

# City of Quinhagak Hazard Mitigation Plan

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*Prepared by  
The City of Quinhagak  
Mitigation Planning Team*

January 2012





FEMA

January 25, 2012

Honorable Willard Church  
Mayor, City of Quinhagak  
P.O. Box 90  
Quinhagak, Alaska 99655

Dear Mayor Church:

The U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) has approved the *City of Quinhagak Local Hazard Mitigation Plan* as a local plan as outlined in 44 CFR Part 201. With approval of this plan, the city of Quinhagak is now eligible to apply for the Robert T. Stafford Disaster Relief and Emergency Assistance Act's hazard mitigation project grants through January 25, 2017.

The plan's approval provides eligibility to apply for hazard mitigation projects through your State. All requests for funding will be evaluated individually according to the specific eligibility and other requirements of the particular program under which the application is submitted. For example, a specific mitigation activity or project identified in the plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved for FEMA funding under any of the aforementioned programs. Approved mitigation plans may be eligible for points under the National Flood Insurance Program's Community Rating System (CRS).

Over the next five years, we encourage your community to follow the plan's schedule for its monitoring and updating, and to develop further mitigation actions. The plan must be reviewed, revised as appropriate, and resubmitted for approval within five years in order to continue project grant eligibility.

If you have questions regarding your plan's approval or FEMA's mitigation grant programs, please contact our State counterpart, Alaska Division of Homeland Security and Emergency Management, which coordinates and administers these efforts for local entities.

Sincerely,

A handwritten signature in black ink, appearing to read "Mark Carey".

Mark Carey, Director  
Mitigation Division

cc: Mark Roberts, Alaska Division of Homeland Security and Emergency Management

Enclosure

BH:bb





# City of Quinhagak

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## Table of Contents

1.	Introduction.....	1-1
1.1	Hazard Mitigation Planning.....	1-1
1.2	Planning Requirements .....	1-1
1.2.1	Local Mitigation Plans.....	1-1
1.3	Grant Programs with Mitigation Plan Requirements.....	1-1
1.3.1	Hazard Mitigation Assistance (HMA) Unified Programs .....	1-2
2.	Prerequisites.....	2-1
2.1	Adoption by Local Governing Bodies and Supporting Documentation.....	2-1
3.	Community Description .....	3-1
3.1	Location, Geography, and History.....	3-1
3.2	Demographics .....	3-2
3.3	Economy .....	3-2
4.	Planning Process .....	4-1
4.1	Overview of Planning Process.....	4-1
4.2	Hazard Mitigation Project Team.....	4-2
4.3	Public Involvement & Opportunity for Interested Parties to participate.....	4-3
4.4	Incorporation of Existing Plans and Other Relevant Information .....	4-4
5.	Hazard Profiles .....	5-1
5.1	Overview of a Hazard Analysis.....	5-1
5.2	Hazard Identification and Screening.....	5-1
5.3	Hazard Profile .....	5-2
5.3.1	Earthquake .....	5-4
5.3.2	Erosion .....	5-9
5.3.3	Flood .....	5-15
5.3.4	Ground Failure (Landslide, Subsidence, Unstable Soils) .....	5-22
5.3.5	Weather (Severe) .....	5-27
5.3.6	Wildland Fire .....	5-32
6.	Vulnerability Analysis .....	6-1
6.1	Overview of a Vulnerability Analysis .....	6-1
6.2	Vulnerability Analysis: Specific steps .....	6-2
6.2.1	Asset Inventory .....	6-2
6.2.2	Methodology .....	6-9

# City of Quinhagak

---

	6.2.3	Data Limitations.....	6-9
	6.2.4	Exposure Analysis .....	6-10
	6.3	Land Use and Development Trends.....	6-14
7.		Mitigation Strategy .....	7-1
	7.1	Developing Mitigation Goals.....	7-1
	7.2	Identifying Mitigation Actions .....	7-2
	7.3	Evaluating and Prioritizing Mitigation Actions.....	7-5
	7.4	Implementing a Mitigation Action Plan .....	7-7
8.		Plan Maintenance .....	8-1
	8.1	Monitoring, Evaluating, and Updating the HMP .....	8-1
	8.2	Implementation Through Existing Planning Mechanisms.....	8-2
	8.3	City of Quinhagak Capability Assessment .....	8-3
	8.4	Continued Public Involvement .....	8-14
9.		References .....	9-1

# City of Quinhagak

---

## Tables

Table 4-1	Hazard Mitigation Project Team.....	4-2
Table 4-2	Public Involvement Mechanisms.....	4-3
Table 5-1	Identification and Screening of Hazards.....	5-2
Table 5-2	Hazard Probability Criteria.....	5-3
Table 5-3	Hazard Magnitude/Severity Criteria.....	5-4
Table 5-4	Magnitude/Intensity/Ground-Shaking Comparisons.....	5-6
Table 5-5	Historical Earthquakes for Quinhagak.....	5-6
Table 5-6	Historic Flood Events (NWS).....	5-18
Table 5-7	USACE Community Flood Survey Elevations.....	5-19
Table 5-8	Severe Weather Events.....	5-28
Table 5-9	Wildfire Locations Since 1939 within 50 Miles of Quinhagak.....	5-33
Table 6-1	Estimated Population and Building Inventory.....	6-2
Table 6-2	Critical Facilities.....	6-1
Table 6-3	Potential Hazard Exposure Analysis – Critical Infrastructure.....	6-10
Table 6-4	Potential Hazard Exposure Analysis – Critical Infrastructure.....	6-11
Table 6-5	Planned and Funded Projects.....	6-17
Table 6-6	Completed Projects.....	6-22
Table 7-1	Mitigation Goals.....	7-1
Table 7-2	Mitigation Goals and Potential Actions.....	7-3
Table 7-3	Evaluation Criteria for Mitigation Actions.....	7-6
Table 7-4	City of Quinhagak’s Mitigation Action Plan Matrix.....	7-7
Table 8-1	Quinhagak’s Regulatory Tools.....	8-3
Table 8-2	Quinhagak’s Technical Resources for Hazard Mitigation.....	8-13
Table 8-3	Financial Resources Available for Hazard Mitigation.....	8-14

## Figures

Figure 3-1	Quinhagak Location Map.....	3-1
Figure 3-2	Quinhagak Historic Population.....	3-2
Figure 3-3	Aerial Photograph of the City of Quinhagak.....	3-4
Figure 5-1	Active and Potentially Active Faults in Alaska.....	5-7
Figure 5-2	Image from the “Neotectonic Map of Alaska” – Quinhagak Area.....	5-8
Figure 5-3	Quinhagak’s Earthquake Probability.....	5-9
Figure 5-4	Aerial Photo of Quinhagak’s Intertidal Floodplain.....	5-13
Figure 5-5	Quinhagak Dredging Location.....	5-17
Figure 5-6	Quinhagak’s Limited Water Access.....	5-20
Figure 5-7	Quinhagak Wetlands.....	5-21
Figure 5-8	DGGS Permafrost Map of Alaska.....	5-25
Figure 5-9	Quinhagak’s Historical Wildfires.....	5-34
Figure 6-1	Quinhagak’s Community Layout.....	6-8
Figure 6-2	Quinhagak’s Sewer Project 2011-2013.....	6-8
Figure 6-3	City of Quinhagak’s Land Use Map.....	6-21

# City of Quinhagak

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## Appendices

- A Crosswalk
- B Adoption Resolution
- C Public Outreach
- D Benefit-Cost Analysis Fact Sheet
- E Plan Maintenance Documents



# City of Quinhagak

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## Acronyms/Abbreviations

°F	Degrees Fahrenheit
ACCIMP	Alaska Climate Change Impact Mitigation Program
ACWF	Alaska Clean Water Fund
ADWF	Alaska Drinking Water Fund
AEA	Alaska Energy Authority
AEEE	Alternative Energy and Energy Efficiency
AFG	Assistance to Firefighters Grant
AHFC	Alaska Housing Finance Corporation
AICC	Alaska Interagency Coordination Center
ANA	Administration for Native Americans
ANTHC	Alaska Native Tribal Health Consortium
APA	American Planning Association
ARC	American Red Cross
AVEC	Alaska Village Electric Cooperative
BFE	base flood elevation
BIA	Bureau of Indian Affairs
Boutet	The Boutet Company Incorporated
CCP	Citizen Corps Program
CDBG	Community Development Block Grant
CFR	Code of Federal Regulations
CFP	Community Forestry Program
CGP	Comprehensive Grant Program
City	City of Quinhagak (aka Kwinhagak)
CWSRF	Clean Water State Revolving Fund
DCCED	Department of Commerce, Community, and Economic Development
DCRA	Division of Community and Regional Affairs
DEC	Department of Environmental Conservation
DHS	Department of Homeland Security
DHS&EM	Division of Homeland Security and Emergency Management
DGGS	Division of Geological and Geophysical Survey
DMA 2000	Disaster Mitigation Act of 2000
DMVA	Department of Military and Veterans Affairs
DNR	Department of Natural Resources
DOE	Department of Energy
DOF	Division of Forestry
DOI	Division of Insurance
DOL	Department of Labor

# City of Quinhagak

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DOT/PF	Department of Transportation and Public Facilities
DSS	Division of Senior Services
EDA	Economic Development Administration
EMPG	Emergency Management Performance Grant
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
EWP	Emergency Watershed Protection Program
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FMA	Flood Mitigation Assistance
FP&S	Fire Prevention and Safety
ft	feet
FY	Fiscal Year
g	gravity as a measure of peak ground acceleration
GIS	Geospatial Information System
IG	Inspector General
HAZUS-MH	Hazard United States – Multiple Hazards
HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program
HMP	Hazard Mitigation Plan
HSGP	Homeland Security Grant Program
HUD	Housing and Urban Development
IBHS	Institute for Business and Home Safety
ICDBG	Indian Community Development Block Grant
IHBG	Indian Housing Block Grant
IHS	Indian Health Service
INAP	Indian and Native American Programs
IRS	Internal Revenue Service
Kts	knots
M	Magnitude
MGL	Municipal Matching Grants and Loans
MMI	Modified Mercalli Intensity
mph	miles per hour
msl	mean sea level
NAHASDA	Native American Housing Assistance and Self Determination Act
NFIP	National Flood Insurance Program
NIMS	National Incident Management System
NOAA	National Oceanic and Atmospheric Administration

# City of Quinhagak

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NRF	National Response Framework
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
PDM	Pre-Disaster Mitigation
PGA	peak ground acceleration
PNP	private non-profits
QCDP	Quinhagak Community Development Plan
RCASP	Remote Community Alert Systems
RD	US Division of Rural Development
RDA	Rural Development Assistance
RL	repetitive loss
RFC	Repetitive Flood Claim
SAFER	Staffing for Adequate Fire and Emergency Response
SBA	U.S. Small Business Administration
SHMP	Alaska State Hazard Mitigation Plan
SHSP	State Homeland Security Program
SOA	State of Alaska
Sq.	Square
SRL	Severe Repetitive Loss
Stafford Act	Robert T. Stafford Disaster Relief and Emergency Assistance Act
STAPLEE	Social, Technical, Administrative, Political, Legal, Economic, and Environmental
SWCD	Soil and Water Conservation District
TBM	Temporary Bench Mark
URS	URS Corporation
US or U.S.	United States
USACE	United States Army Corps of Engineers
USC	United States Code
USDA	United States Department of Agriculture
USFS	US Forest Service
USGS	United States Geological Survey
VFA-RFA	Volunteer Fire Assistance and Rural Fire Assistance Grant
VSW	Village Safe Water
WARN	Warning, Alert, and Response Network
WHIP	Wildlife habitat Incentives Program

# City of Quinhagak

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

### 1.1 HAZARD MITIGATION PLANNING

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

### 1.2 PLANNING REQUIREMENTS

#### 1.2.1 Local Mitigation Plans

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

To implement these planning requirements, FEMA published an Interim Final Rule in the Federal Register on February 26, 2002 (FEMA 2002a), 44 CFR Part 201 with subsequent updates. The planning requirements for local entities are described in detail in Section 2 and are identified in their appropriate sections throughout this HMP.

