City of Koyukuk, Alaska

Local Hazards Mitigation Plan

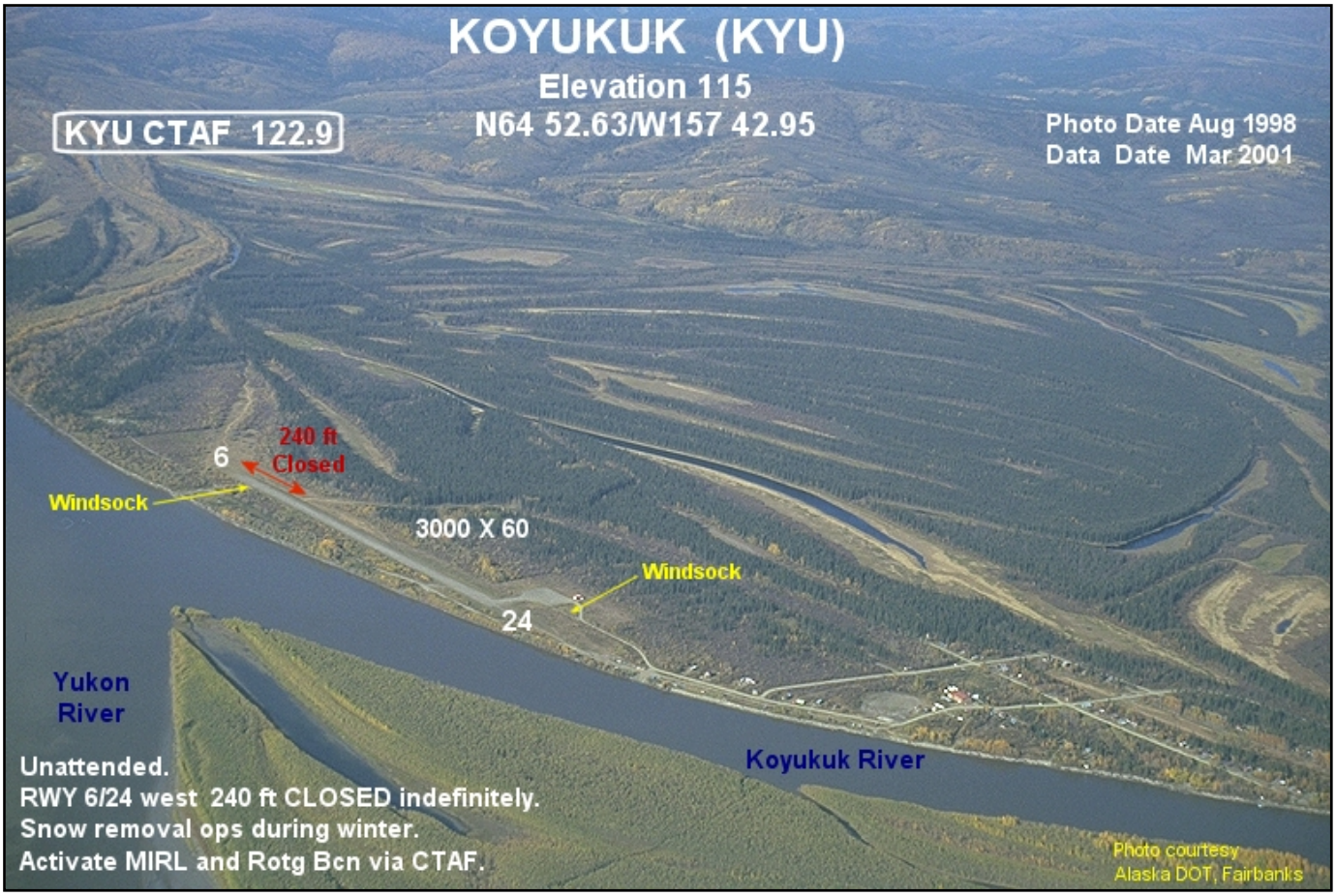

Photo: Federal Aviation Administration Website

Date of Plan April 29, 2008

Prepared by:

City of Koyukuk

WHPacific

and

Bechtol Planning and Development

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Acronyms

AEIS	Alaska Earthquake Information System
AWCG	Alaska Wildfire Coordinating Group
BCA	Benefit- Cost Analysis
BCR	Benefit-Cost Review
BFE	Base Flood Elevation (100 year flood)
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
CMP	Coastal Management Plan
DCRA	(Alaska) Department of Commerce, Community and Economic Development
DHS&EM	(Alaska) Division of Homeland Security and Emergency Management
FDIC	Federal Deposit Insurance Corporation
FEMA	Federal Emergency Management Agency
FHLBB	Federal Home Loan Bank Board
FIRM	Flood Insurance Rate Maps
FLD	Flood Projects
fps	feet per second
FLD	Flood Projects
HMPG	Hazard Mitigation Planning Grant
HWE	High Water Elevation
IAW	Immediate Action Workgroup
LHMP	Local Hazard Mitigation Plan
NFIP	National Flood Insurance Program
NOAA	National Oceanographic and Atmospheric Administration
PDMG	Pre Disaster Mitigation Grant
REAA	Regional Education Attendance Area
SBA	Small Business Administration
STIP	Statewide Transportation Improvement Program
T/S	Tsunami/Seiche Projects
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

Sample Resolution

Note: To be submitted to City Council after pre-approval from DHS&EM and FEMA

City of Koyukuk, Alaska

Local Hazards Mitigation Plan Adoption Resolution

Resolution # _____

Adoption of the City of Koyukuk Local Hazards Mitigation Plan

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

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

Whereas, an adopted Local Hazards Mitigation Plan is required as a condition of future grant funding for mitigation projects; and

Whereas, the Koyukuk Local Hazards Mitigation Plan has been sent to the Alaska Division of Homeland Security and Emergency Management and the Federal Emergency Management Agency for their approval.

Now, therefore, be it resolved, that the Koyukuk City Council*,* hereby adopts the City of Koyukuk Local Hazards Mitigation Plan as an official plan; and

Be it further resolved, that the City of Koyukuk will submit the adopted Local Hazards Mitigation Plan to the Alaska Division of Homeland Security and Emergency Management and the Federal Emergency Management Agency officials for final review and approval.

CERTIFICATION

It is hereby certified that on the _____ day of _____, 2008, a quorum of the City of Koyukuk was formed and did pass and adopt the preceding resolution by a vote of _____ in favor, _____ opposed, and _____ not voting.

_____ _____

President, City of Koyukuk Date

_____ _____

Secretary/Treasurer Date

Chapter 1. Planning Process and Methodology

Introduction

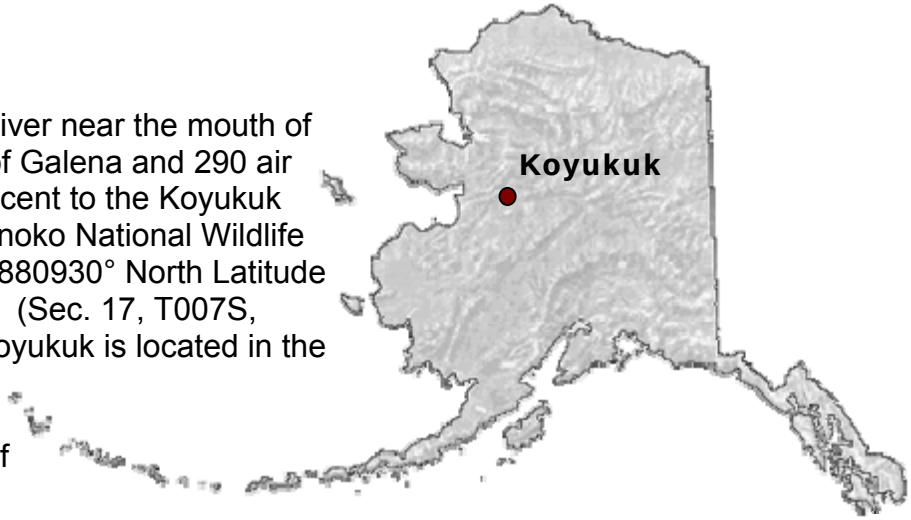
The scope of this plan is natural hazards: flooding, erosion, severe weather, wildland fire, avalanche, tsunami and earthquake hazards. However, some of the mitigation projects for the natural hazards would also mitigate impacts from other hazards.

The City of Koyukuk Local Hazards Mitigation Plan (LHMP) includes information to assist the city government and residents with planning to avoid potential future disaster losses. The plan provides information on natural hazards that affect Koyukuk, descriptions of past disasters, and lists projects that may help the community prevent disaster losses. The plan was developed to help the City make decisions regarding natural hazards that affect Koyukuk.

Plan Development

Location

Koyukuk is located on the Yukon River near the mouth of the Koyukuk River, 30 miles west of Galena and 290 air miles west of Fairbanks. It lies adjacent to the Koyukuk National Wildlife Refuge and the Innoko National Wildlife Refuge. It lies at approximately 64.880930° North Latitude and -157.701030° West Longitude. (Sec. 17, T007S, R006E, Kateel River Meridian.) Koyukuk is located in the Nulato Recording District. The area encompasses 6.2 square miles of land and 0.1 square mile of water.



Project Staff

The Koyukuk LHMP City staff included Marilyn Roberts and Koyukuk Tribal Administrator Cindy Pilot.

WHPacific and Bechtol Planning & Development were hired to write the plan with the City.

Ervin Petty and Andrew Jones of the Division of Homeland Security & Emergency Management (DHS&EM) provided technical assistance and reviewed the drafts of this plan.

Plan Research

The plan was developed utilizing existing Koyukuk plans and studies as well as outside information and research. The following list contains the most significant of the plans, studies and websites that were used in preparing this document. Please see the bibliography for more sources.

1. *Alaska All-Hazard Risk Mitigation Plan*. Prepared by and for DHS&EM. October 2007

2. *DCRA Community Information*: http://www.commerce.state.ak.us/dca/commdb/CF_BOCK.htm.

3. *Koyukuk Immediate Action Matrix,* Prepared by the Immediate Action Workgroup, March 4, 2008

4. *Draft Koyukuk Comprehensive Community Development Plan*, Prepared by Gerald Pilot, September 2007

5. *Koyukuk Draft Flood Mitigation Plan, 2003*, Prepared Tanana Chiefs Conference

6. *USACE Draft Section 117 Project Fact Sheet for Koyukuk*, Prepared by Alaska USACE, 2008

Public Involvement

A copy of the draft LHMP is available for public perusal at the City and Tribal Government Offices.

The Koyukuk City Council will review and approve the plan after pre-approval by DHS&EM and FEMA.

2003 Public Involvement: The draft *2003 Flood Mitigation Plan* prepared by Tanana Chiefs Conference included the following public involvement processes.

- Community Meetings: Three community meetings were held. The meetings were well advertised and refreshments were provided. All meetings were well attended by community members.
- Planning Committee Meetings: The Koyukuk Flood Mitigation Planning Committee was made up of a cross-section of community members, including representatives from the City and Tribal Councils and interested community members.
- Community Survey: A survey was designed to provide further insight into the concerns of community members regarding risks, evacuation, mitigation, and relocation. Thirty-two complete surveys were received.
- Flood History Interviews: A community planning team member conducted interviews with community residents on flood history in the village. Information gathered through the interviews includes how residents have prepared for, responded to and dealt with flood situations or the threat of flood situations.

2008 Public Involvement:

The contractors and the Koyukuk Tribal Administrator met on February 11, 2008. A teleconference was conducted on April 17, 2008, which was attended by the contractor, City Administrator and Tribal Administrator.

A public gathering on the plan was held in Koyukuk on April 28, 2008. The following newsletter was distributed in the community. Attendance at the community meeting included city staff, tribal staff, members of the city council, members of the tribal council and residents of Koyukuk.

The Koyukuk City Council and Tribal Council will again review the document after pre-approval from the State and FEMA. The Koyukuk City Council will be responsible for approval of the final document.

Figure 1. Koyukuk Newsletter

Koyukuk
Local Hazard Mitigation Plan

April 1, 2008

The Planning Process

The Disaster Mitigation Act of 2000 requires the plan to follow and record the following elements:

1. Planning process
2. Hazard Identification
3. Risk Assessment
4. Mitigation Strategy with Goals, Objectives and Actions
5. Plan Maintenance
6. Adoption by local government
7. Approval from FEMA, and the State Department of Homeland Security and Emergency Management

For more information on mitigation planning you can visit FEMA's website at http://www.fema.gov/plan/mitplanning/index.shtm

Local Hazards Mitigation Planning

Disasters, such as avalanches, coastal erosion, earthquakes, floods, high winds, landslides, tsunamis, wildfires, and severe weather, are events beyond human control. However, reducing the risks and damage from these events through mitigation efforts is possible.

The Federal Emergency Management Agency (FEMA) wants to ensure that each community's critical facilities and services will continue to function after a natural disaster. FEMA has funds available for projects that help to do this.

Preparing a Local Hazards Mitigation Plan (LHMP) is the first step in this process. Through the planning process risks from each type of hazard are assessed, critical facilities are identified within the community and their vulnerability to hazard is determined, potential losses are estimated, and community land use is considered.

With this information, a mitigation strategy will be developed, including mitigation goals, objectives and actions to reduce or avoid long-term risk or damage from disaster events. Projects will be identified, evaluated and prioritized, and an implementation strategy developed.

The plan must be approved by the local government, FEMA, and the state Department of Homeland Security and Emergency Management (DHS&EM) before it is official.

Once the plan is finalized, the community is eligible to apply to FEMA and DHS&EM for funds for the community's identified mitigation projects.

State DHS&EM sponsors planning effort in Koyukuk

The Alaska Division of Homeland Security and Emergency Services has funded a local hazards mitigation plan for Koyukuk. WHPacific, Inc. and Bechtol Planning and Development (BP&D) have been hired to help the community to prepare the plan.

The LHMP will include information specific to Koyukuk, including critical facilities, potential threats from natural hazards, and strategies to minimize the risk to people and property.

Strategies may be for immediate implementation or long term activities, and can range from educating residents about what to do in the event of a natural disaster to relocating structures away from high-risk areas.

To Get Involved

The most practical plans are ones that have local public input. Your ideas are valuable to the planning team and to the usefulness of the plan. A public gathering about the LHMP is planned for the community on April 28, 2008 at 3 p.m. at the Community Hall. At this meeting team members will share information about the plan and its value to the community.

Your comments are welcome!

The planning team hopes that you will take an active role in the Koyukuk LHMP development. If you would like more information or have questions or comments, you can reach the planning team by phone or email:

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Marilyn Roberts, City Administrator and
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907.927.2253 or 927.2215
Cityofkoyukuk@hotmail.com
Cynthia.pilot@tananachiefs.org

Erv Petty
DHS&EM Mitigation Section
907.428.7015 or

Nicole McCullough or Suzanne Taylor
WHPacific, Inc.
300 W 31st, Anchorage, AK 99503
1.800.427.4153, 907.339.6570
staylor@whpacific.com

Eileen Bechtol
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907.235.4246

Further information may also be found on the DHS&EM website at:

http://www.ak-prepared.com/plans/mitigation/mitplanresourcesa.htm

Public Meeting

Date/Time: April 28, 2008, 3 p.m.

Where: Community Hall

Why: Solicit Input in the Hazard Plan.

Please Join Us, Snacks will be Provided!

Mitigation is any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event.

WHPacific

Plan Implementation

The City Council of Koyukuk will be responsible for adopting the Koyukuk LHMP and all future updates or changes. This governing body has the authority to promote sound public policy regarding hazards. The Hazards Mitigation Plan will be assimilated into other Koyukuk plans and documents as they come up for review according to each plan's review schedule.

Table 1. Koyukuk Plans

Document	Completed	Next Review
Koyukuk Comprehensive Development Plan	In progress 2007	As needed, 10 year plan
Long Range Transportation Plan	2008	As needed, 20 year plan

Continuing Review Process

The Koyukuk LHMP will be reviewed on an annual basis to determine whether the plan reflects the current situation in regards to natural hazards.

