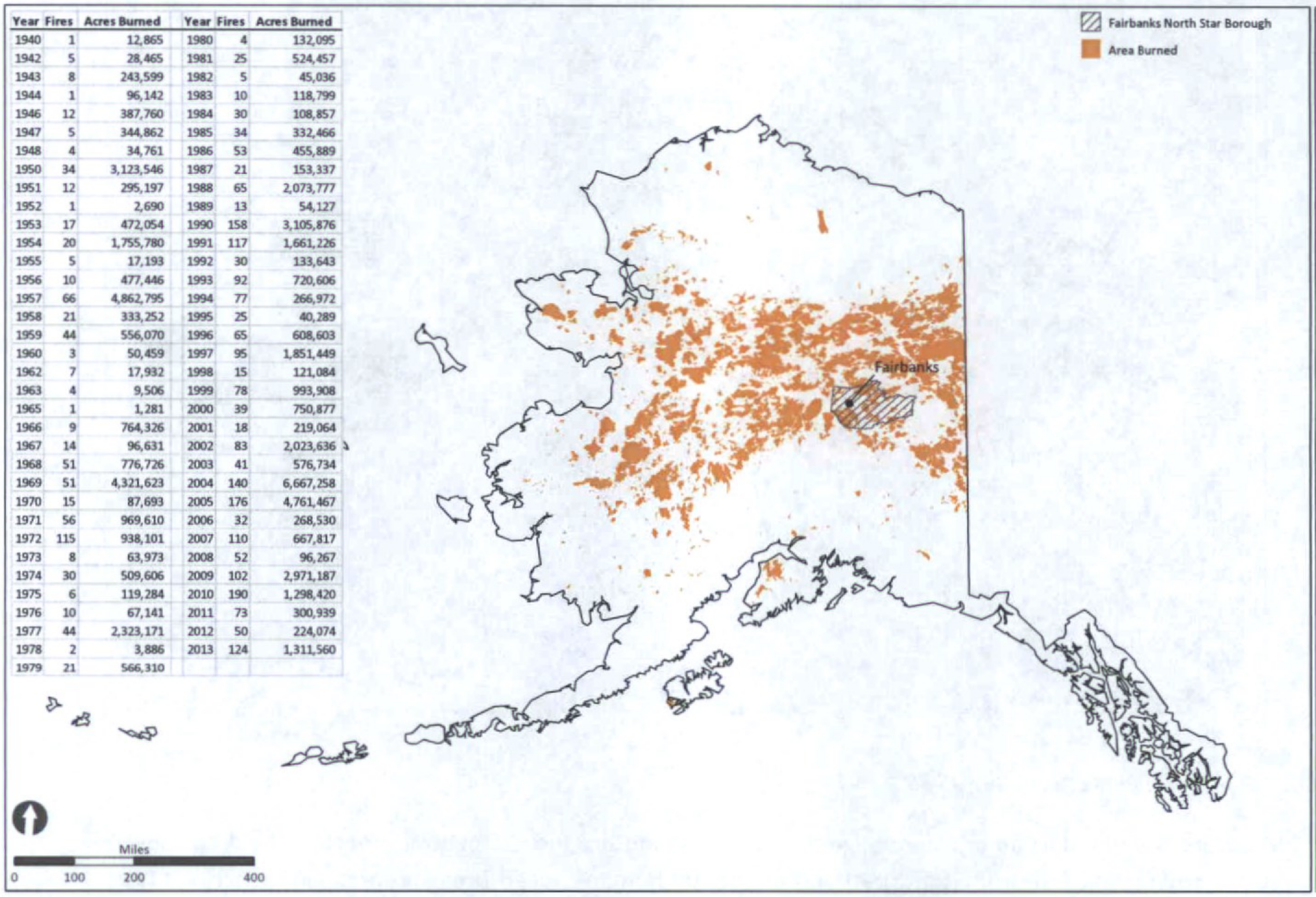
SOURCE: MICHAEL FLEMING, USGS, 1991

Wildfire is defined as an unplanned ignition of a wildland fire (non-structural fire) that could be caused by lightning, volcanoes, unauthorized and accidental human-caused fires and escaped prescribed fires (Alaska Interagency Wildland Fire Management Plan 2010). Wildfires are typically a natural phenomenon with the possibility of occurring in almost any FNSB location igniting a variety of vegetation types. Coal seam fires are another source important in interior Alaska. Most fires occur in the interior of the state between the Alaska Range and the Brooks Range as indicated by Map 7-1 .

Map 7-1: Statewide Wildfire History, 1940 - 2013

Hazard Mitigation Plan, Chapter 7: Wildfire Hazard Profile

Year	Fires	Acres Burned	Year	Fires	Acres Burned
1940	1	12,865	1980	4	132,095
1942	5	28,465	1981	25	524,457
1943	8	243,599	1982	5	45,036
1944	1	96,142	1983	10	118,799
1946	12	387,760	1984	30	108,857
1947	5	344,862	1985	34	332,466
1948	4	34,761	1986	53	455,889
1950	34	3,123,546	1987	21	153,337
1951	12	295,197	1988	65	2,073,777
1952	1	2,690	1989	13	54,127
1953	17	472,054	1990	158	3,105,876
1954	20	1,755,780	1991	117	1,661,226
1955	5	17,193	1992	30	133,643
1956	10	477,446	1993	92	720,606
1957	66	4,862,795	1994	77	266,972
1958	21	333,252	1995	25	40,289
1959	44	556,070	1996	65	608,603
1960	3	50,459	1997	95	1,851,449
1962	7	17,932	1998	15	121,084
1963	4	9,506	1999	78	993,908
1965	1	1,281	2000	39	750,877
1966	9	764,326	2001	18	219,064
1967	14	96,631	2002	83	2,023,636
1968	51	776,726	2003	41	576,734
1969	51	4,321,623	2004	140	6,667,258
1970	15	87,693	2005	176	4,761,467
1971	56	969,610	2006	32	268,530
1972	115	938,101	2007	110	667,817
1973	8	63,973	2008	52	96,267
1974	30	509,606	2009	102	2,971,187
1975	6	119,284	2010	190	1,298,420
1976	10	67,141	2011	73	300,939
1977	44	2,323,171	2012	50	224,074
1978	2	3,886	2013	124	1,311,560
1979	21	566,310			



Wildland fires are characterized as (State of Alaska DHS 2013):

- Prescribed fires: ignited under predetermined conditions to meet specific objectives to mitigate risks to people and their communities, and/or to restore and maintain healthy, diverse ecological systems, or;
- Wildfire: any unplanned wildland fire

Unfortunately wildfire is most often associated with the weather patterns of lightning, winds and low humidity which can cause an outburst of multiple fires almost simultaneously placing a time constraint on a response team's efforts of trying to knock down numerous fires as soon as possible when multiple wildfires may be spread apart over large areas.

The FNSB is one of the State's most vulnerable locations for widespread wildfire, burning thousands of acres annually. Given the continuing trend of expanded human settlement patterns into both the rural and the wildland-urban interface (WUI) areas of the FNSB the risk of wildland fire hazards to both human life and habitation is growing.[6]

7.02. Historical Occurrence

Fires in Alaska have accounted for significant property damage. Since 2000 the State has had nine FEMA declared disasters related to fire. Two of those wildfires were located in the FNSB, the Moose Mountain Fire (2011) burning 858 acres in close proximity to rural residences and the Boundary Fire (2004) burning 537,627 acres. (Center 2011)

The costs to fight such remote fires can be exorbitant. An example is the Moose Mountain fire that started May 20, 2011 within the FNSB near the small community of Goldstream and not declared out until September 9, 2011. The fire suppression costs were over $5 million. Within the same time period another fire, the Hastings fire, in the Fairbanks area burned 54,217 acres for an estimated suppression cost of over $18 million. Both of these fires were human caused (Center 2011).

By the very nature of wildfire is the creation of smoke and air pollution. The impact of smoke pollution can be severe for a large number of citizens in the densely populated areas of the FNSB in multiple ways. Dense smoke leads to a variety of health concerns for at risk populations such as the elderly, people with respiratory or heart disease and children. Wildfire smoke is a mixture of gas and particulate matter made up of acids, organic chemicals, metals, soil or dust particles and allergens such as pollens or mold spores. The smallest particles are the greatest threat because they can be absorbed deep within the lungs and enter into the blood stream. The particles that are 2.5 micrometers in diameter or less are called particulate matter (PM) 2.5 (State of Alaska, Dept. of Environmental Conservation, Division of Air Quality Monitoring and Quality Assurance 2004).

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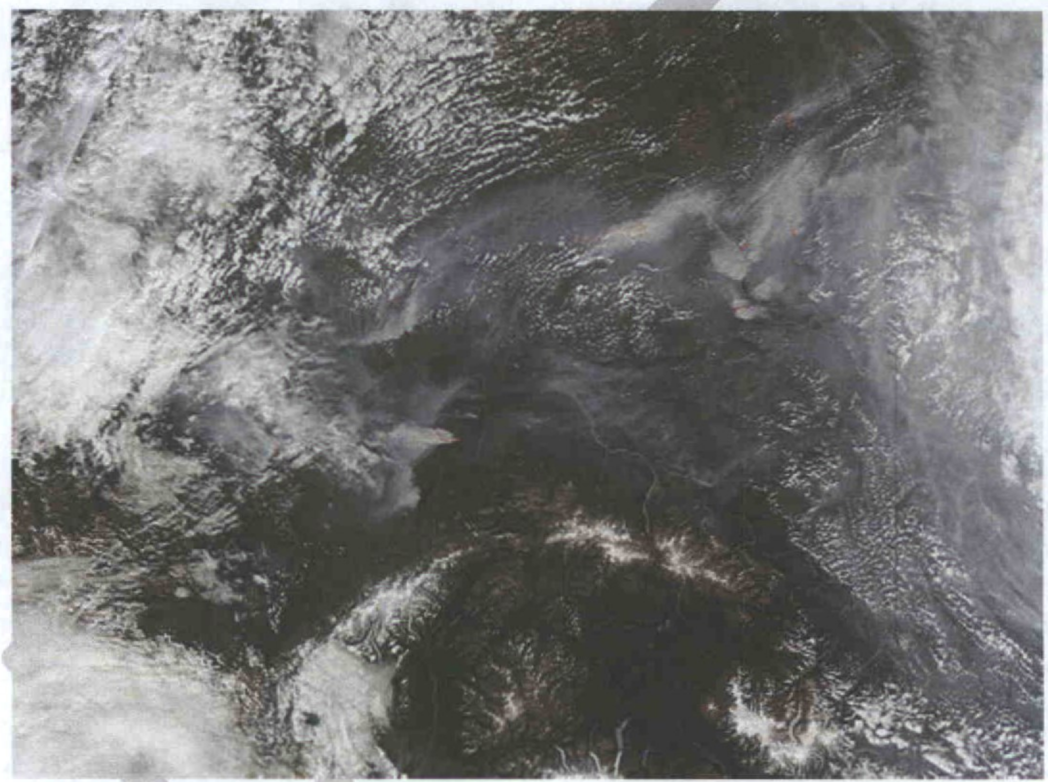
[6] Wildland Urban Interface (WUI) –the area where human habitation and wildlands meet

Wildfire smoke pollution also creates severe transportation issues for vehicular travel, significantly impacts air travel for both military and civilians in the greater Fairbanks area and has closed the Alaska Railroad line between Anchorage and Fairbanks at times. This phenomenon is illustrated in Figure 7-4, taken by NASA in August of 2009. In a report dated 2010, recent changes in the fire regime across boreal Alaska indicated that since 2000 interior Alaska has experienced four large fire years (years in which more than 1 percent of the landscape burned) where 17 percent of the landscape burned (E.S. Kasischke 2010). It was estimated that these fires reduced the coverage of coniferous black spruce forest by 4.2 percent and increased the coverage of broadleaf deciduous forest by 20 percent.

Figure 7-4: Hundreds of Thousands of Acres Burning in Interior Alaska, August 2009



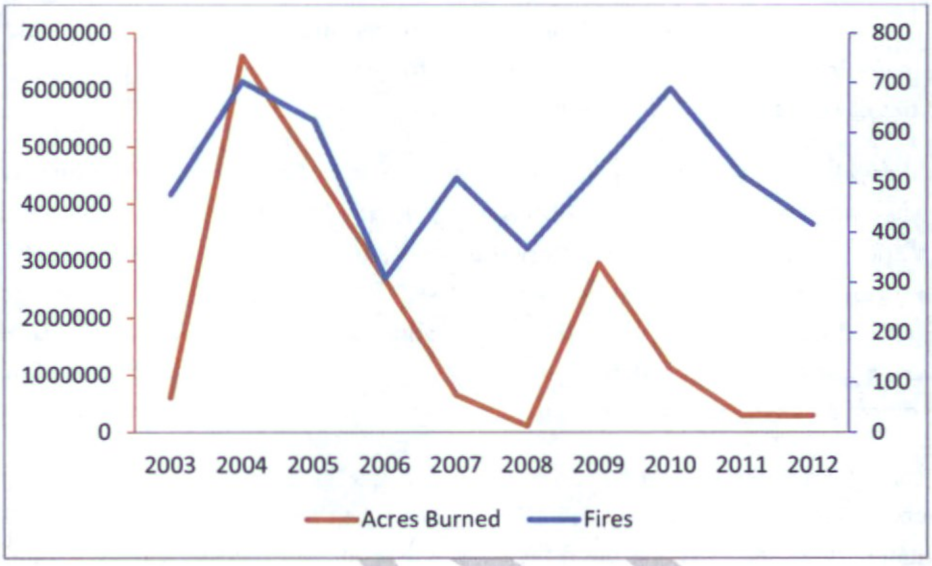
SOURCE: NASA MODIS, AUGUST 4, 2009

Within the past ten years the 2004 fire season is noted as the worst fire season in the Borough's recorded history when over 780,000 acres burned. Smoke pollution from wildfires was also at an all-time high in the Borough. The highest hourly smoke levels recorded in Fairbanks were over 1000 micrograms/cubic meter. Recorded levels were over the Environmental Protection Agency (EPA) Hazardous level for 15 days (250 micrograms/cubic meter for a 24 hour average). Lastly Fairbanks' PM 2.5 levels were over the EPA's Unhealthy category (65 micrograms/cubic meter) for 31 days (E.S. Kasischke 2010).

Table 7-1, and its accompanying chart, represents the Alaska 10-Year Fire Rank, indicating the number of fires per year and the number of acres burned per year.

Table 7-1: Alaska Ten-Year Fire Statistics

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Fires	476	701	624	307	509	367	527	688	515	416
Acres Burned	602,718	6,590,140	4,663,880	266,268	649,411	103,649	2,951,593	1,125,419	293,018	286,888



SOURCE: ALASKA INTERAGENCY COORDINATION SYSTEM

In 2010, one of the biggest fires, 13,766 acres, was the Willow Creek fire located only ten miles south of the Fairbanks airport in a grassy swamp area. It started on June 10 and burned into August causing smoke pollution in the Salcha and North Pole areas (AICC 2010).

There were two notable fires in the FNSB in 2011: the Moose Mountain Fire and the Hastings Fire. The Moose Mountain Fire, started on May 20 and was not extinguished until September 8. As previously noted, although this fire appears small in acreage compared to others in the Borough it cost over $5 million to suppress due to its location nearby the small community of Goldstream and numerous rural residences.

Within the same month of May 2011, the Hastings Fire ignited and ultimately burned over 54,000 acres. On June 6, an evacuation advisory was issued for residents of the Hayes Creek Subdivision. By June 16, the initial risk to over 400 residences was greatly reduced. This was a human caused fire and was declared extinguished at 54,217 acres on September 8. Estimated suppression costs were over $18 million dollars. In addition to this cost, fighting this fire simultaneously with the Moose Mountain Fire was a significant drain on available local resources.

In 2012, the Dry Creek Fire consumed 47,154 acres lasting from June 23 to November 15, and represented almost 20% of the total acreage burned within all of Alaska during the 2012 fire season. The Dry Creek fire was lightning caused (AICC 2012).

Most recently, the Stuart Creek Fire 2, located between Chena Hot Springs and Eielson Air Force Base, burned 87,154 acres, forcing evacuation of over 300 residents and 450 animals. Smoke from the fire created unhealthy air quality and poor driving visibility within many areas of the FNSB. The estimated cost was $21 million.

Within the past ten years the Borough has been dotted with wildfires, as illustrated by the Alaska Interagency Coordination Center map in Map 7-3. Although difficult to discern individual fires on this map, it clearly illustrates the number of wildfires and frequency of occurrence of wildfires within the WUI of the cities of Fairbanks and North Pole.

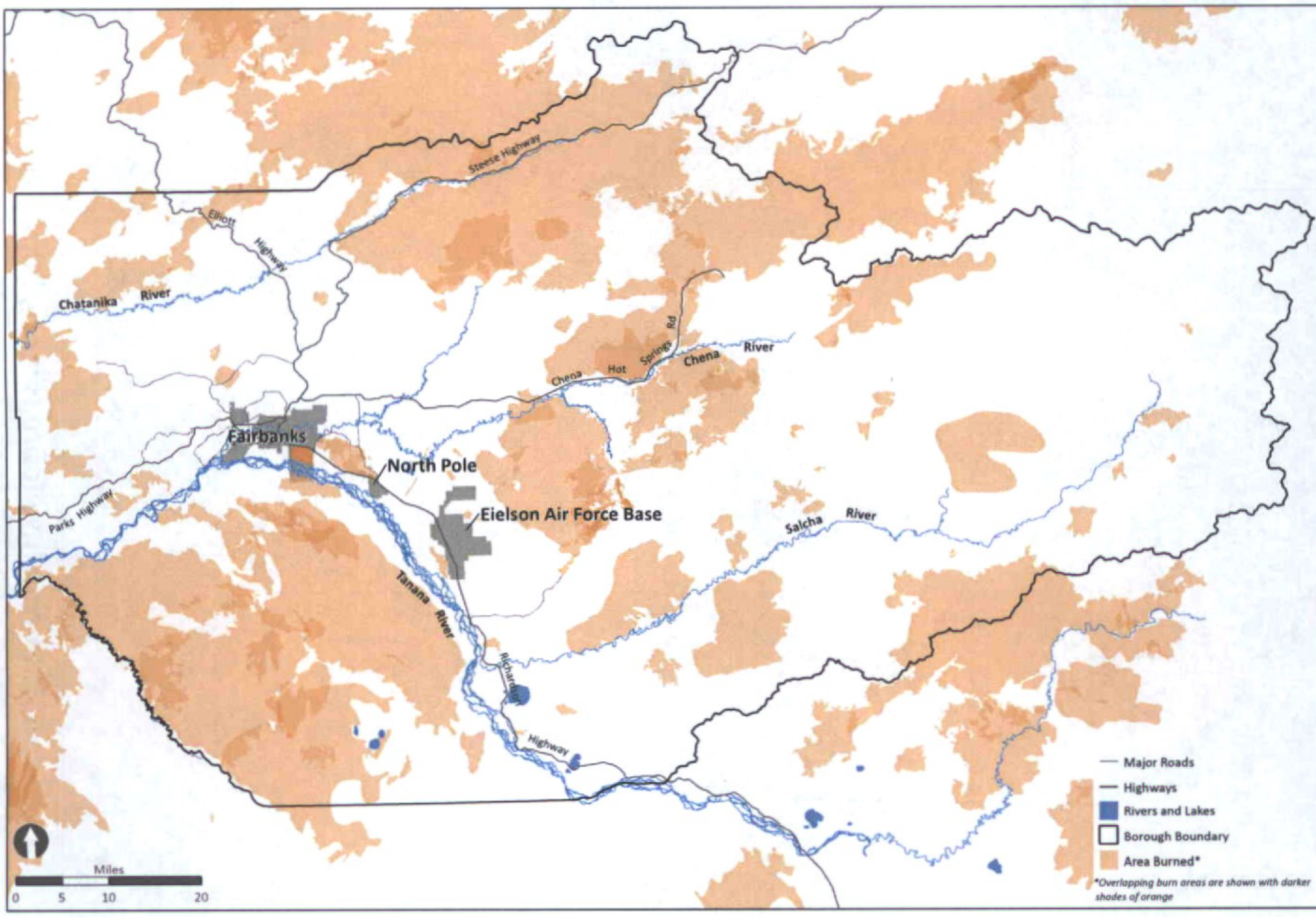
Fairbanks has played an important role historically in the field of fire management rather than just fire "control". The first meeting in Alaska to bring together resource managers, fire control specialists, scientists and private citizens in order to explore the ramifications of wildland fire, its control and its role in the boreal forest ecosystem was held in Fairbanks in 1971. The keynote address at the conference was delivered by Ed Komarek as he pointed out the distinction between the terms fire control and fire management. Mr. Komarek noted that fire *control* consisted primarily of fire suppression techniques whereas fire *management* included prevention and an understanding of fire ecology (Todd 2006).

Fire control could be defined in a very straight forward way - "put the fire out", fire management was more ambiguous adding complexity and room for debate with the potential to involve private property owners in creating defensible space around their dwellings, and making forest health and regeneration decisions with timber harvest and utilizing fire in remote areas to maintain wildlife habitat.

The history of wildfire would not be complete without mention of land laws that influence fire policy. In 1971 the Alaska Native Claims Settlement Act (ANCSA) and in 1980 the Alaska National Interest Lands Conservation Act (ANILCA) prompted debate between conservation and development advocates but also between national interests of conservation and preservation versus state interests relative to extractive resources to benefit the State's natural resource-based economy. Ultimately the decisions made reflect which agency at the Federal or State level is responsible to fire management where. Land conveyances, based primarily from these acts, resulted in the distribution of land ownership status in the Borough as shown in Figure 7-5.