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

This HMP complies with Title 44 CFR dated December 31, 2010 and applicable guidance documents.

### 1.3 GRANT PROGRAMS WITH MITIGATION PLAN REQUIREMENTS

FEMA HMA grant programs provide funding to States, Tribes, and local entities that have a FEMA-approved State, Tribal, or Local Mitigation Plan. Two of the grants are authorized under the Stafford Act and DMA 2000, while the remaining three are authorized under the National

Flood Insurance Act and the Bunning-Bereuter-Blumenauer Flood Insurance Reform Act. The Hazard Mitigation Grant Program (HMGP) is a directly funded competitive disaster grant program. Whereas the Unified Mitigation Assistance Programs: Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss (SRL) programs although competitive, rely on specific grant pre-disaster grant funding sources, sharing several common elements.

*“Hazard mitigation is any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards and their effects. This definition distinguishes actions that have a long-term impact from those that are more closely associated with immediate preparedness, response, and recovery activities. Hazard mitigation is the only phase of emergency management specifically dedicated to breaking the cycle of damage, reconstruction, and repeated damage. As such, States, Territories, Indian Tribal governments, and communities are encouraged to take advantage of funding provided by HMA programs in both the pre- and post-disaster timeframes.*

*Together, these programs provide significant opportunities to reduce or eliminate potential losses to State, Tribal, and local assets through hazard mitigation planning and project grant funding. Each HMA program was authorized by separate legislative action, and as such, each program differs slightly in scope and intent.*

*The Hazard Mitigation Grant Program (HMGP) may provide funds to States, Territories, Indian Tribal governments, local governments, and eligible private non-profits (PNPs) following a Presidential major disaster declaration. The Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Claims (RFC), and Severe Repetitive Loss Pilot (SRL) programs may provide funds annually to States, Territories, Indian Tribal governments, and local governments. While the statutory origins of the programs differ, all share the common goal of reducing the risk of loss of life and property due to natural hazards” (FEMA 2010).*

### 1.3.1 Hazard Mitigation Assistance (HMA) Unified Programs

The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. Projects must provide a long-term solution to a problem, for example, elevation of a home to reduce the risk of flood damages as opposed to buying sandbags and pumps to fight the flood. In addition, a project’s potential savings must be more than the cost of implementing the project. Funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The amount of funding available for the HMGP under a particular disaster declaration is limited. FEMA may provide a State or Tribe with up to 20 percent of the total aggregate disaster damage costs to fund HMGP project or planning grants. In Fiscal Year (FY) 2006 was approximately \$232 million, FY 2007 was \$316 million, FY 2008 was \$1.246 billion, FY 2009 was \$359 million, and FY 2010 was \$23 million. The cost-share for these grants is 75 percent Federal/25 percent non-Federal. Communities that fulfill “Impoverished Community” criteria and receive FEMA Regional Administrator approval may be funded at percent 90 percent Federal/10 percent non-Federal.

The PDM grant program provides funds to State, Tribes, and local entities, including universities, for hazard mitigation planning and mitigation project implementation prior to a disaster event. PDM grants are awarded on a nationally competitive basis. Like HMGP funding, a PDM project’s potential savings must be more than the cost of implementing the project. In

addition, funds may be used to protect either public or private property or to purchase property that has been subjected to, or is in danger of, repetitive damage. The total amount of PDM funding available is appropriated by Congress on an annual basis. In FY 2008, PDM program funding totaled approximately \$114 million, FY 2009 was \$90 million, and FY 2010 was \$100 million. The cost-share for these grants is 75 percent Federal/25 percent non-Federal.

The goal of the FMA grant program is to reduce or eliminate flood insurance claims under the NFIP. Particular emphasis for this program is placed on mitigating repetitive loss (RL) properties. The primary source of funding for this program is the National Flood Insurance Fund. Grant funding is available for three types of grants, including Planning, Project, and Technical Assistance. Project grants, which use the majority of the program's total funding, are awarded to States, Tribes, and local entities to apply mitigation measures to reduce flood losses to properties insured under the NFIP. In FY 2010, FMA funding totaled \$32.3 million. The cost-share for these grants is 75 percent Federal/25 percent non-Federal. However, 90 percent Federal/10 percent non-Federal to mitigate SRL properties is available in certain situations.

The City of Quinagak does not currently participate in the NFIP and is therefore ineligible for National Flood Insurance Act Grant Programs until they become a NFIP participant.

The SRL program provides funding to reduce or eliminate the long-term risk of flood damage to residential structures insured under the NFIP. Structures considered for mitigation must have at least four NFIP claim payments over \$5,000 each, when at least two such claims have occurred within any 10-year period, and the cumulative amount of such claim payments exceeds \$20,000; or for which at least two separate claim payments have been made with the cumulative amount of the building portion of such claims exceeding the value of the property, when two such claims have occurred within any 10-year period. Congress authorized \$40 million for FY 2006 and FY 2007, \$80 million for FY 2008, \$80 million for FY 2009, and \$70 million for FY 2010. The cost-share for these grants is 75 percent Federal/25 percent non-Federal. However, 90 percent Federal/10 percent non-Federal to mitigate SRL properties is available when the State or Tribal plan addresses ways to mitigate SRL properties.

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

### HMP Description

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

#### **Prerequisites**

Section 2 addresses the prerequisites of plan adoption, which include adoption by the City of Quinagak (City). The adoption resolution is included in Appendix B.

#### **Community Description**

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



### **Planning Process**

Section 4 describes the planning process and identifies the Project Team Members, the meetings held as part of the planning process, the Boutet Company, Inc.'s (Boutet) consultants, URS Corporation (URS), and the key stakeholders within the City and the surrounding area. In addition, this section documents public outreach activities (Appendix C) and the review and incorporation of relevant plans, reports, and other appropriate information.

### **Hazard Analysis**

Section 5 describes the process through which the Project Team identified, screened, and selected the hazards to be profiled in this version of the HMP. The hazard analysis includes the nature, history, location, extent, impact, and probability of future events for each hazard. In addition, historical and hazard location figures are included.

### **Vulnerability Analysis**

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

### **Mitigation Strategy**

Section 7 defines the mitigation strategy which provides a blueprint for reducing the potential losses identified in the vulnerability analysis. The Project Team developed a list of mitigation goals and potential actions to address the risks facing the City. Mitigation actions include preventive actions, property protection techniques, natural resource protection strategies, structural projects, emergency services, and public information and awareness activities. In the spirit of the new requirements, mitigation strategies were developed encouraging participation with the NFIP and the reduction of flood damage to flood-prone structures.

### **Plan Maintenance**

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

### **References**

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

### **Appendix A**

Appendix A provides the FEMA crosswalk, which documents compliance with FEMA criteria.

### **Appendix B**

Appendix B provides the adoption resolution for the City.

### **Appendix C**

Appendix C provides public outreach information, including newsletters.

### **Appendix D**

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

### **Appendix E**

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

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### 2.1 ADOPTION BY LOCAL GOVERNING BODIES AND SUPPORTING DOCUMENTATION

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

#### DMA 2000 REQUIREMENTS: PREREQUISITES

##### Local Plan Adoption

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

##### Element

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

*Source: FEMA, July 2008.*

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

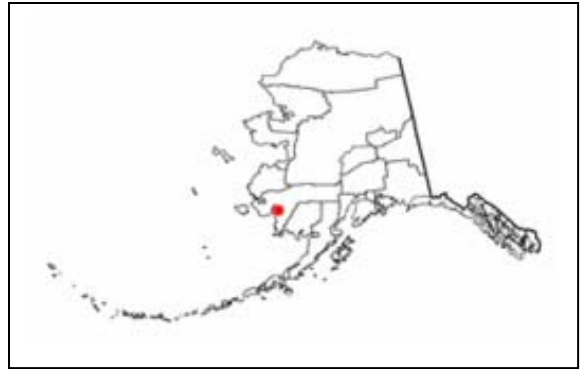
The local governing body of the City adopted the HMP by resolution on January 25, 2012. A scanned copy of the resolution is included in Appendix B.

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

### 3.1 LOCATION, GEOGRAPHY, AND HISTORY

“Quinhagak is on the Kanektok River on the east shore of Kuskokwim Bay, less than a mile from the Bering Sea coast. It lies 71 miles southwest of Bethel. It lies at approximately 59.748890 North Latitude and -161.915830 West Longitude. (Sec. 17, T005S, R074W, Seward Meridian.) Quinhagak is located in the Bethel Recording District” (Department of Community, Commerce, and Economic Development [DCCED], Division of Community and Regional Affairs [DCRA] 2011).



**Figure 3-1 Quinhagak Location Map**

The City covers approximately 4.7 square (sq.) miles of land and approximately 0.6 sq. miles of water. Extreme temperature changes occur throughout Alaska’s interior. The City’s temperatures range from a winter low of -34 degrees Fahrenheit (°F) to a high of 82 °F. The area receives approximately 22 inches of rain and 43 inches of snow.

Quinhagak’s Yup’ik name is Kuinerraq, which means “new River Channel”. The Village has existed since 1000 AD originally located on the lower Kuskokwim River and were the first to have sustained European contact” (DCCED/DCRA). The following is a brief sketch of the City’s history:

1826	First reported and mapped by Gavril Sarichev.
1867	The Alaska Commercial Company sent annual supply ships to Quinhagak with goods for Kuskokwim River trading posts shortly after Alaska’s purchase from Russia.
1893	Moravian mission was built. Village as a waiting point for up-river travelers.
1904	Mission store opened.
1905	Post Office opened.
1909	First school opened.
1906 – 1909	The Native-owned Kuskokwim Reindeer Company Domestic managed Quinhagak’s first reindeer herd with over 2,000 reindeer. This was not a long-term endeavor as the herd intermingled with migrating wild caribou; scattering the heard by the 1950s.
1915	The Kuskokwim River was charted. Goods were then able to be barged directly upriver to Bethel.
1928	First electric power plant opened.
1934	First mail plane arrived.