Continued Plan Development

The Koyukuk LHMP will be further developed as funding and time allow. Additional hazards not currently covered in the plan, including technological and manmade hazards, will be added, if funding becomes available during the next five-year update cycle.

If funding is available, the plan will be updated every 5 years, after a Federally Declared Disaster, or as required by DHS&EM.

The City Administrator will be responsible for updating and maintaining the plan by adding additional hazards and completing vulnerability assessments for existing hazard chapters.

The following table lists the schedule for completion of these tasks, provided that funds are available to do so:

Table 2. Continued Plan Development

Hazard	Status	Hazard Identification Completion Date	Vulnerability Assessment Completion Date
Floods	Completed	2008	2008
Erosion	Completed	2008	2008
Severe Weather	Completed	2008	2008
Wildland Fire	Completed	2008	2008
Earthquake	Completed	2008	2008
Tsunami/Seiche	N/A	N/A	N/A
Avalanche	N/A	N/A	N/A
Economic	Future Addition	2010	2011
Technological	Future Addition	2010	2011
Public Health Crisis	Future Addition	2010	2011

Continued Public Involvement

On an annual basis the community will have the opportunity to discuss and review the plan at gatherings of the city and tribal governments. One technique would be to have the plan available at annual break-up meetings held in the spring before spring thaw.

Risk Assessment Methodology

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, and disruption to local and regional economies, environmental damage and disruption, and the amount of public and private funds spent to assist with recovery.

Mitigation efforts begin with a comprehensive risk assessment. A risk assessment measures the potential loss from a disaster event caused by an existing hazard by evaluating the vulnerability of people, buildings, and infrastructure. It identifies the characteristics and potential consequences of hazards and their impact on community assets.

A risk assessment typically consists of three components; hazards identification, vulnerability assessment and risk analysis.

1. *Hazards Identification* - The first step in conducting a risk assessment is to identify and profile hazards and their possible effects on the jurisdiction. This information can be found in Chapter 3: Hazards.
2. *Vulnerability Assessment* – Step two is to identify the jurisdiction's vulnerability; the people, infrastructure and property that are likely to be affected. It includes everyone who enters the jurisdiction including employees, commuters, shoppers, tourists, and others.

Populations with special needs such as children, the elderly, and the disabled should be considered; as should facilities such as the hospital, health clinic, senior housing and schools because of their additional vulnerability to hazards.

Inventorying the jurisdiction's assets to determine the number of buildings, their value, and population in hazard areas can also help determine vulnerability. A jurisdiction with many high-value buildings in a high-hazard zone will be extremely vulnerable to financial devastation brought on by a disaster event.

Identifying hazard prone critical facilities is vital because they are necessary during response and recovery phases. Critical facilities include:

- Essential facilities, which are necessary for the health and welfare of an area and are essential during response to a disaster, including hospitals, fire stations, police stations, and other emergency facilities;
- Transportation systems such as highways, airways and waterways;
- Utilities, water treatment plants, communications systems, power facilities;
- High potential loss facilities such as bulk fuel storage facilities; and
- Hazardous materials sites.

Other items to identify include economic elements, areas that require special considerations, historic, cultural and natural resource areas and other jurisdiction-determined important facilities.

3. *Risk Analysis* – The next step is to calculate the potential losses to determine which hazard will have the greatest impact on the jurisdiction. Hazards should be considered in terms of their frequency of occurrence and potential impact on the jurisdiction. For instance, a possible hazard may pose a devastating impact on a community but have an extremely low likelihood of occurrence. Such a hazard must take lower priority than a hazard with only moderate impact but a very high likelihood of occurrence.

   For example, there might be several schools exposed to one hazard but one school may be exposed to four different hazards. A multi-hazard approach will identify such high-risk areas and indicate where mitigation efforts should be concentrated.

   Currently there are insufficient funds and data with which to conduct an accurate risk analysis for all the hazards affecting Koyukuk. However, risk analysis information will be added as it is completed.

Vulnerability Assessment Methodology

The purpose of a vulnerability assessment is to identify the assets of a community that are susceptible to damage should a hazard incident occur.

Critical facilities are described in the Community Profiles Section of this hazard plan. A vulnerability matrix table of critical facilities as affected by each hazard is provided in Chapter 3 of this document.

Facilities were designated as critical if they are: (1) vulnerable due to the type of occupant (children, disabled or elderly for example); (2) critical to the community's ability to function (roads, power generation facilities, water treatment facilities, etc.); (3) have a historic value to the community (museum, cemetery); or (4) critical to the community in the event of a hazard occurring (emergency shelter, etc.).

This hazard plan includes an inventory of critical facilities from the records and land use map.

Federal Requirement for Risk Assessment

Recent federal regulations for hazard mitigation plans outlined in 44 CFR Part 201.6 (c) (2) include a requirement for a risk assessment. This risk assessment requirement is intended to provide information that will help the community identify and prioritize mitigation activities that will prevent or reduce losses from the identified hazards. The federal criteria for risk assessments and information on how the Koyukuk LHMP meets those criteria are outlined below:

Table 3. Federal Requirements

Section 322 Requirement	How is this addressed?
Identifying Hazards	Koyukuk city staff and community members identified natural hazards at community meeting, which were used in developing the LHMP.
Profiling Hazard Events	The hazard-specific sections of the Koyukuk LHMP provide documentation for all natural hazards that may affect the City. Where information was available, the Plan lists relevant historical hazard events.
Assessing Vulnerability: Identifying Assets and Estimating Potential Losses of Critical Facilities	Vulnerability assessments for floods/erosion, severe weather, wildland fire, earthquakes, avalanches and tsunamis have been completed and are contained within the hazard chapter. Additional vulnerability assessments will be added as they are funded and completed.
Assessing Vulnerability: Analyzing Development Trends	The Community Profile Section and Chapter 3 include a description of development in Koyukuk.

Chapter 2: Community Profile

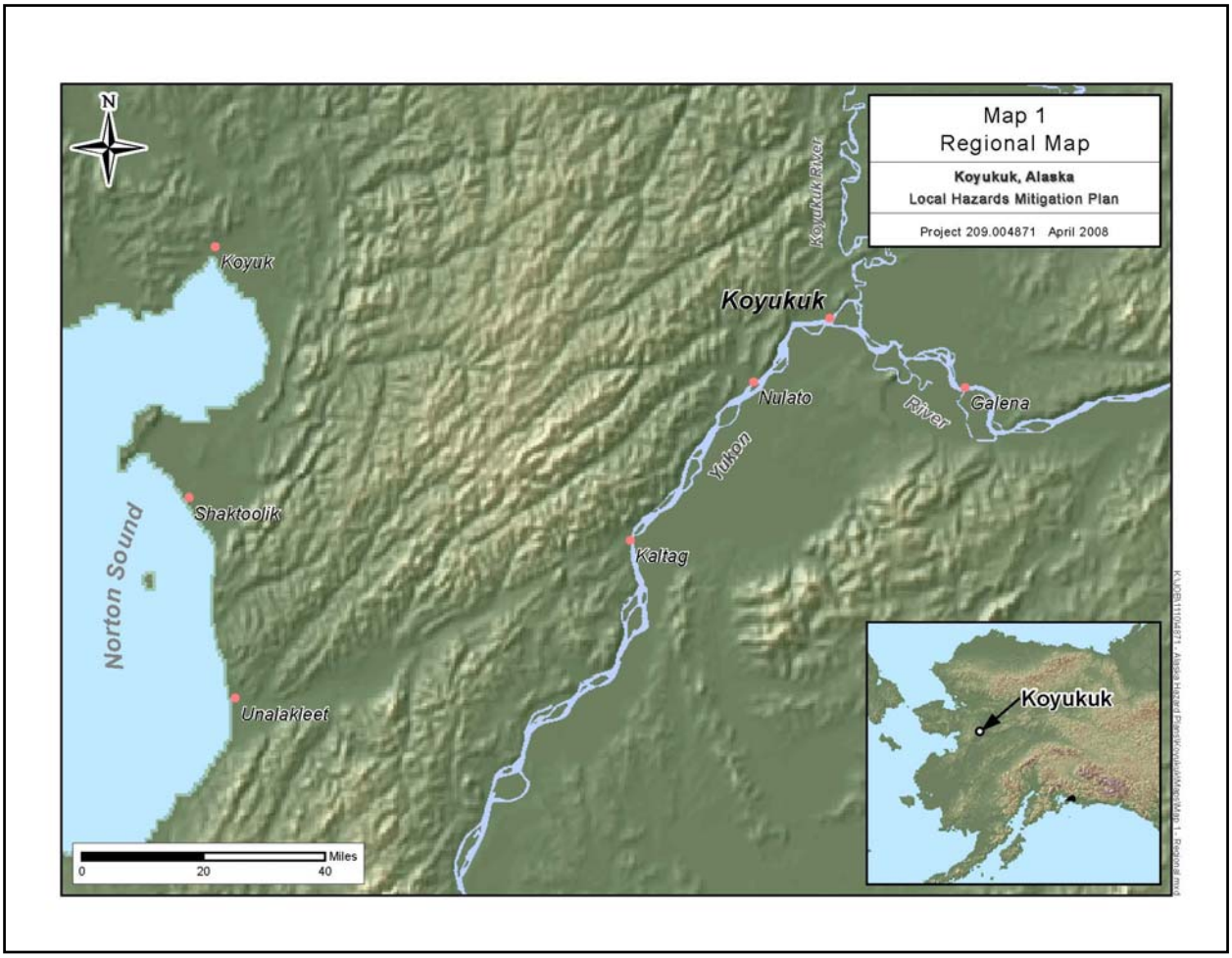
Community Overview

Current Population:	88 (2006 DCRA Certified Population)
Pronunciation:	KOY-yuh-kuck
Incorporation Type:	Second Class City
Borough:	Unorganized
Census Area:	Yukon/Koyukuk

History

According to the 1987 Koyukuk Community Profile, Koyukuk is located in traditional Koyukon Athabascan territory, with is referred to as Yukon-Kateel in historical records. The traditional Athabascan term for the community is “Mineelghaadza T’oh” which means “Under the Mineelghaadza Bluff.” Prior to becoming a village, it was known as Koyukuk Station, a military telegraph site.

Map 1. Regional Map



Koyukon Athabascans frequently lived in large semi-permanent villages during the summers, most commonly located near the primary fishing grounds. They moved from these into the tributary drainage for hunting and trapping in the fall and winter, setting up temporary camps, as needed. At the time of contact with people of European descent, it is estimated that the Koyukuk River group numbered nearly 300 people, while the Lower Yukon group consisted of over 400.

Most of Koyukuk's current population are descendents of families that lived in camps or settlements along the Koyukuk River. There were two big camps on the Koyukuk River – one a summer camp at the mouth of the Nicholia Slough, and one a year-round camp at the mouth of Andrew Paul's Slough. There were also camps at the mouth of Kateel River and Dulbi River, which are located further up the Koyukuk. According to Native elders in Koyukuk, most families would board rafts in the early summer and float to the Yukon River to fish. There were 12 summer fish camps located on the Yukon River between the Koyukuk River and the Nowitna River. Friendships and trading between the Koyukon and Inupiat Eskimos of the Kobuk area have occurred for generations.

A Russian trading post was established at nearby Nulato in 1838. A smallpox epidemic, the first of several major epidemics, struck the Koyukon in 1839. A military telegraph line was constructed along the north side of the Yukon around 1867, and Koyukuk became the site of a telegraph station. A trading post opened around 1880, just before the gold rush of 1884-85. The population of Koyukuk at this time was approximately 150.

Missionary activity was intense along the Yukon, and a Roman Catholic Mission and school opened downriver in Nulato in 1887. A post office operated from 1898 to 1900. Steamboat activity on the Yukon, which served gold prospectors, peaked in 1900 with 46 boats in operation. A measles epidemic and food shortages during 1900 tragically reduced the Native population by one-third. Gold seekers left the Yukon after 1906, but other mining activity, such as the Galena lead mines, began operations in 1919.

The first school was constructed in 1939. After the school was built, families began to live at Koyukuk year-round. The City was incorporated in 1973. The community has experienced severe flooding from both the Yukon and Koyukuk Rivers, and residents want to relocate.

Economy

There are few full-time jobs in the community; the city, tribe, clinic, school and store provide the only year-round employment. BLM fire fighting, construction work, and other seasonal jobs often conflict with subsistence opportunities. Two residents hold commercial fishing permits. Trapping and beadwork supplement incomes. Subsistence foods include salmon, whitefish, moose, waterfowl and berries.

U.S. Census data for Year 2000 showed 40 residents as employed. The unemployment rate at that time was 23.1 percent, although 41.2 percent of all adults were not in the work force. The median household income was $19,375, per capita income was $11,342, and 35.1 percent of residents were living below the poverty level.

Transportation:

The primary mode of transportation into the City is air travel. The City is equipped with a 3,000-foot gravel runway that does not have navigational lights. Scheduled air service is provided five times per week to Koyukuk. The river provides another major mode of transportation. The community receives barge service three times per year during the ice-free summer months. Residents also use private boats for local travel, fishing, hunting, and recreational purposes. Snowmachines, three and four wheelers, dog sleds, and trucks are utilized for local travel.

Climate:

The area experiences a cold, continental climate with extreme temperature differences. The average daily high temperature during July is in the low 70s; the average daily low temperature during January ranges from 10 to below zero. Sustained temperatures of 40 degrees below zero are common during winter. Extreme temperatures have been measured from -64 to 92. Annual precipitation is 13 inches, with 60 inches of snowfall annually. The river is ice-free from mid-May through mid-October.

Population

The population of the community consists of 91 percent Alaska Native or part Native. Residents are primarily Koyukon Athabascans with a subsistence lifestyle. During the 2000 U.S. Census, total-housing units numbered 55, and vacant housing units numbered 16. These 16 units were reported as being used seasonally.

Community Information

Table 4. Community Information

Community Information	Contact Information
City of Koyukuk	City of Koyukuk Laurie Lolnitz, Mayor P.O. Box 49 Koyukuk, Alaska 99754 Phone: (907) 927-2214 Fax: (907) 927-2215
Borough Located In:	Unorganized
Village Council	Koyukuk Tribal Council Cindy Pilot, Tribal Administrator P.O. Box 109 Koyukuk, AK 99754 Phone (907) 927-2253 Fax (907) 927-2220 Email cynthia.pilot@tananachiefs.org
Electric Utility	City of Koyukuk P.O. Box 49 Koyukuk, AK 99754 Phone: (907) 927-2214 Fax: (907) 927-2215

Community Information	Contact Information
Regional Native Corporation	Doyon, Ltd. 122 First Avenue, Ste. 600 Fairbanks, AK 99701 Phone: (907) 452-8251 Toll Free in Alaska (800) 478-6822 Toll Free out of Alaska (800) 770-8251 Web: www.tananachiefs.org
School District	Yukon-Koyukuk School District 4762 Old Airport Way Fairbanks, Alaska 99709-4456 Phone: (907) 374-9400 Fax: (907) 374-9440 Web www.yksd.com
Regional Native Non-Profit	Doyon, Limited 1 Doyon Place, Suite 300 Fairbanks, Alaska 99701-2941 Phone 907-459-2000 Toll-free 1-888-478-4755 Fax 907-459-2060 E-Mail info@doyon.com Web: www.doyon.com

Facilities

In addition to housing units, facilities in the City include: a store, a post office, a power plant, a school, a health clinic/library, an airport maintenance building, a city office building, a national guard armory, a church, two abandoned school buildings, a community hall, an Alascom building, and a washeteria. The school in Koyukuk provides students with a K-10 education. High school-aged students must attend their last years of high school outside of Koyukuk in Kaltag, Nulato, Galena, Nenana or Fairbanks. The community also provides a Headstart program for preschool children.