Map 7-2: Borough Wildfire History, 1940 - 2013

Hazard Mitigation Plan, Chapter 7: Wildfire Hazard Profile



Map 7-3: Borough Wildfire History, 2004 - 2013

Hazard Mitigation Plan, Chapter 7: Wildfire Hazard Profile

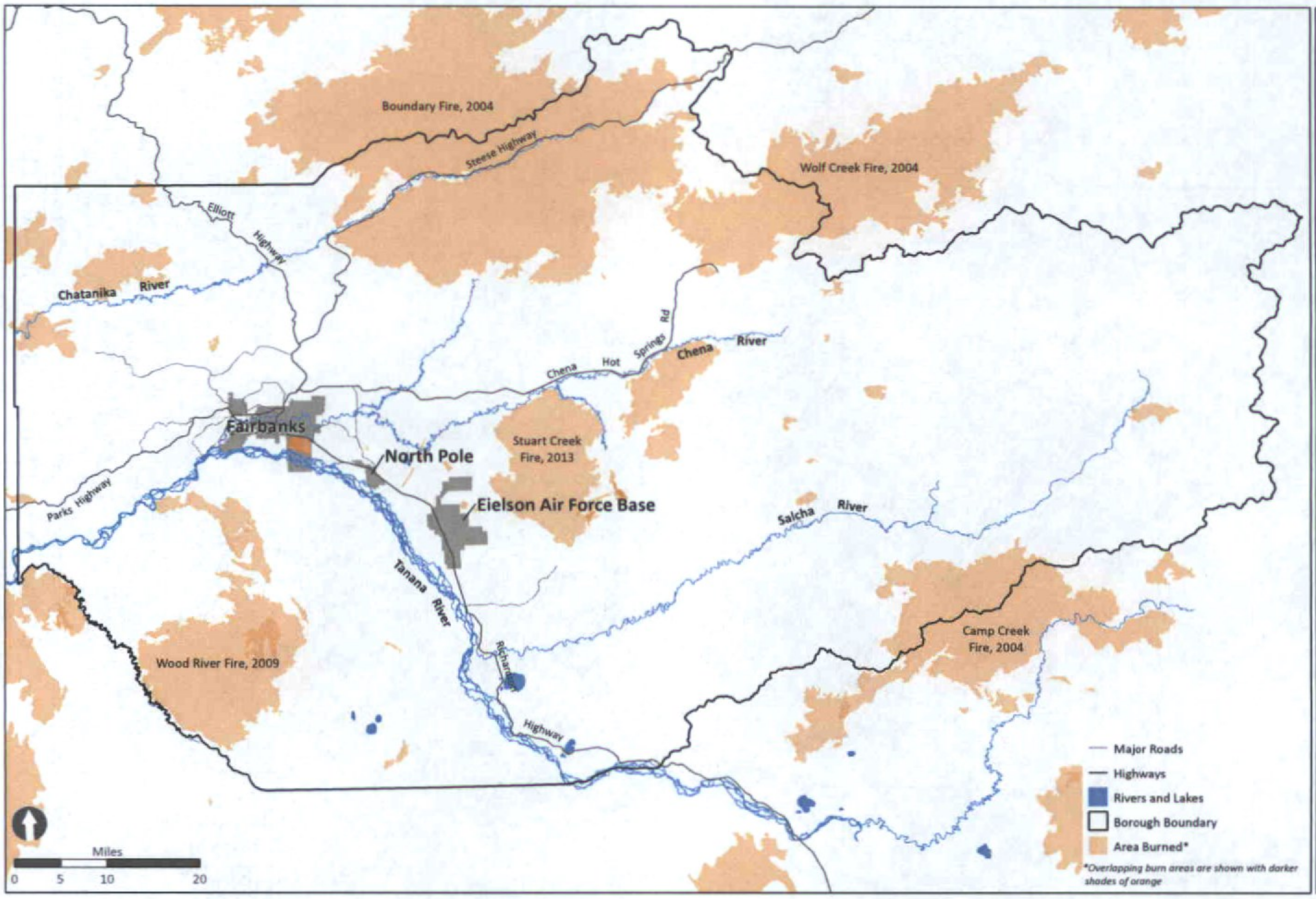
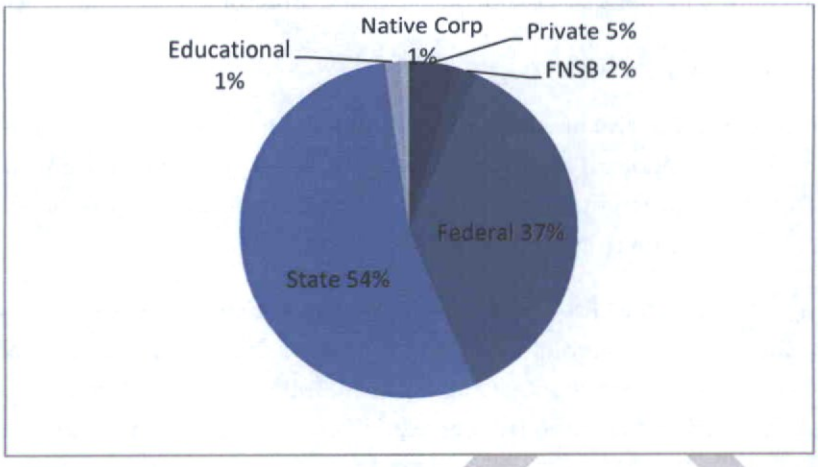


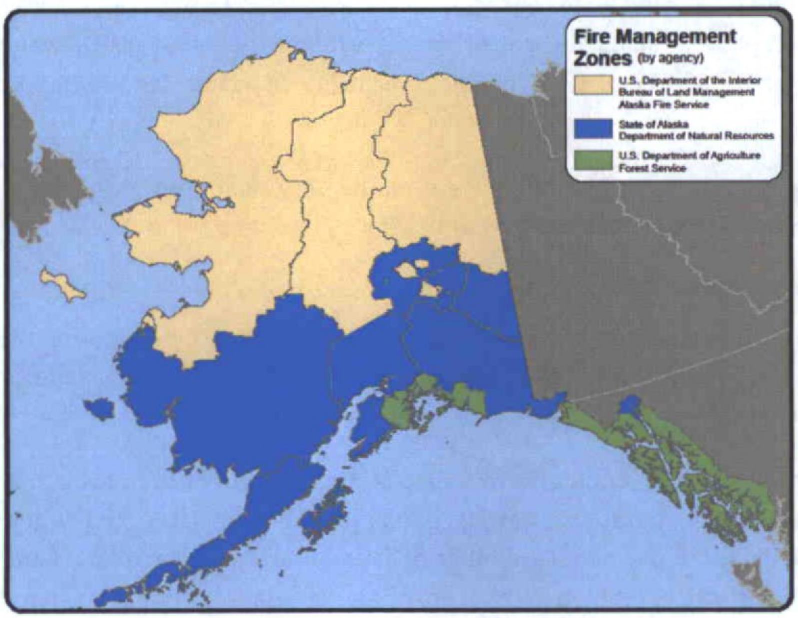
Figure 7-5: FNSB Land Ownership 2013



SOURCE: FNSB ASSESSING DEPARTMENT, AUGUST 2013

The FNSB fire management (exclusive of the cities of Fairbanks and North Pole) operates under the management of the State of Alaska, Department of Natural Resources (DNR) and the BLM/ Alaska Fire Service as illustrated in Figure 7-6.

Figure 7-6: Alaska Fire Management Zones



SOURCE: ALASKA INTERAGENCY COORDINATION CENTER

Although fire management zones were still in place in 1989, both state and federal fire resources joined forces relative to the facilitation of coordinated fire suppression efforts by creating the Alaska

Interagency Coordination Center (AICC) based in Fairbanks. The AICC assists during other natural disasters when requested based upon its successful management structure in fire emergencies.

7.03. Possible Impacts from Future Events

The entire FNSB is vulnerable to the risk of wildfire. Some populations and facilities will have a higher risk than others due to their location. Factors impacting the extent of damage from future events include population distribution, structural distribution and design, transportation facilities design and locations and necessary infrastructure to support all land uses.

In the event of a major catastrophic fire event the FNSB could require emergency medical care, evacuation, alternative shelter, food, water and supplies. Air quality could be significantly affected with the potential for long-term negative health effects to citizens. Both road and air transportation access through the WUI could be closed for extended periods of time limiting commerce and associated supplies to citizens.

Large-scale infrastructure could be damaged causing short or long-term disruptions. These could include disruptions to the TransAlaska Pipeline flow of crude oil, intertie electrical power grid, regional refinery productions of fuels utilized throughout the state, rail belt transportation of goods and passengers, highway transport of natural gas to Fairbanks and air transport of freight and passengers in and out of the region. Although Fairbanks' local water supply is from a well located in the metropolitan area, disruption of electrical service could impact the supply. It is common for rural residents in the FNSB to transport their household water or receive water delivered to their residences from local water services in Fairbanks. If a wildland fire cut off transportation routes, available water could become extremely limited for rural residents. Even the availability of water for fire suppression could be impacted.

Finally, the tangible impacts to national defense could be very significant given the proximity of both Fort Wainwright Army Post and Eielson AFB.

7.04. Probability of Future Events

It is not a matter of "if" as a matter of "when" catastrophic fire events will occur in the FNSB. A given stand of spruce in the boreal forest will burn every 50 to 150 years, and some areas burn more frequently. The boreal forest is a fire-driven ecosystem (Todd 2006).

As the climate trend of warming continues to impact Alaska's natural resources in many ways the fire season not only extends in duration, starting earlier and ending later, but without preventative mitigation will likely increase the overall number of fires occurrences per season and the number of acres burned. This trend is documented in the State of Alaska's Hazard Mitigation Plan 2013:

> *In the 21st century, Alaska is seeing an increasing wildland fire risk due to several factors including climate trends, expansion of population and development into wildland areas and the results of a spruce beetle infestation.*

Within the past 100 years, weather in Fairbanks reflects a positive trend to higher temperatures in both summer and winter. The frequency of days below -40°F has gone from roughly 14 to 8 days per year over the past century and the average number of days above freezing has increased from 85 to 123. The average heat wave index has increased three times that seen prior to 1976 (Carl J. Markon 2012).

As human development into wildland areas increases, a correlation between development and added risk of wildland fire is increased. A component of risk assessment is the distinction between human caused fires and lightning caused fires. The March 2006 report "*Wildland Fire In Alaska: A History of Organized Fire Suppression and Management in the Last Frontier*" indicates that, between 1952 and 2004, 86 percent of the acreage burned in Alaska was due to lightning caused wildfire (Carl J. Markon 2012).

Human-caused fires are typically detected earlier and suppressed more successfully with a lesser number of acres burned per event. This is due to the fact that lightning caused fire can go undetected for a longer period of time due to the remote areas where they can occur. Also access to the lightning caused wildfire may not be adjacent to a roadway leading to suppression difficulties whereas human caused wildfire tends to be in more accessible areas. Conversely the economic loss associated with human caused fires can also correlate to a greater expense for the loss/benefit ratio as the human caused fire would have a higher probability of occurring in a more highly populated area and therefore typically with more structures at risk.

Many other risk factors inherent to the geography and development of the FNSB become significant to the suppression of wildfire such as lack of adequate water sources, steep terrain, limited road access, structures with no defensible space, flashy fuels and distance to available firefighting resources.

The DOF and the Borough partnered with local, state and federal agencies to share resources and consolidate wildfire risk to the FNSB residents. Beginning in 2005 the FNSB and DOF signed a cooperative agreement to complete mapping of hazardous fuels for the entire FNSB and to complete a comprehensive Community Wildfire Protection Plan (CWPP). The CWPP provides a detailed assessment of wildfire issues facing the FNSB and its residents by completing mapping, modeling and rating zones of fire risk for the entire Borough. Goals were then developed; a thorough list of risk reduction projects in the high risk areas were identified and prioritized as identified by the exposure model; and an implementation schedule was created. The CWPP is an open-ended plan involving continuing mitigations and actions to accomplish its goals and objectives presently and in the future.

The components that contribute to wildfire exposure were categorized as follows:

- Hazardous Fuels – the potential intensity of a fire and provides a relative measure of the risk of various fuel types;
- Ignition Risk – the potential for a fire ignition at particular locations;
- Values of Concern – cultural and resource values being exposed (or threatened) from wildfire
- Suppression Difficulty – the initial attack capability of suppression forces based on accessibility and response time.

The original model's calculated risk of exposure to wildfire was specific to communities determined to be at the highest risk from wildland fire (not the entire Borough). The mapping series in Figure 7-7 through Figure 7-10 illustrates the modeling and mapping process.

Figure 7-7: Hazardous Fuels Modeling Component

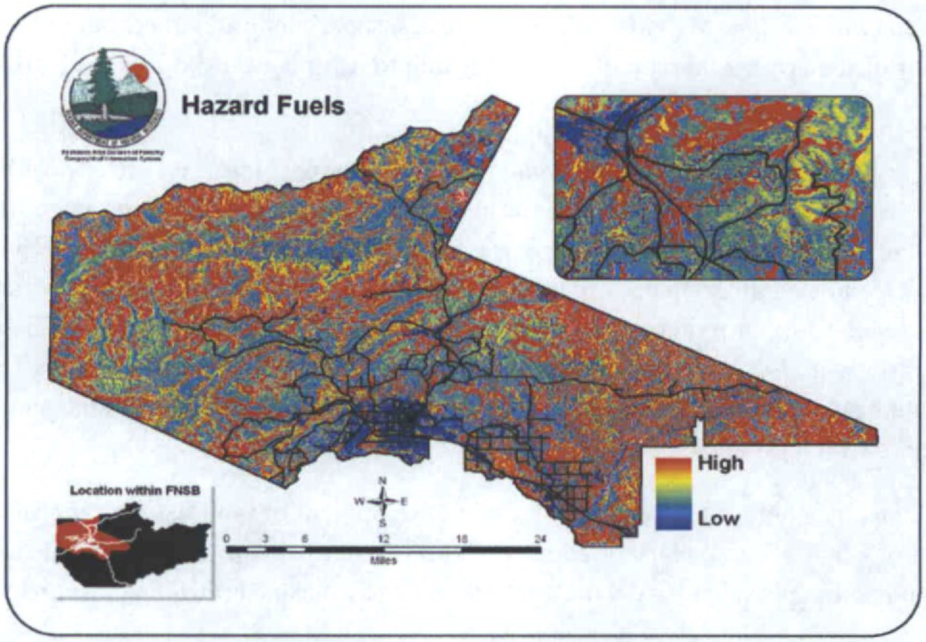


Figure 7-8: Ignition Risk Modeling Component

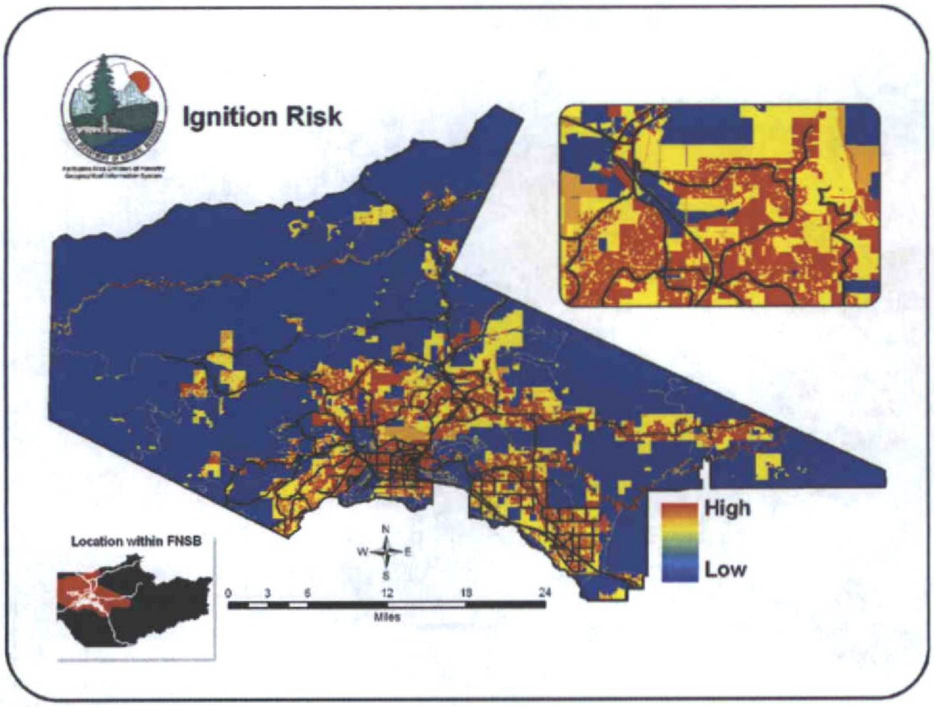


Figure 7-9: Values of Concern Modeling Component

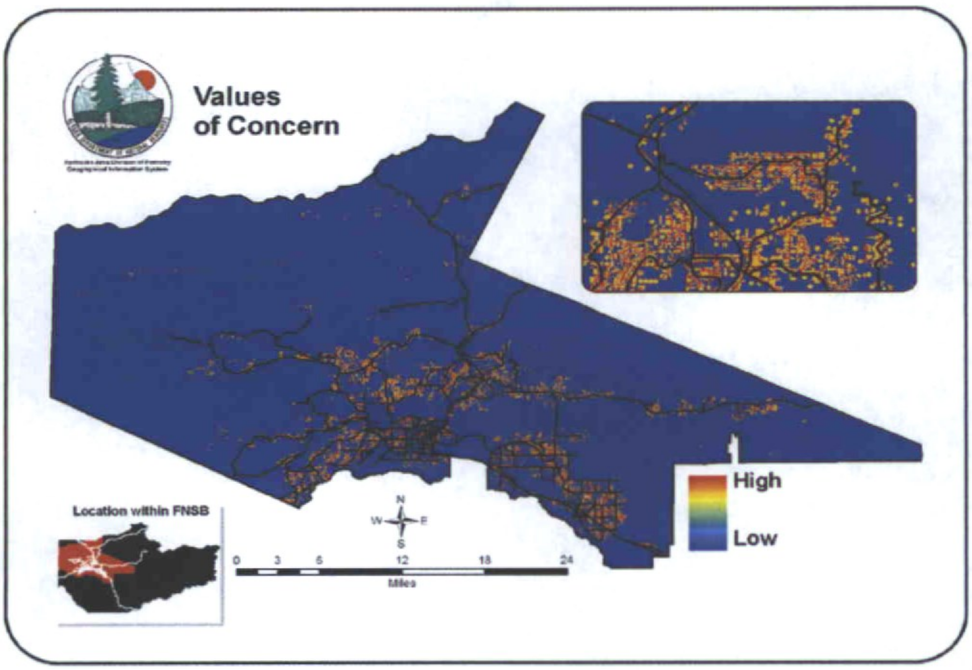
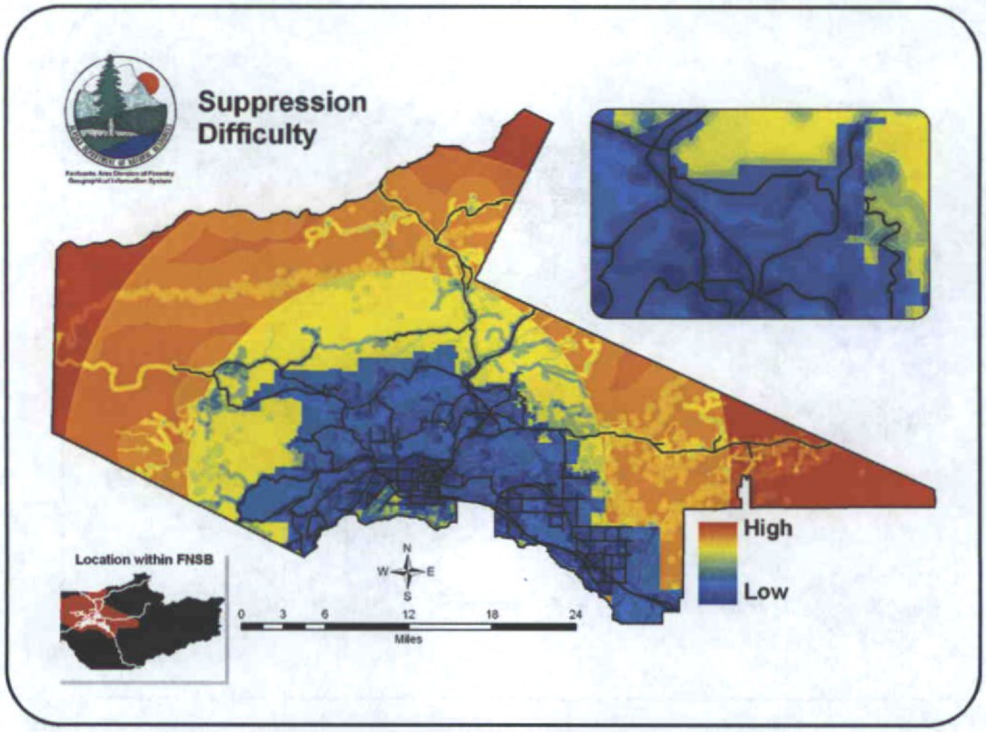
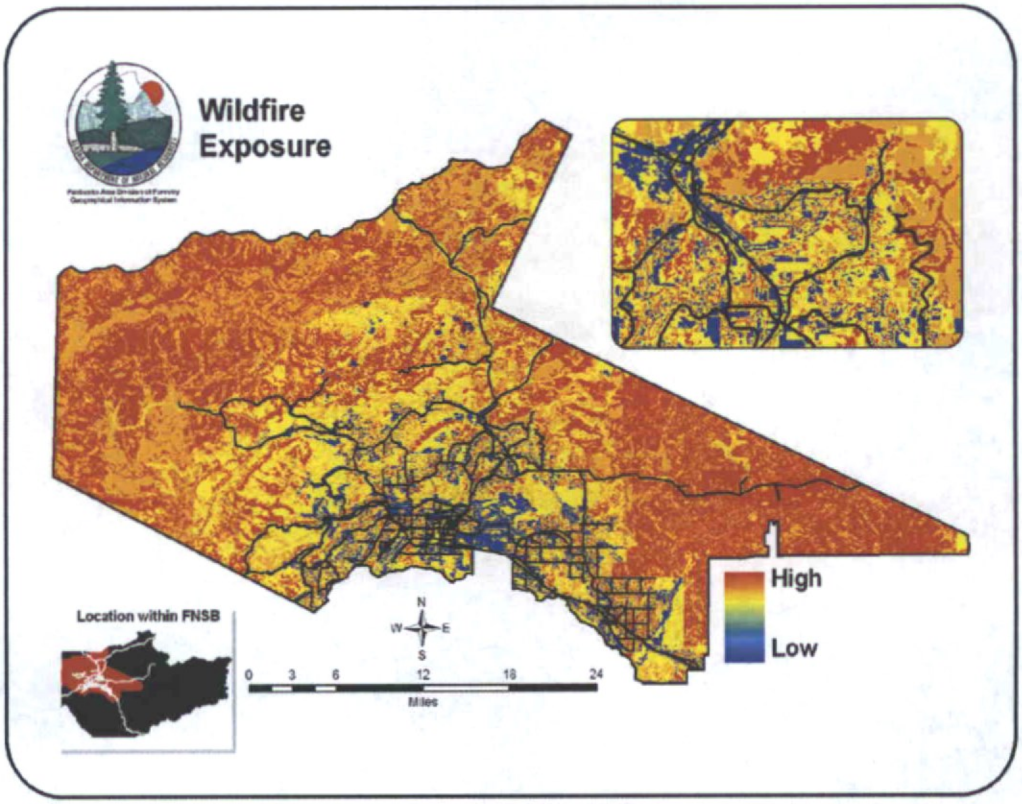


Figure 7-10: Suppression Difficulty Modeling Component



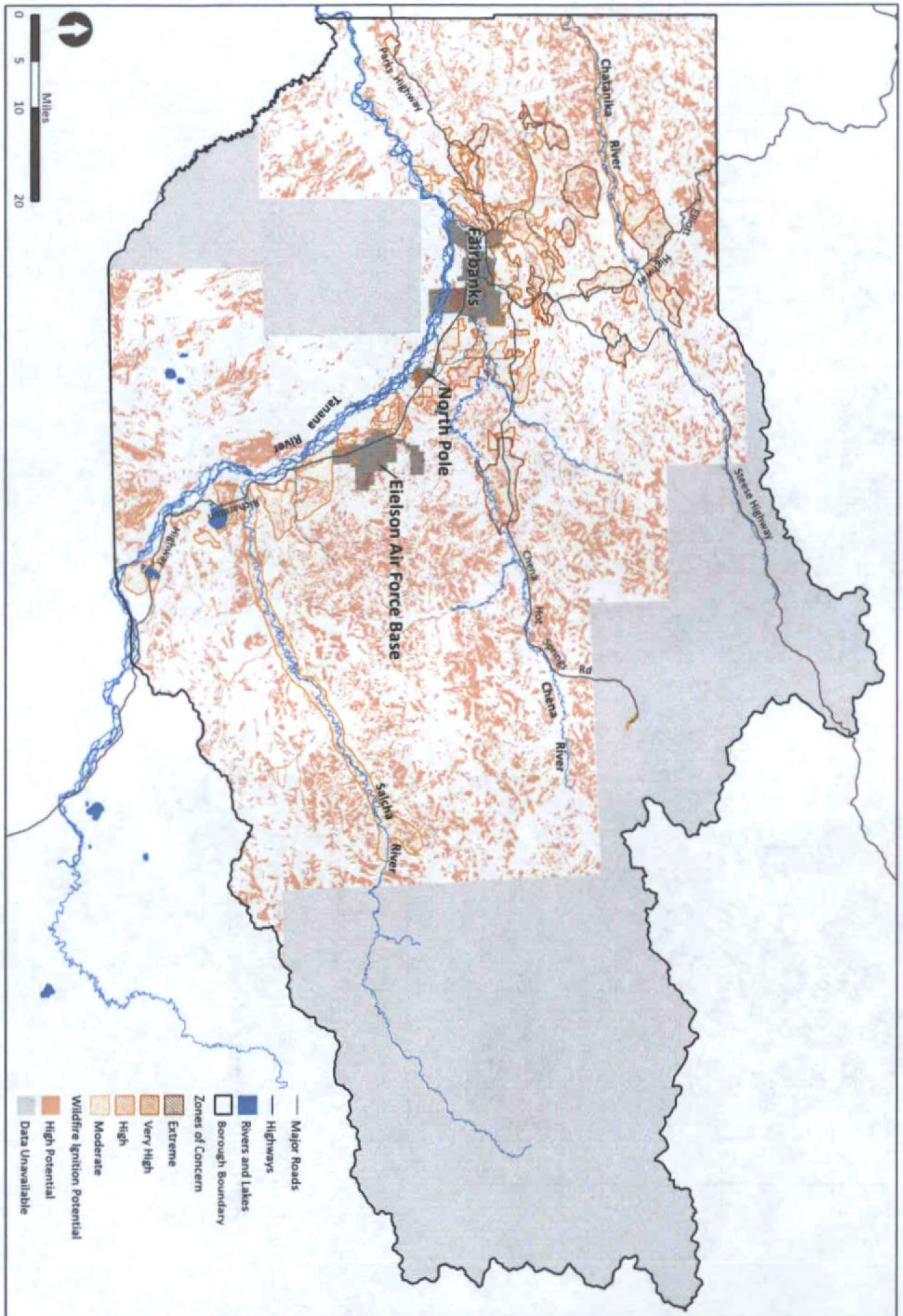
From these components a wildfire exposure ranking was modeled and mapped in Figure 7-11.