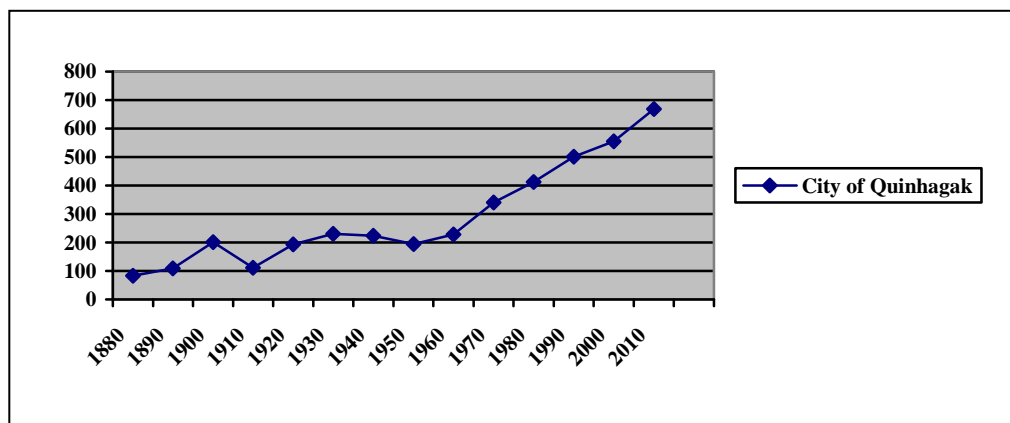
1975                      The city was incorporated as a second class city in the State's Unorganized Borough.

Quinhagak residents are descendants of the original Yup'ik villagers spanning back over 1000 years. "...[T]he Yupiit were organized into at least twelve, and perhaps as many as twenty, territorially distinct regional groups tied together by kinship — hence the Yup'ik word *tungelquellriit*, meaning "those who share ancestors (are related)"... Quinhagak is located south of Kuskokwim Bay." (Wikipedia 2011).

*"While Yupiit were nomadic, the abundant fish and game of the Y-K Delta and Bering Sea coastal areas permitted for a more settled life than for the many of the more northerly Inuit peoples. Under normal conditions, there was little need for interregional travel, as each regional group had access to enough resources within its own territory to be completely self-sufficient. However, fluctuations in animal populations or weather conditions sometimes necessitated travel and trade between regions" (Wikipedia 2011).*

### 3.2 DEMOGRAPHICS

The 2000 census recorded 555 residents, of which the median age was 26.6 indicating a relatively young population. The population of Quinhagak is expected to remain steady because over half of the population is between 20 and 54 years of age. The City is principally a Yup'ik community with approximately 97.3 percent of residents recognize themselves as Alaska Native. The male and female composition is approximately 52.2 and 47.8 percent respectively. The 2000 census revealed that there are 137 households with the average household having approximately 4.05 individuals. The most recent 2010 DCCED certified population is 669. Figure 3-2 illustrates the historic population of the City.



**Figure 3-2      Quinhagak Historic Population**

### 3.3 ECONOMY

There are limited employment opportunities in the City. Established government provides the bulk of the employment opportunities such as the City, State, and Federal agencies and the school district, the health clinic, commercial fishing, the Coastal Village Seafood fish processing plant, and other commercial enterprises. Residents also derive income from trapping and native handicrafts such as ivory carving, basket weaving and wearable skin articles such as hats, gloves, outerwear and native toys. Subsistence is the primary mechanisms by which the residents derive income and food sources from seal, salmon, halibut, and herring (DCRA 2011).



According to the 2000 census, the median household income in Quinhagak was \$25,156. Approximately 142 individuals (26.1 percent) were reported to be living below the poverty level. The potential work force (those aged 16 years or older) in the City was estimated to be 364, of which 127 were actively employed. In 2000 the unemployment rate was 15.4 percent; however, this rate included part-time and seasonal jobs, and practical unemployment or underemployment is likely to be significantly higher.

Figure 3-3 depicts an aerial photograph of the City obtained from the DCCED/DCRA community profile.



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

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

### DMA 2000 Requirements: Planning Process

#### Local Planning Process

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

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

#### Element

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

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

#### Element

- Does the plan provide a narrative description of the process followed to prepare the new or updated plan?
- Does the new or updated plan indicate who was involved in the planning process?
- Does the new or updated plan indicate how the public was involved?
- Does the new or updated plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?
- Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?
- *Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process? (Not applicable until 2013 update)*

Source: FEMA, July 2008.

## 4.1 OVERVIEW OF PLANNING PROCESS

The State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) provided funding and project oversight to The Boutet Co. Inc. URS, Boutet's subcontractor, guided development of a Project Team to assist the City with HMP development.

The planning process began with Willard Church, Quinhagak City Mayor, coordinating a local Project Team kick-off meeting to coincide with their City Council meeting on March 15, 2011. The Project Team identified applicable City resources and capabilities during the meeting. URS and Boutet explained how the HMP differed from their current grant to assess the City's erosion hazard. The Project Team then discussed the City's rolls such as: acting as an advocate for the planning process, assisting with gathering information, and supporting public participation

opportunities. There was also a brief discussion about hazards that affect the community such as erosion, sediment deposition, and permafrost impacts, which are increasing in intensity.

The Project Team further discussed the hazard mitigation planning process, asking participants to help identify hazards that affect the City and to also identify impacts to residential and critical facilities.

Mr. Jim Galanes, was introduced to describe Boutet's responsibility for assisting the Project Team with identifying mitigation actions and to develop a project for potential funding. These projects will then be prioritized and the top project selected for Boutet to prepare a separately funded Division of Homeland Security and Emergency Management (DHS&EM) HMGP Project Grant Application.

In summary, the following five-step process took place from March through June 2011.

1. Organize resources: Members of the Project Team identified resources, including staff, agencies, and local community members, who could provide technical expertise and historical information needed in the development of the hazard mitigation plan.
2. Assess risks: The Project Team identified the hazards specific to Quinhagak, and with the assistance of a hazard mitigation planning consultant (URS), developed the risk assessment for the eight identified hazards. The Project Team reviewed the risk assessment, including the vulnerability analysis, prior to and during the development of the mitigation strategy.
3. Assess capabilities: The Project Team reviewed current administrative and technical, legal and regulatory, and fiscal capabilities to determine whether existing provisions and requirements adequately address relevant hazards.
4. Develop a mitigation strategy: After reviewing the risks posed by each hazard, the Project Team developed a comprehensive range of potential mitigation goals and actions. Subsequently, the Project Team identified and prioritized the actions to be implemented.
5. Monitor, evaluate, and update the plan: The Project Team developed a process to ensure the plan was monitored to ensure it was used as intended while fulfilling community needs. The team then developed a process to evaluate the plan to compare how their decisions affected hazard impacts. They then outlined a method to share their successes with community members to encourage support for mitigation activities and to provide data for incorporating mitigation actions into existing planning mechanisms and to provide data for the plans five year update.

## 4.2 HAZARD MITIGATION PROJECT TEAM

The local Project Team members are Mayor Willard Church (Planning Team Leader), City Administrator Fannie Moore, City Council Member/Secretary/Treasurer Vera Roberts, and City Council Member Pauline Matthews. Table 4-1 identifies the hazard complete mitigation Project Team.

**Table 4-1 Hazard Mitigation Project Team**

Name	Title	Organization	Phone
Willard Church	Mayor	City of Quinhagak	556.8202
Fannie Moore	City Administrator	City of Quinhagak	556.8202

**Table 4-1 Hazard Mitigation Project Team**

Name	Title	Organization	Phone
Vera Roberts	City Council Secretary/Treasurer	City of Quinhagak	556.8202
Edward Mark	Vice Mayor	City of Quinhagak	556.8202
Emma White	Council Member	City of Quinhagak	556.8202
Grace Mark	Council Member	City of Quinhagak	556.8202
Timothy Kelly	Council Member	City of Quinhagak	556.8202
Pauline Matthew	City Councilmember	City of Quinhagak	556.8202
Scott Simmons	Hazard Mitigation Planner	URS Corporation	261.9706
Jim Galanes	HMGP Project Development	The Boutet Company	522.6776

### 4.3 PUBLIC INVOLVEMENT & OPPORTUNITY FOR INTERESTED PARTIES TO PARTICIPATE

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

**Table 4-2 Public Involvement Mechanisms**

Mechanism	Description
Newsletter Distribution (March 15 2011)	In March 2011, the jurisdiction distributed a newsletter describing the upcoming planning activity. The newsletter encouraged the whole community to provide hazard and critical facility information. It was posted at the City and Tribal Offices and the Post Office to ensure everyone was aware of the meeting.
Newsletter Distribution (May 2011)	In May 2011, the jurisdiction distributed a newsletter describing the HMPs availability and present potential HMP projects for review. The newsletter encouraged the whole community to provide comments or input. It was posted at the City and Tribal Offices and the Post Office to ensure everyone was aware of the meeting.

On March 15, 2011, the Mayor introduced the hazard mitigation planning project during the City Council Meeting to the community and other interested parties. URS and Boutet extended an invitation to all individuals and entities identified on the project mailing list via a project newsletter describing the planning process and announcing the upcoming public meeting. The newsletter was either faxed or emailed to relevant academia, nonprofits, and local, state, and federal agencies and placed on the DSH&EM website and signs posted throughout the community announcing the March 15, 2011 public meeting.

During the meeting, the Project Team led the attending public through a hazard identification and screening exercise. The attendees identified six hazards: earthquake, erosion, flood, ground failure (permafrost and subsidence), severe weather, and wildland fire which periodically impact the City.

Following the hazard screening process, the Project Team led the attendees through the process of identifying critical facilities in the community. URS also described the specific information

needed from the Project Team and public to complete the risk assessment including the location, value, and population of residents and critical facilities in the community.

A risk assessment was completed after the community asset data was collected by the Project Team over the spring of 2011, which identified the assets that are exposed and vulnerable to specific hazards.

A Project Team meeting was held on April 1, 2011 to review and prioritize the mitigation actions identified based on the results of the risk assessment. A second newsletter was prepared and delivered on April 6, 2010 describing the process to date, presenting the prioritized mitigation actions, and announcing the availability of the draft HMP for public review and comment.

The Project Team held a special meeting in August 2011 to review the draft HMP for accuracy – ensuring it meets the City’s needs. The meeting was productive with the Team highlighting several minor corrections or refinements. Changes were specifically targeted to plan development information, hazard impacts, community vulnerability analysis, and the mitigation strategy.