The City has a water treatment plant that is directly connected to the school complex and the washeteria. Individuals draw water supplies from a watering point in the washeteria. Some residents reportedly still take their water from the Yukon River during the winter months. The sewage from the school complex, the teachers' quarters, and the washeteria flows directly to a sewage treatment plant located in the lower level of the washeteria. Individual sewage disposal systems consist of honeybuckets and outdoor pit privies. The residents burn their combustible refuse in 55-gallon barrels and haul the remaining debris and ash to a solid waste disposal site located approximately one mile west of town.

Health Care

Health care is available through the Koyukuk Health Clinic, which is operated by Tanana Chiefs Conference (TCC). Emergency services beyond the local clinic capacity can be accessed by air or river.

The City Volunteer Fire and EMS Department provide fire and rescue services.

Vegetation and Soils

Koyukuk is situated near the foothills of the Nulato Hills, which extend approximately 300 miles along the bank of the Yukon River. The City of Koyukuk is located in the Koyukuk Flats region, which is primarily characterized as extensive lowland dotted with thaw lakes, randomly meandering streams, and numerous side sloughs.

The vegetation in this area is generally taiga and muskeg with black spruce, sedge, and moderately dense stands of willow. Several low bedrock hills rise from the center of the lowland. These hills and the surrounding uplands are composed mainly of sedimentary rocks, older volcanic rocks, and some rocks of intrusive origin. A soils report prepared by the Alaska Department of Transportation and Public Facilities (ADOT&PF) for the Koyukuk Airport indicates that eh airport, which is about 1.5 miles southwest of the village, is located on wet silt, silty sand, and sandy silt foundation soils deposited by the Yukon River. Koyukuk is located in a continuous permafrost zone.

Wildlife

Koyukuk lies just north of the Innoko National Wildlife Refuge and just south of the Koyukuk National Wildlife Refuge. This is a region of wetlands, home to fish, waterfowl, beaver and moose, and wooded lowlands where black and grizzly bears, wolves, lynx and marten prowl. It is an extremely productive breeding area for migratory waterfowl and fish. The streams and rivers in the area support three species of salmon, arctic grayling, sheefish, and many other fish species. Migratory waterfowl, songbirds, and raptors are plentiful in the region.

Community Resources

This section outlines the resources available to Koyukuk for mitigation and mitigation related funding and training.

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

FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from the FEMA Publication Warehouse (1-800-480-2520) and are briefly described below:

- **How-to Guides.** FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides mirror the four major phases of hazard mitigation planning used in the development of the Newtok Hazard Mitigation Plan. The last five how-to guides address special topics that arise in hazard mitigation planning such as

conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting Disaster Mitigation Act (DMA) 2000 requirements (http://www.fema.gov/fima/planhowto.shtm).

- **Post-Disaster Hazard Mitigation Planning Guidance for State and Local Governments.** FEMA DAP-12, September 1990. This handbook explains the basic concepts of hazard mitigation and shows state and local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.
- **Mitigation Resources for Success CD.** FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for state and local government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.
- **A Guide to Federal Aid in Disasters.** FEMA 262, April 1995. When disasters exceed the capabilities of state and local governments, the President's disaster assistance program (administered by FEMA) is the primary source of federal assistance. This handbook discusses the procedures and processes for obtaining this assistance, and provides a brief overview of each program.
- **The Emergency Management Guide for Business and Industry.** FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to Newtok businesses.

Other federal agencies providing guidance regarding mitigation planning are listed below.

- **Department of Agriculture.** Assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.
- **Department of Energy, Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program.** This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks.

- **Department of Housing and Urban Development, Office of Homes and Communities, Section 108 Loan Guarantee Programs.** This program provides loan guarantees as security for federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing.
- **Department of Housing and Urban Development, Community Development Block Grants.** Administered by the Alaska DCRA, Division of Community Advocacy. Provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons.
- **Department of Labor, Employment and Training Administration, Disaster Unemployment Assistance.** Provides weekly unemployment subsistence grants for those who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible.
- **Federal Financial Institutions.** Member banks of the Federal Deposit Insurance Corporation (FDIC) or Federal Home Loan Bank Board (FHLBB) may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.
- **Internal Revenue Service, Tax Relief.** Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous tax returns to reflect loss back to three years.
- **United States Small Business Administration (SBA).** May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. Requests for SBA loan assistance should be submitted to the Alaska DHS&EM.

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

- **Federal Emergency Management Agency,** http://www.fema.gov – includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.
- **American Planning Association,** http://www.planning.org – is a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
- **Institute for Business and Home Safety,** http://ibhs.org – an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. Online resources provide information on natural hazards, community land use, and ways citizens can protect their property from damage.

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 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.

- **DCRA, Division of Community Advocacy:** 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 (VA)-insured homes, and assists with filing for survivor benefits.

Other Funding Sources and Resources

- **Real Estate Business.** Real estate disclosure is required by state law for properties within flood plains.
- **American Red Cross.** Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided.
- **Crisis Counseling Program.** Provides grants to State and Borough mental health departments, which in turn provide training for screening, diagnosing and counseling techniques. Also provides funds for counseling, outreach, and consultation for those affected by disaster.

Local Resources

Koyukuk is a small community with a very limited number of planning and land management tools. The resources available in these areas have been assessed by the City, and are summarized in the following tables.

Table 5. Legal and Technical Capability

Regulatory Tools (ordinances, codes, plans)	Local Authority (Yes/N0)	Comments (Year of most recent update; problems administering it, etc)
Building code	No	
Zoning ordinance	No	
Subdivision ordinance or regulations	No	
Special purpose ordinances (floodplain management, stormwater management, hillside or steep slope ordinances, wildfire ordinances, hazard setback requirements)	Under Emergency NFIP	No local ordinances
Growth management ordinances (also called "smart growth" or anti-sprawl programs)	No	
Site plan review requirements	No	
Comprehensive plan	Yes	In progress
A capital improvements plan	No	
An economic development plan	No	
An emergency response plan	No	
A post-disaster recovery plan	No	
Real estate disclosure requirements	No	
Long Range Transportation Plan	Yes	2008

Table 6. Administrative and Technical Capability

Staff/Personnel Resources	Y/N	Department/Agency and Position
City Administrator	**Yes**	
City Clerk	Yes	
Fire Chief	No	Fire Response is conducted by Village Residents and the State
City Planner	No	
Public Works Director	No	
Public Safety Director	No	
Librarian	No	
Fire Department	No	Volunteers from community, no established organization
Engineer(s) or professional(s) trained in construction practices related to buildings and/or infrastructure	No	
Planners or Engineer(s) with an understanding of natural and/or human-caused hazards	No	
Floodplain manager	No	
Surveyors	No	
Staff with education or expertise to assess the community's vulnerability to hazards	No	
Personnel skilled in GIS and/or HAZUS	No	

Table 7. Fiscal Capability

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

Chapter 3: Hazards

DHS&EM Matrices

(Note: The following tables are from the State Hazard Plan, 2007)

Table 8. Hazard Matrix

Yukon - Koyukuk REAA					
Flood	**Wildland Fire**	**Earthquake**	**Volcano**	**Avalanche**	**Tsunami & Seiche**
Y-H	Y	Y	N	Y-M	N
Severe Weather	**Ground Failure**	**Erosion**	**Technological**	**Economic**	
Y	U	Y	Y	U	

Y = Hazard is present in jurisdiction but probability unknown
Y – L = Hazard is present with a low probability of occurrence within the next ten years. Event has up to 1 in 10 years chance of occurring.
Y – M = Hazard is present with a moderate probability of occurrence with the next three years. Event has up to 1 in 3 years chance of occurring.
Y – H = Hazard is present with a high probability of occurrence within the calendar year. Event has up to 1 in 1 year chance of occurring.
N = Hazard is not present
U = Unknown if the hazard occurs in the jurisdiction

Extent:
Z = Zero
L = Limited
T = Total

Previous Occurrence
Y = Yes
N = No

Source: Alaska State Hazard Plan, 2007

Table 9. Previous Occurrences of Hazards 1978 – Present

Yukon – Koyukuk REAA					
Flood/ Erosion	**Wildland Fire**	**Earthquake**	**Volcano**	**Avalanche**	**Tsunami & Seiche**
8 – L	Z	1 - L	Z	Z	Z
Severe Weather	**Ground Failure**	**Erosion**	**Technological**	**Economic**	
1 – L	Z	Z	Z	1 - L	

Extent Z - Zero - Used for historical information. An event occurred but may not have caused damage or loss.
L - Limited – Minimal through maximum impact to part of community. *Falls short of the definition for total extent*.
T - Total – Impact encompasses the entire community.

Number: Number of occurrences

Source: Alaska State Hazard Plan, 2007

Identification of Assets and Vulnerability

The Hazard Vulnerability Matrix below lists the City of Koyukuk facilities, utilities and transportation systems, including the school and clinic.

Community Assets

This section outlines the resources, facilities and infrastructure that, if damaged, could significantly impact public safety, economic conditions, and environmental integrity of Koyukuk.

Community Maps

List of Maps from this plan:

Map 1. Koyukuk Regional Map

Map 2. Koyukuk Critical Infrastructure, Geo-Reference Photography

Map 3. Koyukuk Regional Critical Infrastructure

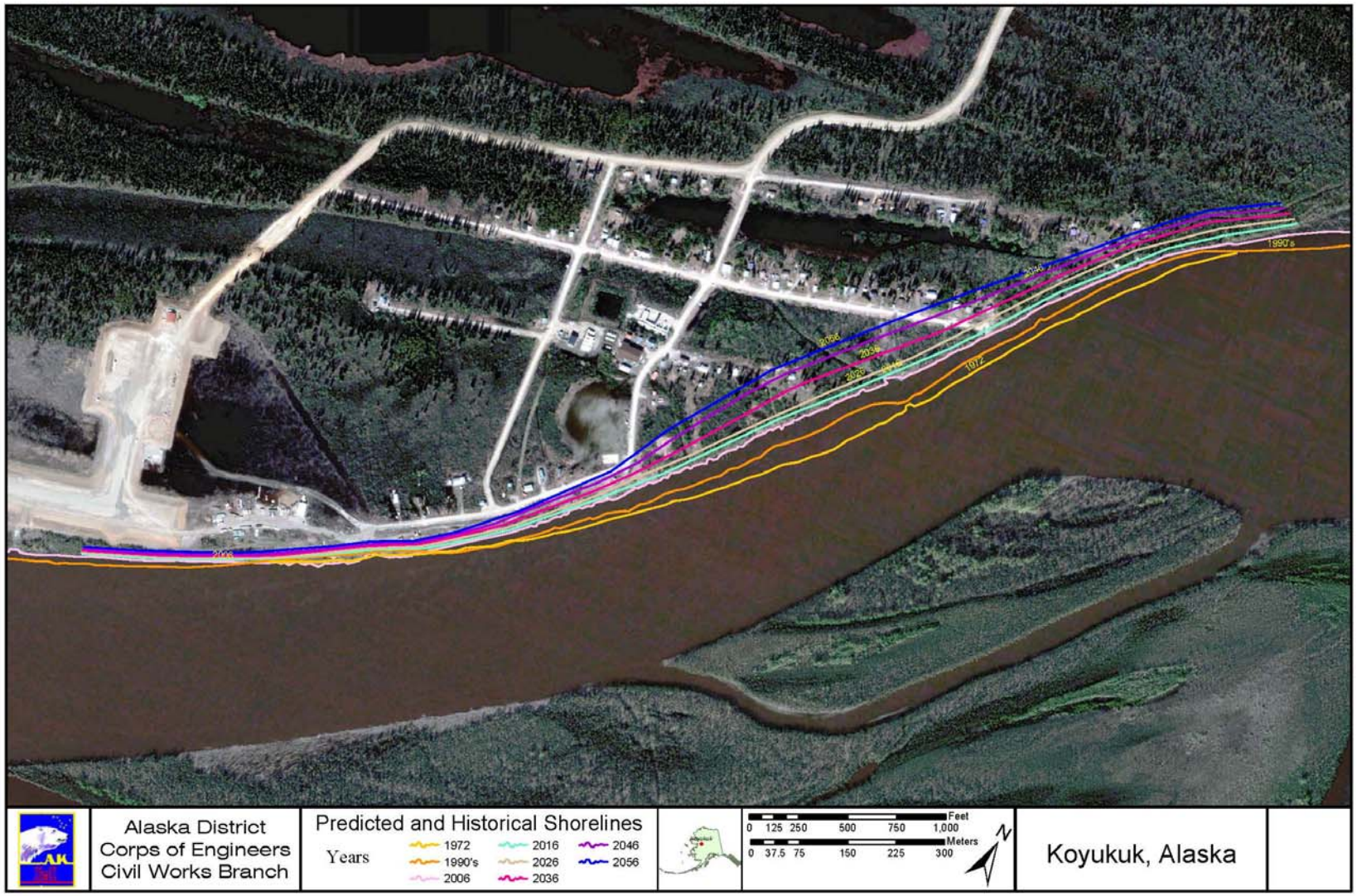
Critical Facilities: Those facilities and infrastructure necessary for emergency response efforts.

- Landfill
- Roads and Bridges
- Communications
- Utilities
- Clinic
- Koyukuk Airport

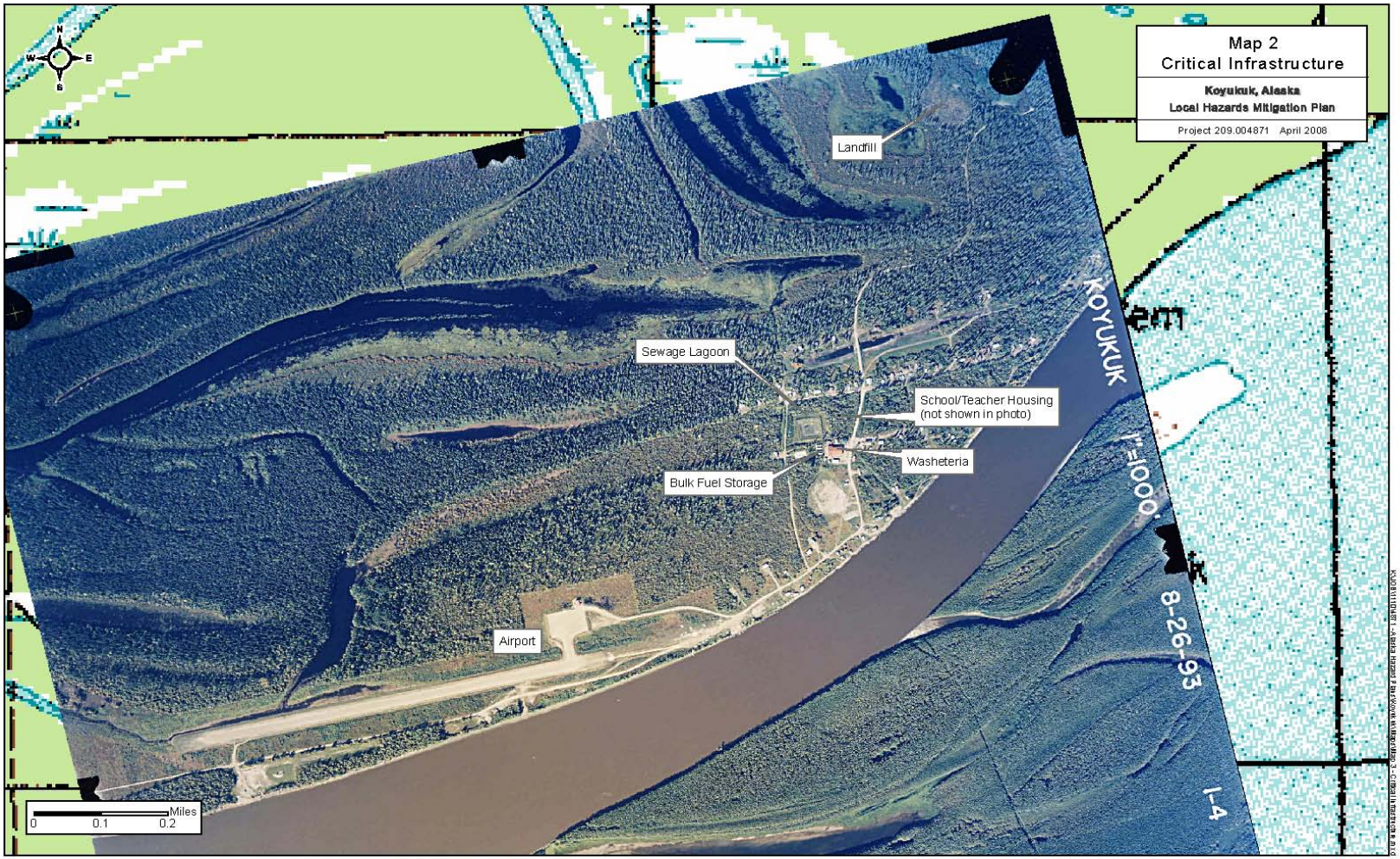
Essential Facilities: Those facilities and infrastructure that supplement response efforts.