Figure 7-11: Wildfire Exposure



SOURCE: FNSB COMMUNITY WILDFIRE PROTECTION PLAN, PHASE III (DRAFT), FEBRUARY 2013

The data in Map 7-4, indicating the wildfire ignition potential and zones of concern, was a product of the CWPP process representing the entire Borough's wildland fire risk analysis for the HMP.



Map 7-4: Wildfire Potential and Zones of Concern

Hazard Mitigation Plan, Chapter 7: Wildfire Hazard Profile

Prepared By: Fairbanks North Star Borough Department of Community Planning | Date: 1/27/2014 | Doc: HMP_Map_07WildfireHazardProfile_2014-0121 | Data Source: FNSB GIS

7.05. Wildfire Hazard Actions

7.05.1. Wildfire Current Mitigation Actions and Authorities

- Alaska Master Cooperative Wildland Fire Management and Stafford Act Response Agreement – The Alaska DNR; the United States Department of the Interior Bureau of Indian Affairs, BLM, Fish and Wildlife Service; and the United States Forest Service have signed a cooperative fire management agreement to share information, personnel, equipment, supplies, services and funds for wildland fire management activities. This includes prevention, preparedness, communication and education, fuels treatment and hazard mitigation, fire planning, response strategies, tactics and alternatives, suppression and post-fire rehabilitation and restoration.
- Alaska Wildland Fire Coordinating Group – The mission of the Alaska Wildland Fire Coordinating Group (AWFCG) is to provide a forum that fosters cooperation, coordination, collaboration and communication for wildland fire management and related activities in Alaska. The AWFCG plans and implements interagency fire management practices statewide and promotes programs and interagency partnerships. Goals, objectives and membership are documented in the *AWFCG Memorandum of Understanding and Standard Operating Procedures.*
- The AWFCG has formed committees and taskforce groups to address specific issues. Long standing committees include Air Quality and Smoke Management, Education and Prevention, Fire Research and Development, Fire Weather, Safety, Operations and Fuels. A full list of committees and their charters are available online. Alaska Multi-Agency Coordination Group – The Alaska Multi-Agency Coordination Group (AMAC) is activated when wildland fire activity levels warrant. The AMAC is tasked with the following: incident prioritization; resource allocation; coordination of State and Federal disaster responses; political interfaces; media and agency information; anticipation of future resource needs; and the identification and resolution of issues.
- Alaska Interagency Wildland Fire Management Plan – The Purpose of the *Alaska Interagency Wildland Fire Management Plan* (AIWFMP) is to promote a cooperative, consistent, cost-effective, interagency approach to wildland fire management. It is the interagency reference for wildfire operational information online. Firefighter and public safety is emphasized throughout the plan as the single, overriding priority in fire management activities for agencies. The AWFCG is responsible to review and update, as warranted, the AIWFMP.
- Alaska Interagency Coordination Center – The AICC is the Geographic Coordination Center for Alaska. AICC coordinates statewide tactical resources, logistics support and predictive services for State and Federal agencies involved in wildland fire management and suppression in Alaska. AICC is located at the Alaska Fire Service (AFS) facility in Fairbanks. AICC is staffed and managed by State and Federal employees who mobilize interagency personnel and resources to fires statewide.

  The AICC website is a comprehensive source of fire-related information such as the Alaska Preparedness Levels, the Daily Situation Report, current and historic fire perimeter maps, media releases, planned prescribed fires, historical fire data and current weather forecasts.

- Community Wildfire Protection Plan – The CWPP is a collaborative effort between wildfire suppression agencies, Federal, State and local governments, community groups and individuals to identify sources of fire risk and prioritize areas for mitigation projects. The completed CWPP is available online. The CWPP process assists communities in developing an appropriate and desired wildfire protection plan addressing elements of community protection. Through collaboration, residents develop their strategy for protecting life, property and critical infrastructure in the wildland urban interface.
- Alaska Firewise – Firewise is a collaborative effort among local, State, Federal and private agencies and organizations to promote fire safety and mitigation in the wildland/urban interface. Communities are eligible to be recognized as a Firewise Community/USA after adopting a CWPP and completing one Firewise project. An Alaska Firewise brochure and other prevention materials are available online.
- Alaska Fire Service – The BLM Alaska Fire Service (AFS) located at Fort Wainwright, Alaska, (within the FNSB) provides wildland fire suppression services for all Department of Interior and Native Corporation lands in Alaska. In addition to suppressing wildland fires, AFS has other statewide responsibilities, including: interpretation of fire management policy; oversight of the BLM Alaska Aviation program; planning, implementing and monitoring fuels management projects; operating and maintaining advances communication and computer systems such as the Alaska Lightning Detection System. AFS also operates on an interagency basis.

7.05.2. Wildfire Hazard Mitigation Successes

In conjunction with the DNR, the Borough completed a Borough-wide CWPP in 2006. An update of the CWPP is currently under review. To date the following mitigations have been carried out:

- Resolution by the Fairbanks North Star Borough Emergency Services Commission recommending the compliance with the NFPA 1141 Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas (2012 Edition) establishing practices and guideline to develop fire protection and emergency services infrastructure to reduce the impact of land use changes on fire protection and emergency services delivery.
- Creation of exposure model of hazardous fuels
- Identification of Zones of Concern inside and outside of fire service areas within the Borough with rating system developed
- Hazardous fuels reduction through silvaculture treatments of 2,300 acres, the largest accomplishment for any single community of its size in the United States. The treatments required numerous public meetings and contacts, as well as several interagency permits. Funding for a portion of the work was obtained under the 2009 American Recovery and Restoration Act in the amount of $1.4 million. All funded projects were completed by the end of 2010.
- Three ultramobile laptops were loaded with imagery, datasets and ArcPad applications developed by DOF and deployed within the Borough by the Steese, Chena-Goldstream and North Star Fire Departments. The mobile GIS applications were a success improving response time and providing better information to the emergency responder program.

- Booths and displays promoting Firewise programs were at the Alaska Home show, Midnight sun Festival, Alaska Public Lands Information Center, Fred Meyers Safety Weekend, Sportsman's Warehouse Outdoor Days and the Tanana Valley State Fair.
- Two national home insurance companies, Allstate and State Farm, have conducted home visits with their locally insured homeowners to recommend Firewise improvements. The insurance companies are requesting a variety of improvements be completed in order to continue being insured.
- FNSB organized and hosted Firewise and fire prevention training for several volunteer fire departments creating 2 person teams to conduct door to door visits of residences in the high risk Zones of Concern. The department teams left special Zones of Concern door hangers and offered home risk evaluations. Many residents requested risk evaluations and received a rating and recommendations for improvements.
- Borough Smart 911 Program
- FNSB GIS aerial pictometry was updated in the summer of 2012 providing emergency managers with improved GIS data and map production of high-resolution imagery of settled areas of the Borough and structure locations.

7.05.2.a City of Fairbanks

- The City of Fairbanks has adopted by Ordinance the family of International Code Council (ICC) codes, including the International Building Code, International Fire Code, International Mechanical Code, International Fuel Gas Code, and International Residential Code.

7.05.2.b City of North Pole

- The City of North Pole has adopted the same family of ICC codes as the City of Fairbanks.

7.05.2.c FNSB

The Borough is responsible for the safety of all structures constructed under Borough ownership. When a new structure is built such as a library, the Borough utilizes its own engineers for plan review and conformance with State Codes and the family of ICC codes. Additionally, the Borough must meet the standards of their insurance provider, FM Global, which is often more stringent than the IBC. Such is the case with internal fire sprinkler systems in Borough owned structures.

Table 7-2: Wildfire Hazard Mitigation Action Plan Matrix							
Objective Number	Objective Description	Specific Actions	Ranking Priority	Administering Department	Time-frame	Benefit - Costs	Goals Attained
W-1	Utilize the FNSB, City of Fairbanks and City of North Pole EOPs and EOCs to support wildfire operations.	a. Secure grant funding for enhancement of the FNSB EOC. b. Critique use of EOC following activation and identify improvement opportunities.	High	FNSB, City of Fairbanks and City of North Pole EOCs	On-going	Highly cost effective: The implementation of plans and procedures that improve the coordination and efficiency of the emergency response system has a high benefit relative to a low cost.	6
W-2	Adopt Firewise as the preventative education program for the FNSB, Fairbanks and North Pole	a. Encourage fire proofing of residences, including the installation of sprinkler systems. b. Distribute educational materials about defensible space.	High	FNSB PIO, City of Fairbanks and North Pole Fire Departments	1-2 Years	Highly cost effective: Participation in programs that promote community preparedness and education has a high benefit relative to a low cost.	5
W-3	Participate in outdoor burn permit process for residents.	a. Annually review notification and response procedures. b. Continue to direct monies received from burn violation fines towards fire prevention education.	Low	AK DOF	On-going	Highly cost effective: The implementation of programs and policies that protect public safety has a high benefit relative to low cost.	6
W-4	Address wildland interface issues	a. Create a hazard notification process for people intending to build in areas with dense Black Spruce.	High	FNSB Emergency Operations Dept.; FNSB School District; City of Fairbanks Engineering Division; City of North Pole	On-going	Highly cost effective: Community preparedness and education has a high benefit relative to a low cost.	2
W-5	Complete wildfire mitigation projects.	a. Plan for and require fire breaks on the perimeter of residential areas vulnerable to wildfires.	High	FNSB, Cities of Fairbanks and North Pole	On-going	Highly cost effective: The securing of funding through grants affords opportunities not possible with local funding.	1

8. Seismic Event Hazard Profile

"Fairbanks - ...The Denali Fault quake was a monster – the largest inland earthquake in North America in nearly 150 years – and its west-to-east shockwave was powerful enough that it was felt as far away as Louisiana. Roads were sheared apart along the fault line in the Interior, and some glaciers literally were ripped in two." (Fairbanks Daily News-Miner)

Figure 8-1: Denali Earthquake Road Damage

SOURCE: JEFF RICHARDSON, FAIRBANKS DAILY NEWS-MINER, NOVEMBER 4, 2002

8.01. Nature and Location

The Alaska Earthquake Information Center (AEIC), a partnership between UAF, USGS and the National Oceanic and Atmospheric Administration (NOAA), collects all available seismic data into a single statewide network and serves as the Regional Data Center for the state. AEIC reports that (AEIC n.d.):

- Alaska has 11 percent of the world's recorded earthquakes
- Three of the six largest earthquakes in the world occurred in Alaska

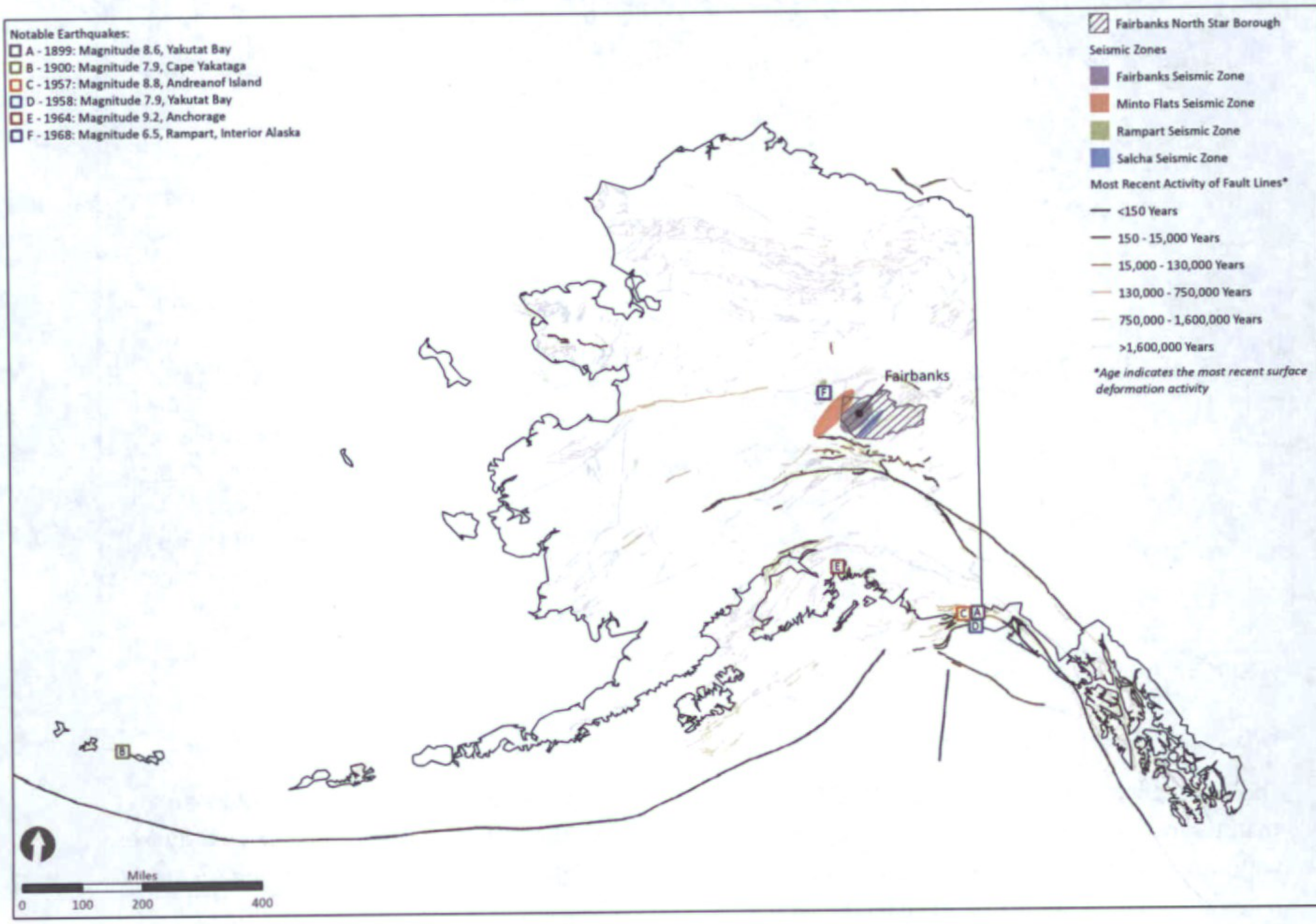
- Since 1900, Alaska has had an average of one magnitude 8 or larger earthquake every 13 years and one magnitude 7 to 8 earthquake every year.

In order to understand why Alaska has such a disproportionate number of earthquakes compared to the rest of the world it is necessary to understand the geological makeup of Alaska. The earth's crust is composed of tectonic plates that may be more than 40 miles thick and greater than a thousand miles across. One of those plates, the Pacific plate, slides toward the northwest, past southeastern Alaska and beneath south central Alaska. AEIC gives a layman's analogy. The Pacific plate can be thought of as a conveyor belt. Riding on the Pacific plate is the Yakutat Terrane which is a buoyant piece of crust that is colliding with the southern Alaska margin. Interior Alaska is also being squeezed because of the collision of the Yakutat Terrane. Earthquakes occur along plate boundaries and in interior Alaska where it is being squeezed. Earthquakes are generated at the margins of the Yakutat Terrane and further inland where the curst is breaking in response to being shoved northward and under the adjacent plate, the North American Plate.

The associated hazards of earthquakes include duration of ground shaking, strength of ground shaking, frequency of intervals between shaking, surface faulting, ground settlement and liquefaction, snow and rock avalanches and slides, tsunamis and seiches. Tsunamis and seiches are specific to ocean or large bodies of water. The damage generated by an earthquake is relative to the distance from the epicenter, magnitude of the quake, local soil types/degree of slope/geology, and local building design and construction (State of Alaska DHS 2013).

The duration of ground shaking depends on how the fault ruptures, the distance from the rupture and underlying soil type and thickness. During a magnitude 7.0 earthquake, the shaking may last 30 to 40 seconds. The longer structures shake, the greater the damage. Since many of the damaging earthquakes occur close to the earth's surface, shaking can decrease rapidly with increasing distance from the fault that produced the earthquake. When soils are soft, thick and wet shaking can strengthen and the soils may slide or subside. More rapid shaking with shorter intervals between tremors, produces more damage. Buildings can exhibit side-to-side and up-and-down shaking during earthquakes necessitating building design standards that can factor in both motions (AEIC n.d.).

The energy released during an earthquake is difficult to imagine. Magnitude used to be measured by a seismograph (a machine that measures how much the ground moves) and was delineated by the Richter scale developed by Dr. Charles F. Richter in 1934. Over the years the science community has come to utilize a value called a "moment" magnitude. The moment magnitude scale is a logarithmic scale of 1 to 10 that enables seismologists to compare the energy released by different earthquakes on the basis of the area of the geological fault that ruptured in the quake (The Free Dictionary n.d.). The change occurred because it was felt that the Richter scale underestimated the energy released by the larger earthquakes. For instance, in 1964 the most devastating earthquake in Alaska's known history occurred in the Anchorage bowl area and is commonly known as the Good Friday quake. It was initially assigned a Richter magnitude of 8.4 but is now considered to have had a magnitude of 9.2 (AEIC n.d.).



Map 8-1: Fault Lines and Seismic Zones

Hazard Mitigation Plan, Chapter 8: Earthquake Hazard Profile

Another scale used to measure the intensity of an earthquake is the Mercalli intensity scale. This scale uses Roman numerals I through XII (I – not felt by people to XII – catastrophic with total destruction) and represents the intensity of the quake's energy magnitude plus quantifying the effects of the Earth's surface, humans, object of nature and man-made structures. Table 8-1 compares earthquake magnitude and intensity scales.

Table 8-1: Comparison of Earthquake Magnitude and Intensity Scales

Earthquake Magnitude	Equivalent Energy in Weight of TNT	Equivalent Energy in Hiroshima-size Atomic Bombs	Mercalli Intensity	Human Observations
4	15 tons	1/1000	II-III	Feels like vibration from a nearby truck
5	477 tons	3/100	IV-V	Small objects are upset, sleepers awaken
6	15,095 tons	1	VI-VII	Difficult to stand, damage to masonry
7	477,335 tons	32	VII-VIII	Widespread panic, some walls fall
8	15,094,673 tons	1006	IX-XI	Wholesale destruction, large landslides
9	477,335,482 tons	31,822	Xi-XII	Total damage, waves seen of ground surface

SOURCE: AEIC

8.02. Historical Occurrence

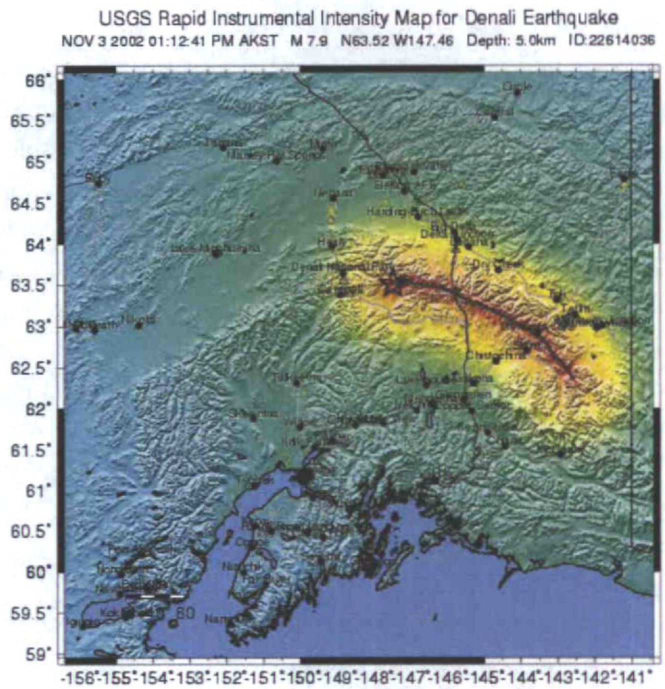
The historical earthquake activity of the FNSB is close to the Alaska state average, but still 725% greater than the overall U.S. average. Map 8-2 and Map 8-3 illustrate the historical occurrence of earthquakes within Alaska and the FNSB. There have been three magnitude 7.0 earthquakes occurring within 50 miles of Fairbanks in the last 90 years (Plafker 2003).

On November 3, 2002 an earthquake with a registered magnitude of 7.9 occurred along the Denali Fault, the strongest earthquake ever recorded in Interior Alaska. The earthquake shot westward along the Denali Fault before branching onto the Totschunda Fault. The surface rupture was approximately 209 miles long cutting a swath through anything in its way with a horizontal offset of up to 22 feet.

The earthquake was felt as far away as Louisiana and Texas. It was the strongest known quake generated in interior Alaska. Fairbanks experienced over 3 minutes of continuous shaking but escaped serious damage. Fortunately in 2002 the fault released most of its energy in a sparsely populated area away from Alaska's major cities although the damage to the Richardson and Parks Highways and bridges from mudslides and buckling generated by the fault cost at least $25 million. Only minor damage was reported in Fairbanks. Figure 8-2 illustrates the Mercalli intensity of the Denali Earthquake.

The Denali fault, as close as 85 miles south of Fairbanks, is located on the boundary of the Pacific and North American plates. It is the largest of the faults in interior Alaska and it moves in response to the Yakutat Terrane collision at about 9mm per year. It is defined as a strike-slip fault as the crust blocks slide by each other. There are several other known active faults within the immediate area of the FNSB. The Kaltag Fault and the Tintina Fault are among those and other smaller unnamed faults.

Figure 8-2: Strong Motion Map for Denali Earthquake, 2002



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Source: USGS, Nov. 3, 2002

Liquefaction, a process in which strong, prolonged earthquake shaking transforms loose, water-saturated sediments into liquid slurry, impacted much of the Tanana River Valley (USGS n.d.).

One of the most significant structures to withstand the quake was the Trans-Alaska Pipeline. The Denali Fault runs directly under the pipeline. As a testament to extensive preventative structural engineering design, the pipeline moved with the shifting fault but suffered relatively minor damage requiring only repairs to pipeline supports in case of future quakes.

Within the past century there have been several large earthquakes with epicenters within 50 miles of Fairbanks.

- August 27, 1904, Fairbanks – Magnitude 7.3

  The second largest quake ever reported in interior Alaska causing buildings to sway and crack.

- July 7, 1912, Paxson – Magnitude 7.2

  This earthquake was reportedly "violent" at Fairbanks and "strong" in Kennicott. The earth heaved and rolled at the north base of Mount McKinley and the country was scarred with landslides.

- July 22, 1937, Central Alaska – Magnitude 7.3

  This large earthquake occurred in central Alaska, about 25 miles southeast of Fairbanks. It was felt over most of Alaska's Interior (about 300,000 square miles). Aftershocks occurred for several months. Fairbanks sustained considerable minor damage. At Salcha Bluff, southeast of Fairbanks, the highway was blocked for several meters by a landslide. Near there, mud boils appeared and cracks as wide as 38 centimeters formed. Water in the nearby slough rose considerably above its normal level and did not subside for several days.