#### 4.4 INCORPORATION OF EXISTING PLANS AND OTHER RELEVANT INFORMATION

During the planning process, the Project Team reviewed and incorporated information from existing plans, studies, reports, and technical reports into the HMP. The following were available from two of the City’s websites and were reviewed and used as references for the jurisdiction information and hazard profiles in the risk assessment of the HMP for the City (DCCED 2011, Kwinhagak 2011a, Kwinhagak 2011b).

- *The City of Quinhagak Community Development Plan, 2010: explains the City’s land use initiatives and natural hazard impacts.*
- *The Quinhagak Land Use Plan, 2009.*
- *The Kwinhagak Capital and Land Use Plan, 1999, describes the City’s community development goals and initiatives.*
- *The Native Village of Kwinhagak Piped Water and Sewer Feasibility Study, describes the City’s utility requirements along with soil composition and permafrost locations.*
- *The Natural Resources Conservation Service Trip Report – Quinhagak, Alaska Soil and Water Conservation District (SWCD), September 10, 2004 provided excellent description of the City’s erosion threats.*
- *City of Quinhagak’s Carter Road Subdivision II Site Plan, developed by CE2 Engineering Inc. displays the City’s layout and describes proposed residential building, critical facilities, and infrastructure locations.*
- *State of Alaska, Department of Commerce, Community and Economic Development Community Profile, provided historical and demographic information.*
- *State of Alaska Hazard Mitigation Plan, 2010 (SHMP) defines statewide hazards and their potential locational impacts.*

A complete list of references consulted is provided in Section 9.

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

## **5.1 OVERVIEW OF A HAZARD ANALYSIS**

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

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

## **5.2 HAZARD IDENTIFICATION AND SCREENING**

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

### **DMA 2000 Requirements: Risk Assessment: Identifying Hazards**

#### **Identifying Hazards**

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

#### **Element**

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

*Source: FEMA, July 2008.*

For the first step of the hazard analysis, on March 15, 2011 the Project Team reviewed *nine* possible hazards that could affect the Bethel Census Area. They then evaluated and screened the comprehensive list of potential hazards based on a range of factors, including prior knowledge or perception of their threat and the relative risk presented by each hazard, the ability to mitigate the hazard, and the known or expected availability of information on the hazard (see Table 5-1). The Project Team determined that six hazards pose the greatest threat to the City: earthquake, erosion, flood, ground failure, severe weather, and wildland fire. The remaining hazards excluded through the screening process were considered to pose a lower threat to life and property in the City due to the low likelihood of occurrence or the low probability that life and property would be significantly affected.



**Table 5-1 Identification and Screening of Hazards**

Hazard Type	Should It Be Profiled?	Explanation
Avalanche	No	This hazard does not exist for the City.
Earthquake	Yes	Periodic, unpredictable occurrences. The City experienced no damage from the 11/2003 Denali EQ, but experienced storm surges and flooding in the bay from the 1964 Good Friday Earthquake.
Erosion	Yes	The City experiences storm surge, coastal ice run-up, and wind coastal erosion along the shoreline adjacent to Kuskokwim Bay and riverine erosion along the Kanetok River embankments from high water flow, riverine ice flows, wind, and surface runoff. Erosion occurs along the airport.
Flood	Yes	Snowmelt and ice jam flooding occurs during spring thaw and the fall rainy season. Events occur from soil saturation. Several minor flood events cause damage. Severe damages occur from major floods.
Ground Failure (Landslide/Debris Flow, Permafrost)	Yes	Ground Failure occurs throughout Alaska from landslides, land subsidence, and melting permafrost. These hazards periodically cause houses to shift due to ground sinking and upheaval. The City has occasional melting permafrost damage which accelerates erosion damage along the Kanetok River embankment. Impacts all structure types throughout the community.
Tsunami & Seiche	No	This hazard does not exist for the City.
Volcano	No	This hazard does not exist for the City.
Weather, Severe	Yes	Annual weather patterns, severe cold, heavy rain, freezing rain, snow accumulations, storm surge, and wind, are the predominate threats. Intense wind and heavy rain are the primary impacts to the community. Severe weather events cause fuel price increases and frozen pipes. Heavy snow loads potentially damage house roofs. Winds potentially remove or damage roofs and moved houses off their foundations.
Tundra/Wildland Fires	Yes	The City and the surrounding tundra area become very dry in summer months with weather and human caused incidents igniting dry vegetation (i.e., lightning and trash burning).

### 5.3 HAZARD PROFILE

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

### DMA 2000 Requirements: Risk Assessment – Profiling Hazards

#### Profiling Hazards

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

#### Element

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

Source: FEMA, July 2008.

The specific hazards selected by the Project Team for profiling have been examined in a methodical manner based on the following factors:

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

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

**Table 5-2 Hazard Probability Criteria**

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

**Table 5-2 Hazard Probability Criteria**

Probability	Criteria
<i>1 - Unlikely</i>	Event is possible within the next ten years. Event has up to 1 in 10 years chance of occurring (1/10=10 percent). History of events is less than or equal to 10 percent likely per year. Event is "Unlikely" but is possible of occurring.

Probability is determined based on historic events, using the criteria identified above, to provide the likelihood of a future event.

**Table 5-3 Hazard Magnitude/Severity Criteria**

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

Similar to estimating probability, magnitude, and severity are determined based on historic events using the criteria identified above.

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

### 5.3.1 Earthquake

#### 5.3.1.1 Nature

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

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

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

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

The severity of an earthquake can be expressed in terms of intensity and magnitude. Intensity is based on the damage and observed effects on people and the natural and built environment. It varies from place to place depending on the location with respect to the earthquake epicenter, which is the point on the earth's surface that is directly above where the earthquake occurred. The severity of intensity generally increases with the amount of energy released and decreases with distance from the fault or epicenter of the earthquake. The scale most often used in the U.S. to measure intensity is the Modified Mercalli Intensity (MMI) Scale. As shown in Table 5-4, the MMI Scale consists of 12 increasing levels of intensity that range from imperceptible to catastrophic destruction. Peak ground acceleration (PGA) is also used to measure earthquake intensity by quantifying how hard the earth shakes in a given location. PGA can be measured as acceleration due to gravity (g) (see Table 5-4) (MMI 2006).

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

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

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

(MMI 2006)

### 5.3.1.2 History

The Project Team determined that the City of Quinhagak has a minimal concern for earthquake damages as they have not experienced damaging effects from their historical earthquake events and only needed to be concerned with earthquakes with a magnitude > M 5.0. Table 5-5 lists historical earthquakes from 1973 to present which exceeded M5.0 located within 100 miles of the City.

**Table 5-5 Historical Earthquakes for Quinhagak**

*(Highlight is earthquake of record)*

Year	Mo	Day	Time(hhmmss.mm)UTC	Latitude	Longitude	Magnitude	Depth (Miles)
1976	09	07	001624.10	60.373	-159.598	N/A	108
1980	12	12	160009.90	60.382	-160.990	N/A	82
1992	05	16	025559.91	58.987	-160.279	4.2	0
1994	02	09	075550.15	59.771	-159.614	4.0	0
1994	02	10	213542.75	59.856	-159.327	4.4	10
2007	06	13	142431.11	59.823	-159.356	2.6	22

(USGS 2007)

Since 1977, only six earthquakes have been recorded within a 100 mile radius of the City of Quinhagak. The average magnitude of these earthquakes is M 3.7. The largest recorded earthquakes within 100 miles of the City measured M 4.4 occurring on February 10, 1994. This earthquake did not cause any damage to critical facilities, residences, non-residential buildings, or infrastructure.

Project Team members stated that Quinhagak experienced moderate to severe ground shaking from the November 3, 2002 M 7.9 Denali EQ located approximately 300 miles away. No

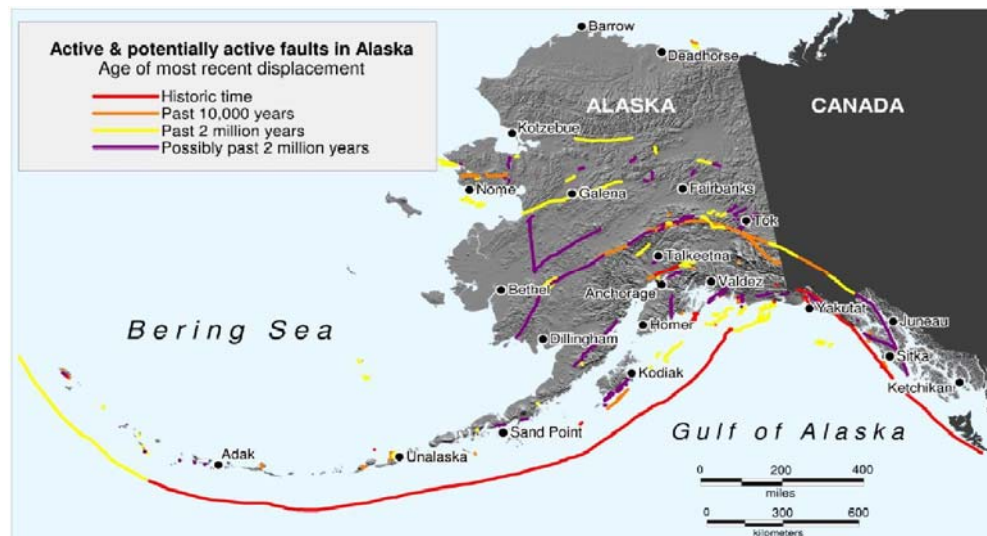
significant damage occurred from this event. However, North America's strongest recorded earthquake occurred on March 27, 1964 in Prince William Sound, measuring M 9.2 and was felt by many residents throughout Alaska. Quinhagak felt ground motion resulting from this historic event; however, no local damage occurred.

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

#### Location

The entire geographic area of Alaska, and thus the City of Quinhagak, is prone to earthquake effects.

Figure 5-1 shows the locations of active and potentially active faults in Alaska.