- Designated Shelters
- Tribe and City Buildings
- School
- School Housing
- Sewage Lagoon
- Washertia
- Post Office

Figure 2. USACE Erosion Prediction Figure



Map 2. Critical Infrastructure



Map 3. Regional Critical Infrastructure

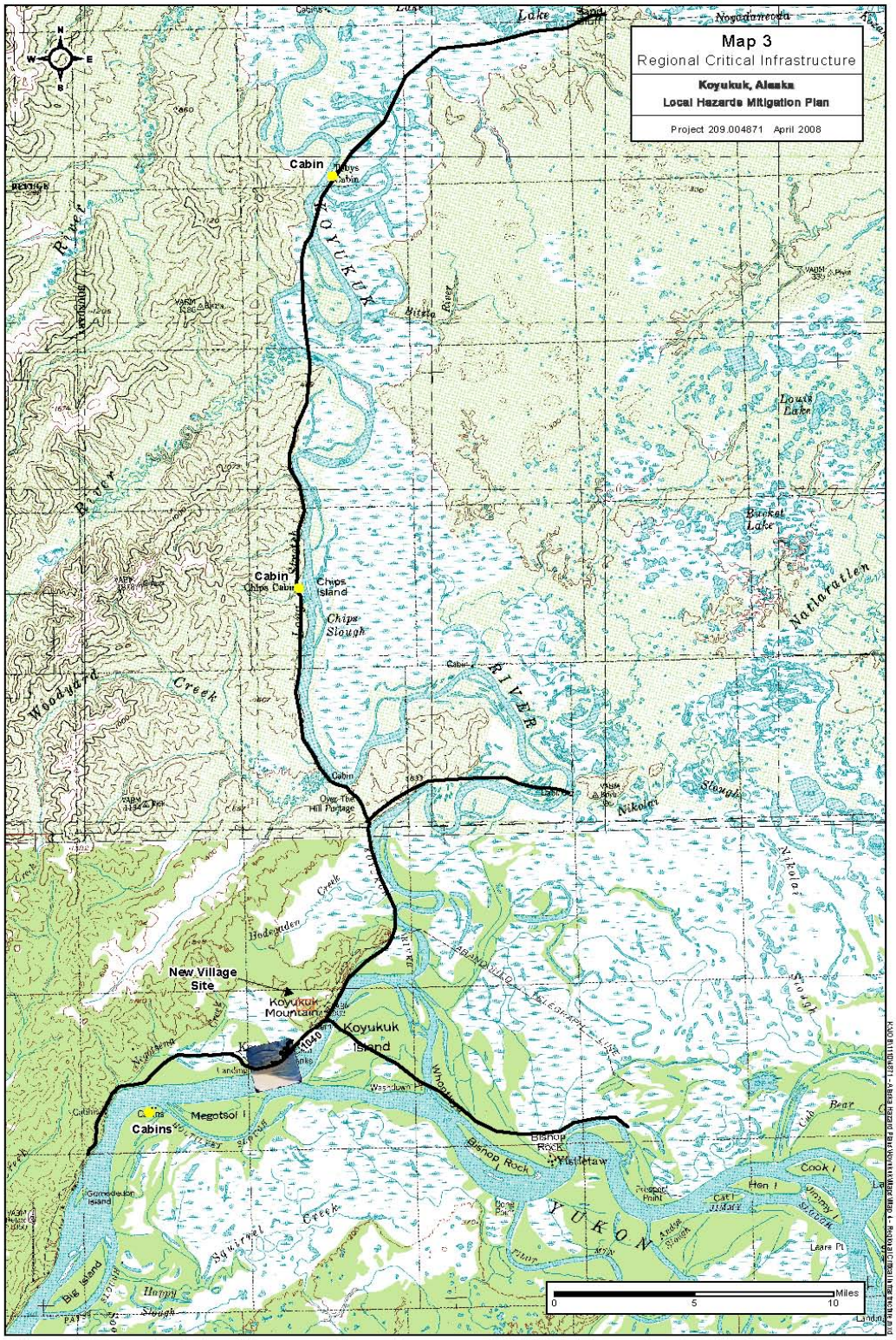


Table 10. Koyukuk Asset and Vulnerability Matrix - Structures and Infrastructure

Facility	Flood/Erosion	Severe Weather	Wildland Fire	Earthquake
Landfill	X	X	X	X
Roads and Bridges	X	X	X	X
Communications	X	X	X	X
Clinic	X	X	X	X
Koyukuk Airport	X	X	X	X
Tribal Offices	X	X	X	X
City Buildings	X	X	X	X
School	X	X	X	X
Teacher Housing	X	X	X	X
Sewage Lagoon	X	X	X	X
Washertia	X	X	X	X
Post Office	X	X	X	X

Koyukuk's Vulnerability to Identified Hazards:

As noted in the previous chapters Koyukuk is a small native community of 88 persons and located on 6.2 square miles of land. The community is located wholly within a flood plain and is at equal risk to all the natural hazards listed above.

Further information on Koyukuk's vulnerability to identified hazards was researched and delineated by the agencies described below as part of the Alaska Climate Change Strategy.

Alaska Climate Change Strategy and Koyukuk Hazards

Administrative Order 238 by Governor Sarah Palin established the Alaska Climate Change Sub-Cabinet to advise the Office of the Governor on the preparation and implementation of an Alaska climate change strategy.

The Alaska Climate Change Strategy website states in part the following:

> *Alaska's Perspective*
>
> *The impacts of climate warming in Alaska are already occurring. These impacts include coastal erosion, increased storm effects, sea ice retreat and permafrost melt. The villages of Shishmaref, Kivalina and Newtok have begun relocation plans. The U.S. Army Corps of Engineers has identified over 160 additional rural communities threatened by erosion.*

The unique task of the Climate Change Sub-Cabinet is to appropriately attend to these immediate needs.

An Immediate Action Workgroup (IAW) was formed to deal with the early assessment and development of an action plan addressing climate change impacts on coastal and other vulnerable communities in Alaska.

IAW Members include:

- United States Army Corps of Engineers - Patricia Opheen, Co-Chair
- Department of Commerce, Community/Eco Development - Mike Black, Co-Chair
- Department of Natural Resources, Division of Forestry - Chris Maisch
- Department of Transportation and Public Facilities - Frank Richards
- Denali Commission - George Cannelos
- Alaska Municipal League - Luke Hopkins
- Alaska Climate Impact Assessment Commission - Bob Pawlowski
- Alaska Division of Homeland Security / Emergency Management - John Madden

The IAW completed its "Draft Recommendations Report to the Governor's Subcabinet on Climate Change" on March 20, 2008. Six communities were designated as facing imminent threats of loss of life, loss of infrastructure, loss of public and private property, or health epidemics as caused by coastal erosion, thawing permafrost and flooding.

The communities identified were Newtok, Shishmaref, Kivalina, Koyukuk, Unalakleet and Shaktoolik.

The IAW developed matrices regarding immediate actions that should be taken for each community. Koyukuk was designated as being in imminent danger from flooding, erosion and wildfire.

Since the community is located wholly within a floodplain and only encompasses 6.2 square miles the entire community is at equal threat from these hazards.

The IAW report to the Governor’s Subcabinet are included under the Flood and Erosion and Wildfire Sections of this document.

Section 1. Flood and Erosion

Koyukuk Draft Flood Mitigation Plan, 2003, Prepared Tanana Chiefs Conference

The Tanana Chief Conference prepared a draft *Koyukuk Flood Mitigation Plan in 2003*. The following section incorporates this document.

Hazard Description and Characterization

Types of Flooding in Koyukuk

Koyukuk is at significant risk from flooding and erosion from the Yukon and Koyukuk Rivers, mostly due to river ice break-up. The picture at the right demonstrates that the Village is located directly next to the rivers.

Photo: Federal Aviation Administration Website

Riverine Flooding

Floods occur in rivers as a result of a large input of water to the drainage basin in the form of rainfall, snowmelt, river ice break-up.

Flood and Erosion Hazards

Deposition

Deposition is the accumulation of soil, silt, and other particles on a river bottom or delta. Deposition leads to the destruction of fish habitat and presents a challenge for navigational purposes. Deposition also reduces channel capacity, resulting in increased flooding or bank erosion.

Erosion

Erosion is a process that involves the wearing away, transportation, and movement on land. Erosion rates can vary significantly as erosion can occur quite quickly as the result of a flash flood, coastal storm or other event. It can also occur slowly as the result of long-term environmental changes. Erosion is a natural process but its effects can be exacerbated by human activity.

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.

Contaminated water

Floodwaters pose a health hazard by picking up contaminants and disease as they travel. Outhouses, sewers, septic tanks, and dog yards are all potential sources of disease transported by floodwaters. Individual wells in Koyukuk could be contaminated during flood events. The private well systems must be tested and disinfected after a flood. Lack of a water source is a significant concern for flood victims, especially if the flood has been extensive enough to contaminate the public water supply. In such a case, outside bottled water is at times the only source of clean water.

The community of Koyukuk is located entirely within a floodplain and is potentially at risk of flooding several times each year. Spring thaw (April to mid-May) and the subsequent breakup of the Koyukuk and Yukon Rivers (mid to late May) pose the highest risks for the community.

Residents have learned through years of experience how to best prepare for flood situations. Larger items that are not easily replaced, such as snowmobiles, furniture and four wheelers, are placed on rafts constructed of wood and empty 55-gallon fuel barrels. Smaller belongings are boxed up and stowed in the family cache or other location for safekeeping.

Flood and Erosion Identification

Earlier in this decade the Village of Koyukuk received three ($500,000 each) Indian Community Development Block Grants from the Housing and Urban Development Agency to elevate structures in the community.

Three flood gauges have been placed in the community. One is located on the corner of the Washeteria and the other is located on a utility pole at Dry Lake. High Water Elevation (HWE) signs are placed at three locations in Koyukuk, with the sign's water symbol at the elevation of the 1963 flood. One of these is on the northwest corner of the city office building, about 8.5 feet above the ground. The second is on a utility pole near the new school, about 8.6 feet above ground. The third is on the southwest corner of the Post Office, at 8.3 feet above ground.

The IAW described the following flooding and erosion situation in Koyukuk in the following paragraphs.

> **Situation Description:** There are three types of serious threats/impacts facing Koyukuk –erosion, flooding and fires. The entire village of Koyukuk lies within the floodplain of the Yukon River. Erosion occurs during anytime the river is open and specifically during high flow events on the Yukon River. These events happen throughout the year, including floods during spring breakup ice jam events; spring/ summer/fall significant rainfall events; wind and permafrost melt at Koyukuk and upstream. These floods are often severe, inundating a majority of the Village and sometimes requiring evacuation of citizens to other villages. These problems have been persistent and serious enough – often flood warnings provide only a 2 hour window to evacuate – that the community has begun planning efforts to relocate themselves to higher ground above the floodplain of the Yukon River upon nearby Koyukuk Mountain.

Overarching Problem: No definite timeline or authorities for erosion control and/or relocation makes it difficult to plan for needed erosion control projects and relocation. It's difficult to coordinate and focus resources. (IAW 2008)

National Flood Insurance Program

Koyukuk participates in the National Flood Insurance Program under an emergency basis.

The USACE is currently working on a Flood Rate Insurance Map (FIRM) for the community. There is no available data on repetitive loss properties.

On September 18, 2001, the City of Koyukuk passed resolution #02-01 entitled "A Resolution by the City of Koyukuk Concerning Participation in the National Flood Insurance Program". The resolution calls for the enforcement of FEMA provisions under Section 60.3 of the NFIP. Regulations and further recognizes the role and responsibilities of the City of Koyukuk, with assistance provided by Federal, State, regional, and local agencies, in undertaking a study and mapping the Koyukuk flood plain areas.

Ordinance #02-01 established land use provisions that conform to requirements of the National Flood Insurance Program and encourage new development away from the floodplain. Observance of these land use provisions will provide an opportunity for residents and businesses to purchase flood insurance through NFIP at a reasonable cost. Participation in the NFIP is also meant to be an alternative to disaster assistance because it shifts the financial burden from the general taxpayer to floodplain occupants.

The USACE recently prepared *Draft Section 117 Project Fact Sheet for Koyukuk*. The community has not yet reviewed this draft. In the draft fact sheet the USACE listed several alternative plans considered for dealing with the flooding and erosion hazards in the community. The IAW recommended in their report to the Subcabinet on Climate Change that the community review the draft as soon as possible and decide upon an alternative. The alternatives were researched and detailed in USACE report and are listed here by title of the alternative only.

- No Action.
- Relocation of Erosion Threatened Structures
- Streambank Protection
- Flood Damage Reduction Alternatives
- Blockage of Flood Prone Alternatives
- Collocation
- Village Relocation
- Construction of Emergency Road to and Shelter at Koyukuk Mountain

During the *2003 Flood Mitigation Plan* the community was surveyed regarding relocating the community. The results of the respondents were as follows:

> Twenty-three respondents (100% of the sample) believe that the community should be relocated above the floodplain; however, only 19 out of 23 responses would like to see their homes moved to the new community site. Statements as to why some respondents would rather not move their house included, "It would

be a lot easier if we just go [to] new housing," and "It would be too hard to move plus we need a house to live in the summer for fish." These statements reflect the lack of knowledge regarding funding eligibility for moving structures out of the floodplain. Many community members are unaware that if public funding is used to move their community that all structures left behind (except for open structures such as kiosks) will have to be destroyed. This is contrary to cultural values as many residents like their homes so close to the river to ease fishing efforts.

Thirteen respondents have considered moving away from the community because of the flood threat. (FMP 2003)

Flood and Erosion Hazard Vulnerability

Please see matrices at the beginning of Chapter 3. The *Draft Section 117 Project Fact Sheet for Koyukuk* prepared by USACE included the following section on economic analysis.

> Economic Analysis. Economic damages from both erosion and flood damages were determined. Erosion damages considered include damages to land, structures, and infrastructure. Flood damages considered include damages to land, structures, contents, and roads, associated costs of clean up and emergency actions, and income and subsistence losses.
>
> The evaluation of economic damages associated with erosion and flooding in the study area identified a total damages over the 50-year period of analysis at $3,063,000, with a total present value of $873,000 and total expected annual damages of $46,900. (USACE 2008)

There is no available data regarding repetitive loss properties.

Previous Occurrences of Flooding and Erosion

Previous flooding and erosion have been reported in 1928, 1939, 1963, 1964, 1971, 1989, 1992, 2001 and 2006.

1928 Flood

A devastating flood occurred on the Koyukuk River in 1928. This flood occurred in the spring, following an especially cold winter, which caused thicker than usual river ice. During breakup (the point when the temperature reaches the threshold of melting the ice), an ice jam was met head-on with free-flowing river ice.

Sidney Huntington, an elder residing in Galena, gives this account of the 1928 flood in his biography "Shadows on the Koyukuk":

He had a cabin that was "perched on a point of high, gravelly ground, well above any flood level in memory" approximately 250 miles upriver from the village of Koyukuk.

"The rising water soon floated huge chunks of ice and spread them out along the riverbanks. Trees snapped like toothpicks and crashed into the jumble of ice and flooding water. As the water reached our cabin, we boosted the dogs ahead of us and climbed onto the roof."