- October 16, 1947, Wood River – Magnitude 7.2

  This major earthquake was centered southeast of Nenana, on the Salcha River Fault. It was felt over most of central and southern Alaska and at two places in the Yukon Territory of Canada. It was related to more than 200 foreshocks and aftershocks. Considerable moderate damage extended from Fairbanks to Nenana. Landslides occurred on the Tanana River.

- June 21, 1967, Fairbanks – Magnitude 5.6 and less

  This was an earthquake "swarm" of smaller quakes causing minor local damage.

- October 29, 1968, Minot Creek fault – Magnitude 6.5

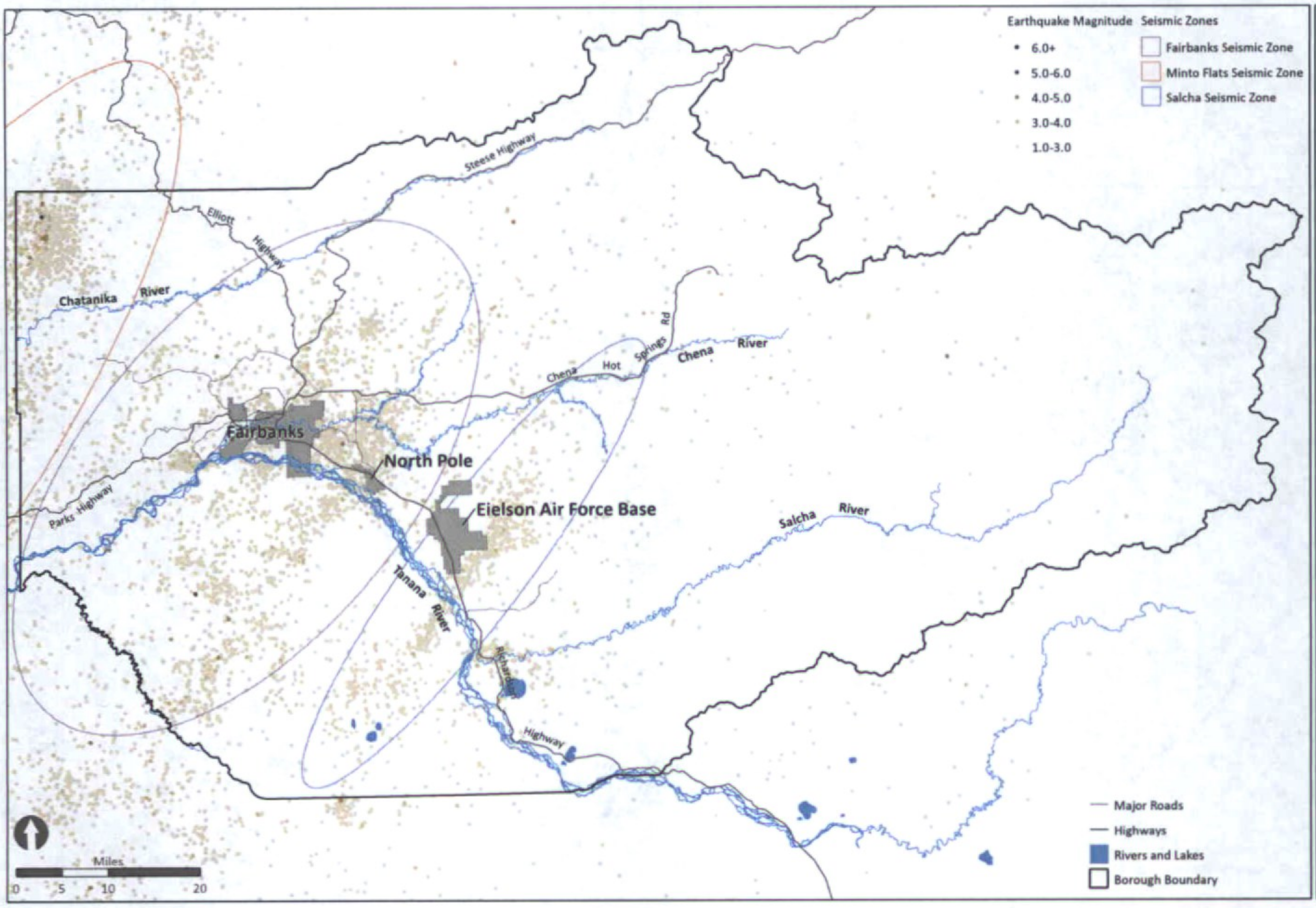
  Passed beneath the Yukon River Bridge.

- February and March, 1977, North Pole – Magnitude 4.1 or less

  This was an anomalous resurgence of activity on the Badger Road fault of several thousand earthquakes. No significant damage was caused (Davies 1983).

- November 3, 2002, Denali Fault – Magnitude 7.9

  As previously noted.

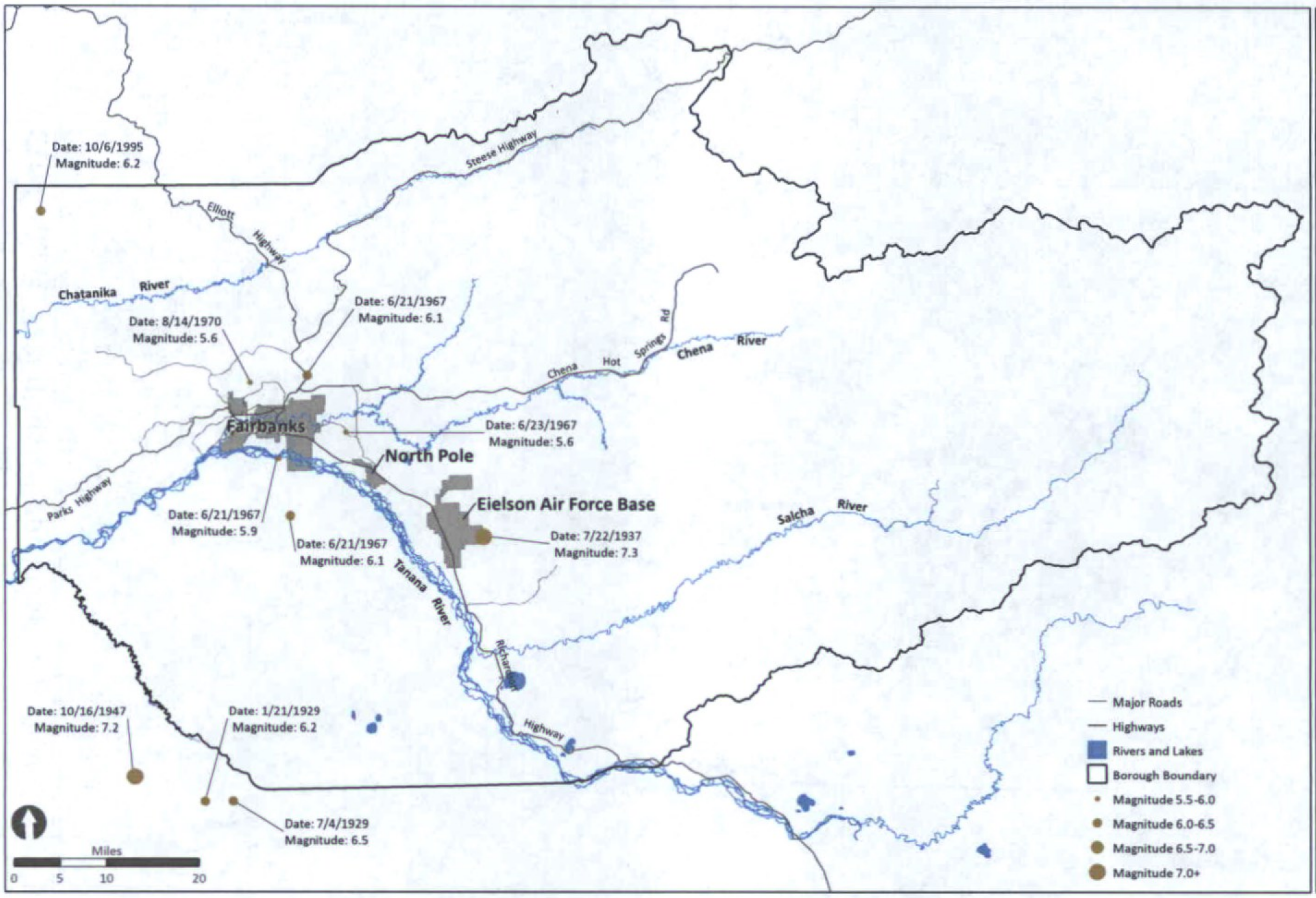


Map 8-2: Recorded Earthquakes, 1980 - 2013

Hazard Mitigation Plan, Chapter 8: Seismic Hazard Profile

Map 8-3: Major Earthquakes, 1900 - 2013

Hazard Mitigation Plan, Chapter 8: Seismic Hazard Profile



8.03. Possible Impacts from Future Events

As indicated in the *Revision of Time-Independent Probabilistic Seismic Hazard Maps for Alaska*, written by the USGS in 2007, "Although the population of Alaska remains small, the potential for very significant impacts on important natural-resource production and transportation facilities, on critical military facilities, and on the more populated regions of the State from a large earthquake must be taken very seriously."

As the population and infrastructure of the FNSB grows, so does the need to prepare for future earthquakes of significant magnitudes. As exhibited by the prior historic occurrences, earthquakes frequently occur in interior Alaska.

Earthquakes with a magnitude of 7.0, having previously occurred within the FNSB and having the probability of occurring again, are evidenced by widespread panic and structural failure.

The entire FNSB is vulnerable to the risk of earthquakes. Some populations and facilities will have a higher risk than others due to their location. Factors that are considered for risk analysis include population distribution, structural distribution and design, transportation facilities design and locations and necessary infrastructure to support all land uses.

The most significant possible impacts could be on important natural-resource production and transportation facilities. Additionally the impact to operations of military facilities could pose an inherent risk to national defense.

8.04. Probability of Future Events

Like floods, earthquakes have probable rates of occurrence. The basis for the probability rates for earthquakes takes into consideration evidence of prehistoric earthquakes, combined with historic records and seismologic monitoring.

Within the region between the Denali and Tintina/Kaltag faults lies the FNSB. In the most recent 2007 USGS review of seismic hazard maps for Alaska this area was denoted as having experienced several earthquakes in the magnitude 7.0 range during the 20th century and, in addition, has a number of young faults. Many of smaller earthquakes in the region are concentrated in three diffuse bands striking north-northeast. The bands are termed the Minto Flats, Fairbanks and Salcha seismic zones. As of 2007 none of the bands had been clearly associated with a geologic fault, however, it was noted that a number of other northeast- to north-northeast-striking faults along the north side of the Denali fault were evidenced by youthful activity. But there continues to be insufficient information to include any individual faults explicitly in the hazard map rather they are captured in the smoothed seismicity of the region (Robert L. Wesson 2007).

A summary of the probability of an earthquake occurring in the cities of Fairbanks and North Pole and 15 census districts follows. The information is provided by the USGS database. Table 8-2 represents the chance of a major earthquake of at least 5.0 magnitude within 50 miles of the community within the next 50 years.

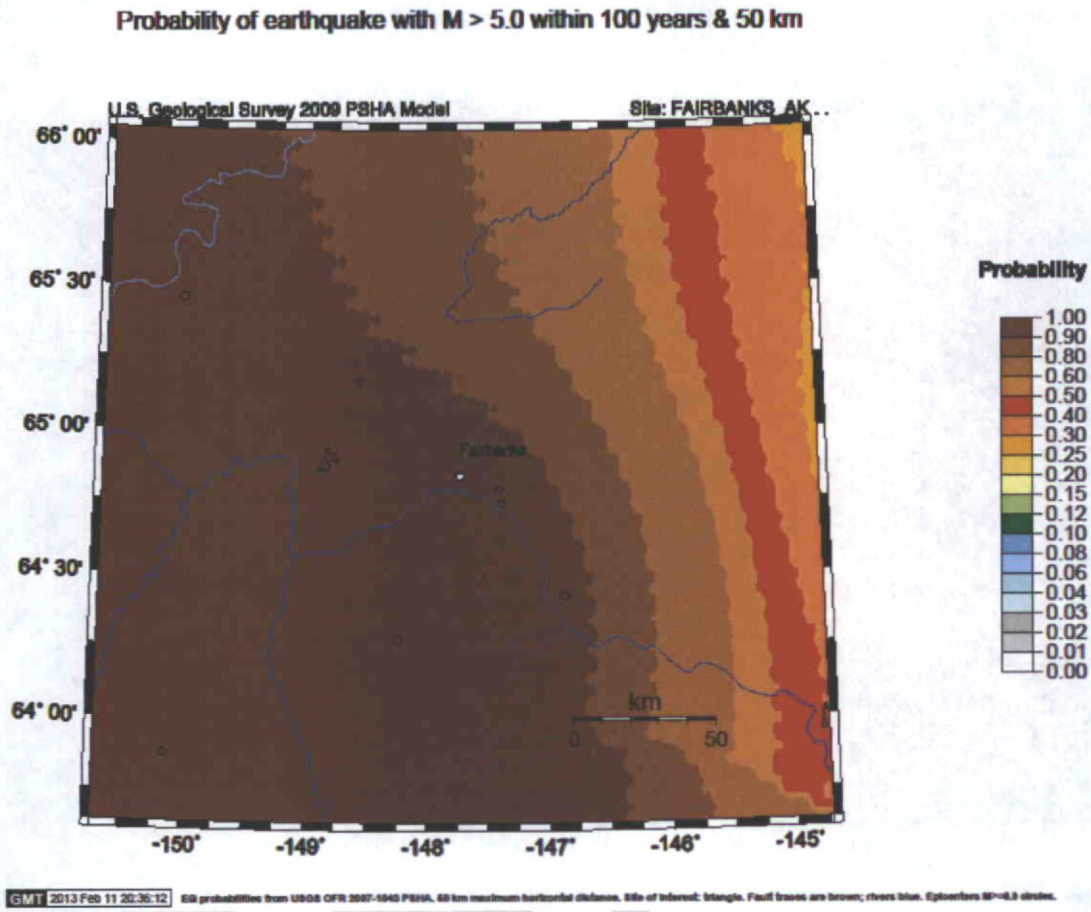
Table 8-2: Community Earthquake Risk Grade

Location	Probability of Occurrence 5.0 magnitude, within 50 miles, within 50 years
Fairbanks	83%
North Pole	82%
Badger	82%
Chena Ridge	85%
College	83%
Eielson AFB	81%
Ester	84%
Farmers Loop	83%
Fox	81%
Goldstream	81%
Harding Birch Lakes	76%
Moose Creek	82%
Pleasant Valley	76%
Salcha	81%
South Van Horn	85%
Steele Creek	81%
Two Rivers	78%

Source: USGS

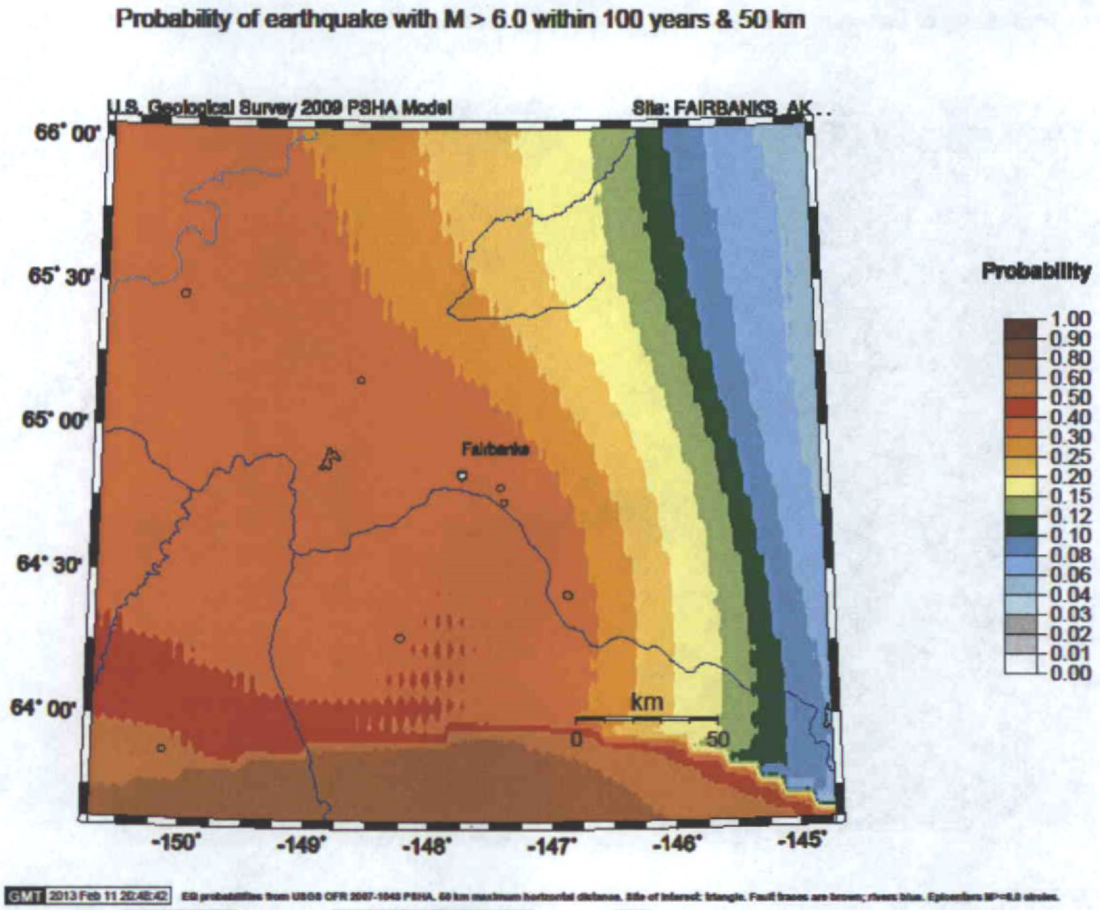
The USGS also has a website that allows for the creation of probability models (2009). Three scenarios for a 5.0, 6.0 and 7.0 magnitude earthquake occurring within the next 100 years were modeled. Figure 8-3 through Figure 8-5 illustrate this model.

Figure 8-3: Earthquake Probability with M > 5.0



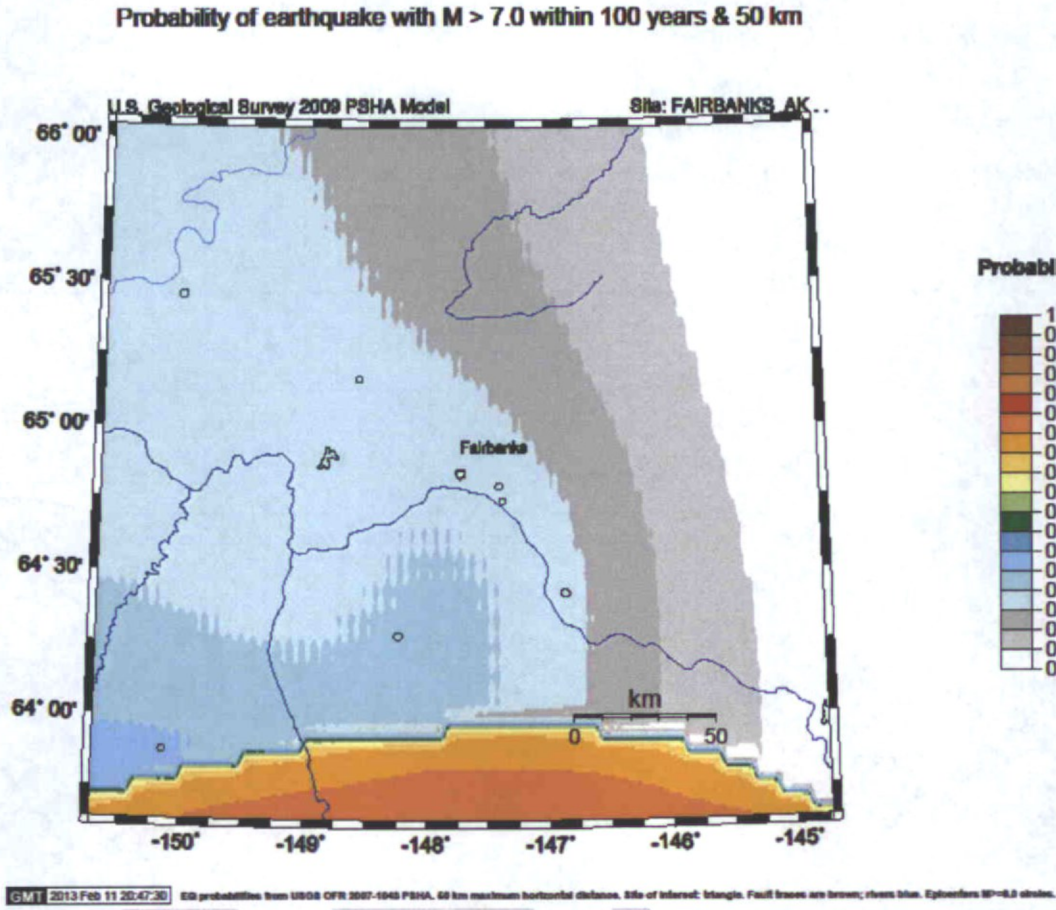
SOURCE: USGS, PSHA MODEL, 2009

Figure 8-4: Earthquake Probability M > 6.0



SOURCE: USGS, PSHA MODEL, 2009

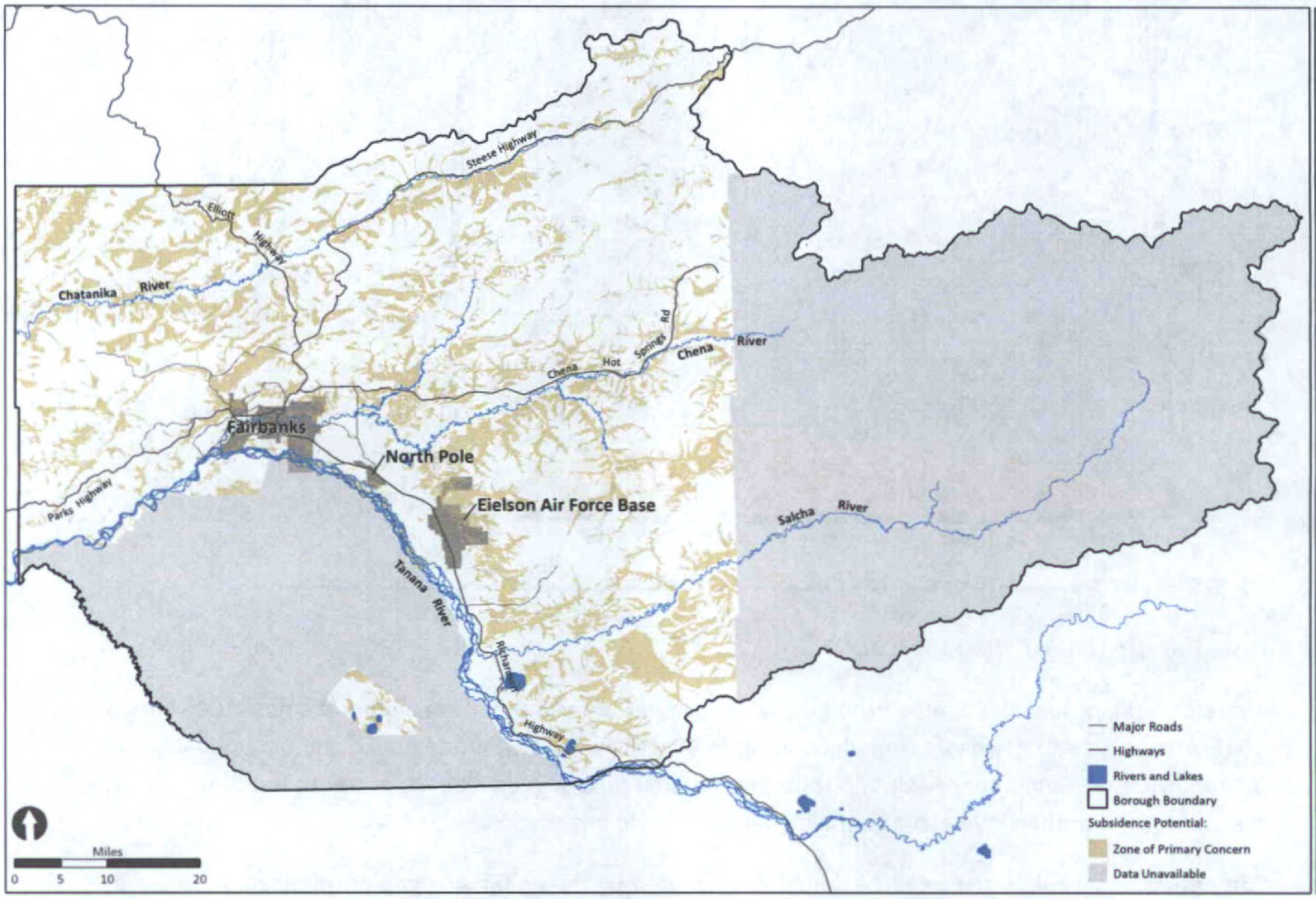
Figure 8-5: Earthquake Probability M > 7.0