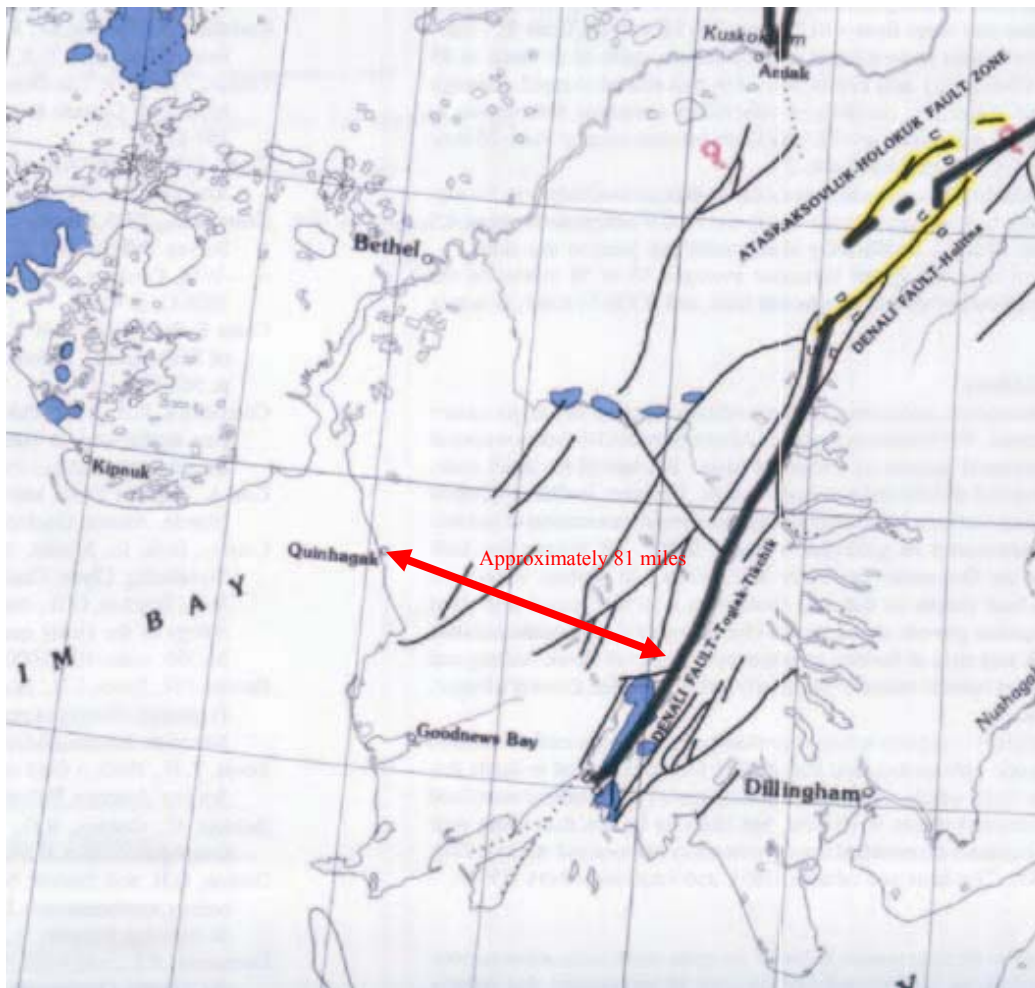
**Figure 5-1 Active and Potentially Active Faults in Alaska**

The Department of Geological and Geophysical Survey (DGGS) Neotectonic Map of Alaska depicts Alaska's known earthquake fault locations. DGGS states,

*"The Neotectonic Map of Alaska is the most comprehensive overview of Alaskan Neotectonics published to date; however, users of this map should be aware of the fact the map represents the author's understanding of Alaskan Neotectonics at the time of publication. Since publication of the Neotectonic map, our understanding of Alaskan Neotectonics has changed and earthquakes have continued to occur. For example, M7.9 Denali fault earthquake ruptured three faults, including the Susitna Glacier fault, which was previously undiscovered..."* (DGGS 2009).

The western extent of the Denali Fault is located about 81 miles southeast of the City and comprises a fault system of smaller faults running northeast by southwest along the Kuskokwim Mountains. The City lies west by northwest of the Denali Fault-Togiak-Tikchik and south by south west of the Ataskaksovluk-Holokuk Fault Zone. The City can expect to be impacted by future earthquake events (DGGS 2009).

Of the six recorded earthquakes since 1973, none exceeded M 5.0. (USGS 2009) They both occurred with the epicenter located between 54 and 91 miles from the City.



**Figure 5-2** Image from the “Neotectonic Map of Alaska” – Quinhagak Area (DGGs 2009)

### Extent

Earthquakes felt in the Quinhagak area have not exceeded M 4.4 in the past 37 years, and damage has never been reported due to an earthquake event.

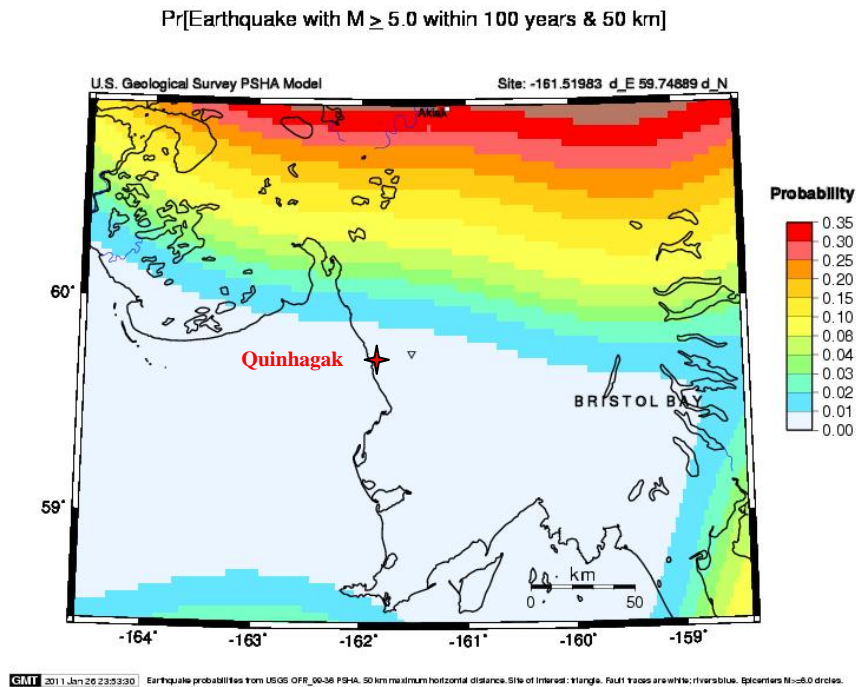
Based on historic earthquake events and the criteria identified in Table 5-3, the magnitude and severity of earthquake impacts in the City are considered negligible with minor injuries, the potential for critical facilities to be shut down for less than 24 hours, less than 10 percent of property or critical infrastructure being severely damaged, and little to no permanent damage to transportation or infrastructure or the economy.

### Impact

The City is located in an area that is less active than others in the State, although the effects of earthquakes centered elsewhere are expected to be felt in the City. Impacts to the community such as significant ground movement that may result in infrastructure damage are not expected. Minor shaking may be seen or felt based on past events. Impacts to future populations, residences, critical facilities, and infrastructure are anticipated to remain the same.

## Probability of Future Events

The City has no official record of significant earthquake activity resulting in damage or injuries. While it is not possible to predict when an earthquake will occur, Figure 5-3 was generated using the United States Geological Survey (USGS) Earthquake Mapping model and indicates less than a 0.01percent probability of an M 5.0 or greater earthquake occurring within 100 years and 100 miles of the City. Therefore it is expected that an event is unlikely, but possible within the next 10 years.



**Figure 5-3 Quinhagak's Earthquake Probability (USGS 2009)**

This 2002 shake map is the most current map available for this area. However, it is a viable representation to support probability inquiries. According to Peter Haeussler, USGS, Alaska Region:

*"The occurrence of various small earthquakes does not change earthquake probabilities. In fact, in the most dramatic case, the probability of an earthquake on the Denali fault was/is the same the day before the 2002 earthquake as the day afterward. Those are time-independent probabilities. The things that change the hazard maps is changing the number of active faults or changing their slip rate."* (Haeussler, 2009).

## 5.3.2 Erosion

### 5.3.2.1 Nature

Erosion rarely causes death or injury. However, erosion causes the destruction of property, development and infrastructure. Erosion is the wearing away, transportation, and movement of land. It is usually gradual but can occur rapidly as the result of floods, storms or other event or



slowly as the result of long-term environmental changes such as melting permafrost. Erosion is a natural process, but its effects can be exacerbated by human activity.

Coastal and riverine erosion are problems for communities where disappearing land threatens development and infrastructure. Coastal erosion is a major erosion threat to the City as it threatens the embankment, structures, and utilities of Quinhagak's residents.

Coastal erosion, sometimes referred to as tidal, bluff, or beach erosion, may other times encompass different categories altogether. For this profile, tidal, bluff and beach erosion will be nested within the term erosion.

Coastal erosion is the attrition of land resulting in loss of beach, shoreline, or dune material from natural activity or human influences. Coastal erosion occurs over the area roughly from the top of the bluff out into the near-shore region to about the 30 feet water depth. It is measured as the rate of change in the position or horizontal displacement of a shoreline over a period of time. Bluff recession is the most visible aspect of coastal erosion because of the dramatic change it causes to the landscape. As a result, this aspect of coastal erosion usually receives the most attention.

The forces of erosion are embodied in waves, currents, and winds on the coast. Surface and ground water flow, and freeze-thaw cycles may also play a role. Not all of these forces may be present at any particular location. Coastal erosion can occur from rapid, short-term daily, seasonal, or annual natural events such as waves, storm surge, wind, coastal storms, and flooding, or from human activities including boat wakes and dredging. The most dramatic erosion often occurs during storms, particularly because the highest energy waves are generated under storm conditions.

Coastal erosion may also be due to multi-year impacts and long-term climatic change such as sea-level rise, lack of sediment supply, subsidence, or long-term human factors such as aquifer depletion or the construction of shore protection structures and dams.

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

Attempts to control erosion using shoreline protective measures such as groins, jetties, seawalls, or revetments can lead to increased erosion however the City Council feels that "no action leads to increased damages". Inaction has resulted in loss of the old airfield; the sewage lagoon is presently threatened. It is imperative that actions be taken to protect potential loss of these essential infrastructures.

Land surface erosion results from flowing water across road surfaces due to poor or improper drainage during rain and snowmelt run-off which typically result from fall and winter sea storms.

### **5.3.2.2 History**

As previously stated, the City of Quinhagak's Comprehensive Development Plan (QCDP) sites several incidents where erosion has impacted the City adjacent to the Kanektok River. Over the past 40 years substantial infrastructure was destroyed or relocated due to the severity of those impacts (QCDP 2010). The QCDP further states,

- *“There is substantial erosion on the banks of the Kanektok River at the location of the old airport. It is also threatening the Cleaveland family's home.*
- *Erosion is taking its toll on the city dock and harbor area.*
- *The "Old Village" continues to lose ground. It has already lost the cemetery and several houses have been moved so they would not fall into the river.*
- *The traditional fish drying rack area is experiencing considerable erosion.*
- *There is a concern over the loss of cultural artifacts and history to the forces of erosion” (QCDP 2010).*

Research shows that the Army Corp of Engineers (USACE) did not receive any response from Quinhagak during their USACE’s 2009 Baseline Erosion Assessment.

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

#### **Location**

The City’s Comprehensive Plan, 1996 states, “There is substantial erosion on the banks of the Kanektok River [near] the old airport [and] threatens the Cleaveland family’s home... the City dock and harbor area... the traditional fish drying rack area... The “Old Village” continues to lose ground. It has already lost the cemetery and several houses have been moved so they would not fall into the river. There is a concern over the loss of cultural artifacts and history to the forces of erosion” (QCDP 2010)

Mayor Willard Church shared more concerns during a phone interview. He stated that, “Quinhagak experiences ocean generated storm surge because the community is located on the south side of Kuskokwim Bay within a mile of the Bering Sea. The embankment along a three mile stretch of the Kanektok River east and west of the old airport is rapidly eroding because the storms’ melt the permafrost. This location is vital to the community because it is the proposed site of a new water pick-up system” (QPT 2011).