They eventually escaped from the roof via canoe to a hill because the water kept rising.

"...We spent two days and a night listening to the destruction. It sounded as if Hell had broken loose on the Koyukuk. Trees crashed to the ground as they were struck by ice. Great chunks of ice collided

and scraped against one another, creating a never-ending roar. Ice rubbing against ice produced high-pitched screeches and low growls. Suddenly ice down stream broke free and the water dropped swiftly. (2003 Flood Mitigation Plan.)

1963

During this flood the recorded base flood elevation (BFE) reached 16.7 feet. When the river reached eleven feet, both the power plant and the airport were unusable. At thirteen feet, the school was flooded. The community building elevation in Koyukuk is 17.7 feet.

2001

During the 2001 flood, Koyukuk men hurried to save tribally and city-owned equipment from the river. By the time this was done, their own homes were flooded and they had little time to save their own possessions. The village generator was shut down. Communications with the outside world ended. However, the community was able to phone TCC's Subregional Director in Galena just before, who in turn phoned the Bureau of Land Management. The BLM sent a helicopter to rescue the elderly, young children, and mothers with babies.

01-196 **DHS&EM Disaster Cost Index: Middle Yukon Flood**: On May 31, 2001 Governor Knowles declared a disaster for the communities of **Koyukuk** and Nulato due to ice jams on the Yukon River. On May 24, 2001, ice jams at Last Chance and Nine-Mile Island caused flooding in Nulato and **Koyukuk**. The ice jam persisted for several days and floodwaters continued to rise until there was little or no dry ground in the village of Koyukuk. Weather conditions were unseasonably cold, and windy. Both snow and rain showers exacerbated the human misery. As precautionary and planned event to avoid attempting to respond to a crisis on a long holiday weekend, 35 high-risk individuals were transported to Galena via helicopter. Able-bodied adults remained in town to minimize losses. Flooding occurred in the village of Nulato on the Yukon River.

Homes sustained water damages inside of the structures. City owned fuel tanks at tank farm were unstable. Fuel intake heads were inundated and sustained damages. Water overtopped the public landfill. Individual Assistance totaled $209K for 30 applicants. Public Assistance totaled $250K for 4 applicants with 17 PW's. The total for this disaster is $510,554.

2006 Flood

06-218 DHS&EM Disaster Cost Index. 2006 Spring Floods (AK-06-218) declared June 27,2006 by Governor Murkowski then FEMA declared (DR-1657) on August 04, 2006

Beginning May 5, 2006 continuing through May 30, 2006, the National Weather Service (NWS) issued flooding warnings and watches across the state as excessive snowmelt and ice jams caused flooding along the **Yukon**, Kuskokwim, and **Koyukuk river drainages**. The most serious impacts were reported in the communities of Hughes, **Koyukuk**, Kwethluk, Alakanuk, and Emmonak, along with substantial damage to State-maintained airports, roads, and highways. In each community, large portions of the village, city infrastructure, and several roads were inundated and eroded by the floodwaters. Total eligible state damages (item V.C. Remaining Costs, $6,704,370) less ineligible repairs for Federal-Aid roads ($469,600), less IA funds ($485,000), less ERFO road costs ($240,500) still leaves approximately $5,509,270 that may be eligible under FEMA's Public Assistance program.

During the 2006 flood season, elders and children were evacuated from the community, approximately 30 villagers stayed behind in the Village.

Flood and Erosion Mitigation Goals and Projects

Note: the community established these goals during the Draft 2003 Flood Mitigation Plan and reaffirmed the goals at a public meeting on April 28, 2008.

Goal 1: Safety of the Community.

Support efforts to ensure the safety of all community members during a flood event.

Goal 2: Implementation of Plan

Ensure community members and local officials are aware of and understand their roles and responsibilities regarding mitigation, relocation and evacuation.

Goal 3: Evaluation of Plan

Ensure periodic evaluation of the Koyukuk Flood Mitigation Plan and direct local officials to maintain knowledge on legislation regarding flood management and other opportunities.

Projects

- Adopt the IAW project recommendations (please see Chapter 4, Mitigation Strategy).

- Review the *Draft Section 117 Project Fact Sheet for Koyukuk* prepared by USACE.
- Public Education

  Increase public knowledgeable about mitigation opportunities, floodplain functions, emergency service procedures, and potential hazards. This would include advising property owners, potential property owners, and visitors about the hazards. In addition, dissemination of a brochure or flyer on flood hazards in Koyukuk could be developed and distributed to all households.

- Install new river and rainfall measuring gauges.
- Educate host community and Koyukuk on respective culture and customs. Develop courtesy agreements for host community on how temporary relocation will be organized (e.g. supplies, shelter).
- Identify location for temporary shelter.
- Build shelter/camp area and helipad.

Section 2. Severe Weather

Hazard Description and Characterization

Weather is the result of four main features: the sun, the planet's atmosphere, moisture, and the structure of the planet. Certain combinations can result in severe weather events that have the potential to become a disaster.

In Alaska, there is great potential for weather disasters. High winds can combine with loose snow to produce a blinding blizzard and wind chill temperatures to 75°F below zero. Extreme cold (-40°F to -60°F) and ice fog may last a week at a time Heavy snow can impact the interior and is common along the southern coast. A quick thaw means certain flooding.

Winter Storms

Winter storms originate as mid-latitude depressions or cyclonic weather systems. High winds, heavy snow, and cold temperatures usually accompany them.

Extreme cold

What is considered an excessively cold temperature varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold". In Alaska, extreme cold usually involves temperatures below –40 degrees Fahrenheit. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity.

Extreme cold, can bring transportation to a halt across interior Alaska for days or sometimes weeks at a time. Aircraft may be grounded due to extreme cold and ice fog conditions, cutting off access as well as the flow of supplies northern villages.

Extreme cold also interferes with a community's infrastructure. It causes fuel to congeal in storage tanks and supply lines, stopping electric generation. Without electricity,

heaters do not work, causing water and sewer pipes to freeze or rupture. If extreme cold conditions are combined with low or no snow cover, the ground's frost depth can increase disturbing buried pipes.

The greatest danger from extreme cold is its effect on people. Prolonged exposure to the cold can cause frostbite or hypothermia and become life threatening. Infants and elderly people are most susceptible. The risk of hypothermia due to exposure greatly increases during episodes of extreme cold, and carbon monoxide poisoning is possible as people use supplemental heating devices.

Ice Storms

The term ice storm is used to describe occasions when damaging accumulations of ice are expected during freezing rain situations. They can be the most devastating of winter weather phenomena and are often the cause of automobile accidents, power outages and personal injury. Ice storms result from the accumulation of freezing rain, which is rain that becomes super cooled and freezes upon impact with cold surfaces. Freezing rain most commonly occurs in a narrow band within a winter storm that is also producing heavy amounts of snow and sleet in other locations.

Freezing rain develops as falling snow encounters a layer of warm air in the atmosphere deep enough for the snow to completely melt and become rain. As the rain continues to fall, it passes through a thin layer of cold air just above the earth's surface and cools to a temperature below freezing. The drops themselves do not freeze, but rather they become super cooled. When these super cooled drops strike the frozen ground, power lines, tree branches, etc., they instantly freeze.

Local Severe Weather Hazard Identification

The Koyukuk area has a continental climate, which is characterized by mild summers, cold winters, and low levels of precipitation. This type of climate is typical of the interior areas of Alaska, far from the modifying influence of the ocean.

Koyukuk's winters are extremely cold. The coldest month (January) has an average daily temperature of about -18 degrees F. and temperatures as low as -70 degrees F. have been recorded. Summer temperatures in the community tend to be on the warmer side, averaging between 55 and 60 degrees F., with daily maximums reaching into the high 80's. Since there is no official weather station in Koyukuk, data is collected from the Galena Airport station about 20 miles east of Koyukuk. The record high temperature in Galena is 92 degrees F., a mark set back in 1969.

Table 11. Galena Weather Summary, from 1949 - 1993

	Daily Extremes				Monthly Extremes				Max. Temp.		Min. Temp.	
	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	<= 32 F	<= 0 F
	F	dd/yyyy	F	dd/yyyy	F	-	F	-	# Days	# Days	# Days	# Days
January	43	04/1974	-70	27/1989	12.0	1981	-31.4	1971	0.0	29.8	30.8	24.1
February	41	03/1981	-57	06/1968	11.9	1989	-26.8	1990	0.0	27.0	28.2	21.7
March	50	28/1954	-54	12/1971	20.5	1965	-10.5	1972	0.0	27.0	30.8	18.8
April	64	30/1953	-35	03/1964	32.1	1990	7.8	1985	0.0	13.8	28.0	6.0
May	82	30/1974	-2	03/1992	50.5	1979	34.8	1992	0.0	0.7	9.9	0.2
June	92	15/1969	33	01/1968	64.0	1957	52.9	1980	0.0	0.0	0.0	0.0
July	89	29/1953	36	02.1976	65.0	1977	47.8	1969	0.0	0.0	0.0	0.0
August	87	07/1978	28	15/1969	61.2	1997	47.8	1969	0.0	0.0	0.4	0.0
September	75	05/1957	2	24/1992	47.8	1991	31.1	1992	0.0	0.6	8.4	0.0
October	56	01/1950	-29	31/1975	34.0	1979	13.5	1974	0.0	18.7	27.3	3.8
November	45	29/2979	-52	30/1990	22.8	1979	-12.0	1956	0.0	28.2	29.9	16.0
December	44	30/1973	-62	27/1961	9.7	1985	-28.5	1956	0.0	30.0	30.8	23.3

Source: Western Regional Climate Center, wrcc@dri.edu

Heavy Snow

Heavy snow is not a hazard to the community. Daily snowfall averages are all less than one inch and the highest recorded daily snowfall is less than 11 inches. Heavy snowfall is generally considered hazardous if it exceeds 12 inches in a 24-hour period.

High Winds

Another major weather factor in the community is high winds. The wind chill factor can bring temperatures down to -70°F, which can lead to frozen pipes and dangerous conditions for outdoor activities. While most home and business owners are prepared for the heavy winds and low temperatures, construction practices must be followed to protect against the high winds.

High wind also causes damages due to trees falling on homes and other critical facilities.

Previous Occurrences of Severe Weather

Omega Block Disaster, January 28, 1989 & FEMA declared (DR-00826) on May 10, 1989 The Governor declared a statewide disaster to provide emergency relief to communities suffering adverse effects of a record breaking cold spell, with temperatures as low as -85 degrees. The State conducted a wide variety of emergency actions, which included: emergency repairs to maintain and prevent damage to water, sewer and electrical systems, emergency resupply of essential fuels and food, and DOT/PF support in maintaining access to isolated communities.

Hazard Mitigation Cold Weather, 1990. The Presidential Declaration of Major Disaster for the Omega Block cold spell of January and February 1989 authorized federal funds for mitigation of cold weather damage in future events. The Governor's declaration of disaster provided the State matching funds required for obtaining and using this federal money.

01-196 Middle Yukon Flood: On May 24, 2001, ice jams at Last Chance and Nine-Mile Island caused flooding in Nulato and Koyukuk. The ice jam persisted for several days and floodwaters continued to rise until there was little or no dry ground in the village of Koyukuk. Weather conditions were unseasonably cold, and windy.

On May 31, 2001 Governor Knowles declared a disaster for the communities of Koyukuk and Nulato due to ice jams on the Yukon River. As precautionary and planned event to avoid attempting to respond to a crisis on a long holiday weekend, 35 high-risk individuals were transported to Galena via helicopter. Able-bodied adults remained in town to minimize losses. Flooding occurred in the village of Nulato on the Yukon River. Homes sustained water damages inside of the structures. City owned fuel tanks at tank farm were unstable. Fuel intake heads were inundated and sustained damages. Water overtopped the public landfill. Individual Assistance totaled $209,000 for 30 applicants. Public Assistance totaled $250,000 for four applicants. The total for this disaster was $510,554.

Severe Weather Hazard Vulnerability

The entire community is obviously vulnerable to severe weather, bitter cold, and high winds. Alaskans are known for self-efficiency and hardy behavior in the face of often-inclement weather. Citizens who do not live on the road system must be able to survive without outside assistance several times throughout most winters.

Please see the tables at the beginning of this chapter, which illustrate the city structures, infrastructure, and transportation systems, which are vulnerable.

Severe Weather Mitigation Goals and Projects

Severe Weather Goals and Projects

Goal 1: Mitigate the effects of extreme weather by instituting programs that provide early warning and preparation.

Goal 2: Educate people about the dangers of extreme weather and how to prepare.

Goal 3: Develop weather resistant building practices to mitigate damage from sever weather events, especially high wind and bitter cold.

Projects

- Cut down trees around homes and critical facilities so that high winds will not cause further damage from the location of the trees.
- Research and consider instituting the National Weather Service program of *"Storm Ready"*.

Storm Ready is a nationwide community preparedness program that uses a grassroots approach to help communities develop plans to handle all types of severe weather—from tornadoes to tsunamis. The program encourages communities to take a new, proactive approach to improving local hazardous weather operations by providing emergency managers with clear-cut guidelines on how to improve their hazardous weather operations.

To be officially Storm Ready, a community must:

1. Establish a 24-hour warning point and emergency operations center.
2. Have more than one way to receive severe weather forecasts and warnings and to alert the public.
3. Create a system that monitors local weather conditions.
4. Promote the importance of public readiness through community seminars.
5. Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.
6. Demonstrate a capability to disseminate warnings.

Specific Storm Ready guidelines, examples, and applications also may be found on the Internet at: www.nws.noaa.gov/stormready

- Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.
- Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability.
- Encourage weather resistant building construction materials and practices.

Section 3. Wildland Fire

Hazard Description and Characterization

Wildland fires occur in every state in the country and Alaska is no exception. Each year, between 600 and 800 wildland fires, mostly between March and October, burn across Alaska causing extensive damage.

Fire is recognized as a critical feature of the natural history of many ecosystems. It is essential to maintain the biodiversity and long-term ecological health of the land. In Alaska, the natural fire regime is characterized by a return interval of 50 to 200 years,

depending on the vegetation type, topography and location. The role of wildland fire as an essential ecological process and natural change agent has been incorporated into the fire management planning process and the full range of fire management activities is exercised in Alaska to help achieve ecosystem sustainability, including its interrelated ecological, economic, and social consequences on firefighter and public safety and welfare, natural and cultural resources threatened, and the other values to be protected dictate the appropriate management response to the fire. Firefighter and public safety is always the first and overriding priority for all fire management activities.

Fires can be divided into the following categories:

Structure fires – originate in and burn a building, shelter or other structure.

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.

Wildland fire - any non-structure fire, other than prescribed fire, that occurs in the wildland.

Wildland Fire Use - a wildland fire functioning in its natural ecological role and fulfilling land management objectives.

Wildland-Urban Interface Fires - fires that burn within the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. The potential exists in areas of wildland-urban interface for extremely dangerous and complex fire burning conditions, which pose a tremendous threat to public and firefighter safety.

Fuel, weather, and topography influence wildland fire behavior. Wildland fire behavior can be erratic and extreme causing fire whirls and firestorms that can endanger the lives of the firefighters trying to suppress the blaze. Fuel determines how much energy the fire releases, how quickly the fire spreads and how much effort is needed to contain the fire. Weather is the most variable factor. Temperature and humidity also affect fire behavior. High temperatures and low humidity encourage fire activity while low temperatures and high humidity help retard fire behavior. Wind affects the speed and direction of a fire. Topography directs the movement of air, which can also affect fire behavior. When the terrain funnels air, like what happens in a canyon, it can lead to faster spreading. Fire can also travel up slope quicker than it goes down.

Wildland fire risk is increasing in Alaska due to the spruce bark beetle infestation. The beetles lay eggs under the bark of a tree. When the larvae emerge, they eat the tree's phloem, which is what the tree uses to transport nutrients from its roots to its needles. If enough phloem is lost, the tree will die. The dead trees dry out and become highly flammable.