Source: USGS, PSHA Model 2009

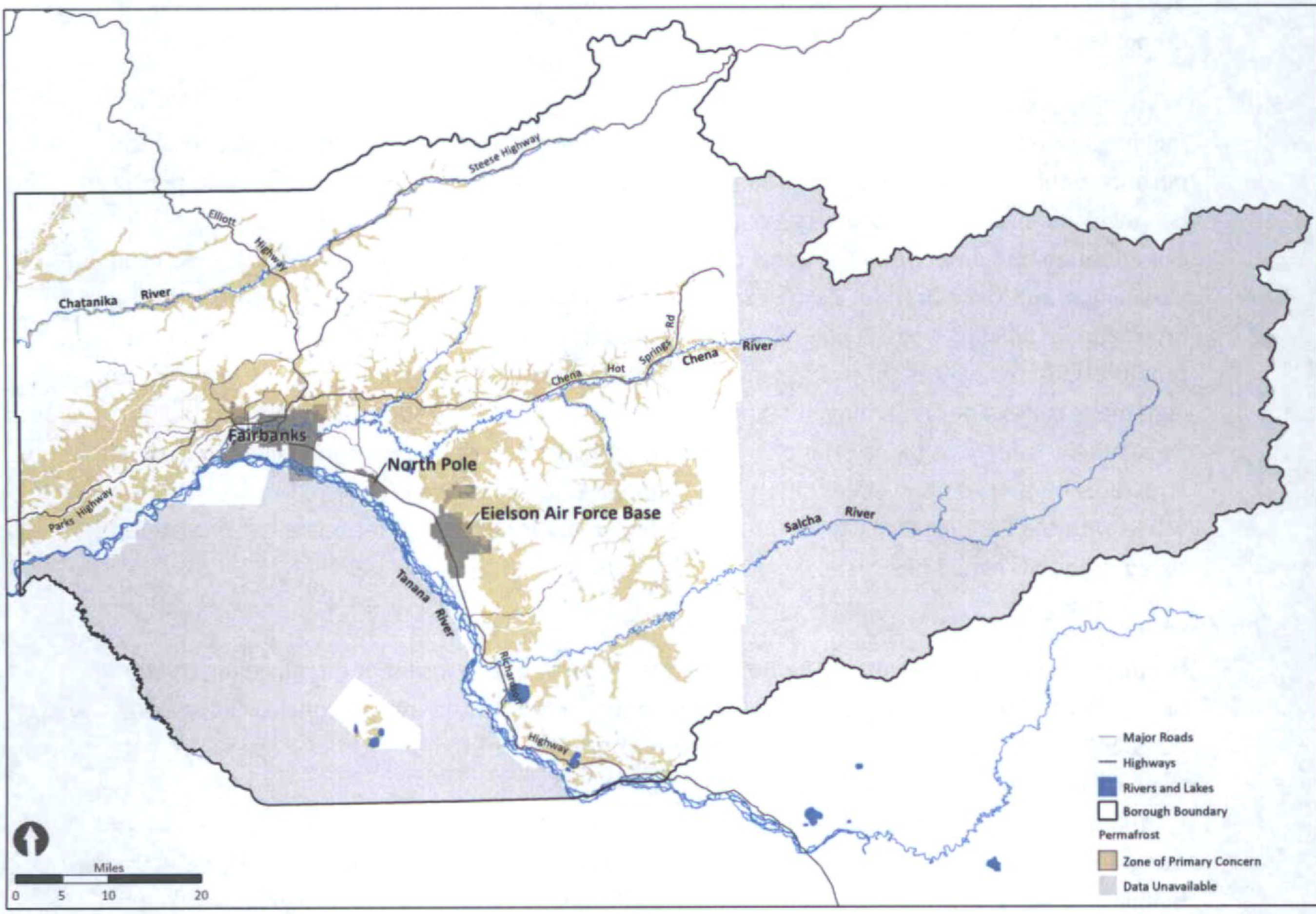
Therefore, the probability of an earthquake with a magnitude of 5.0 or more within the next 100 years is 100% for the greater Fairbanks area decreasing to 40% for a 6.0 magnitude quake and between 4% and 6% for a 7.0 magnitude quake. On the southern boundary of the map extents, closer to the Denali Fault, the greater the probability becomes of a higher magnitude quake.

The effects of seismic activity can be amplified or muted by the underlying geomorphology of the area, including the presence of bedrock, thermokarst and permafrost, hydric soils, and the liquefaction potential of the underlying silts and soils.



Map 8-4: Subsidence Potential

Hazard Mitigation Plan, Chapter 8: Seismic Hazard Profile



Map 8-5: Location of Permafrost

Hazard Mitigation Plan, Chapter 8: Seismic Hazard Profile

8.05. Seismic Hazard Actions

8.05.1. Seismic Current Mitigation Actions and Authorities

- Alaska Seismic Hazard Safety Commission – The Alaska Seismic Hazard Safety Commission is made up of public and private Commissioners to increase public awareness and education with a particular focus on mitigating risk. One of the Commission's major goals is to insure the seismic safety of Alaska's public schools. The Alaska Department of Education and Early Development has a representative serving as a liaison with the Commission. Through their joint efforts there was State funding for site specific seismic design and construction inspection for new school construction. There are also online resources provided for the public from the Commission.

8.05.1.a City of Fairbanks

- Building permit requirements – The Building Department is responsible for issuing construction permits within the city limits of Fairbanks. This process typically includes plan review, permit issuance and inspection of projects from the ground up. The Department is also responsible for the adoption and amendment process of nearly a dozen codes relating to plumbing, electrical, mechanical and structural, for both new and some existing construction in compliance with the International Building Code 2009 Edition as adopted by Ordinance No. 5834, § 1, 3-12-2011 with modifications. As well as the enforcement of these codes, the Building Department responds to legitimate complaints regarding sub-standard housing and dangerous buildings. The Building Department is responsible for the plan review and inspection of all residential and commercial structures built or remodeled within the city limits of Fairbanks. The City's Fire Department also works with the Building Department to ensure fire safety is addressed, including but not limited to, adoption of related fire codes.

8.05.1.b City of North Pole

- Building permit requirements – The Building Department is responsible for issuing construction permits within the city limits of North Pole in compliance with the International Building Code, 2209 Edition, as published by the International Conference of Building Officials, together with the local amendments per Ordinance 12-07 §2(part), 2012).
- In addition the City of North Pole has adopted the Uniform Code for the Abatement of Dangerous Buildings, 1997 Edition. This allows the city to evaluate dilapidated, defective buildings which endanger life, health, property and public safety. The buildings are evaluated for structural integrity and compliance with locally accepted standards. If the building does not meet those standards there is a process for abatement protecting adjacent properties.

8.05.2. Seismic Hazard Mitigation Successes

- Trans-Alaska Pipeline System – During the Denali Fault earthquake of 2002 the Trans-Alaska Pipeline withstood an impact that moved the pipeline almost 20 feet but did not rupture the line. This was due to mitigating the impact of potential earthquake risk to the pipeline system at the time of engineering design and construction. The Borough has 89.4 miles of the Trans-Alaska Pipeline within its boundary.

Table 8-3: Seismic Hazard Mitigation Action Plan Matrix

Objective Number	Objective Description	Specific Actions	Ranking Priority	Administering Department	Time-frame	Benefit - Costs	Goals Attained
E-1	Discourage development where soils are prone to settling, sliding, shaking violently or liquefying. Prevent building on top of active faults.	a. Support State and Federal soil surveys to determine where shaking will be the strongest and showing the relative chances of earthquake-induced ground failure. b. Update Title 18. c. Request that UAF Geophysical Institute conducts a presentation of FNSB geology and soils using the existing hazard map.	High	FNSB Planning Department	5 Years	Moderately cost effective: Although accurate earthquake hazard maps are critical for making land use decisions, selecting appropriate mitigation measures, and providing creditable public education, the cost of mapping is high.	2
E-2	Conduct seismic strength evaluations for critical facilities and infrastructure. Identify funding sources to upgrade them to meet current seismic standards.	a. Conduct an audit of critical facilities and infrastructure with the FNSB, Cities of Fairbanks and North Pole. b. Conduct a feasibility study. c. Secure funding.	Medium	FNSB Public Works Dept.; City of Fairbanks Engineering Division and Building Dept. and City of North Pole's Building Department	3-5 Years	Moderately cost effective; Although ensuring the sustainability of critical facilities and infrastructure is imperative for saving lives during earthquakes, the costs associated with retrofitting existing structures is high.	2
E-3	Implement current seismic standards for new construction.	a. Support the development of a statewide uniform seismic code. b. Continue to use the IBC. c. Continue to meet or exceed insurance carrier seismic requirements.	Medium	FNSB Public Works Dept.; Cities of Fairbanks and North Pole Building Departments	On-going	Highly cost effective: The development of coordinated planning ordinances and policies has a high benefit relative to low cost.	2
E-4	Encourage reduction of non-structural and structural hazards in homes, schools, businesses and government offices.	a. Participate in earthquake mitigation workshops and presentations. b. Distribute earthquake mitigation preparedness information at fairs and on the FNSB website. c. Participate in FNSB School District program for preparing school buildings for earthquakes (securing file cabinets, computers, etc.) d. Develop earthquake preparedness and mitigation instructional videos for distribution within the FNSB School District.	High	FNSB Emergency Operations Dept.; FNSB School District; fire agencies; Cities of Fairbanks and North Pole	On-going	Highly cost effective: Community preparedness and education has a high benefit relative to a low cost.	6
E-5	Implement, update and maintain plans and procedures for communicating with the AEIC to obtain accurate, real-time data and information about potential earthquake damages.	a. Continue daily notifications of seismic activity within the FEMA Region X area.	Medium	FNSB Emergency Operations Dept.	1 Year	Highly cost effective: The development of plans and procedures, and acquisition of technical equipment to obtain real time earthquake information has a high benefit relative to low cost.	6
E-6	Complete seismic mitigation projects.	a. Structurally retrofit critical facilities to make them more resistant to seismic activity, ground motion and soil failure due to earthquakes. b. Brace critical equipment such as emergency/ back-up generators to protect vital infrastructure. c. Construct temporary structure to house critical emergency vehicles in the event of earthquake damage to public facilities (police, fire, utilities).	High	FNSB, Cities of Fairbanks and North Pole; various utilities	On-going	Highly cost effective: The securing of funding through grants affords opportunities not possible with local funding.	1

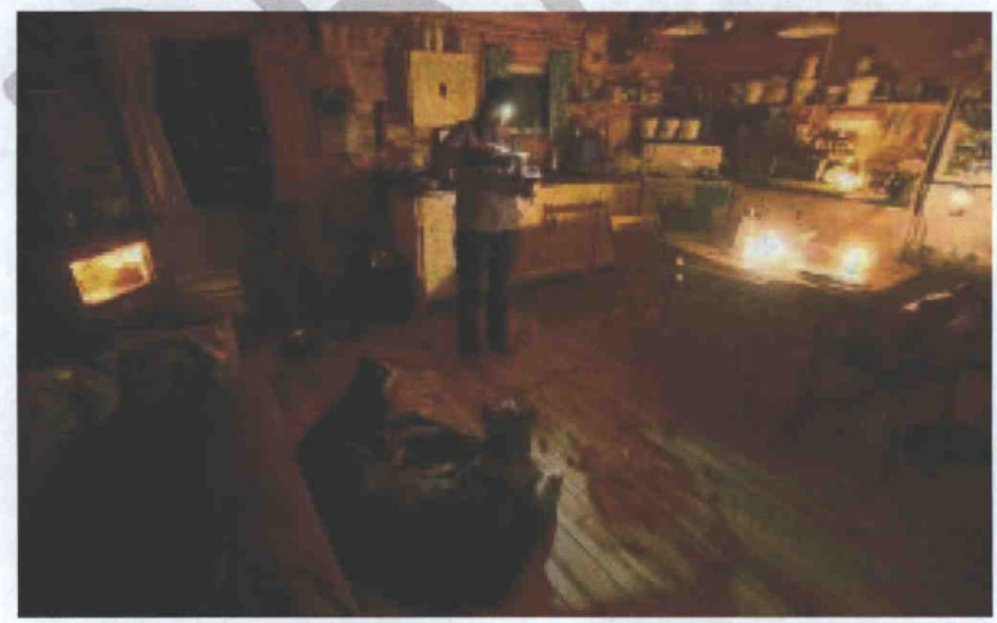
9. Severe Weather Hazard Profile

"Thousands without power – The Storm at a Glance

- *Sustained winds of 27 mph, Gusts of 55 mph*
- *More than 10,000 Golden Valley Electric Association customers without power at peak of storm. 3,000 to 5,000 still without power Thursday night [24 hours after the storm]. Some may not get power until weekend.*
- *Schools closed Wednesday through today [Friday].*
- *Warming shelters set up at West Valley and North Pole high schools.*
- *Widespread toppling of trees. Some damage to buildings (Fairbanks Daily News-Miner, November 15, 2013)*

"Winter storm drains Fairbanks' supply of generators... Northern Power Sports nearly sold out of its supply of Yamaha generators Thursday, the day after the storm hit...20 generators in two days...There was a line of people waiting to buy generators at Alaska Fun Center when it opened Thursday morning. The store sold all 30 generators it had in stock – ranging in price from $1,000 to $3,700 – before the end of the day, so owner Bill Larry sent a crew down to Anchorage to pick up another 20. Those units went on sale Saturday morning, and at noon, there were only six left...The Outpost sold out its supply of 63 Honda generators in the course of nine hours Thursday...Home Depot sold out of its supply of generators within a matter of minutes Thursday morning...The store also sold out its inventory of about 20 kerosene heaters."(Tim Mowry, Fairbanks Daily News-Miner, November 17, 2013)

Figure 9-1: Power Outage for over Thirty-six Hours



SOURCE: SAM HARREL, FAIRBANKS DAILY NEWS MINER, NOVEMBER 16, 2013

"Alaska Gov. Sean Parnell declared a state of disaster for the wind-damaged and power-stricked Fairbanks North Star Borough...Golden Valley Electric Association estimates some 600 businesses and households remain without power throughout the borough. Original estimates just after Wednesday night's wind storm claimed around 15,000 households and businesses in the wider valley region served by GVEA has lost power...A state disaster declaration comes with two measures of assistance. The state can assist in initial emergency response and post-emergency recovery...The main aid to the Fairbanks area would come in the form of recovery funding for damages incurred in the storm or subsequent power outage. That aid could go to the property owners with damaged homes, to the borough or to the city for infrastructure or additional personnel hours...[City of Fairbanks' Mayor] Eberhart, who joined Parnell and Hopkins at Monday's news conference, said he was aware of as many as 130 buildings within the city limits that still did not have power." (Weston Morrow, Fairbanks Daily News-Miner, November 19, 2013)

9.01. Nature and Location

Weather is the day-to-day state of the atmosphere in combination with temperature, humidity, precipitation, cloudiness, visibility and wind. Climate is the weather of a place averaged over a period of time, often 30 years. Climate tells about the normal weather as well as the range of weather extremes for a location (The Arctic: All About Arctic Climatology and Meterology n.d.). Weather forecasts will relate short-term information such as daily or weekly predictions. Longer-term seasonal forecasts use statistical relationships between large-scale climate signals and more current weather patterns to predict outlooks of one to six months. Climate predictions take a much longer view – looking at global models and do not utilize current weather observations but look at large scale patterns over time.

Climate in Alaska is influenced by three main factors: Latitude, altitude and geographic location (including seasonal distribution of sea ice as noted by the Alaska Climate Research Center in 2009). The Arctic Circle represents the latitude of 66° 32' north of the Equator, marking the latitude above which the sun does not set on the summer solstice (approximately June 21, the longest day of the year) and above which the sun does not rise on the winter solstice (approximately December 21, the shortest day of the year). At the latitude of 64° 50' north, Fairbanks experiences 23 hours of direct sunlight on June 21 but only 3 hours of direct sunlight on December 21. The Borough varies from an elevation of 436' – 2,000' above sea level with Fairbanks at 446'. Interior Alaska has natural boundaries of the Brooks Range to the north and the Alaska Range to the south. Within Alaska the general southeast corner of this large interior geographic area lays the FNSB located south of the Arctic Circle deep within the North American Continent.

As indicated previously the Borough's climate is defined as a continental climate characterized by long and cold winters, sunny and warm summers, large annual temperature variability, low humidity and generally light and irregular precipitation. The National Climate Data Center describes Fairbanks' climate as follows (Alaska Climate Research Center n.d.):

The climate of Fairbanks is conditioned mainly by the response of the land mass to large changes in solar heat received by the area during the year. The sun is above the horizon from 18 to 21 *hours during June and July. During this period, daily average maximum temperatures reach the lower 70s*[7]*. Temperatures of 80 degrees or higher occur on about 10 days each summer. In contrast, from November to early March, when the period of daylight ranges from 10 to less than 4 hours per day, the lowest temperature readings normally fall below zero quite regularly. Low temperatures of -40 degrees or colder occur each winter. The range of temperatures in summer is comparatively low, from the lower 30s to the mid 90s. In winter, this range is larger, from about 65 below to 45 degrees above. This large winter range of temperature reflects the great difference between frigid weather associated with dry northerly airflow from the Arctic to mild temperatures associated with southerly airflow from the Gulf of Alaska, accompanied by Chinook winds off the Alaska Range, 80 miles to the south of Fairbanks.*

Compared with many moderate climates within the United States, normal weather patterns in the winter of Interior Alaska would be considered "severe". Severe weather can be defined as any weather event that has the potential to cause threats to life and/or damage to property and serious social disruption. Severe weather events in the Borough usually involve long periods of extreme cold, ice fog, wind chill or a combination of the three. Heavy snow and freezing rain also create structural, power, and transportation issues, making driving and walking difficult, slow, and very hazardous.

The following definitions reflecting severe weather events were developed primarily in the 2013 State of Alaska Hazard Mitigation Plan or elsewhere as noted:

- Extreme Cold—"Excessively cold" temperature definitions vary according to the normal climate of a region. In Alaska, extreme cold usually involves temperatures below –40 degrees. In the FNSB temperature inversions[8] and the warmth produced by the city's urban heat island effect will keep temperatures higher than many of the adjacent low lying areas such as the town of North Pole, which is sometimes as much as 15 degrees colder than Fairbanks (Alaska Climate Research Center n.d.).

- Heavy Snow: generally means snowfall accumulating to 4 inches or more in depth in 12 hours or less *or* snowfall accumulating to 6 inches or more in depth in 24 hours or less. Snowfalls of 4 inches or more in a day occur only three times during winter (Alaska Climate Research Center n.d.).

[7] All data presented is in Fahrenheit

[8] A temperature inversion is a thin layer of the atmosphere where the normal decrease in temperature with height switches to the temperature increasing with height. An inversion acts like a lid, keeping normal convective overturning of the atmosphere from penetrating through the inversion. This can cause several weather-related effects. One is the trapping of pollutants below the inversion, allowing them to build up. If the sky is very hazy, or is sunsets are very red, there is likely an inversion somewhere in the lower atmosphere. This happens more frequently in high pressure zones, where the gradual sinking of air in the high pressure dome typically causes an inversion to form at the base of a sinking layer of air. http://weatherquestions.com/What_is_a_temperature_inversion.htm

- Freezing Rain: develops as falling snow encounters a deep layer of warm air in the atmosphere sufficient enough for the snow to completely melt and become rain. As the rain passes through a thin layer of cold air just above the earth's surface it cools to below freezing. The drops do not freeze but they become super cooled then instantly freeze when they strike the frozen ground, power lines, vegetation, etc.

- Aufeis: also called glaciations or icing. This phenomenon occurs when emerging ground water freezes in successive sheets until the ice is thick and covers a large area. The thickness can vary from only a couple of feet to 30 feet or more. Aufeis is common in the valleys of the Interior and especially prevalent in permafrost-underlain settings.

- Lightning: within the FNSB is a common summer occurrence averaging about one thunderstorm every eight days in Fairbanks but at least three times more frequently over the hills to the north and east of the city (Alaska Climate Research Center n.d.).

- High Winds: The most common wind occurrence is the warming Chinook wind, which typically occurs in the fall and winter months. The Chinook comes from the south, funneling through the passes of the Alaska Range, which causes the strongest winds to occur on the hilltops around town and moderate winds around the rest of the FNSB. Another wintertime wind event occurs when bitter cold arctic air to the north starts pouring to the south. These cold wind events not only can inflict damage, but also bring brutally cold wind chills.

- Wind Chill: Ambient air temperature is the air temperature of the environment, with no wind effects. Wind chill temperature is how cold people and animals feel when outside. Wind Chill is based on the rate of heat loss from exposed skin resulting from the combined effect of low temperature and wind. As winds increase, heat is carried away from the body at a faster rate, driving down both the skin temperature and eventually the internal body temperature. Exposure to low wind chills can be life threatening to both humans and animals alike. Fortunately, wind chill is not usually a significant factor at extreme cold temperatures because winds are generally calm when temperatures fall below -30F.

- Ice Fog: a suspension of very small ice crystals in the air that occurs at temperatures below -25°F. It is created by the freezing of water vapor from cooling water dumped into rivers and lakes, and from combustion sources including automobiles, heating systems and power plants. Ice fog can become extremely dense, reducing horizontal visibility to less than 10 feet. Ice fog is often thickest along roadways due to the constant supply of water vapor from passing vehicles. Cold snaps accompanied by ice fog can last up to three weeks in unusual situations.

9.02. Historical Occurrences

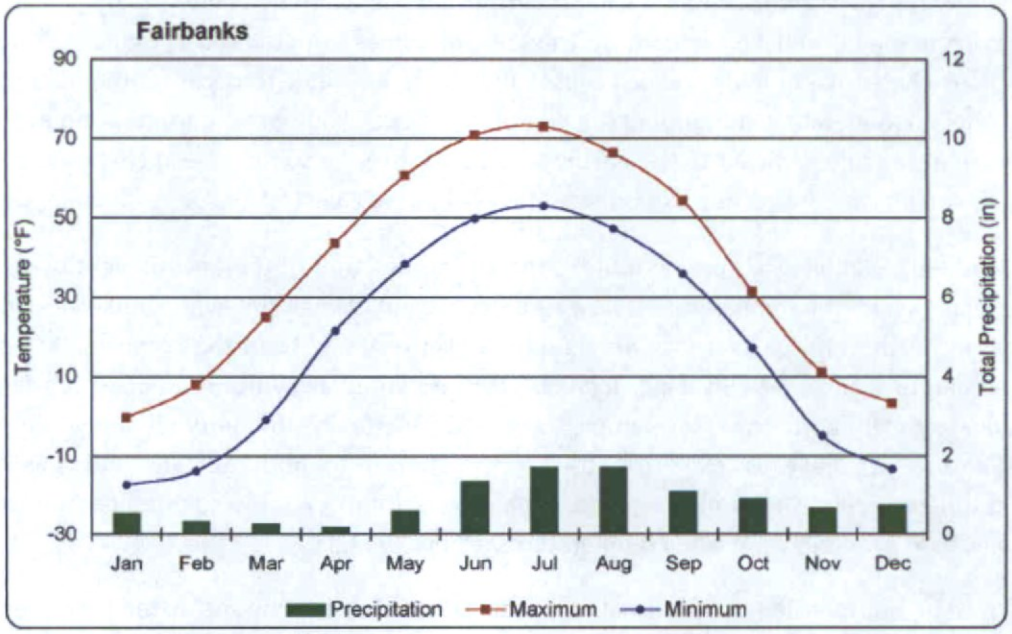
Fairbanks has the only climatological station in Interior Alaska with an unbroken 100-year record of meteorological parameters (Shulski, A Century of Climate Change for Fairbanks, Alaska 2009). Fairbanks remains one of 21 first-order weather stations serving in Alaska. The station has physically moved throughout the town but has been operated by professional meteorologists by the National Weather

Service since its inception. Although the mean values for temperatures by season show substantial increases for all seasons except autumn the report points out that for many purposes, mean values are of less importance than the occurrence of extreme values. Extreme temperatures are also most significant in understanding severe weather.