The NRCS Trip Report dated September 10, 2004 provides detailed erosion threat information obtained during travels to the area to “assist the Native Village of Kwinhagak with various concerns along the Kanektok River.” The report listed the following locational concerns:

- 1. The first area of concern shown to us is the riverbank adjacent to the “Old” Airport. (This airport is a 2600’ x 60’ gravel strip. A new longer airstrip is scheduled to be commissioned by the end of 2004. Until the new airstrip is commissioned, the “Old” airstrip is the primary means of access to emergency medical care, goods and services.) The airstrip has been protected by sandbagging the bank for about 11 years. The Village has purchased the sandbags and installed them with its own discretionary funds, which are scarce due to the small tax base. The village has not been successful in seeking reimbursement from Alaska Department of Transportation/Public Facilities.*

*The river is said to be 3-4 feet deep in the shallow areas and 6-7 feet deep in the pools. The concern is once the new airport is commissioned, there will be less incentive to repair the “old” airstrip, it will continue to erode and once it breeches, the river will flow directly behind the school and into the village. As previously stated, the river was captured by an off-channel gravel mine during a flood approximately 15 years ago. The river hits the riverbank/airstrip at about 40° and then flows parallel to the airstrip for approximately 600 feet. During high flow events, primarily occurring in the spring, the bank erodes. During normal to low flow periods, boat wakes play a*

*primary role in undercutting the bank. The typical boat used by local residents is a 16' to 18' skiff with a 40 horsepower motor. The boats used by guides to transport clients typically use a 45 to 90 horsepower motor. The bank height along this reach varies from 3' to 6' above channel forming flow. The channel depth in this reach is estimated to be as deep as 6 to 7 feet.*

*There is a concrete slab at the old airport apron which used to be a floor of a hangar. The slab continues to undercut, leaving debris of rebar and concrete in the river. Downstream of the apron is Ham Cleveland's home which is within 30 feet of the riverbank and is the downstream extent of the erosion. Mr. Cleveland's home has been flooded during periods of high water.*

- 2. The second area of concern is the point at the Old Village. The elders say the ground is sinking. This old section of the village is impacted by high tides and storm surges. In the past forty years an old cemetery has been lost and three houses moved. Fish drying racks and fish smoking sheds have all been lost or relocated due to the lost ground. There are seven houses remaining in the old village. One of these houses was moved 100' away from the banks and is now within 50 feet. Along with getting shorter, the point is getting narrower and more flood prone. The upper banks are composed of saturated silt bound together by the beach grass roots.*
- 3. The third area of concern is the City Dock. The dock is constructed of a sheet pile retaining wall and gravel fill. It was built 10 years ago. The reflected waves from the dock have eroded gravel fill and native soil material from both ends of the dock area. The dock is 6' to 10' high. The area eroded at either end is approximately 35' to 50' long. The dock is critical to the community's and region's economic stability as the fishermen offload their catch at the dock. Fuel is delivered and dispersed from the dock as well. The other problem occurring in the area of the dock is that the slough in front of the dock is very shallow at low tide and sometimes shallow at high tide. This make access difficult both for fishermen and even more so for barges.*
- 4. The fourth area of concern is the traditional fish drying rack area. The area has seen considerable erosion. It is upstream of the point in the old village but still in the intertidal zone. This area has eroded approximately 30 feet in the last 20 years. The erosion occurs primarily during high water. Another significant factor contributing to the moving of the fish racks is because of water quality concerns in this area. A slough that runs through this area carries drainage from the sewage lagoon and the lagoon is believed to be leaking. During periods of high flow, the odor and color of flow is apparently distinct. Another lagoon is to be constructed within the next couple of years, but it is not clear what the plans are for decommissioning or sealing this lagoon. There is concern the new lagoon has been sited too close to the beach...*

*There has been, and continues to occur, substantial erosion along the banks of the Kanektok River. Most notable is the erosion on the banks of Kanektok River at the location of the old airport. The old airport was decommissioned in 2004 because of the rate and magnitude of erosion. This situation is exacerbated during the spring months when the river is at its highest and swiftest levels.*

*Erosion is also taking its toll on the City Dock and harbor area. The peninsula of land between the harbor and the Kuskokwim Bay continues to narrow due to erosion. Should this fail, the city dock and harbor will not be sheltered from open waters. Additionally, more materials from erosion will fill the harbor rendering it non-navigational.*

*On the right bank of the harbor is the "Old Village" which is in a precarious situation. The Old Village is impacted by high tides and storm surges. In the past forty years the old cemetery has been lost and houses have had to be moved to escape falling into the river.*

*Fish drying racks and fish-smoking sheds, located a little further up the river, have been lost or moved due to erosion...*

*The existing drainage system throughout the Native Village of Kwinhagak is not adequate to eliminate heavy ponding along the roads. The roadside ponding not only erodes the road embankment but also contributes to an unstable road subgrade. High traffic volume intersections, including those recently upgraded, are eroding and showing excessive wear on their inside corners, due to runoff and ATV traffic" (NRCS 2004).*

Figure 5-4 depicts the intertidal floodplain and wetlands which directly influence water related impacts to the City's infrastructure.



**Figure 5-4      Aerial Photo of Kwinhagak's Intertidal Floodplain (DCRA 2011)**

### **Extent**

A variety of natural and human-induced factors influence the erosion process within the community. Coastal orientation and proximity to ocean waves, currents, and storm surges can influence erosion rates. Embankment composition also influences erosion rates, as sand and silt will erode easily, whereas boulders or large rocks are more erosion resistant. Other factors that may influence coastal erosion include:

- Shoreline type
- Geomorphology
- Structure types along the shoreline

- Amount of encroachment in the high hazard zone
- Proximity to erosion inducing coastal structures
- Nature of the coastal topography
- Density of development
- Elevation of coastal dunes and bluffs
- Shoreline exposure to wind and waves

Climate change may also play a part in increasing coastal erosion. Rising sea levels and retreating sea ice may leave stretches of coastline open to increased exposure to wave action during normal and winter storm conditions.

Based on the City's QCDP, past erosion events, and the criteria identified in Table 5-3, the magnitude and severity of erosion impacts in the City are considered "limited" with potential for critical facilities to be shut down for more than a week, and more than 10 percent of property or critical infrastructure being severely damaged.

### **Impact**

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

The Old Village experiences high tide and storm surge impacts during the past 40 years. The old cemetery, homes, and subsistence materials and equipment have been lost during significant events (QCDP 2010).

DCRA funded two erosion control protection grants in 1994 totaling \$231,316 (DCRA 2011). The City Council emphatically expressed they overwhelmingly believe that "no action leads to increased damages". Inaction and project development delays have resulted in infrastructure losses that could have been avoided. It is imperative that the threatened sewage lagoon and water infiltration gallery have mitigation actions developed to assure their longevity. Loss of these critical infrastructures creates a strain on the community.

### **Probability of Future Events**

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

### 5.3.3 Flood

#### 5.3.3.1 *Nature*

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

Flood events not only impact communities with high water levels, or fast flowing waters, but sediment transport also impacts infrastructure and barge and other river vessel access limitations. Dredging may be the only option to maintain an infrastructure's viability and longevity.

Four primary types of flooding occur in the City: rainfall-runoff, snowmelt, storm surge, and ice override floods.

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

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

**Storm Surges**, or coastal floods, occur when the sea is driven inland above the high-tide level onto land that is normally dry. Often, heavy surf conditions driven by high winds accompany a storm surge adding to the destructive-flooding water's force. The conditions that cause coastal floods also can cause significant shoreline erosion as the flood waters undercut roads and other structures. Storm surge is a leading cause of property damage in Alaska.

The meteorological parameters conducive to coastal flooding are low atmospheric pressure, strong winds (blowing directly onshore or along the shore with the shoreline to the right of the direction of the flow), and winds maintained from roughly the same direction over a long distance across the open ocean (fetch).

Communities that are situated on low-lying coastal lands with gradually sloping bathymetry near the shore and exposure to strong winds with a long fetch over the water are particularly susceptible to coastal flooding. Several communities and villages along the Bristol Bay coast, the Bering Sea coast, the Arctic coast, and the Beaufort Sea coast have experienced significant damage from coastal floods over the past several decades. Most coastal flooding occurs during the late summer or early fall season in these locations. As shorefast ice forms along the coast before winter, the risk of coastal flooding abates, but, later freeze-ups greatly increase the risk of erosion, storm surge flooding and ice override events.

**Ice Override** is a phenomenon that occurs when motion of the sheet ice is initiated by wind stress acting on the surface of ice that is not confined. Onshore wind, coupled with conditions such as a smooth gradual sloping beach and high tides can cause ice sheets to slide up or "override" the beach and move inland as much as several hundreds of feet. Ice override typically occurs in fall and early winter (though events have been reported at other times) and is usually associated with coastal storms and storm surge but may also happen in calm weather.

Override advances are slow enough to allow people to move out of its path, and therefore poses little immediate safety hazard. Intact sheets of ice up to several feet thick moving into buildings or

across roads and airports can however cause structural damage and impede travel. Shoreline protection in the form of bulkheads or other structures to break-up the ice can limit the movement of ice. In at least one occasion, a bulldozer was able to break-up the ice and prevent damage.

### Timing of events

Many floods are predictable based on rainfall patterns. Most of the annual precipitation is received from April through October with August being the wettest. This rainfall leads to flooding in early/late summer and/or fall. Spring snowmelt increases runoff, which can cause flooding. It also breaks the winter ice cover, which causes localized ice-jam floods.

#### 5.3.3.2 History

According to the City's Comprehensive Plan, "Floods were reported in 1978 and 1989. The 1978 flood reached an elevation of 86.5 feet, approximately 9.0 feet above sea level. Based on the 1978 flood, the COE recommends that the minimum building elevation should be 88.5 feet (11.0 feet above the mean sea level)" (QCDP 2010).