Local Wildland Fire Hazard Identification

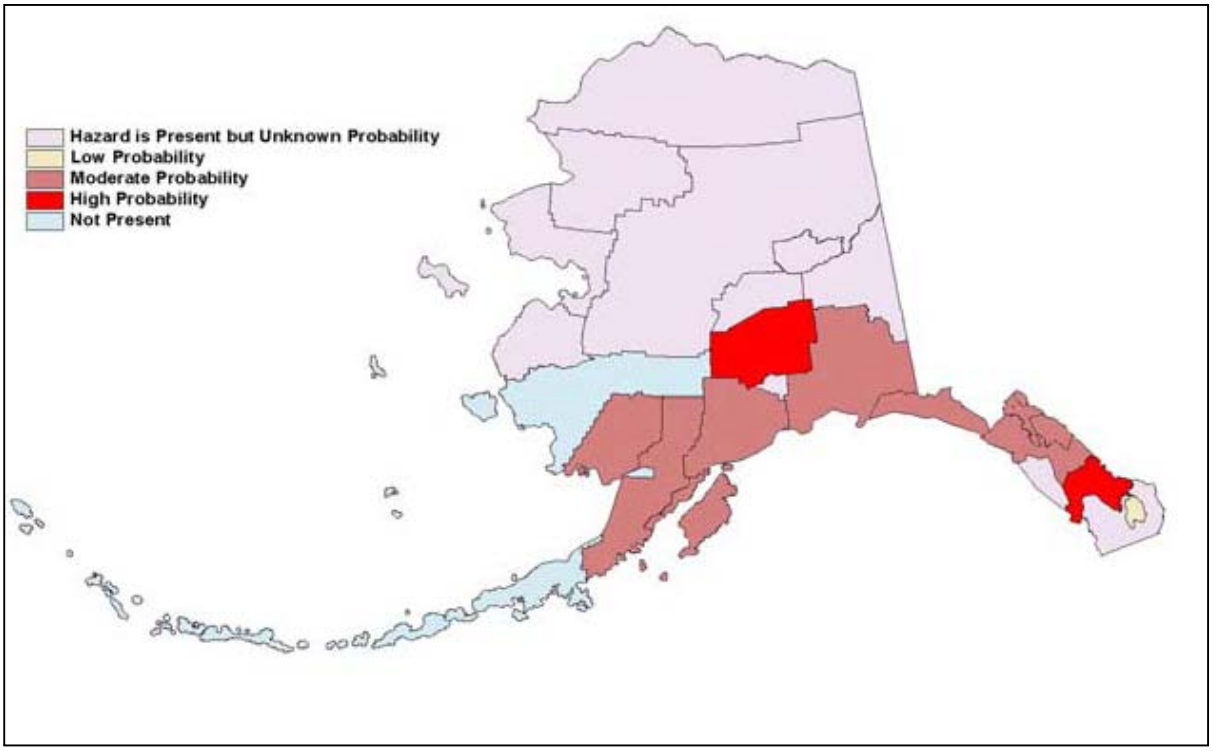
Situation Description: There are three types of serious threats/impacts facing Koyukuk –erosion, flooding and fires.

Of the six communities identified in the IAW Fire Management is only indicated in Koyukuk, with the Department of DNR as the lead. (IAW 2008)

Though Koyukuk has an unknown probability of occurrence, the Alaska Interagency Fire Management Plan lists it as a full protection area. Please see map and explanation on the following pages.

The following map from the Alaska State Hazard Plan depicts Koyukuk as being in an unknown probability area of the state.

Figure 3. Alaska Hazard Plan - Fire Risk Map



Koyukuk is located in a full protection area of the state protection option areas. Full protection is suppression action provided on a wildland fire that threatens uninhabited private property, high-valued natural resource areas, and other high-valued areas such as identified cultural and historical sites. The suppression objective is to control the fire at the smallest acreage reasonably possible. The allocation of suppression resources to fires receiving the full protection option is second in priority only to fires threatening a critical protection area.

Wildland Fire Hazard Vulnerability

Please see Hazard Vulnerability Assessment Matrix and description at the beginning of this chapter.

Previous Occurrences of Wildfire

The community tells of two very serious wildland fires in the community. The first fire occurred in 1974. The fire was started by a lightening and burned a substantial portion of the proposed community site before it was brought under control.

Another wildland fire started in 1998, behind the landfill area. Young people playing with matches started this fire. The Bureau of Land Management responded and activated the Hot Shot Firefighters.

Wildland Fire Mitigation Goals and Projects

Wildland Fire Goals and Projects

Goal 1: Establish building regulations to mitigate against fire damage.

Goal 2: Conduct outreach activities to encourage the use of Fire Wise development techniques.

Goal 3: Encourage the evaluation of emergency plans with respect to wildland fire assessment.

Goal 4: Acquire information on the danger of wildland fires and how best to prepare.

Projects

- The IAW has designated a budgetary need of $25,000 to DNR for a Koyukuk Fire Management Plan.
- Support the volunteer fire department with adequate firefighting equipment and training.
- Promote Fire Wise building design, siting, and materials for construction. The Alaska Fire Wise Program is designed to educate people about wildland fire risks and mitigation opportunities. It is part of a national program that is operated in the State by the Alaska Wildfire Coordinating Group (AWCG).
- Consider establishing building codes and requirements for new construction
- Enhance public awareness of potential risk to life and personal property.
- Encourage mitigation measures in the immediate vicinity of their property.
- Develop a fire break around the community.

Section 4. Earthquake

Hazard Description and Characterization

Approximately 11 percent of the world's earthquakes occur in Alaska, making it one of the most seismically active regions in the world. Three of the ten largest quakes in the

world since 1900 have occurred here. Earthquakes of magnitude 7 or greater occur in Alaska on average of about once a year; magnitude 8 earthquakes average about 14 years between events.

Most large earthquakes are caused by a sudden release of accumulated stresses between crustal plates that move against each other on the earth's surface. Some earthquakes occur along faults that lie within these plates. The dangers associated with earthquakes include ground shaking, surface faulting, ground failures, snow avalanches, seiches and tsunamis. The extent of damage is dependent on the magnitude of the quake, the geology of the area, distance from the epicenter and structure design and construction. A main goal of an earthquake hazard reduction program is to preserve lives through economical rehabilitation of existing structures and constructing safe new structures.

Ground shaking is due to the three main classes of seismic waves generated by an earthquake. Primary waves are the first ones felt, often as a sharp jolt. Shear or secondary waves are slower and usually have a side-to-side movement. They can be very damaging because structures are more vulnerable to horizontal than vertical motion.

Surface waves are the slowest, although they can carry the bulk of the energy in a large earthquake. The damage to buildings depends on how the specific characteristics of each incoming wave interact with the buildings' height, shape, and construction materials.

Earthquakes are usually measured in terms of their magnitude and intensity. Magnitude is related to the amount of energy released during an event while intensity refers to the effects on people and structures at a particular place. Earthquake magnitude is usually reported according to the standard Richter scale for small to moderate earthquakes.

Large earthquakes, like those that commonly occur in Alaska are reported according to the moment-magnitude scale because the standard Richter scale does not adequately represent the energy released by these large events.

Intensity is usually reported using the Modified Mercalli Intensity Scale. This scale has 12 categories ranging from not felt to total destruction. Different values can be recorded at different locations for the same event depending on local circumstances such as distance from the epicenter or building construction practices. Soil conditions are a major factor in determining an earthquake's intensity, as unconsolidated fill areas will have more damage than an area with shallow bedrock. Surface faulting is the differential movement of the two sides of a fault. There are three general types of faulting.

Strike-slip faults are where each side of the fault moves horizontally. Normal faults have one side dropping down relative to the other side. Thrust (reverse) faults have one side moving up and over the fault relative to the other side.

Earthquake-induced ground failure is often the result of liquefaction, which occurs when soil (usually sand and course silt with high water content) loses strength as a result of the shaking and acts like a viscous fluid.

Liquefaction causes three types of ground failures: lateral spreads, flow failures, and loss of bearing strength. In the 1964 earthquake, over 200 bridges were destroyed or damaged due to lateral spreads. Flow failures damaged the port facilities in Seward, Koyukuk and Whittier.

Similar ground failures can result from loss of strength in saturated clay soils, as occurred in several major landslides that were responsible for most of the earthquake damage in Anchorage in 1964. Other types of earthquake-induced ground failures include slumps and debris slides on steep slopes.

Local Earthquake Hazard Identification

Koyukuk is east of the Nulato Hills, northeast trending ridges that reach as high as 4,000 feet. It is west of the Yukon-Tanana Uplands, and north of the Kuskokwim Mountains.

Although there have been no major recorded earthquakes in Koyukuk, it is located close to the Kaltag fault. The active strike-slip fault extends approximately 350 miles in a NE-SW direction. A few minor seismic disturbances in the past few decades have been attributed to motion along the fault.

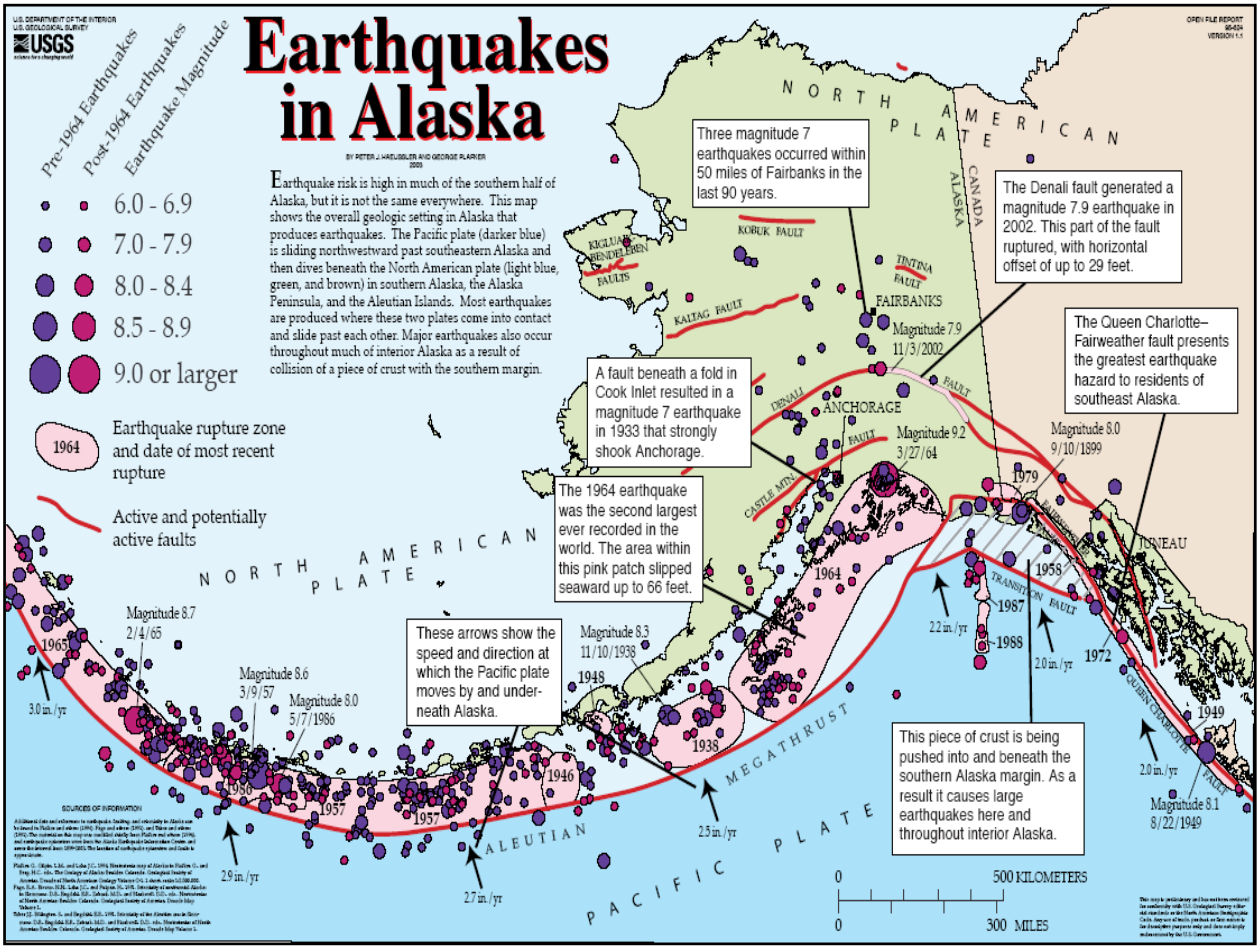
Previous Occurrences of Earthquakes

<u>03-203 DHS&EM Disaster Cost Index. Denali Fault Earthquake (AK-DR-1440) Declared November 6, 2002 by Governor Knowles then FEMA Declared November 8, 2002</u> - A major earthquake with a preliminary magnitude of 7.9 occurred on the Denali Fault in Interior Alaska on November 3, 2002, with strong aftershocks. The earthquake caused severe & widespread damage and loss of property, and threat to life & property in the Fairbanks North Star Borough, the Denali Borough, the Matanuska-Susitna Borough, and numerous communities within the Delta Greely, Alaska Gateway, Copper River, and Yukon-**Koyukuk** Regional Education Attendance Areas including the cities of Tetlin, Mentasta Lake, Northway, Dot Lake, Chistochina and Tanacross, and the unincorporated communities of Slana and Tok. The areas experienced severe damage to numerous personal residences requiring evacuations and sheltering of residences; extensive damage to primary highways including the Richardson Highway, the Tok Cutoff, the Parks Highway and road links to communities including the road to Mentasta and Northway. Damage to supports for the Trans-Alaska Pipeline necessitated the shutdown of the pipeline. Additionally; fuel spills from residential storage tanks, significant damage to water, septic, sewer and electrical systems also occurred. Not all of the areas listed in the State disaster were included in the Federal Individual Assistance Program. Assistance to those areas was thought the State Individual Assistance Program. Additionally, not all of the areas listed in the State declaration were eligible for all categories of assistance under the federal Public Assistance Program. Those areas were only eligible for Debris Removal & Emergency Protective Measures under the Federal Public Assistance Program but were eligible for all Permanent Work categories under the State public Assistance Program. FEMA also authorized 404 Mitigation funding. DOT submitted an appeal letter after funding was denied by FEMA for permanent repair of the runways at Northway and Gulkana Airports. On August 10, 2004, FEMA granted the second appeal, which awarded DOT an extra $13.5 million to conduct the repairs. Individual Assistance totaled $67K for

12 applicants. Public Assistance totaled $24.8 million for 17 applicants with 53 PW's.

There has been no reported damage of earthquakes in Koyukuk.

Figure 4. USGS Earthquakes in Alaska



Earthquake Hazard Vulnerability

Please see Hazard Vulnerability Assessment Matrix and description at the beginning of this chapter.

Earthquake Mitigation Goals and Projects

Goal

Goal 1: Obtain funding to protect existing critical infrastructure from earthquake damage.

Projects

- If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Koyukuk.
- Identify buildings and facilities that must be able to remain operable during and following an earthquake event.
- Contract a structural engineering firm to assess the identified buildings and facilities to determine their structural integrity and strategy to improve their earthquake resistance.