The precipitation database is not as complete as for temperature becoming consistent by 1916. The annual mean precipitation amount is 11". The mean precipitation amount can vary from 5.9' to 17.7". The decrease in precipitation for the 90-year period is 11%. The combination of the increase in temperatures and lowered amounts of precipitation were concluded to make the occurrences of droughts and wildfires more likely in the 2009 report's review of 100 years of climate change data for Fairbanks (Shulski, A Century of Climate Change in Fairbanks, Alaska 2009).

Figure 9-2 illustrates the mean high and low temperatures within the FNSB.

Figure 9-2: FNSB Mean Annual Temperature



SOURCE: ALASKA CLIMATE RESEARCH CENTER

The following historic severe weather events exemplify the necessity of reviewing severe weather as a FNSB hazard:

Extreme Cold:

- January 1989: Fairbanks came to a halt for fourteen days with temperatures of -50 to -70°F. Aircraft were grounded more than six days during this event.
- December 27, 2008 to January 12, 2009: There were 15 consecutive days of 40 below zero or colder temperatures recorded in Fairbanks. This was the longest cold snap recorded since 1973.

Heavy Snow:

- January 19-20, 1937: Second greatest two-day snowfall since records began.
- February 11-12, 1966: Record two-day heavy snowfall of 26.9 inches.
- February 11-12, 1966: Record 24-hour heavy snowfall of 20.1 inches.
- The month of February of 1966 also set a record as the snowiest February with 43.1 inches of total monthly snowfall.
- September 1992: Early wet snowfall caused trees still in foliage to fall, toppling power lines and leaving 3,600 homes without power for one to ten days.
- March 2009: Within 36 hours, 11.2 inches of snow fell causing numerous traffic accidents and road closures.
- The month of February of 2011 set a record of the second-snowiest February with 30.3 inches for a monthly total.
- February 25, 2011: Rail car derailment within Fairbanks due to extreme snow conditions.

Freezing Rain:

- February 2003: 0.29 inches of rain fell on the area.
- November 22-24, 2010: Steady rain fell turning to freezing rain in many sectors of the Borough that led to the buildup of ice on tree branches causing many power outages and extreme hazardous road conditions.
- November 13-15, 2013: Freezing rain and high winds mixed with a prior heavy snow load toppled trees; damaged structures; closed airports, schools and government facilities; and caused significant power outages. As the power outages extended into days, rather than hours, citizens' safety became perilous as outdoor temperatures dipped to 20°F below zero.

Lightning:

- 1986: One person died and three others injured near Tok while taking shelter from a lightning storm under a tree. Although Tok is located outside of the FNSB, this incidence exemplifies the lightning hazard within the interior of Alaska.
- 1993: Within the FNSB, at a ball field in North Pole, one person was injured from a lightning strike.

High Winds:

- September 1985: Gusts to 51 mph were recorded at the Fairbanks International Airport due to a late season thunderstorm. The wind, while isolated and of short duration, caused trees to fall into power lines and left 3,000 homes without power for up to 14 hours.
- February 25, 2011: High winds and heavy wet snow caused severe driving conditions with drifting and blowing snow on the Park's Highway between Denali State Park and Fairbanks for

180 miles. The Steese Highway was closed at 12 Mile and Eagle Summit due to the high winds and snow drifts.

- November 14, 2013: Wind gusts of 50-60 mph downed spruce trees and power lines across the entire Fairbanks North Star Borough, leaving almost 14,000 homes without power, some for as long as a week.

Wind Chill:

- February 2011: Numerous snowmobilers rescued in the White Mountains Recreation Area north of Fairbanks after being stranded without shelter for several days and impacted by blizzard conditions from two back to back storms creating extreme wind chill factors.

9.03. Possible Impacts from Future Events

Severe weather within the extents of the Borough could seriously affect travel with the cancelation of flights and potential for deadly motor vehicle accidents on major roadways within Interior Alaska. It is also possible that during a severe cold weather event the loss of heat provided by area power plants could impact a large percentage of local residents. Buildings could freeze, pipes could burst, and homes could become uninhabitable without heat.

The day-to-day operations of emergency services are critically affected when severe weather events occur. One of the most important considerations is the ability to get to victims in need or have residents able to get out of their homes to emergency shelter locations. Relief efforts could be hampered by treacherous roads and poor visibilities. Additionally, from a regional perspective, the ability to receive goods and services from outside could also be hindered leaving Borough residents critically vulnerable to food, fuel and other necessary commodities shortages.

Possible consequences from a variety of severe weather events could result as follows:

- Extreme Cold can result in frost bite, hypothermia and eventual death. Additionally, carbon monoxide poisoning can increase as people supplement heating through sources without adequate ventilation. Utility failure such as congealed fuel in storage tanks and supply lines resulting in failure of electric generation and heating supplies, transportation shut downs such as grounded aircraft, and buried pipes freezing causing water and sanitary sewer failures (particularly when combined with no or low snow cover).
- During periods of extreme weather, transportation by air is nearly halted. Villages off the road system that rely on aircraft for transportation and supplies may experience significant delays. Villagers trying to return home may be stranded for weeks, while supplies of food may run low at the local grocery store. Critical medevac services to transport the sick or injured from a village to definitive care in Fairbanks or Anchorage are unavailable.
- Heavy snow can cause physical consequences such as injuries and fatalities through overexertion and hypothermia to people lost while traveling or recreating. It is also a leading cause of traffic related accidents.

- Immobilization of most forms of transportation including airports, roadways, and rail lines can occur because of heavy snow loads. This causes a variety of issues including disrupting the flow of supplies and emergency services. Snow accumulations can cause structural failure, downed trees and utility lines resulting in long term power failures. Freezing rain results in a weather phenomenon called an ice storm Ice storms often cause numerous auto accidents, power and communication outages due to downed lines and many personal injuries due to the inability to walk safely. The aftermath of an ice storm may result in severe flooding due to sudden thawing, with large quantities of displaced water.
- Aufeis can cause significant damage to rail lines and railways. It occurs throughout the Salcha area and on the Steese Highway near Fox, frequently causing significant travel issues.
- The most critical consequence of lightning is the ignition of wildland fires but there are recent documented cases of threat to life in addition to fire threat.
- High winds may impact vehicular/truck travel to and from the Borough as the Chinook winds pass over the Alaska Range 80 miles to the south of Fairbanks. In combination with a snow event high winds cause drifting snow obliterating trails and roadway demarcations quickly within the Borough. Winds can also bring down the shallow rooted spruce tree that is found throughout the FNSB causing substantial access issues to the nearly 65,000 rural residents.
- Windchill can become potentially life threatening when combined even moderating cold weather resulting in frostbite and hypothermia. As noted in a National Weather Service Forecast bulletin (Wind Chill in Colorado 2010), "Winter storms often bring heavy snow that cause traffic accidents and stranded travelers. While most people's attention is focused on expected snow accumulation before a storm arrives many ignore the life threatening combination of extreme cold and strong wind which often develops after the storm passes…Wind chill values near minus 25 degrees mean that frostbite can occur in as little as 15 minutes…Hypothermia, a dangerously low body temperature, is the most common weather killer in winter."
- The consequences of ice fog are often associated with the darkness of winter also. It is common for motorists to be unable to see traffic control devices across intersections, or to have difficulty seeing brake lights of vehicles in front of them. Since ice fog goes hand-in-hand with icy intersections, this poses a high risk to drivers and pedestrians alike.

9.04. Probability of Future Events

The probability of future extreme weather events is certain. Such extreme weather conditions force residents to conduct everyday living in the face of weather hazards. Though many of these problems are only considered a nuisance, it is possible that significant issues may arise, most likely during transition seasons or when multiple hazards strike at the same time.

The FNSB must be prepared for such contingencies. The challenge is how to reduce vulnerability to and build local resilience against risk from weather related impacts when the extent of future events cannot be predicted. With the implementation of preparedness for weather event emergencies the extent can be reduced.

9.05. Severe Weather Hazard Actions

9.05.1. Severe Weather Current Mitigation Actions and Authorities

- StormReady: a program started in 1999 in Tulsa, Oklahoma, helping to arm America's communities with the communication and safety skills needed to save lives and property – before and during the event. The program helps emergency managers strengthen local safety programs. The FNSB and cities of Fairbanks and North Pole are not currently StormReady participants but multiple communities within Alaska do participate in the program. The StormReady program is included in the mitigation measures for severe weather hazard. To be officially StormReady, a community must:

    - Establish a 24-hour warning point and emergency operations center.
    - Have more than one way to receive severe weather forecasts and warnings.
    - Be able to alert the public.
    - Create a method to monitor local weather conditions.
    - Promote the importance of public readiness through community seminars.
    - Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.
    - Demonstrate a capability to disseminate warnings.

  Guidelines vary with community size. StormReady is administered through the local National Weather Service Offices in Juneau, Anchorage and Fairbanks.

9.05.2. Severe Weather Hazard Mitigation Successes

Include any structural evaluations and changes in response to severe weather at the local level. Such as roof bracing for snowload, etc.

Table 9-1: Severe Weather Hazard Mitigation Action Plan Matrix

Objective Number	Objective Description	Specific Actions	Ranking Priority	Administering Department	Time-frame	Benefit - Costs	Goals Attained
S-1	Educate and inform the public about severe weather hazards, including winter weather driving.	a. Utilize Public Service Announcements during severe weather to foster personal preparedness and safety.	High	National Weather Service	On-going	Highly cost effective: Community preparedness and education has a high benefit relative to a low cost.	5
		b. Utilize Borough website and available media to provide timely information on winter hazards.					
S-2	Maintain and update resource lists and mobility plan to buses, portable generators, portable heating devices, shelters and fuel caches.	a. Inventory the cache resources currently available.	High	FNSB Emergency Operations Dept.; Cities of Fairbanks and North Pole Public Works Departments	On-going	Highly cost effective: The development and maintenance of plans and resource lists are a high benefit relative to low cost.	1
		b. As appropriate, obtain OUs with participating agencies.					
S-3	Adopt the StormReady program to partnership the community and the NWS.	a. Insure that NWS criteria are met.	Medium	National Weather Service; FNSB; Cities of Fairbanks and North Pole	1 -2 Years	Highly cost effective: Participation in programs that promote community preparedness and education has a high benefit relative to a low cost.	6
		b. Participate in the StormReady review process.					
S-4	Follow school policies when ice fog and/or freezing rain cause severe driving hazards.	a. Conduct an annual review of school district policies on ice fog and freezing rain prior to the beginning of the school year.	Low	FNSB School District	On-going	Highly cost effective: The implementation of plans and policies that protect public safety has a high benefit relative to low cost.	7
S-5	Complete severe weather mitigation projects.	a. Install safety film on windows of critical facilities to protect them breaking (and injuring building occupants) and creating openings (where building heat will be lost) during severe weather and/or seismic events.	Medium	City of Fairbanks, City of North Pole, utilities	On-going	Highly cost effective: The securing of funding through grants affords opportunities not possible with local funding.	1, 5

10. Volcanic Ash Hazard Profile

"…A larger explosive event on December 15 [1989], sent a column of volcanic ash (rock fragments smaller than 1 ½ inch) [from Redoubt Volcano in Alaska's Aleutian Chain] more than 40,000 feet above sea level. The ash was blown northward by strong winds, and the resulting eruption cloud nearly brought down a 747 jetliner carrying 244 people.

En route from Amsterdam to Anchorage, the plane unknowingly descended into the ash cloud and quickly lost power in all four engines as gritty ash and sulfurous gas filled the aircraft. Gliding powerless for more than four frightening minutes, the plane fell nearly 12,000 feet to within a few thousand feet of the ground. Disaster was averted when the engines were restarted and the jetliner landed safely in Anchorage. The 747 encountered the eruption cloud about 150 miles downwind from Redoubt, 90 minutes after the strong explosive event (USGS 2009)."

Figure 10-1: Pavlof Volcano Eruption 2013, View from Cold Bay, Alaska

SOURCE: RACHEL KREMER, MAY 14, 2013

10.01. Nature and Location

Since that time scientists monitoring volcanic activity have worked closely with Federal, State and local agencies and the aviation industry to prevent another such occurrence.

Of the 80 volcanoes in Alaska, 40 located along the Alaska Peninsula and the Aleutian Islands are considered active. Active volcanoes are those that are currently erupting or showing signs of unrest, such as unusual earthquake activity or significant new gas emissions. The greatest hazard posed by eruptions from Alaskan volcanoes to the FNSB is airborne ash. Large volcanic eruptions can result in ash fall over enormous areas and ash clouds can travel thousands of miles and some even circle the earth.

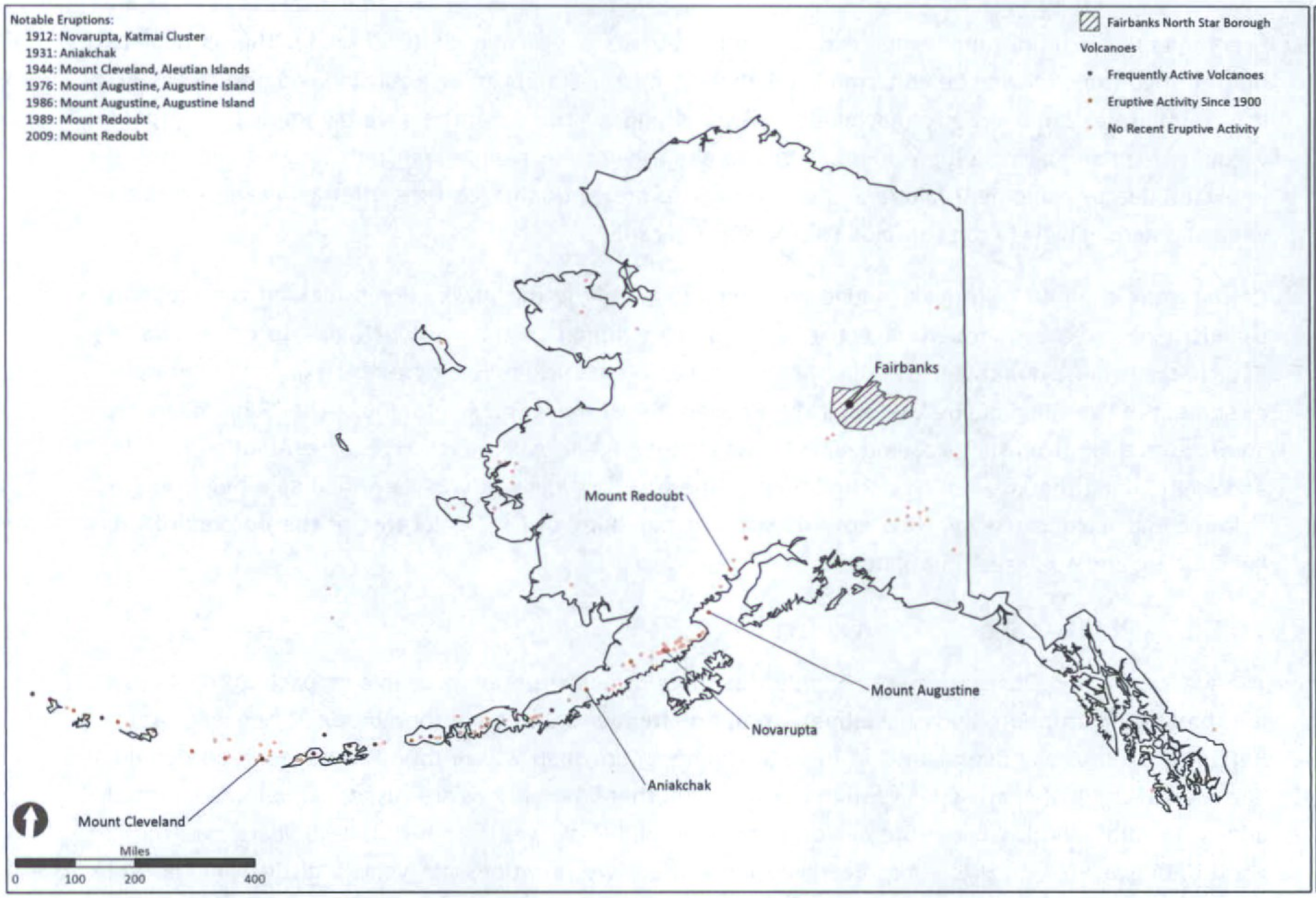
Everyone in an ash fall zone will be exposed to the effects of volcanic ash (USGS n.d.). The particulate matter of volcanic ash can be very small, less than 10 microns, and can be easily inhaled into the lungs. It also infiltrates buildings and machinery. Ground and air travel can be severely impacted by poor visibility, road and air conditions and damage to all forms of mechanical transport. Power can also be impacted due to equipment failure and shut downs to prevent damage. Long after a volcanic eruption wind and human activity can continue to create ash hazards.

Of the more than 40 historically active volcanoes found along the Alaska Peninsula and the Aleutian Islands, even greater numbers of active volcanoes are found to the west of Alaska on the Russian Kamchatka Peninsula and in the Kurile Islands. This 2,400 nautical-mile arc from Alaska to the Kuriles is a segment of the "Ring of Fire", which includes over 75% of the world's volcanoes. The "Ring of Fire" is an arc stretching from New Zealand, along the eastern edge of Asia, north across the Aleutian Islands, and south along the coast of North and South America. Originally, it was identified as a huge ring of volcanic and seismic activity. It is now known that the "Ring of Fire" is located at the borders of the Pacific Plate and other tectonic plates.

10.02. Historical Occurrence

The Alaska Volcano Observatory (AVO) indicates that volcanic eruption accounts go back to the 1760's but that known eruptions and calculating an eruption frequency has been sporadic and often inaccurate. But since 1760 it is apparent that from 27 volcanoes more than 230 eruptions have been confirmed. This is an average of nearly one eruption per year. Another 54 eruptions are suspected but unconfirmed adding to total 424 possible eruptions or an average of 1.7 per year. In the past 40 years, with fairly good data available, the state has averaged more than two eruptions per year, a distinct increase in frequency.

On June 6, 1912, the Novarupta volcano erupted on the Kenai Peninsula, widely considered the largest volcanic eruption of the 20th century. People in Fairbanks, Alaska, approximately 500 miles away, heard the sound of the blast over an hour after it occurred. For 60 hours the eruption sent columns of ash and gas into the atmosphere.



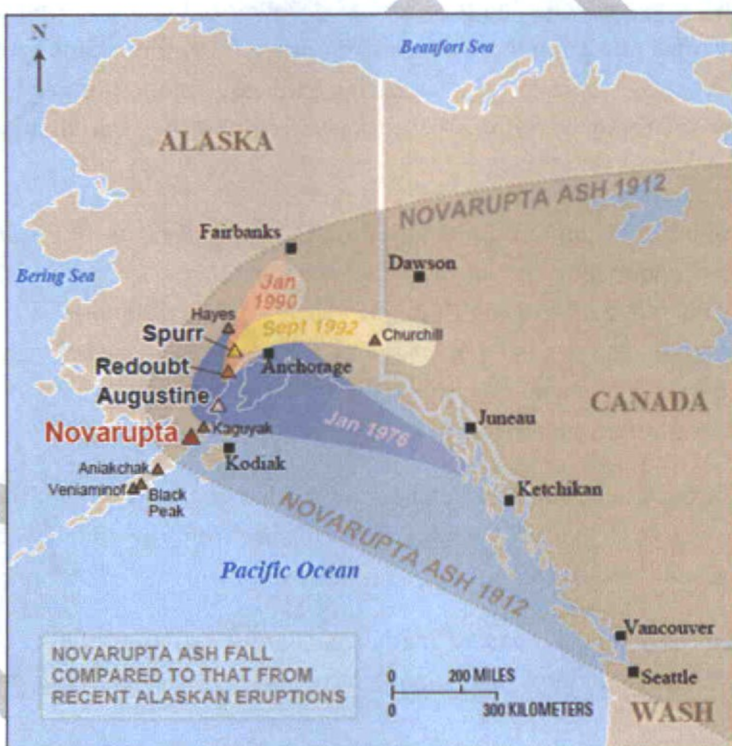
Map 10-1: Volcanoes and Eruptive Activity

Hazard Mitigation Plan, Chapter 10: Volcanic Ash Hazard Profile

Upon conclusion of the eruption about 30 kilometers of tephra blanketed the entire region: 30 times more than the 1980 eruption of Mount St. Helens and three times more than the 1991 eruption of Mount Pinatubo, the second largest in the 20th Century. The town of Kodiak on Kodiak Island was approximately 100 miles away. Within hours after the initial eruption ash began falling and fell for the next three days covering the town with ash a foot deep. Residents took shelter indoors and many buildings collapsed from the weight of the ash on the roofs. At midday the sun was completely blocked. The ash rose to an elevation of 20 miles and was carried by the prevailing winds dropping ash as it moved westward.

Figure 10-2 illustrates the historic patterns of ash movement from significant volcanic events in Alaska within the past 20th century.

Figure 10-2: Volcanic Ashfall Drift Patterns



SOURCE: USGS FACT SHEET 075-98

10.03. Possible Impacts from Future Events

Volcanic ash consists of jagged pieces of rocks, minerals and volcanic glass the size of sand and silt. Very small ash particles are not like the soft fluffy material created by burning wood, leaves or paper. Volcanic ash is hard, does not dissolve in water, is extremely abrasive and mildly corrosive, and conducts electricity when wet.

Even minor amounts of ash can create health problems, close roads, disrupt utilities and interrupt communications, contaminate local water supplies and ground aircraft. Because of its abrasive, corrosive and conductive characteristics, volcanic ash is likely to damage vehicles and machinery, and cause computers, bankcard machines, and other electronic equipment to break down. Volcanic ash can also destroy crops and harm livestock, fish and wildlife.

When volcanic ash accumulates on buildings, its weight can cause roofs to collapse. A dry layer of ash 4 inches thick weighs 120 to 200 pounds per square yard, and wet ash can weigh twice as much. Roofs in Fairbanks (in accordance with building codes) are only designed for a 60-pound per square foot snow load. The load of ash that different roofs can withstand before collapsing varies greatly – flat roofs are more likely to collapse than steeply pitched ones.

Because wet ash conducts electricity, it can cause electronic components to short circuit and fail. This is especially true of high-voltage circuits and transformers. Power outages are common in ash-fall areas. Eruption clouds and ash fall also commonly interrupt or prevent telephone and radio communications. This occurs in several ways, including physical damage to equipment, frequent lightning (electrical discharges), and either scattering or absorption of radio signals by the heated and electrically charged ash particles.

Volcanic ash can cause internal-combustion engines to stall by clogging air filters and also damage the moving parts of vehicles and machinery, including bearings and gears. As previously noted, engines of jet aircraft have suddenly failed after flying through clouds of thinly dispersed ash. During the past 25 years, about 80 commercial jets have been damaged by inadvertently flying into ash clouds, and several have nearly crashed because of engine failure. A least 15 aircraft have been damaged since 1980 by flying through volcanic ash clouds along North Pacific air routes.