The USACE Statewide Barge Landing Assessment stated,

*"The barge operators also report that in general, the communities on the lower Yukon and Kuskokwim River areas have the most difficult landings, and are most in need of improvements. Especially problematic are those that have marginal permafrost, soft soils and high erosion rates, as well as low-lying villages with boardwalks and utilities close to the shoreline that get in the way of offloading operations. The report finds that improvements at these sites would generally consist of ramps and/or docks, stabilized staging pads, and barge mooring points..."*

*Barge operators and other users indicate that the needed landing facility improvements (not including fuel system upgrades) in order of priority are:*

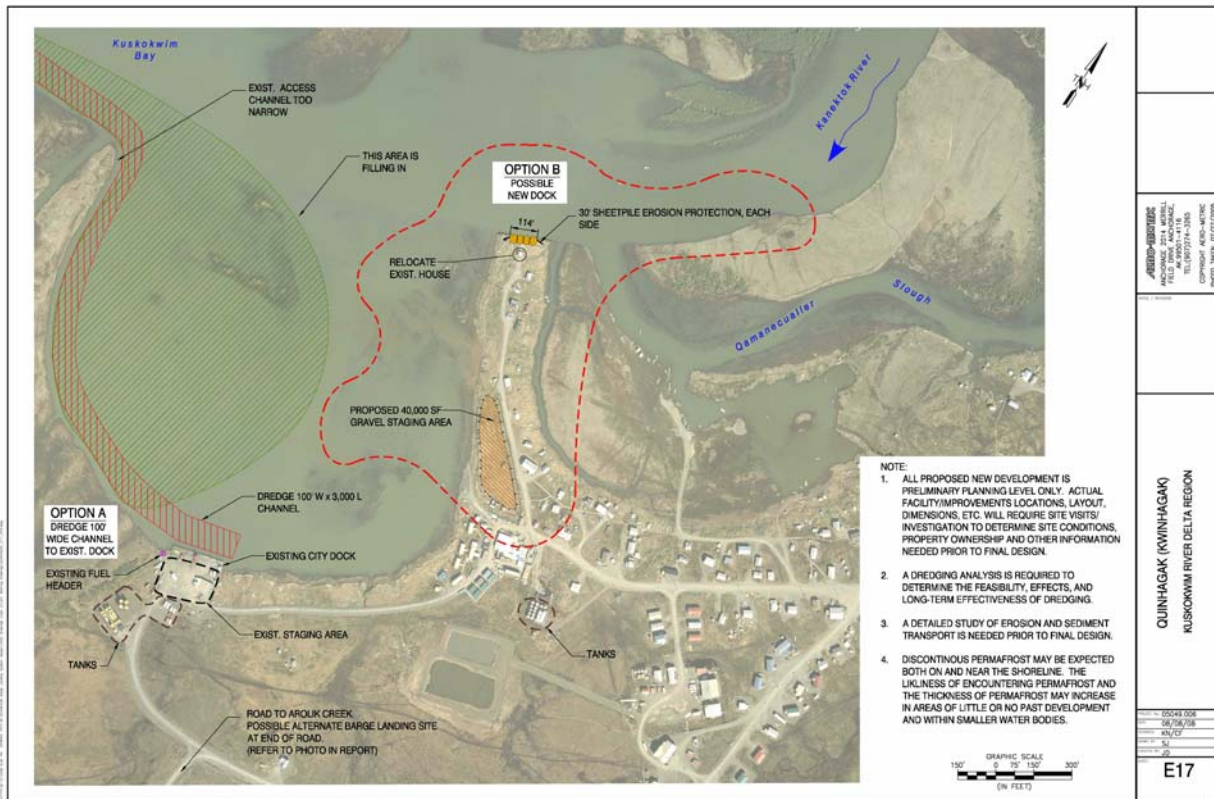
- (1) Installing mooring points with chains for tie-offs*
- (2) Upland staging areas/gravel pads for freight operations*
- (3) Dredging for access to shallow areas or for navigation safety (i.e., removing specific boulder hazards)*
- (4) A dedicated landing site including permanent ramps and/or bulkhead docks with erosion protection*
- (5) Minor repairs to existing facilities such as dock repairs, widening, grading or repairing landings, erosion protection, road widening, and staging area improvements...*

*Five or so communities in the proposed project list require minor dredging such as boulder/hazard removal to improve access to landing sites. An additional seven communities were identified as possibly benefiting from more involved dredging in order to maintain safe, all-tide access to the sites or to eliminate the need for lightering to shore. One of these sites, Quinhagak, was cited by one operator as needing immediate emergency dredging in order to allow continued fuel deliveries..." (USACE 2008).*

The barge landing study listed Quinhagak with two barge landing improvement options. Option A would potentially fund dredging the current dock's access channel. Option B would potentially fund constructing a new dock location where access is not a problem. Two potential sites were identified in the report. (USACE 2008).



Figure 5-5 shows Option A and Option B locations.



**Figure 5-5 Quinhagak Dredging Location (USACE 2008)**

The City experiences severe damages from heavy rainfall, snowmelt, and spring run-off flooding. Spring run-off causes the most damages. The old airport, residential structures, fish camps and other community infrastructure have been damaged or destroyed by these events.

Fall storm surge also exacerbates flooding and erosion damages, changes channel flow, and even reroutes the adjacent rivers and sloughs.

The US Army Corp of Engineers reported “There is a river gauge in the community. Significant floods have been reported since 1925. Most floods are ice-jam floods. The 1945 ice-jam flood destroyed most of the community. The flood of record is 1971 ice-jam flood, which reached an elevation of 134.7 ft (mean sea level [MSL]) at ‘Old Town.’ Floodwaters were approximately 8 ft deep” (USACE 2009).

The National Weather Service continued to modify their system for assigning weather zones to facilitate and more accurately confine weather patterns to relevant geographic areas. Consequently the data in Table 5-6 reflects different zone numbering patterns. Each weather event may not have specifically impacted the City but they are listed due to the City’s close proximity to listed communities or by location within the identified zone.



**Table 5-6 Historic Flood Events (NWS)**

Location	Date	Event Type	Magnitude
Countywide	11/13/2000	Storm Surge	Strong hurricane force storm with peak winds reaching 63 miles per hour (mph) (55 knots [kts]), heavy rains, and high tides. Coastal flooding caused significant damage to several locations. \$500K damages
AKZ155 - 161	9/4/2001	Flood	Coastal flooding. Water reached close to vegetation line along parts of the southwest Alaska Coast \$7K damages
Countywide	9/12/2002	Storm Surge	Strong winds in Bristol Bay and Kuskokwim Delta zone. (\$1K damages)
AKZ155 - 161	12/9/2003	Storm Surge	Coastal storm surge along the Yukon and Kuskokwim Delta and northern Bristol Bay
AKZ155	9/9/2004	Flood	Coastal storm surge resulting in minor coastal flooding along the Kuskokwim Delta
AKZ155	10/18/2004	Flood	Hurricane force wind produced a storm surge and high tides caused coastal flooding and beach erosion. \$22K damages
AKZ155	11/19/2004	Flood	Strong southeasterly winds combined with high astronomical tide, resulted in coastal flooding
AKZ155	9/22/2005	Flood	Strong southwest wind with storm surge and high tides, all low lying areas flooded at Quinhagak
AKZ155 - 161	9/6/2006	Coastal Flood	Storm surge and the very high tides produced minor coastal flooding along the Bristol Bay coast and the Kuskokwim Delta coast
AKZ155 - 161	10/10/2006	Coastal Flood	Extremely heavy rainfall, very warm air resulted in excessive snow melt that contributed to the flooding
AKZ155	10/15/2006	Coastal Flood	Strong south to southwest wind produced surge along the Kuskokwim Delta coast
AKZ155	1/30/2007	High Wind, tidal overflow	Storm caused wide spread power outages in the Kuskokwim Delta, damaged roofs two houses, two houses shifted on their foundation and minor tidal overflow along Kuskokwim Bay. Wind 78 mph (68 kts) \$100K damages

(Albanese 2011, NWS 2011, DHS&EM 2010)

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

#### Location

The City's Comprehensive Plan states,

*"The land surrounding Quinhagak is a flat, low-lying coastal plain characterized by intertidal areas, and swampy floodplains. Developed areas of the community are relatively flat. Surrounding areas range in elevation from less than 10 feet to approximately 22 feet above mean sea level. Numerous shallow lakes, ponds and streams of various sizes dominate the landscape.*

*The materials underlying the city are typical of the area and include coastal deposits of inter-layered alluvial and marine sediments and coastal delta deposits. The existing airport rests on alluvial deposits in the floodplain of the Kanektok River. To the south of the community are marine beach and thawed lacustrine deposits.*

*Groundwater can be expected at fairly shallow depths within thawed areas of the flood plain and at depths of 150 feet or more, in areas with permafrost.*

*The City of Quinhagak is adjacent to the floodplain of the Kanektok River. The U.S. Army Corps of Engineers rates flood hazards in the Quinhagak area as high noting that the*

*Kanektok River is subject to constantly changing channels and severe bank erosion” (QCDP 2010).*

The USACE, Floodplain Management Flood Hazard Data report states “Spring breakup generally does not cause flooding. However, river levels rise significantly three to four weeks after spring breakup due to snow melt in the mountains. The river at times floods the airport road due this rise.”

There is one temporary benchmark (TBM) located on the front porch of the new Quinhagak School, at an assumed elevation of 100 ft. (USACE 2011).

The USACE reported the structure elevations depicted in Table 5-7 were accurate as of July 1994

**Table 5-7 USACE Community Flood Survey Elevations**

Description	Elevations
1978 flood level (flood of record)	86.5
Recommended building elevation	88.5
First floor of the clinic	95.4
Front doorsill of the city office building	94.4
Front porch (1st floor) of the city power plant	95.1
Bottom of fuel tanks (near power plant)	92.7
Center of doorsill of the old Moravian Church	90.7

### **Extent**

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

The following factors contribute to riverine flooding frequency and severity:

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

The USACE has reported is one temporary benchmark within the City and recommended structure elevations based on the 1978 flood of record. The City has used the TBM to ensure they construct any new structures or infrastructure well above the recommended base flood elevation

(BFE) to minimize flood impact damages. Table 5-7 demonstrates that the City has surpassed the recommended building elevation for the identified structures by at least two feet.

The City's location adjacent to the very serpentine Kanektok River and the intertidal zone combined with the Kanektok's changing navigational channel limits access to the City dock. This is mainly due to riverine sediment transport. Delivery barges, commercial fishing vessels, and subsistence harvesters sustain damage from groundings as they attempt to navigate these shallow waters. The City dock is located within a tidally influenced Oxbow which continuously collects riverine sediments and debris. Figure 5-6 depicts historical river courses and sediment accumulation at the Kanektok River's mouth.



**Figure 5-6** Quinhagak's Limited Water Access (Denali 2010)

Figure 5- 7 on the following page depicts the City's surrounding wetlands and its susceptibility to flooding.



**Figure 5-7**      **Quinhagak Wetlands** (Denali 2010)

### **Impact**

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

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

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

Impacts and problems also related to flooding are deposition and stream bank erosion (erosion is discussed in detail in Section 5.3.2). Deposition is the accumulation of soil, silt, and other particles on a river bottom or delta. Deposition leads to the destruction of fish habitat, presents a challenge for navigational purposes, and prevents access to historical boat and barge landing areas. Deposition also reduces channel capacity, resulting in increased flooding or bank erosion. Stream bank erosion involves the removal of material from the stream bank. When bank erosion is excessive, it becomes a concern because it results in loss of streamside vegetation, loss of fish habitat, and loss of land and property (BKP 1988).