Section 5. Hazards not present in Koyukuk

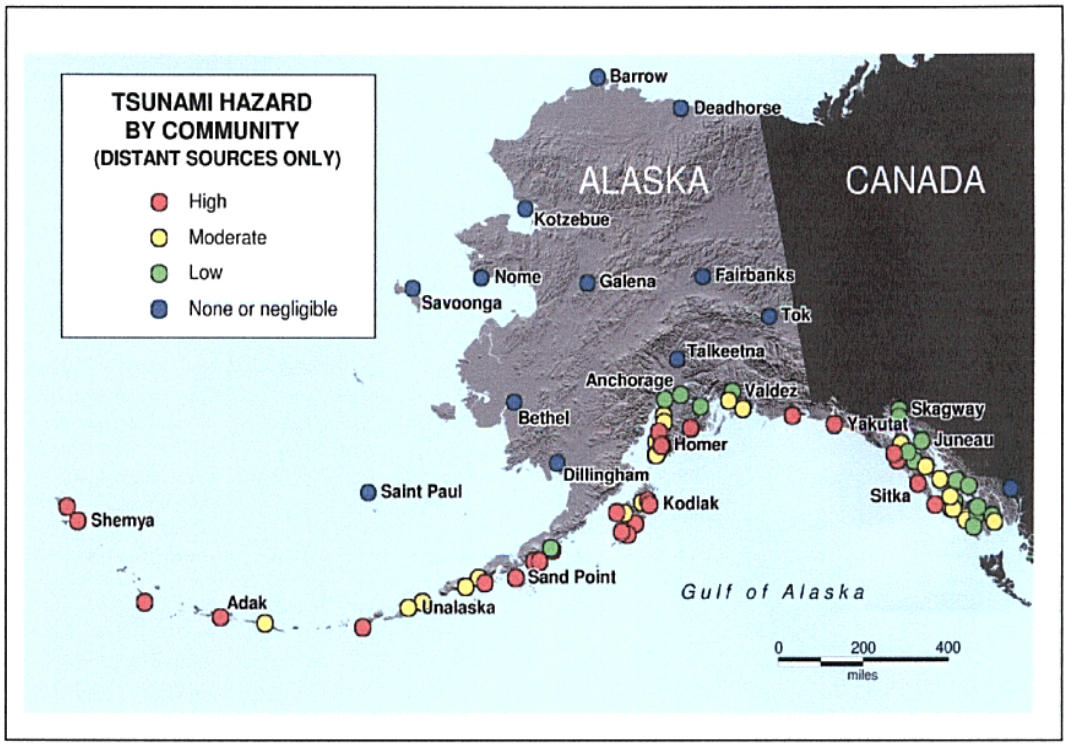
Tsunami and Seiche

A ***tsunami*** is a series of ocean waves generated by any rapid large-scale disturbance of the seawater. These waves can travel at speeds of up to 600 miles per hour in the open ocean. Most tsunamis are generated by earthquakes, but they may also be caused by volcanic eruptions, landslides (above or under sea in origin), undersea slumps, or meteor impacts.

A ***seiche*** is a wave that oscillates in partially or totally enclosed bodies of water. They can last from a few minutes to a few hours as a result of an earthquake, underwater landslide, atmospheric disturbance or avalanche. The resulting effect is similar to bathtub water sloshing repeatedly from side to side. The reverberating water continually causes damage until the activity subsides. The factors for effective warning are similar to a local tsunami, in that the onset of the first wave can be a few minutes, giving virtually no time for warning.

Since Koyukuk is not located on the coast, tsunamis do not present a hazard to the community. Please see the following map to illustrate this point.

Figure 5. Tsunami by Community



Source: Alaska State Hazard Mitigation Plan, 2007

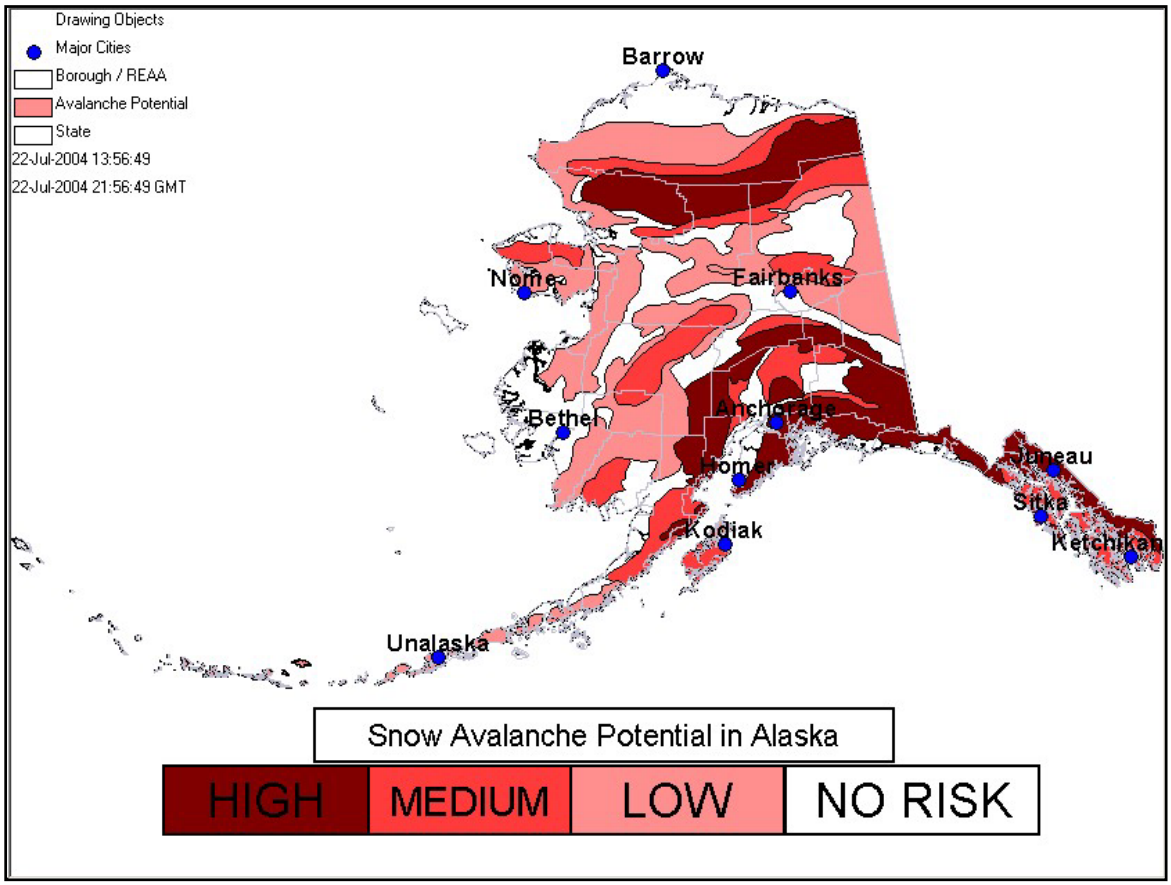
Avalanche and Landslide

Alaska experiences many snow avalanches every year. The exact number is undeterminable as most occur in isolated areas and go unreported. Avalanches tend to occur repeatedly in localized areas and can sheer trees, cover communities and transportation routes, destroy buildings, and cause death. Alaska leads the nation in avalanche accidents per capita.

A snow avalanche is a swift, downhill moving snow mass. The amount of damage is related to the type of avalanche, the composition and consistency of the material in the avalanche, the force and velocity of the flow, and the avalanche path.

Since the topography of Koyukuk is flat there is no danger from avalanches or landslides. The following figure further illustrates that that Koyukuk faces no avalanche threat.

Figure 6. Snow Avalanche Potential in Alaska



Chapter 4: Mitigation Strategy

Benefit - Cost Review

This chapter of the plan outlines Koyukuk's overall strategy to reduce its vulnerability to the effects of the hazards studied. Currently the planning effort is limited to the hazards determined to be of the most concern; flooding, erosion, severe weather and earthquake; however the mitigation strategy will be regularly updated as additional hazard information is added and new information becomes available.

The projects listed on Table 12, Benefit and Costs Listing, were prioritized using a listing of benefits and costs review method as described in the FEMA *How-To-Guide Benefit-Cost Review in Mitigation Planning* (FEMA 386-5).

Due to monetary as well as other limitations, it is often impossible to implement all mitigation actions. Therefore, the most cost-effective actions for implementation will be pursued for funding first, not only to use resources efficiently, but also to make a realistic start toward mitigating risks.

The City of Koyukuk considered the following factors in prioritizing the mitigation projects. Due to the dollar value associated with both life-safety and critical facilities, the prioritization strategy represents a special emphasis on benefit-cost review because the factors of life-safety and critical facilities steered the prioritization towards projects with likely good benefit-cost ratios.

1. Extent to which benefits are maximized when compared to the costs of the projects, the Benefit Cost Ratio must be 1.0 or greater.
2. Extent the project reduces risk to life-safety.
3. Project protects critical facilities or critical city functionality.
    A. Hazard probability.
    B. Hazard severity.

Other criteria that were used to develop the benefits – costs review listing depicted on the following table are listed below.

1. Vulnerability before and after Mitigation
    - Number of people affected by the hazard, areawide, or specific properties.
    - Areas affected (acreage) by the hazard
    - Number of properties affected by the hazard
    - Loss of use
    - Loss of life (number of people)
    - Injury (number of people)
2. List of Benefits

- Risk reduction (immediate or medium time frame)
- Other community goals or objectives achieved
- Easy to implement
- Funding available
- Politically or socially acceptable

3. Costs
   - Construction cost
   - Programming cost
   - Long time frame to implement
   - Public or political opposition
   - Adverse environmental effects

This method supports the principle of benefit-cost review by using a process that demonstrates a special emphasis on 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 next 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.

The Koyukuk Planning Commission will hold another round of public meetings on the LHMP Update. The plan is subject to final Koyukuk City Council approval after pre-approval is obtained by DHS&EM.

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

A description of the BCA process follows, briefly, BCA is the method by which the future benefits of a mitigation project are determined and compared to its cost. The result is a Benefit-Cost Ratio, which is derived from a project's total net benefits divided by its total cost. The BCR is a numerical expression of the cost-effectiveness of a project. Composite BCRs of 1.0 or greater have more benefits than costs, and are therefore cost-effective.

Benefit-Cost Review vs. Benefit-Cost Analysis (FEMA 386-5) states in part:

Benefit-Cost Review for mitigation planning differs from the benefit cost analysis (BCA) used for specific projects. BCA is a method for determining the potential positive effects of a mitigation action and comparing them to the cost of the action. To assess and demonstrate the cost-effectiveness of mitigation actions, FEMA has developed a suite of BCA software, including hazard-specific modules. The analysis determines whether a mitigation project is technically cost-effective. The principle behind the BCA is that the benefit of an action is a reduction in future damages.

DMA 2000 does not require hazard mitigation plans to include BCA's for specific projects, but does require that a BCR be conducted in prioritizing

Benefit-Cost Analysis

The following section is reproduced from a document prepared by FEMA, which demonstrates on how to perform a Benefit –Cost Analysis. The complete guidelines document, a benefit-cost analysis document and benefit-cost analysis technical assistance is available online http://www.fema.gov/government/grant/bca.

Facilitating BCA

Although the preparation of a BCA is a technical process, FEMA has developed software, written materials, and training that simplifies the process of preparing BCAs. FEMA has a suite of BCA software for a range of major natural hazards: earthquake, fire (wildland/urban interface fires), flood (riverine, coastal A-Zone, Coastal V-Zone), Hurricane Wind (and Typhoon), and Tornado.

Sometimes there is not enough technical data available to use the BCA software mentioned above. When this happens, or for other common, smaller-scale hazards or more localized hazards, BCAs can be done with the Frequency Damage Method (i.e., the Riverine Limited Data module), which is applicable to any natural hazard as long as a relationship can be established between how often natural hazard events occur and how much damage and losses occur as a result of the event. This approach can be used for coastal storms, windstorms, freezing, mud/landslides, severe ice storms, snow, tsunami, and volcano hazards.

Applicants and Sub-Applicants must use FEMA-approved methodologies and software to demonstrate the cost-effectiveness of their projects. This will ensure that the calculations and methods are standardized, facilitating the evaluation process. Alternative BCA software may also be used, but only if the FEMA Regional Office and FEMA Headquarters approve the software.

To assist Applicants and Sub-applicants, FEMA has prepared the *FEMA Mitigation BCA Toolkit* CD. This CD includes all of the FEMA BCA software, technical manuals, BC

training courses, Data-Documentation Templates, and other supporting documentation and guidance.

The *Mitigation BCA Toolkit* CD is available free from FEMA Regional Offices or via the BC Helpline (at bchelpline@dhs.gov or toll free number at (866) 222-3580.

The BC Helpline is also available to provide BCA software, technical manuals, and other BCA reference materials as well as to provide technical support for BCA.

For further technical assistance, Applicants or Sub-Applicants may contact their State Mitigation Office, the FEMA Regional Office, or the BC Helpline. FEMA and the BC Helpline provide technical assistance regarding the preparation of a BCA.

Benefit – Costs Review Listing Table

Table 12. Benefit - Costs Review Listing Table

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

0 – 1 year.

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

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

Mitigation Projects	Benefits (pros)	Costs or Issues (cons)	Priority*
Flood/Erosion (FLD)			
FLD 1: (IAW 2008) Suite of Emergency Plans and Training/Drills Emergency Operations, Community Evacuation, Hazard Mitigation	IAW Comments: The Suite of Emergency Plans is the most immediate, most near term and cost effective mechanism to reduce the risk of loss to lives and property. IAW Recommends Completion Date: ASAP – no later than 12/31/08. Work has already been started.	Community will need technical assistance to complete this project. The State needs the federal agencies to provide the weather, tidal and horizontal and vertical control data mandated so the State can meet its FEMA, CZMA and other mandates	High
FLD 2. Community needs to review Corps Recommendations Report that was recently provided to Koyukuk community.	Benefit to community and the State/Federal governments.	No cons to review the report.	High

Mitigation Projects	Benefits (pros)	Costs or Issues (cons)	Priority*
FLD 3: Evacuation Road Design and Construction to upgrade out of floodplain. Current Road only to Rock Quarry beyond Airport	IAW Comments: The current adequacy of the Evacuation Road is unclear. Need to clarify with DOT/PF crew, who was in the community in 2006 when flood hit, if road needs to be elevated. Tribal Administrator believes that riprap along the lower part of the road near the river is all that's needed. Portions of the airport were done in 2006.	IAW Recommendations: Through interagency and local coordination identify cost savings by aligning timing of projects requiring heavy equipment. State should establish a fund to ensure match is available to attract federal funds for Alaska projects. Find/develop Western Alaska rock source to reduce costs Local coordinator is needed to assist with planning efforts and project alignment. Need data on adequacy of road during flood – is it useable for evacuation purposes?	High
FLD 4: Koyukuk Emergency Shelter Conceptual Design	IAW Comments: Recommended actions/next steps for the Shelter have been provided to the Community by the Corps in the report identified in Project 2. If Koyukuk wants to move forward with the Corps recommendation, then studies (geological, etc.) need to be conducted to ensure the selected site is satisfactory. A project cooperation agreement will need to be signed between the community and the Corps. Completion date: Meeting between Koyukuk community and Corps will help to identify this.	Various agency coordination required. A clear process for site assessment, etc. along with a funding strategy will need to be developed. Permitting and environmental coordination is ongoing.	High

Mitigation Projects	Benefits (pros)	Costs or Issues (cons)	Priority*
FLD 5. Community Relocation Plan	Life/Safety project Benefit to government facilities and private properties.	Koyukuk Tribe, City, School and Village Corp need to form local planning committee – soon/ASAP. If funding for a Relocation Planning effort is to be acquired, then local planning committee needs to request funds/assistance. Community will need technical assistance from DCCED and others. Funding will be needed to hire a contractor to work with the community and develop the plan Completion date can't be determined until funding source identified/authorized	High
FLD 6. Flood Overlay Maps Horizontal and vertical control data for establishing plans for relocation and evacuation routes based on what flood levels have historically happened.	FIRMS are needed before Koyukuk can participate in the NFIP under usual means. They are currently in the program under emergency order until the maps are completed.	Expensive, at least $100,000	Medium
FLD 7. Public Education	DCRA funding may be available. Could be done yearly. Inexpensive <$1,000City	Need to determine community interest and participation.	Medium
FLD 8. Install upgraded river and rainfall measuring gauges	Life/Safety project Benefit to government facilities and private properties.	Dollar cost unknown, >$50k 1 – 5 year implementation	Medium