Ash also clogs filters used in air-ventilation systems to the point that airflow often stops completely, causing equipment to overheat. Such filters may even collapse from the added weight of ash, allowing ash to invade buildings and damage computers and other equipment cooled by circulating outside air.

Roads, highways and airport runways can be made treacherous or impassable because ash is slippery and may reduce visibility to near zero. Cars driving faster than 5 miles per hour on ash-covered roads stir up thick clouds of ash.

Agriculture can also be affected by volcanic ash fall. Crop damage can range from negligible to severe, depending on the thickness of ash, type and maturity of plants, and timing of subsequent rainfall. For farm animals, especially grazing livestock, ash fall can lead to health effects, including dehydration, starvation and poisoning.

Like airborne particles from dust storms, forest fires and air pollution, volcanic ash poses a health risk, especially to children, the elderly and people with cardiac or respiratory conditions, such as asthma, chronic bronchitis and emphysema.

Volcanic ash clouds are difficult to distinguish from ordinary clouds, both visually and on radar. Also, ash clouds can drift great distances from their source. For example, in less than 3 days, the ash cloud from the June 15, 1991 eruption of Mount Pinatubo in the Philippines traveled more than 5,000 miles to the east coast of Africa. This ash cloud damaged more than 20 aircraft, most of which were flying at distances greater than 600 miles from the volcano.

Because wind can carry ash thousands of miles, far greater areas and many more people are affected than by other volcanic hazards. Even after a series of ash-producing eruptions has ended, wind and human activity can stir up fallen ash for months or years, presenting a long-term health and economic hazard.

10.04. Probability of Future Events

Each year, about 5 eruptions occur from volcanoes along the arc from Alaska's Aleutian Islands to the Kurile Islands. The resulting ash clouds are usually carried to the east and northeast, directly across busy air transportation routes. In the North Pacific region, volcanic ash is present, on an average of 4 days each year above an altitude of 30,000 feet, where most jet aircraft fly. This is exemplified by eruption of the Pavlof Volcano located in the Aleutian Chain of Alaska, May, 14, 2013. The volcano exhibited elevated seismic activity spewing volcanic ash 20,000 feet above sea level.

The AVO has the primary responsibility to monitor all of Alaska's potential volcanoes and to issue warnings of activity to authorities and the public. The AVO studies various volcanoes extensively on an annual basis. The summary of volcanic hazards at the volcanoes consistently list airborne ash clouds as a severe hazard to aircraft hundreds or thousands of kilometers downwind. (Michelle Coombs 2008)

The probability of a cataclysmic volcanic eruption occurring in any given year is small, but such events have happened in Alaska and are certain to happen again. Within 500 miles of Anchorage, volcanologists have identified at least seven deposits of volcanic ash less than 4,000 years old. These deposits approach or exceed the volume of ash ejected by the state's largest historic eruption, Novarupta, in 1912. During the 1912 eruption, more volcanic ash fell than during all other known historical eruptions in Alaska combined. The ash fall devastated areas hundreds of miles away. Volcanologists believe that, of the numerous volcanoes scattered across southern Alaska, at least 10 are capable of a 1912-scale eruption.

In the future, continued population and economic growth, increased tourism, widespread use of computers and electronics, and the increase in jet-airline traffic will cause more people and property in the FNSB to be vulnerable to the effects volcanic ash. The most significant impacts could be:

- Supply chain interruptions
- Air cargo transport delays
- Diversion of aircraft from Anchorage
- Critical operations shifted from Anchorage to Fairbanks

10.05. Volcanic Ash Hazard Actions

10.05.1. Volcanic Ash Current Mitigation Actions and Authorities

- Alaska Volcano Observatory – The Alaska Volcano Observatory (AVO) is a joint program of the USGS, the Geophysical Institute of the University of Alaska Fairbanks and the State of Alaska Division of Geological and Geophysical Surveys. The AVO, formed in 1988, has three primary objectives:

    1. To conduct monitoring and other scientific investigations in order to assess the nature, timing and likelihood of volcanic activity;
    2. To assess volcanic hazards associated with anticipated activity, including kinds of events, their effects and areas at risk; and
    3. To provide timely and accurate information on volcanic hazards and warnings of impending dangerous activity, to local, state and federal officials and the public.

There is an AVO office located in Fairbanks at the University of Alaska Geophysical Institute. The AVO website indicates, "In support of public land-use planning, development of emergency response plans and general public awareness of the nature of volcanic activity in Alaska, AVO is responsible for assessing the full range of potential hazards at specific volcanic centers. This effort involves studying a volcano to determine the style and frequency of past eruptions, and potential impacts of future activity. Hazard assessments include description of the history of a given volcano, explanations of likely eruption scenarios and determination of probably impact zones for the range of expected hazards.

10.05.2. Volcanic Ash Hazard Mitigation Successes

- Interagency Plan for Volcanic Ash Episodes – The Interagency Plan for Volcanic Ash Episodes was created in response to the incident in 1989 involving a commercial air carrier's loss of power while passing through volcanic ash. At the time, communication between the aviation industry and the volcanic ash warning system was inadequate. Following this incident, a consortium of Federal, State and private sector parties collaborated to improve the early warning system and ash avoidance protocols for the heavily traveled North Pacific Airways. The consortium chose the AVO as the lead agency and created the Alaska Interagency Plan for Volcanic Ash Episodes. The plan specifies responsibilities and protocols for each agency before, during and after a volcanic event. Since the 1989 incident no serious ash-aircraft incidents have been reported in Alaska although major eruptions continue.
- Alaska Volcano Observatory – The AVO's research and collaborative efforts (including monitoring, tracking and disseminating eruption and ash cloud warnings from Russian colleagues that threaten Alaska's air space) have resulted in the creation of the Interagency Plan for Volcanic Ash Episodes and significant knowledge and action towards volcanic ash hazard preparedness.

Table 10-1: Volcanic Ash Hazard Mitigation Action Plan Matrix

Objective Number	Objective Description	Specific Actions	Ranking Priority	Administering Department	Time-frame	Benefit - Costs	Goals Attained
A-1	Implement possible mitigation measures for essential government equipment, facilities and infrastructure adversely affected by ash fall.	a. Develop emergency vehicle maintenance plan. b. Ensure that HVAC systems can accommodate pre-filters. c. Supply ash filters for air handling units of critical facilities and air intakes on emergency/backup generators and emergency vehicles and disaster response equipment. c. Evaluate best practices for cleaning roofs and roads.	High	FNSB Emergency Operations Dept., City of Fairbanks and City of North Pole	3-5 Years	Moderately cost effective: Although ensuring the sustainability of critical facilities and infrastructure is imperative for saving lives during volcanic ash fall, the costs associated with retrofitting existing structures is high.	2
A-2	Establish plans and procedures for communicating with the AVO, AEIC and NOAA/NWS to obtain accurate, real-time data and information about potential ash fall.	a. Create a procedure for Borough GIS to receive ash and plume models, draft overlay and post on website. b. Create a procedure to disseminate overlay maps to emergency response agencies.	Medium	FNSB Emergency Operations Dept.; Cities of Fairbanks and North Pole	1-2 Years	Highly cost effective: The development of plans and procedures, and acquisition of technical equipment to obtain real time volcanic ash information has a high benefit relative to low cost.	7
A-3	Work with transportation, agricultural, health, medical and utility services to develop collaborative response and recovery plans for volcanic ash fall and airflow ash.	a. Use past ash fall and airflow ash models for roundtable scenario exercises.	High	FNSB Emergency Operations Dept.; Cities of Fairbanks and North Pole	3-5 Years	Highly cost effective: Participation in programs that promote community preparedness and education has a high benefit relative to a low cost.	6
A-4	Develop and incorporate a volcanic eruption hazard annex into the Borough and Cities of Fairbanks and North Pole EOPs.	a. Secure grant money for Borough EOP update. b. Facilitate roundtable meetings for Stakeholder input.	High	FNSB Emergency Operations Dept.	3-5 Years	Highly cost effective: The development of plans and policies has a high benefit relative to low cost.	7

11. Flood Hazard Profile

"The heavy rainfall caused flooding along parts of the Chena River and the Tanana River in the Fairbanks area – the flood crest of the Tanana being the highest since August 1967 – and many residential areas had to be evacuated...In addition, the Alaska Railroad was forced to suspend passenger service north of Denali National Park because of rising waters in the Nenana area, with train passengers being bused between the park and Fairbanks." (Cooperative Institute for Meteorological Satellite Studies, University of Wisconsin-Madison, Space Science and Engineering Center, July 31, 2008)

Figure 11-1: Rosie Creek/Tanana River Flood 2008

SOURCE: NATIONAL WEATHER SERVICE, JULY 30, 2008

11.01. Nature and Location

Flooding occurs when rain, snow, or glacial melt causes a waterway to exceed its capacity. Rainfall flooding is the most common type of flood, occurring when waterways can't accommodate the increased volume of water resulting from heavier-than-normal rainfalls. This type of flooding usually occurs in the 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.

Many floods are fairly predictable based on rainfall patterns. In Interior Alaska, the wettest period is June through September with August being the wettest month. This rainfall leads to flooding in late summer and fall. Spring snowmelt increases runoff, which can cause flooding. It also breaks the winter ice cover, which causes localized ice-jam floods.

Flooding in Alaska includes multiple characteristics: rainfall-runoff, snowmelt, ground-water, ice jam, flash, fluctuating lake levels, alluvial fan, glacial outburst floods and aufeis flooding. These characteristics are described as follows.

- Rainfall runoff – The most common type of flooding, rainfall runoff occurs when waterways can't accommodate the increased volume of water resulting from heavier-than-normal rainfalls. The rainfall intensity, duration, distribution and geomorphic characteristics of the watershed all play a role in determining the magnitude of the flood.
- Snowmelt floods – These flood events occur in the spring or early summer, when runoff from melting snowpack overwhelms waterways. The depth of the snowpack and spring weather patterns influence the magnitude of flooding, such as when a rapid rise in temperatures causes melting before the ground is significantly thawed. Snowmelt floods can also be caused by glacial melt.
- Ground-water flooding – This type of flooding occurs when water accumulates and saturates the soil. The water-table rises and floods low-lying areas, including homes, septic tanks and other facilities.
- Ice jam floods – Ice jams can occur when rivers are constricted by large blocks of ice. Flooding from these events can happen when water collects upstream from a jam, creating a lake-like effect and flooding a large area; or when an ice jam suddenly releases, allowing water to rapidly drain into the waterway and rapidly raising the water level.
- Flash flooding – When there is a rapid warming trend during spring thaw, snow melt fills rivers quickly, which can create unexpected flash floods. Heavy rainfall can also create flash floods.
- Winter flooding or Aufeis flooding – These flood events occur most often in December or January when waterways freeze down to channel bottoms and the spring-fed water has no place to go. This is the least predictable type of flooding and is very difficult to manage when it occurs. This type of flooding occurs in the FNSB, most notably in the Salcha area.
- Stream bank erosion and deposition – Erosion is the removal of material from a stream bank; deposition is the deposit or accumulation of soil, silt and other particles on a river bottom or delta. Both are problems generally related to flooding. Deposition leads to the destruction of fish habitat and presents a challenge for navigations purposes. Deposition also reduces channel

capacity, resulting in increased flooding or bank erosion. Stream bank erosion involves the removal of material from the stream bank. When bank erosion is excessive, it becomes a concern because it results in loss of streamside vegetation, loss of fish habitat and loss of land and property.

11.02. Historical Occurrence

The following time-line represents the flood history of the FNSB and cities of Fairbanks and North Pole.

- 1905: City of Fairbanks experienced a significant flood along First Avenue from Lacey to Turner Street. A bridge upstream from the city, on the Chena River, collapsed. Its wreckage caught on the newly constructed bridge across the Chena River in the downtown area blocking the river's ice flow during break-up. As the river rose, the town flooded and the stream bank eroded 50 feet inward along First Avenue. The new bridge had to be dynamited to break the ice free.

- 1911: An ice jam on the Chena River pushed thick ice and debris against buildings, and many buildings in the Garden Island Subdivision where carried away. Damage was estimated at $50,000.

- 1930: Downtown Fairbanks flooded along 1st Avenue west to Cowles Street.

- 1937: Downtown Fairbanks flooded from 1st to 4th Avenues between Lacey and Cowles Streets.

- 1938 to 1941: The Moose Creek Dike was constructed about 20 miles east of Fairbanks, marking the 1st major river re-engineering project in the Fairbanks area after years of ravaging floods culminating in the flood of 1937. Prior to the dike construction, the confluence of the Chena River and Tanana Rivers, was located several miles upstream from the City of Fairbanks and the dike was designed to prevent a Tanana River slough and its floodwaters from entering the Chena River and endangering downtown Fairbanks. The slough at that time was significant in size and was an active link between the Tanana River and Chena River. As part of the project, the slough was blocked off with an earthen dike constructed between Moose Creek Bluff and the Tanana River. This reduced water flow through the City of Fairbanks by approximately 75 percent. This diking project relocated the mouth of the Chena River several miles downstream from its original confluence with the Tanana River slough known as the Chena Slough, to its present day location at the southern end of the Fairbanks International Airport.

- 1948: Fairbanks experienced the second largest flood of record, which inundated approximately 30% of the City.

- 1967: In August 1967, the historical flood of record occurred in the Fairbanks area. Ninety-five percent of the City was inundated with water for approximately five days and caused more than $170 million in damage. Almost 6,000 homes were damaged and many homes and businesses were completely destroyed. This historical flood of record was the result of near continuous rainfall in the early weeks of August 1967 and result in 8 deaths, millions of dollars in damage and significant evacuations of people to communities outside the Fairbanks area.

- 1968: As a result of the Fairbanks' 1967 flood, and other significant flooding events nationwide, Congress passed the Flood Control Act on Aug. 13, 1968. The Act authorized the Chena Lakes Flood Control Project (Project).

- 1973 to 1979: The Project, which included a dam across the Chena River upstream of Fairbanks and a levee and groin system along the Tanana River south of Fairbanks, was constructed and became operational. When the Chena River reaches flood stage the curtain walls of the dam are dropped, diverting the floodwaters south to the Tanana River, effectively bypassing Fairbanks. This dam and levee system has unquestionably prevented millions of dollars in damage to properties in and around Fairbanks to date.

- 1992: In May, rain falling on the remains of a heavy winter snow pack sent a large surge of water down the Chena River. The flood gates were lowered on the Chena River at the Moose Creek dam resulting in a 17 day impoundment of water within the floodway. The impoundment of water was 23 feet deep, covering more than 7200 acres across the floodway. The Project worked exactly as it was designed with potential floodwaters being diverted from the Chena River into the Tanana River over a spillway located at the end of the floodway. During the impoundment however, the groundwater west (downstream) of the Project became elevated as predicted. As a result, over 90 homes in the North Pole area were damaged by elevated groundwater levels.

- 2002 and 2003: Glacial runoff in 2002 and ice jams on the Tanana River in 2003 caused significant flooding of roads and residences in the Community of Salcha. The 2002 spring breakup event received a Major Disaster Declaration designation, DR-1423-AK (June 26, 2002). During the following fall, an ice jam became locked in place and caused flooding in and around Salcha throughout the entire winter of 2002-2003. Both the 2002 and 2003 flood events caused significant monetary damage and inconvenience to the residents of Salcha and other residential areas along the Tanana River.

- 2008: The rapid collection of rainwater run-off in the Tanana Valley Drainage caused record high water levels and severe flooding throughout and beyond the FNSB. Areas impacted by the flood included the communities of Salcha, Rosie Creek, Perkins Landing and lower Chena Pump Road. On September 26, 2008, the U.S. President proclaimed a Declaration of Disaster, DR-1796-AK. An estimated 300 homes were damaged.

- 2009: On April 28, Salcha experienced flooding due to ice jams on the Tanana River. Water dammed up behind the ice jams causing the water to flow over the banks of the river. Sections of roads were impassable, several homes were surrounded with water and the water rose about

3 feet in an hour. The National Weather Service issued a flood warning for the area. On June 11, 2009, the U.S. President proclaimed a Declaration of Disaster Emergency (DR-1843-AK).

11.03. Possible Impacts from Future Events

Floods result in damage to structures via water inundation, high-velocity flow and debris accumulation in critical areas such as culverts and bridge piers. Erosion and scouring of roadways, stream banks, foundations and footings is another example of physical damage that can result from major flooding or even just high stream flows. Flood events, even when impounded by a dam, can also raise the groundwater table leading to inundation of basements and utilidors. Hazardous materials and sewage can be released if the facilities managing these items become inundated with flood waters. The navigability of boats under bridges can also be hampered by rising river water levels from floods.

The economic losses resulting from flooding can be devastating. Utility services, businesses, communications facilities and government facilities are all crucial operations within a community and can be significantly impacted by a flood event. The FNSB encompasses major thoroughfares to Interior Alaska and flooding could compromise important travel routes, affecting the economy and population in communities beyond the Borough that are accessed via these roadways.

The importance of the Moose Creek Dam to the City of Fairbanks and its flood-control ability cannot be overstated. The dam along with other components of the Chena River Lakes Flood Control Project are significant flood mitigating structures that have greatly reduced the likelihood of future flood losses for a large area of urban Fairbanks. The project is a "flood control" project however, not a "flood prevention" project. Flooding can still occur within the much larger and complex floodplain associated with the Tanana River.

11.04. Probability of Future Events

While the likelihood of a future flood event affecting the City of Fairbanks has been significantly mitigated by the Moose Creek Dam, the community of Salcha and other rural neighborhoods within the Tanana River floodplain, are at risk. Areas of new low density rural residential development have expanded east of Ft. Wainwright and are situated in areas where high groundwater occurs due to impoundment of the Chena River at Moose Creek Dam. Groundwater flooding has been also identified as the principal source of flooding in South Fairbanks for areas landward of the Tanana River Levee. (South Fairbanks Local Drainage Study; Northwest Hydraulic Consultants; June 2008) In spite of the fact that the levee has been "certified", groundwater seepage under the levee can still occur during periods of high stream flow on the Tanana River.

Although the Tanana River Levee, erosion protection dikes, Moose Creek Dam and interior drainage channels have greatly reduced the risk of future flood damages for much of the urbanized Fairbanks area, many FNSB residents are still vulnerable to the effects of flooding in areas not benefiting from existing flood control structures. Continued population and economic growth are likely to increase this risk factor if flood hazard awareness is not brought to bear.

11.05. Continued Participation in the NFIP

The NFIP was established by the National Flood Insurance Act of 1968. This act serves to better protect communities and individuals from flood losses by making flood insurance available, reduce future flood damages through community floodplain management regulations and reduce costs for disaster assistance and flood control. The importance of the FNSB's continued participation in the NFIP cannot be overstated.

The FNSB was the second community in the United States to join the program in 1969. As of May 2013, there were 839 in force flood insurance policies within the FNSB, insuring $196, 694,300 worth of property. Since 1978, there have been a total of 207 claims filed in the borough totaling $1,683, 629. These values in the FNSB are highest statewide. In 2008, there were 41 claims submitted due to the July-August flooding.

Table 11-1: FNSB National Flood Insurance Program Statistics

Emergency Program Date Identified	Regular Program Entry Date	Map Revision Date	NFIP Community Number	CRS Rating Number
6/25/1969	12/31/1974	1/2/92, 8/24/82 12/9/77 Ongoing as of 2/2007	025009 G	N/A
Total Annual Premium	**FNSB Total Loss Dollars Paid (since 1978)**	**Total Coverage FNSB**	**FNSB Repetitive Loss Properties**	**FNSB Total # of Current Policies**
$720,915	$1,683,629	$196,694,300	16; (recent updates to the RL list have been submitted as several properties have been mitigated)	839

SOURCE: NFIP POLICY AND CLAIMS REPORT; 5/08/2013

The FNSB has current effective Flood Insurance Rate Maps (FIRM) showing the location of special flood hazard areas in the borough. Many of these maps were comprehensively revised in January 1992 to reflect the completion of the Moose Creek Flood Control Facility. The 1992 revisions introduced the highest level of floodplain mapping attainable with establishment of a "regulatory floodway" for a significant portion of the Chena River as it flows through urban Fairbanks. The Moose Creek Flood Control Project only controls stream flows on the Chena River. There are many areas of residentially developed property however that remain as "approximate A" zones, not protected by the flood control facility. These "approximate A" zone areas are in dire need of flood mapping updates due to increases in population and changes to the floodplain itself.

Toward that end, a re-mapping of South Fairbanks was cooperatively initiated by the FNSB and FEMA within the Map Modernization Program administered by FEMA, in 2007. After a series of delays and appeals, the preliminary DFIRMS are projected to become effective in March of 2014 when the revised flood maps are adopted by ordinance by the FNSB Assembly.

The maps classify the floodplain into flood risk zones and are used for flood insurance rating purposes based on risk. Flood Zone A, which is the 1% chance flood and most prevalent flood zone in the borough, is the flood zone subject to regulation as described in Title 15, the borough's Flood Plain Management Ordinance. The following table describes the Borough's flood zones used in administering the National Flood Insurance Program.

Table 11-2: FNSB/NFIP Flood Zones

Flood Zone	Zone Description/Characteristics
Zone A	Areas with no base flood elevations determined.
Zone AE	Base flood elevations determined.
Zone AH	Flood depths of 1-3 feet; base flood elevations determined.
Zone AO	Flood depths of 1-3 feet; average depths determined.
Zone X500	Areas of 500 year flood; areas of 100 year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100 year flood.
Zone X	Areas determined to be outside 500 year flood plain.

SOURCE: FEDERAL EMERGENCY MANAGEMENT AGENCY

11.06. Repetitive Loss Properties

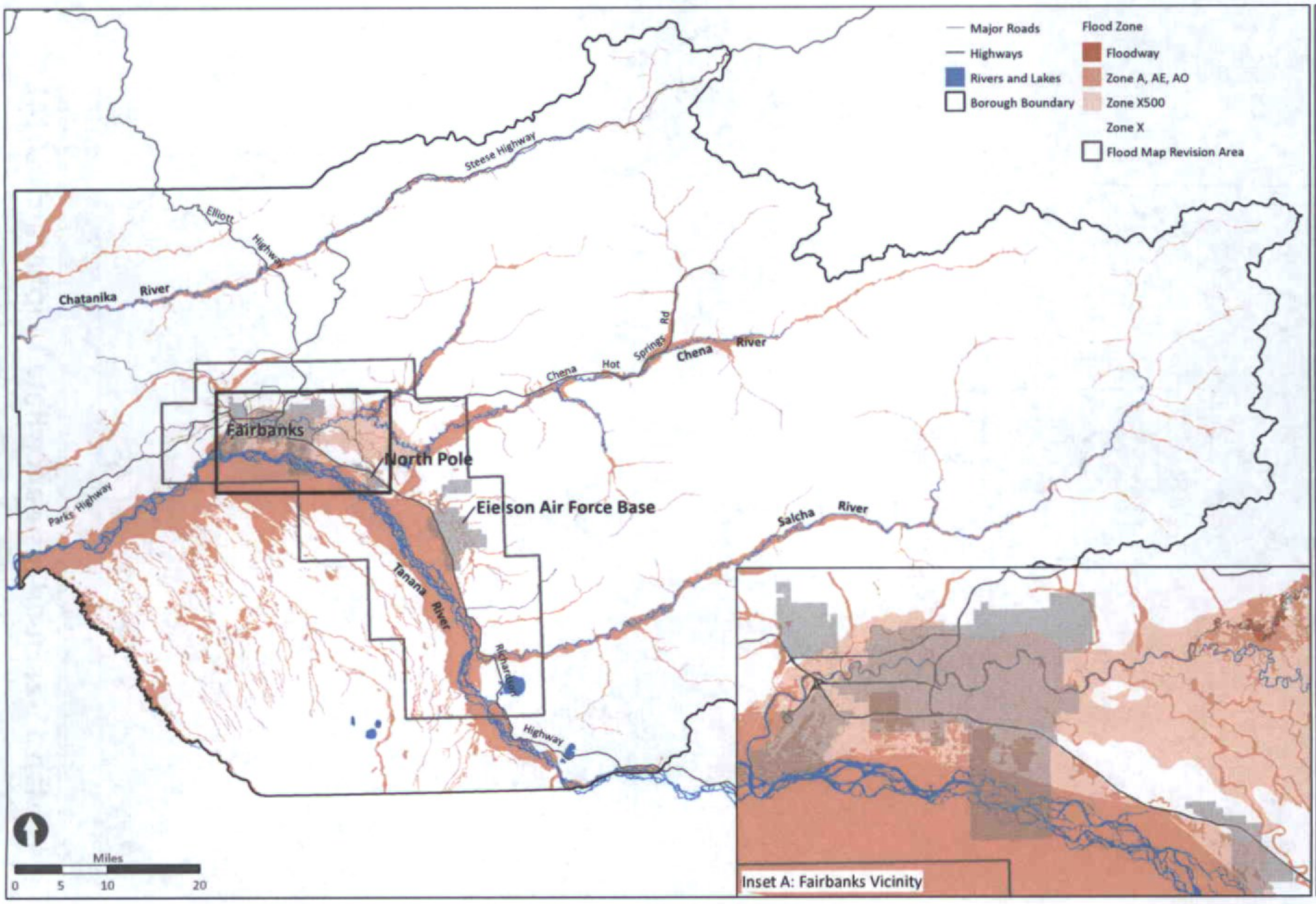
According to the most recent NFIP Repetitive Loss listing, there are 14 Repetitive Loss (RL) properties in the FNSB. A repetitive loss property is one that suffers flooding and has received two or more claim payments of more than $1,000 from the National Flood Insurance Program within any rolling 10-year period for your home or business, your property is considered a Repetitive Loss (RL) structure.

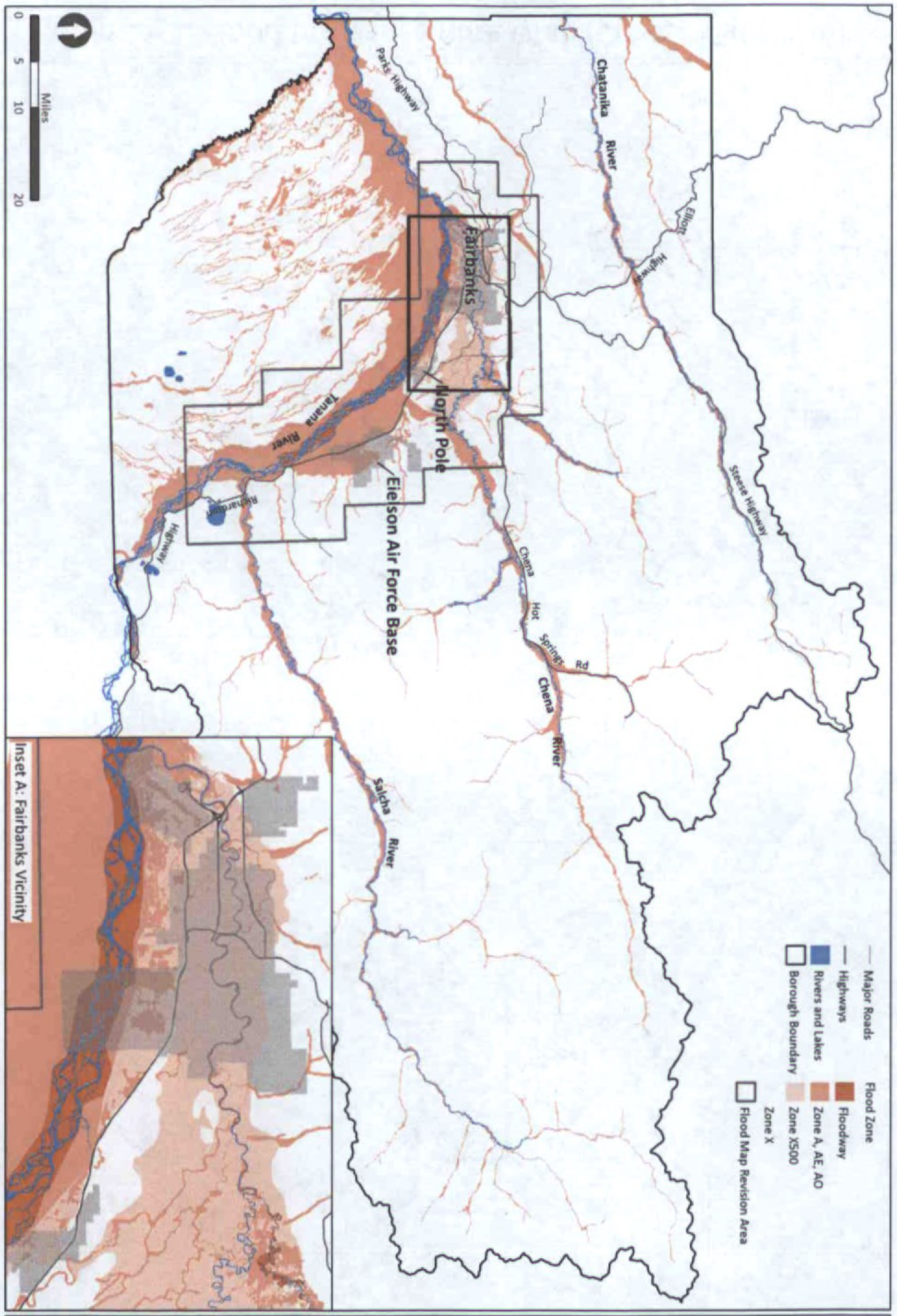
Structures that flood frequently strain the National Flood Insurance Fund. In fact, RL properties are the biggest draw on the fund. FEMA has paid almost $3.5 billion in claims for RL properties. RL properties not only increase the National Flood Insurance Program's (NFIP's) annual losses and the need for borrowing funds from Congress, they drain funds needed to prepare for catastrophic events.

Of the 14 RL properties in the FNSB, 7 have been mitigated. Updated information has been forwarded to the Insurance Services Office to document the mitigated nature of the 7 properties that were acquired by the FNSB using grants from the HMGP and NRCS funding sources. Structures have been removed from the subject properties which are now owned by the FNSB. The other 7 properties remain on the RL list.

Map 11-1: Flood Insurance Rate Map (Current Effective)

Hazard Mitigation Plan, Chapter 11: Flood Hazard Profile





Map 11-2: Flood Insurance Rate Map (March 2014)

Hazard Mitigation Plan, Chapter 11: Flood Hazard Profile

Prepared By: Fairbanks North Star Borough Department of Community Planning | Date: 1/27/2014 | Doc: HMP_Map_11FloodHazardProfile_2014-024 | Data Source: FNSB GIS, FEMA

11.07. Improved Floodplain Management

In March of 2010, FEMA Region 10 reported their findings and results of a Community Assistance Visit (CAV) to the borough. The CAV was conducted by FEMA staff during the summer of 2009. The CAV report listed numerous properties in need of compliance documentation in the form of either an approved FNSB floodplain development permit or completed elevation certificate. The CAV report also pointed out several deficiencies within the borough's overall floodplain management program.

In order to maintain eligibility in the NFIP, the borough administration at that time, took immediate steps to remedy deficiencies identified by FEMA. For the first time, a "floodplain administrator" position was established and charged with all aspects of maintaining the borough's NFIP eligibility. The FNSB floodplain administrator position represents a long term ongoing effort to not only maintain NFIP eligibility, but also to increase flood hazard awareness amongst citizens of the borough through improved public outreach, floodplain permitting and enforcement.

11.08. Ongoing Mitigation Projects

The Chena River Lakes Flood Control Project – This project, as previously mentioned, provides protection to the cities of Fairbanks and North Pole, Fort Wainwright Army Base and the Fairbanks International Airport. It was authorized by Congress in the Flood Control Act of August 13, 1968. The project consists of three principal features. One is the Moose Creek dam and floodway which was completed in 1979 to provide 100-year flood protection by diverting high Chena River flood flows to the Tanana River and limiting flows at Fairbanks. The floodway extends 7 miles south from the dam site on the Chena River, south to the Tanana River. The second feature is the Tanana River levee which protects urban Fairbanks and Fort Wainwright from the Tanana River flows. It extends 12 miles downstream along the Tanana River from the floodway intersection to the mouth of the Chena River. The third feature Interior Drainage Channels These channels are designed to intercept seepage flows from the Tanana River.

The project is designed to limit the flow of the Chena River to 12,000 cfs at downtown Fairbanks and divert flood waters through the floodway into the Tanana River. The floodway conveys waters under the Richardson Highway and Alaska Railroad bridges and over a sill structure into the Tanana River. A series of seepage collector channels located downstream of the dam convey seepage water that percolates beneath the dam and flows into nearby seepage collector channels.

FNSB Floodplain Regulations, Title 15 – In order to maintain eligibility in the NFIP, participating communities are required to adopt minimum flood plain development standards. Title 15 is the borough's flood plain development ordinance and was extensively re written and updated in April 2009. The update brought the borough into conformance with minimum flood plain development standards as required by FEMA as well as provided for an improved permitting and enforcement process.

Public Outreach—The borough continues to undertake routine public outreach activities geared toward promoting flood hazard awareness. This includes active participation in the annual Interior Alaska Builders Association trade show held every Spring. Brief permit reminder notices are sent to every property located in the flood hazard area with low improvement values in order to capture those properties most likely to be developed, just prior to the trade show event.

Flood Mapping Updates—The borough continues to stay abreast of flood plain mapping procedures and maintains a robust enterprise Geographical Information System (GIS) database of geographic information related to land resources in the borough. Preliminary digital FIRM maps are on schedule to become effective in March 2014 at which time, the legacy Map Modernization re-study begun in 2007, will be completed. In the interim, new topographic data, has been acquired for much of the populated areas of the borough that are in need of updated flood maps using FEMA's RISK Map process. Updated HEC-RAS modeling for the Chena River is now available as are updated groundwater models for the Moose Creek Dam area. Both models have been updated recently by the Corps of Engineers. In addition, a new hydraulic model has been developed by the Natural Resource Conservation Service for the Chena Badger Slough. The model was developed in order to address an invasive species issue, but can easily be used to determine flood risk with incorporation of available LIDAR topographic data.

11.09. Flood Hazard Actions

11.09.1. Flood Hazard Mitigation Successes

In early 2005, the borough filed a successful application with the Alaska Division of Homeland Security and Emergency Management to obtain funding through the federal Hazard Mitigation Grant (HMGP) in order to acquire 10 properties in the Sewell Subdivision located along a former river terrace of the Tanana River south of Salcha. The homes and other structures were either purchased and demolished or relocated to safer locations. The vacated homesites are now free of structures and are in permanent public ownership. Several of the properties are listed on the Repetitive Loss Property list which will soon be updated to reflect active mitigation has taken place.

Natural Resource Conservation Service funding was used to acquire several structures and properties in the Boondox Subdivision in 2009-10. The area was experiencing repetitive flooding and erosion hazards associated with the complex and active Tanana River. Several of the properties are in the ISO Repetitive Loss Property listing and have been mitigated.

The borough was a successful co-applicant in 2010 with assistance from Alaska Department of Commerce, Community and Economic Development in receiving a Repetitive Flood Claim grant on behalf of a single property owner located on the banks of the Tanana River in Salcha. The property had suffered multiple flood losses over a 12 year period with numerous flood insurance claims being paid by the NFIP. Beginning in the spring of 2011, the process of elevating the home began and was completed on time and on budget. The residence is now elevated 1.3 feet above base flood elevation.

Table 11-1: Flood Hazard Mitigation Action Plan Matrix

Objective Number	Objective Description	Specific Actions	Ranking Priority	Administering Department	Time-frame	Benefit - Costs	Goals Attained
F-1	Update Title 15 Floodplain Ordinances.	a. Update the Ordinance to comply with NFIP requirements.	High	FNSB Community Planning Dept.	1 Year	Highly cost effective: The development of ordinances has high benefit relative to low cost.	2
F-2	Update FIRM Maps	a. Digitize, update and revise existing flood insurance rate maps. b. Continue efforts as a Co-operating Technical Partner within the NFIP.	High	FEMA; FNSB Community Planning Dept.	On-going	Highly cost effective: Accurate and up to date FIRMs are the cornerstone of effective floodplain management efforts.	2
F-3	Educate the public and encourage public involvement in flood hazard prevention activities.	a. Continue to provide flood insurance information at time of application for zoning permit. b. Continue flood insurance outreach through available media. c. Continue educational presentations for builders, realtors. d. Partner with Army Corps of Engineers, NRCS and Rosie Creek and Salcha area residents to conduct a flood mitigation feasibility study on the Tanana River.	High	FNSB Community Planning Dept.	On-going	Highly cost effective: Community preparedness and education has a high benefit relative to a low cost.	3, 4
F-4	Maintain, enhance and conserve vegetation preferably natural, along transportation corridors, rivers, lakes and ponds to preserve scenic beauty, prevent erosion and support wildlife. Promote open spaces.	a. Continue to protect riparian zones by imposing restrictions on properties at time of re-zoning. b. Continue to address preserving riparian zones as outlined in the FNSB Comprehensive Plan.	Medium	FNSB Community Planning Dept.	On-going	Highly cost effective: The implementation of plans and policies has a high benefit relative to low cost.	3, 4
F-5	Identify critical Borough and City infrastructure and facilities located in flood hazard areas. Determine viable mitigation measures and secure funding.	a. Continue an audit of critical facilities and infrastructure within the FNSB and cities of Fairbanks and North Pole. b. Conduct a feasibility study. c. Secure funding.	High	FNSB Public Works Dept.; City of Fairbanks Engineering Division; and Cities of Fairbanks and North Pole Building Depts.	3–5 Years	Moderately cost effective: Although ensuring the sustainability of critical facilities and infrastructure is imperative for saving lives during floods, the costs associated with retrofitting existing structures is high.	3, 4
F-6	Implement NFIP standards.	a. Continue to make FIRM adjustments and refinements. b. Continue to educate staff and other cooperating agencies on NFIP regulations, policies, and procedures.	High	FNSB Community Planning Dept.	3-5 Years	Moderately cost effective: Although accurate flood hazard maps are critical for making land use decisions, selecting appropriate mitigation measures, and providing credible public education, the cost of expanding/enhancing existing FIRMs is high.	3, 4
F-7	Improve drainage on new construction projects.	a. Require drainage planning for subdivisions. b. Update Title 17.	High	FNSB Community Planning Dept.; City of Fairbanks Engineering Division and Fairbanks & NP Bldg Depts.	On-going	Highly cost effective: The development and implementation of plans and ordinances has a high benefit relative to low cost.	3, 4
F-8	Complete flood mitigation projects.	a. Examine mitigation options that may be available and feasible for properties listed on the Repetitive Loss List.	High	FNSB, City of Fairbanks and City of North Pole	On-going	Highly cost effective: The securing of funding through grants affords opportunities not possible with local funding. Grants for mitigation projects will meet a benefit cost ratio >1.	1

12. Multi-Hazard Mitigation

Multi-hazard mitigation refers to objectives and actions recommended for general emergency preparedness, those that will address multiple hazard events, and those that will benefit the community in the event of a combination of hazard events. The five objectives listed below have applicability across hazard types, or can provide mitigation for events with multiple hazards occurring simultaneously, such as enduring an earthquake at fifty degrees below zero.

Table 12-1: Multi-Hazard Goal Applicability

Objective Number	Objective Description	Plan Goals	Applicability by Hazard				
			Wildfire	Seismic	Severe Weather	Volcanic Ash	Flood
M-1	Develop Additional Egress Routes and Methods	1, 6, 7	X	X	X	X	X
M-2	Stabilization of water heaters and fuel tanks	1, 2, 3	X	X	-	-	X
M-3	Create local non-governmental coordination and communication plans.	5, 6, 7	X	X	X	X	X
M-4	Develop and implement multi-hazard education and outreach programs.	5	X	X	X	X	X
M-5	Update FNSB GIS data to include site addresses of all critical facilities	1, 7	X	X	X	X	X
M-6	Support the Borough-wide use of mutual and automatic aid agreements.	1, 7	X	X	X	X	X
M-7	Address issues of emergency access, including road grade, construction standards, and turnarounds.	1, 2, 7	X	X	X	X	X
M-8	Complete multi-hazard mitigation projects for redundancy in public services and utilities	1, 2, 3, 7	X	X	X	X	X
M-9	Ensure food security during extended events	1, 2, 3, 5, 6	X	X	X	X	X

Table 12-2: Multi-Hazard Mitigation Action Plan Matrix

Objective Number	Objective Description	Specific Actions	Ranking Priority	Administering Department	Time-frame	Benefit - Costs	Goals Attained
M-1	Develop Additional Egress Routes and Methods	a. Construct roads to provide redundant means of access, such as reconstruction of Transmitter Road on Eielson AFB to the Grange Hall Road in Two Rivers.	High	FNSB Community Planning, FNSB Public Works, FNSB Emergency Ops	1 Year	Expensive but only moderately cost-effective. Multimodal evacuations and redundant vehicluar routes are critical for public safety; in most modeled events, the Borough has one or zero methods of egress.	1, 6, 7
		b. Coordinate with local air, rail, and freight services, such as Alaska Airlines, ERA Alaska, and the Alaska Railroad, to work on mass evacuation plans.					
M-2	Stabilization of water heaters and fuel tanks	a. Provide education and financial assistance to stabilize water heaters.	Medium	FNSB Emergency Ops, City of Fairbanks Building Department, City of North Pole Public Works	1-2 years	Highly cost effective; minimal cost with maximum benefit.	1, 2, 3
		b. Provide education and financial assistance to stabilize above-ground fuel storage tanks.					
M-3	Create local non-governmental coordination and communication plans.	a. Work with local NGOs, utility providers, and other quasi-public or private entities to create a local response plan.	Low	FNSB Emergency Ops, FNSB Community Planning	1-5 years	Low cost, moderate benefit.	5, 6, 7
M-4	Develop and implement multi-hazard education and outreach programs.	a. Create a school program to teach children about 72-hour supplies, egress, and other preparedness.	Low	FNSB Emergency Ops., FNSB Community Planning	2-5 years	Low cost, low measure of guaranteed success.	5
		b. Annually present the Hazard Mitigation Plan and other relevant local emergency plans at the Disaster Expo, Home Show, and other public events.					
		c. Utilize the expertise of an outreach coordinator to promote emergency preparedness in the FNSB and Cities of Fairbanks and North Pole.					
M-5	Update FNSB GIS data to include site addresses of all critical facilities	a. Annually review /update critical facilities' addresses	High	FNSB Computer Services Dept., FNSB Community Planning, FNSB Emergency Ops.	On-going	Highly cost effective: Update of GIS information improves the efficiency of emergency response for a relatively low cost compared to the high benefits.	7
M-6	Support the Borough-wide use of mutual and automatic aid agreements.	a. Annually review mutual/ automatic aid agreements.	High	Interior Fire Chief Association	On-going	Highly cost effective: The implementation of plans and procedures that improve the coordination and efficiency of the emergency response system has a high benefit relative to a low cost.	7
M-7	Address issues of emergency access, including road grade, construction standards, and turnarounds.	a. Continue subdivision plat reviews to ensure safe egress for fire equipment.	Medium	FNSB Community Planning, FNSB Emergency Ops.	On-going	Highly cost effective: Community preparedness and education has a high benefit relative to a low cost.	2, 7
		b. Widen roads and/or create turnarounds in residential areas to improve emergency vehicle access.					
M-8	Complete multi-hazard mitigation projects for redundancy in public services and utilities	a. Supply critical facilities with backup heating and power systems, if they currently do not have one, or upgrades to existing systems as needed.	High	FNSB Emergency Ops., FNSB School District, City of Fairbanks Engineering Division, City of North Pole Public Works, Local Utility Providers	Urgent	Essential. Loss of public utilities will have an immediate and deleterious impact on emergency response, recovery, and resonstruction efforts. This is the most highly cost effective mitigation measure due to the cascading negative effects it can prevent.	1, 2, 3, 7
		b. Purchase portable water purification equipment.					

13. Inventory of Assets and Estimated Losses

In order to assess the vulnerability of assets within the Borough, an inventory of critical infrastructure, people, residential properties and repetitive loss properties was conducted.

Five categories of critical buildings and facilities were included in the inventory of assets of the FNSB and cities of Fairbanks and North Pole. These categories are based on their loss potential, as defined in FEMA (FEMA 2001). The following categories are considered critical facilities:

- Essential Facilities are essential to the health and welfare of the whole population and are especially important following hazard events. The potential consequences of losing them are so great, that they should be carefully inventoried. Be sure to consider not only their structural integrity and content value, but also the effects on the interruption of their functions because the vulnerability is based on the service they provide rather than simply their physical aspects. Essential facilities include hospitals and other medical facilities, police and fire stations, emergency operations centers and evacuation shelters and schools.
- Transportation Systems include airways – airports, heliports; highways – bridges, tunnels, roadbeds, overpasses, transfer centers; railways – track, tunnels, bridges, rail yards and deports.
- Lifeline Utility Systems such as potable water, wastewater, oil, natural gas, electric power and communication systems.
- High Potential Loss Facilities are facilities that would have a high loss associated with them, oil and gas pipelines, dams and military installations.
- Hazardous Material Facilities include facilities housing industrial/hazardous materials, such as corrosives, explosives, flammable materials, radioactive materials and toxins.

The vulnerability table (Appendix D) indicates what can be affected by the various hazards events. The table was based on critical facilities and other assets of the Borough that are susceptible to damage from a hazard event. It includes everyone who enters the jurisdiction: residents, employees, commuters, shoppers, tourists and others. Populations with special needs such as children, the elderly and disabled were considered, as well as the locations of these populations such as health clinics, senior housing and schools.

Residential properties are also included. The assessed value for the locally assessed real property within the FNSB was $7,226,523,375 in 2013. (Assessed Values from Municipality Property Taxes 2012)

Finally, repetitive loss properties are listed. Only properties from flood hazards are currently listed as repetitive loss properties. Repetitive loss properties have had at least two $1,000 claims within any 10-year period since 1978. Severe Repetitive Loss properties have experienced four or more separate building and content claims since 1978 each exceeding $5,000 with cumulative claims exceeding $20,000; or at least two separate building claims with cumulative losses exceeding the value of the main living structure. The Borough has 36 losses to 14 properties with a total value of $463,475. The Borough also has one severe repetitive loss property with 5 losses for a total value of $46,942. (Hazard Mitigation Plan 2013)

Risk analysis determines the value of those assets representing estimate of loss in the event of natural hazard. These values are calculated from the structure replacement value, content loss value and function loss (structure use) value, to arrive at the total cost of damage to the community per hazard event. This information was gleaned from tax assessment records, Borough financial records, the State of Alaska financial records, cities of Fairbanks and North Pole financial records and the draft 2013 Alaska State Hazard Mitigation Plan and maps. From this data, areas of the Borough were mapped defining vulnerability for loss per hazard event.

These individual maps represent vulnerability assessment per identified hazard. A composite loss map was created by overlaying these individual maps that identify specific areas of the Borough that have high or extreme vulnerability to hazards. It is important to note that severe weather and volcanic ash could occur Borough-wide rather than site specific. Earthquake risk has some site specific data such as subsidence relative to river soil types and permafrost areas within the Borough but the overall risk of earthquake hazard is also Borough-wide.

One important factor to consider for all hazards and responses is that Alaska's Interior and the Borough are a long distance from the nearest urbanized area. Relative to all disasters within the Interior is the implication of possible isolation, cutoff from goods and services and not an immediate remedy to that situation, whether the natural hazard actually occurred within close proximity of one's community or not.

Additionally many of the statistical analysis software programs available for use in identification of risk do not differentiate between various areas within the state of Alaska. Instead, the programs analyze risk across the state with estimates based upon a state average value when in actuality the value of loss may be significantly different between regions.

Therefore, the statistical analysis implied within the HMP is a "best estimate" but cannot factor in the geographic constraints actually associated with residing in this remote location.

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