Mitigation Projects	Benefits (pros)	Costs or Issues (cons)	Priority*
FLD 9. Weather observation stations should be established and tied into the current, closest data collection sites for monitoring weather related storm data whether from ice jams, seasonal river rise, storms, storm surges or floods.	Life/Safety project Benefit to government facilities and private properties. Potential NOAA assistance.	Dollar cost unknown, >$50k 1 – 5 year implementation	Medium
FLD 10. Continue to enforce NFIP regulations for new and existing buildings and infrastructure.	Life/Safety project Benefit to government facilities and private properties.	Staff time.	Medium
Severe Weather (SW)			
SW 1. Research and consider instituting the National Weather Service program of *"Storm Ready"*.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
SW 2. Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High
SW 3. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be an annual event	Staff time	High

SW 4. Encourage weather resistant building construction materials and practices for new and existing building, especially build for high winds and extreme cold.	Risk and damage reduction. Benefit to entire community.	Would require ordinance change. Potential for increased staff time. Research into feasibility necessary. Political and public support not determined. 1 – 5 year implementation	Medium
SW-5. Cut down trees around structures and electrical lines to mitigate damage from high winds.	Risk and damage reduction. Benefit to entire community.	Cost to be determined.	Medium
Wildland Fire (WF)			
WF 1. IAW. Develop a Fire Management Plan with DNR. Coordinate with community planning projects to ensure dollars go as far as possible.	Life/Safety issue Risk reduction Benefit to entire community State assistance available	Dollar cost not determined. State assistance necessary.	High
WF 2. Promote Fire Wise building design, siting, and materials for construction of new and existing structures.	Life/Safety issue Risk reduction Benefit to entire community, Annual project. State assistance available	Dollar cost not determined. Staff time to research grants	High
WF 3: Consider development of building codes and requirements for new construction.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
WF 4. Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of existing structures.	Life/Safety issue Risk reduction Benefit to entire community Inexpensive State assistance available Could be implemented annually	Staff time	High
WF-5. Develop a fire break around the community	Risk Reduction Benefit to entire community State assistance available	Undetermined	High

WF-6. Purchase firefighting equipment.	Risk Reduction Benefit to entire community State assistance available	Undetermined	High

Mitigation Projects	Benefits (pros)	Costs or Issues (cons)	Priority*
Earthquake (E)			
E 1. If funding is available, perform an engineering assessment of the earthquake vulnerability of each existing identified critical infrastructure and new construction.	Life/Safety issue/Risk reduction Benefit to entire community	State assistance would be necessary.	Medium
E 2. Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	Life/Safety issue/Risk reduction Benefit to entire community	State assistance would be necessary.	Medium
E-3. Contract a structural engineering firm to assess the identified bldgs and facilities.	Benefit to entire community Risk reduction	Feasibility and need analysis needed. 1 – 5 years	Medium

Mitigation Projects

Table 13. Mitigation Strategy

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

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe
Flood/Erosion (FLD)				
FLD 1: (IAW 2008) Suite of Emergency Plans and Training/Drills Emergency Operations, Community Evacuation, Hazard Mitigation	DHS&EM City/Tribe	$75,000	State FY08 and FY09 Capital Budgets PDMG*, FMA**	IAW Recommends Completion Date**:** ASAP – no later than 12/31/08. Work has already been started.
FLD 2. Community needs to review Corps Recommendations Report that was recently provided to Koyukuk community.	Benefit to community and the State/Federal governments.	No cons to review the report.	High	FLD 2. Community needs to review Corps Recommendations Report that was recently provided to Koyukuk community.
FLD 3: Evacuation Road Design and Construction to upgrade out of floodplain. Current Road only to Rock Quarry beyond Airport	USACE DOT/PF	$800,000	Federal and State budget	FY2008/FY 2009
FLD 4: Koyukuk Emergency Shelter Conceptual Design	Koyukuk City and Tribe USACE DCRA	$4.5 million	USACE PDMG FMA	To be determined
FLD 5. Community Relocation Plan	FEMA NOAA USCOE DHS&EM	>$75,000	PDMG	>1 year

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe
FLD 6. Flood Overlay Maps Horizontal and vertical control data for establishing plans for relocation and evacuation routes based on what flood levels have historically happened.	FEMA NOAA USCOE DHS&EM	>$75,000	PDMG	>1 year
FLD 7. Public Education	City DHS&EM	Staff Time	City	Ongoing
FLD 8. Install upgraded river and rainfall measuring gauges	FEMA DHS&EM	$10,000	PDMG	<1 year
FLD 9. Weather observation stations should be established and tied into the current, closest data collection sites for monitoring weather related storm data whether from ice jams, seasonal river rise, storms, storm surges or floods.	FEMA NOAA USCOE DHS&EM	>$75,000	PDMG	>1 year
FLD 10. Continue to enforce NFIP regulations for new and existing buildings and infrastructure.	DCRA City/Tribe	Staff Time	State Budget	<1 year
Severe Weather (SW)				
SW 1. Research and consider instituting the National Weather Service program of *"Storm Ready"*.	City	Staff Time	City	<1 year
SW 2. Conduct special awareness activities, such as Winter Weather Awareness Week, Flood Awareness Week, etc.	City DCRA DHS&EM	Staff Time	City DCRA DHS&EM	<1 year

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe
SW 3. Expand public awareness about NOAA Weather Radio for continuous weather broadcasts and warning tone alert capability	City	Staff Time	NOAA	Ongoing
SW 4. Encourage weather resistant building construction materials and practices for new and existing building, especially build for high winds and extreme cold.	City	Staff Time	City	<1 year
SW-5. Cut down trees around structures and electrical lines to mitigate damage from high winds.	City/Tribe DHS&EM State Forestry	To be determined	PDMG	>1 year
Wildland Fire (WF)				
WF 1. IAW. Develop a Fire Management Plan with DNR. Coordinate with community planning projects to ensure dollars go as far as possible	DNR	$25,000	State	FY2008
Project WF 2. Promote Fire Wise building design, siting, and materials for new construction.	DHS&EM City/Tribe	Staff Time	State	Ongoing
WF 3: Consider development of building codes and requirements for new construction.	City/Tribe	Staff Time	City Budget	Ongoing
WF 4: Enhance public awareness of potential risk to life and personal property. Encourage mitigation measures in the immediate vicinity of their property to protect existing structures.	City/Tribe	Staff Time	City Budget	Ongoing
WF-5. Develop a firebreak around the community.	City/Tribe DHS&EM	To be determined	PDMG	<1 year
WF-6. Purchase firefighting equipment.	City/Tribe DHS&EM	To be determined	PDMG	<1 year

Mitigation Projects	Responsible Agency	Cost	Funding Sources	Estimated Timeframe
Earthquake (E)				
E-1. If funding is available, perform an engineering assessment of the earthquake vulnerability of each identified critical infrastructure owned by the City of Koyukuk.	City/Tribe DHS&EM	To be determined	State Grants	>1 year
E-2. Identify buildings and facilities that must be able to remain operable during and following an earthquake event.	City/Tribe DHS&EM DCRA	Staff Time	State Grants	>1 year
E-3. Contract a structural engineering firm to assess the identified bldgs and facilities.	City/Tribe DHS&EM	>$10,000	PDMG	>5 years

Glossary of Terms

A-Zones

Type of zone found on all Flood Hazard Boundary Maps (FHBMs), Flood Insurance Rate Maps (FIRMs), and Flood Boundary and Floodway Maps (FBFMs).

Acquisition

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

Asset

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

Base Flood

A term used in the National Flood Insurance Program to indicate the minimum size of a flood. This information is used by a community as a basis for its floodplain management regulations. It is the level of a flood, which has a one-percent chance of occurring in any given year. Also known as a 100-year flood elevation or one-percent chance flood.

Base Flood Elevation (BFE)

The elevation for which there is a one-percent chance in any given year that flood water levels will equal or exceed it. The BFE is determined by statistical analysis for each local area and designated on the Flood Insurance Rate Maps. It is also known as 100-year flood elevation.

Base Floodplain

The area that has a one percent chance of flooding (being inundated by flood waters) in any given year.

Building

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

Building Code

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

Community

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

Community Rating System (CRS)

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

Critical Facility

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

Designated Floodway

The channel of a stream and that portion of the adjoining floodplain designated by a regulatory agency to be kept free of further development to provide for unobstructed passage of flood flows.

Development

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

Digitize

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

Disaster Mitigation Act (DMA)

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

Earthquake

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

Elevation

The raising of a structure to place it above flood waters on an extended support structure.

Emergency Operations Plan

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

Erosion

The wearing away of the land surface by running water, wind, ice, or other geological agents.

Federal Disaster Declaration

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

Federal Emergency Management Agency (FEMA)

A federal agency created in 1979 to provide a single point of accountability for all federal activities related to hazard mitigation, preparedness, response, and recovery.

Flood

A general and temporary condition of partial or complete inundation of water over normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

Flood Disaster Assistance

Flood disaster assistance includes development of comprehensive preparedness and recovery plans, program capabilities, and organization of Federal agencies and of State and local governments to mitigate the adverse effects of disastrous floods. It may include maximum hazard reduction, avoidance, and mitigation measures, as well policies, procedures, and eligibility criteria for Federal grant or loan assistance to State and local governments, private organizations, or individuals as the result of the major disaster.

Flood Elevation

Elevation of the water surface above an establish datum (reference mark), e.g. National Geodetic Vertical Datum of 1929, North American Datum of 1988, or Mean Sea Level.

Flood Hazard

Flood Hazard is the potential for inundation and involves the risk of life, health, property, and natural value. Two reference base are commonly used: (1) For most situations, the Base Flood is that flood which has a one-percent chance of being exceeded in any given year (also known as the 100-year flood); (2) for critical actions, an activity for which a one-percent chance of flooding would be

too great, at a minimum the base flood is that flood which has a 0.2 percent chance of being exceeded in any given year (also known as the 500-year flood).

Flood Insurance Rate Map

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

Flood Insurance Study

Flood Insurance Study or Flood Elevation Study means an examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluations and determination of mudslide (i.e., mudflow) and/or flood-related' erosion hazards.

Floodplain

A "floodplain" is the lowland adjacent to a river, lake, or ocean. Floodplains are designated by the frequency of the flood that is large enough to cover them. For example, the 10-year floodplain will be covered by the 10-year flood. The 100-year floodplain by the 100-year flood.

Floodplain Management

The operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and floodplain management regulations.

Floodplain Management Regulations

Floodplain Management Regulations means zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as floodplain ordinance, grading ordinance and erosion control ordinance) and other applications of police power. The term describes such state or local regulations, in any combination thereof, which provide standards for the purpose of flood damage prevention and reduction.

Flood Zones

Zones on the Flood Insurance Rate Map (FIRM) in which a Flood Insurance Study has established the risk premium insurance rates.

Flood Zone Symbols

A - Area of special flood hazard without water surface elevations determined.

A1-30 - AE Area of special flood hazard with water surface elevations determined.

AO - Area of special flood hazard having shallow water depths and/or unpredictable flow paths between one and three feet.

A-99 - Area of special flood hazard where enough progress has been made on a protective system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes.

AH - Area of special flood hazard having shallow water depths and/or unpredictable flow paths between one and three feet and with water surface elevations determined.

B - X Area of moderate flood hazard.

C - X Area of minimal hazard.

D - Area of undetermined but possible flood hazard.

Geographic Information System

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

Governing Body

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

Hazard

A source of potential danger or adverse condition. Hazards in the context of this plan will include naturally occurring events such as floods, earthquakes, tsunami, coastal storms, landslides, and wildfires that strike populated areas. A natural event is a hazard when it has the potential to harm people or property.

Hazard Event

A specific occurrence of a particular type of hazard.

Hazard Identification

The process of identifying hazards that threaten an area.

Hazard Mitigation

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

Hazard Mitigation Grant Program

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

Hazard Profile

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

Hazard and Vulnerability Analysis

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

Mitigate

To cause something to become less harsh or hostile, to make less severe or painful.

Mitigation Plan

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

National Flood Insurance

The Federal program, created by an act of Congress in Program (NFIP) 1968 that makes flood insurance available in communities that enact satisfactory floodplain management regulations.

One Hundred (100)-Year

The flood elevation that has a one-percent chance of occurring in any given year. It is also known as the Base Flood.

Planning

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

Repetitive Loss Property

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

Risk

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

Riverine

Relating to, formed by, or resembling rivers (including tributaries), streams, creeks, brooks, etc.

Riverine Flooding

Flooding related to or caused by a river, stream, or tributary overflowing its banks due to excessive rainfall, snowmelt or ice.

Runoff

That portion of precipitation that is not intercepted by vegetation, absorbed by land surface, or evaporated, and thus flows overland into a depression, stream,

lake, or ocean (runoff, called immediate subsurface runoff, also takes place in the upper layers of soil).

Seiche

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

Seismicity

Describes the likelihood of an area being subject to earthquakes.

State Disaster Declaration

A disaster emergency shall be declared by executive order or proclamation of the Governor upon finding that a disaster has occurred or that the occurrence or the threat of a disaster is imminent. The state of disaster emergency shall continue until the governor finds that the threat or danger has passed or that the disaster has been dealt with to the extent that emergency conditions no longer exist and terminates the state of disaster emergency by executive order or proclamation. Along with other provisions, this declaration allows the governor to utilize all available resources of the State as reasonably necessary, direct and compel the evacuation of all or part of the population from any stricken or threatened area if necessary, prescribe routes, modes of transportation and destinations in connection with evacuation and control ingress and egress to and from disaster areas. It is required before a Presidential Disaster Declaration can be requested.

Topography

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

Tribal Government

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

Tsunami

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

Vulnerability

Describes how exposed or susceptible to damage an asset it. Vulnerability depends on an asset’s construction, contents, and the economic value of its functions. The vulnerability of one element of the community is often related to

the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electrical substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Other, indirect effects can be much more widespread and damaging than direct ones.

Vulnerability Assessment

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

Watercourse

A natural or artificial channel in which a flow of water occurs either continually or intermittently.

Watershed

An area that drains to a single point. In a natural basin, this is the area contributing flow to a given place or stream.

Bibliography

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2. *DCRA Community Information*: http://www.commerce.state.ak.us/dca/commdb/CF_BOCK.htm.

3. *Federal Aviation Administration, Alaska* website: http://www.alaska.faa.gov/fai/afss/index.html

4. *FEMA Benefit-Cost Analysis Website:* http://www.fema.gov/government/grant/bca.

5. FEMA How to Guides

   Getting Started: Building Support for Mitigation Planning (FEMA 386-1)

   Understanding Your Risks: Identifying Hazards and Estimating Losses (FEMA 386-2)

   Developing the Mitigation Plan: Identifying Mitigation Actions and Implementing Strategies (FEMA 386-3)

   Bringing the Plan to Life: Implementing the Hazard Mitigation Plan (FEMA 386-4)

   Using Benefit-Cost Review in Mitigation Planning (FEMA 386-5)

6. *Koyukuk Immediate Action Matrix,* Prepared by the Immediate Action Workgroup, March 4, 2008

7. *Draft Koyukuk Comprehensive Community Development Plan*, Prepared by Gerald Pilot, September 2007

8. *Koyukuk Community Profile, Draft*. Prepared by Fison and Associates. June 1987.

9. *Koyukuk Draft Flood Mitigation Plan, 2003*, Prepared Tanana Chiefs Conference

10. *USACE Draft Section 117 Project Fact Sheet for Koyukuk*, Prepared by Alaska USACE, 2008

Web Sites with General Hazard Planning Information

American Planning Association:	http://www.planning.org
Association of State Floodplain Managers:	http://www.floods.org

Developing the Implementation Strategy:	www.pro.gov.uk
Federal Emergency Management Agency: Mitigation Planning	http://www.fema.gov/fima/planning.shtm
Community Rating System:	http://www.fema.gov/nfip/crs.htm
Flood Mitigation Assistance Program:	http://www.fema.gov/fima/planfma.shtm
Hazard Mitigation Grant Program:	http://www.fema.gov/fima/hmgp
Individual Assistance Programs:	http://www.fema.gov/rrr/inassist.shtm
Interim Final Rule:	http://www.access.gpo.govl
National Flood Insurance Program:	http://www.fema.gov/nfip
Public Assistance Program:	http://www.fema.gov/rrr/pa