### **Probability of Future Events**

Based on previous occurrences, USACE Floodplain Manager's report, and criteria in Table 5-2, there is a 1 in 1 year chance of occurring (1/1=100 percent). History of events is greater than 33 percent likely per year. There is no data identifying a 500-year (0.2 percent chance of occurring in a given year) flood threat in Quinhagak.

#### **5.3.4 Ground Failure (Landslide, Subsidence, Unstable Soils)**

##### **5.3.4.1 *Nature***

Ground failure describes gravitational soil movement. Soil movement influences can include rain snow and/or water saturation, seismic activity, melting permafrost, river or coastal embankment undercutting, or a combination of conditions on steep slopes.

Landslides are a dislodgment and fall of a mass of soil or rocks along a sloped surface, or for the dislodged mass itself. The term is used for varying phenomena, including mudflows, mudslides, debris flows, rock falls, rockslides, debris avalanches, debris slides, and slump-earth flows. The susceptibility of hillside and mountainous areas to landslides depends on variations in geology, topography, vegetation, and weather. Landslides may also be triggered or exacerbated by indiscriminate development of sloping ground, or the creation of cut-and-fill slopes in areas of unstable or inadequately stable geologic conditions.

Additionally, landslides often occur with other natural hazards, thereby exacerbating conditions, such as:

- Earthquake ground movement can trigger events ranging from rock falls and topples to massive slides.
- Intense or prolonged precipitation that causes flooding can also saturate slopes and cause failures leading to landslides.
- Wildfires can remove vegetation from hillsides significantly increasing runoff and landslide potential.

Development, construction, and other human activities can also provoke ground failure events. Increased runoff, excavation in hillsides, shocks and vibrations from construction, non-engineered fill places excess load to the top of slopes, and changes in vegetation from fire, timber harvesting and land clearing have all led to landslide events. Broken underground water mains can also saturate soil and destabilize slopes, initiating slides. Something as simple as a blocked culvert can increase and alter water flow, thereby increasing the potential for a landslide event in an area with high natural risk. Weathering and decomposition of geologic material, and alterations in flow of surface or ground water can further increase the potential for landslides.

The USGS identifies six landslide types, distinguished by material type and movement mechanism including:

- **Slides**, the more accurate and restrictive use of the term landslide, refers to a mass movement of material, originating from a discrete weakness area that slides from stable underlying material. A *rotational slide* occurs when there is movement along a concave surface; a *translational slide* originates from movement along a flat surface.
- **Debris Flows** arise from saturated material that generally moves rapidly down a slope. A debris flow usually mobilizes from other types of landslide on a steep slope, then flows through confined channels, liquefying and gaining speed. Debris flows can travel at speeds of more than 35 mph for several miles. Other types of flows include debris avalanches, mudflows, creeps, earth flows, debris flows, and lahars.
- **Lateral Spreads** are a type of landslide generally occurs on gentle slope or flat terrain. Lateral spreads are characterized by liquefaction of fine-grained soils. The event is typically triggered by an earthquake or human-caused rapid ground motion.
- **Falls** are the free-fall movement of rocks and boulders detached from steep slopes or cliffs.
- **Topples** are rocks and boulders that rotate forward and may become falls.
- **Complex** is any combination of landslide types.

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

Permafrost melting (or degradation) occurs naturally as a result of climate change, although this is usually a very gradual process. Thermokarst is the process by which characteristic land forms result from the melting of ice-rich permafrost. As a result of thermokarst, subsidence often creates depressions that fill with melt water, producing water bodies referred to as thermokarst lakes or thaw lakes.

Human induced ground warming can often degrade permafrost much faster than natural degradation caused by a warming climate. Permafrost degradation can be caused by constructing warm structures on the ground surface allowing heat transfer to the underlying ground. Under this scenario, improperly designed and constructed structures can settle as the ground subsides, resulting in loss of the structure or expensive repairs. Permafrost is also degraded by damaging the insulating vegetative ground cover, allowing the summer thaw to extend deeper into the soil causing subsidence of ice-rich permafrost, often leading to creation of thermokarst water bodies. Evidence of this type of degradation can be seen where thermokarst water bodies are abundant in the ruts of an old trail used by heavy equipment (cat trails) or where roads or railroads constructed by clearing and grubbing have settled unevenly. (Subsidence, liquefaction, and surface faulting are described in Section 5.3.1.1).

Seasonal freezing can cause frost heaves and frost jacking. Frost heaves occur when ice forms in the ground and separates sediment pores, causing ground displacement. Frost jacking causes

unheated structures to move upwards. Permafrost is frozen ground in which a naturally occurring temperature below 32°F has existed for two or more years. Permafrost can form a stable foundation if kept frozen but when thawed; the soil weakens and can fail. Approximately 85 percent of Alaska is underlain by continuous or discontinuous permafrost. (DHS&EM 2010).

Indicators of a possible ground failure include:

- Springs, seeps, or wet ground that is not typically wet
- New cracks or bulges in the ground or pavement
- Soil subsiding from a foundation
- Secondary structures (decks, patios) tilting or moving away from main structures
- Broken water line or other underground utility
- Leaning structures that were previously straight
- Offset fence lines
- Sunken or dropped-down road beds
- Rapid increase in stream levels, sometimes with increased turbidity
- Rapid decrease in stream levels even though it is raining or has recently stopped and
- Sticking doors and windows, visible spaces indicating frames out of plumb

The State of Alaska 2010 State Hazard Mitigation Plan provides additional ground failure information defining mass movement types, topographic and geologic factors which influence ground failure which pertain to Quinhagak.

### 5.3.4.2 History

There are few written records defining ground failure impacts. Those few are cited in this plan. However, Project Team Members stated that,

*“...technology is not preventing continuous and pervasive permafrost damages. The City has spent millions of dollars during the construction of its community building, installing thermal rods and other ‘technology’ and this expensive building is destroying itself by settling, twisting, and turning...the recently completed airport runway has a dip across the middle....when planes land, they bounce into the air giving the passengers quite a ride...roads throughout the community are sinking into the adjacent tundra with the new road surface equal to the height of the neighboring tundra.... The City is built upon discontinuous tundra – we can suggest better construction methods but no one will listen to our ideas... (Quinhagak 2011).*

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

#### Location

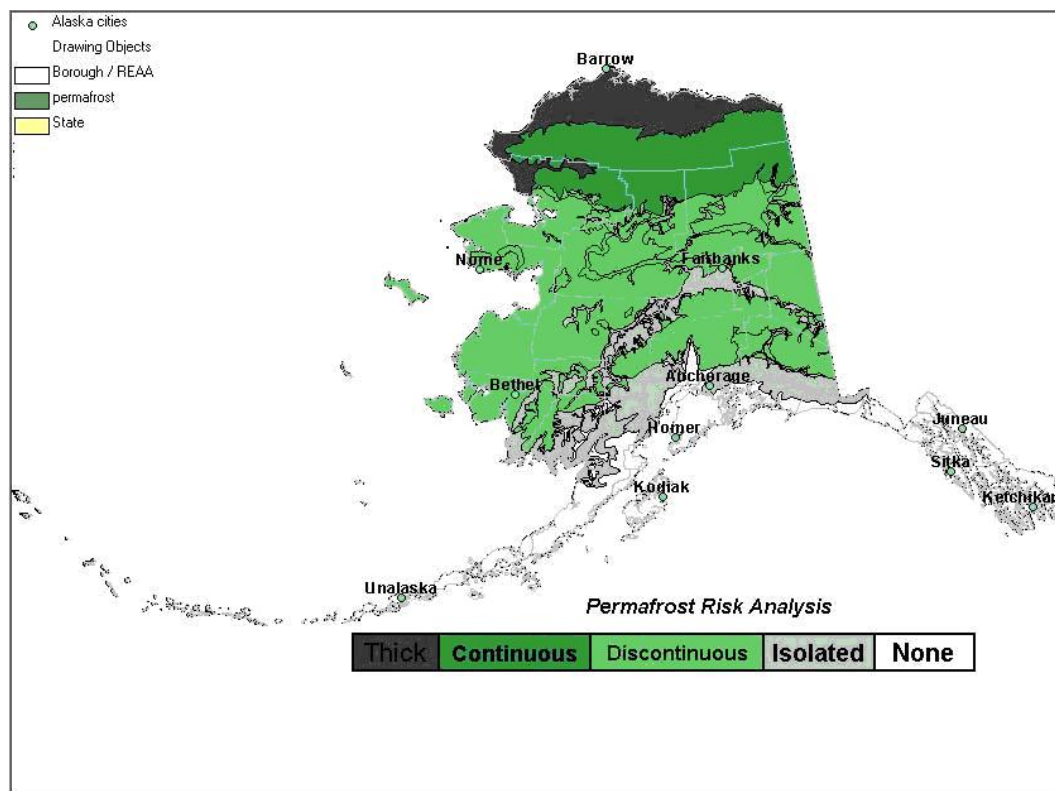
The City is located in an area of discontinuous permafrost. As described in their Community Development Plan:



*“...The Delta Tundra soils within the community are characterized by organic material over saturated silts with shallow discontinuous permafrost. A typical soil sample in the Quinhagak area has a foot or more of peat overlying saturated silts and permafrost. The permafrost is typically ice rich and relatively warm. The depth to permafrost varies depending on soil type and other localized factors but can usually be found within 4 feet of the surface and may extend for several hundred feet. When thawed, the soils are typically saturated...”*

*The Quinhagak Clinic, built in 1999, is a 1684 SF clinic within a larger Multi-use Community Building housing the washeteria, offices, and public sauna space. The building was built with using thermosyphons placed intermittently in the substrate in the gravel pad. Due to significant saturation of the surround soils with moisture due to poor drainage, the building has major settling and foundation problems... The structure is wood frame construction on a concrete slab on grade with gravel pad over tundra with sloped horizontal thermosyphons running in the gravel pad and radiators on the back of the buiding above grade.” (QCDP 2010).*

According to permafrost map (Figure 5-8) completed by the Department of Natural Resources, Division of Geological and Geophysical Survey (DNR/DGGS) located in the State Hazard Mitigation Plan (SHMP) (DHS&EM 2007), the City’s Comprehensive Plan, and comments received from the Project Team, the entire City is underlain by discontinuous permafrost.



**Figure 5-8 DGGS Permafrost Map of Alaska (DHS&EM 2007)**



### **Extent**

The damage magnitude could range from minor with some repairs required and little to no damage to transportation, infrastructure, or the economy to major if a critical facility (such as the airport) were damaged and transportation was effected.

Based on research and the Project Team's knowledge of past ground failure and permafrost degradation events and the criteria identified in Table 5-3, the extent of ground failure impacts in the City are considered limited. Impacts would not occur quickly but over time with warning signs. Therefore this hazard would not likely cause injuries or death, neither would it shutdown critical facilities and services. However, 10 percent of property is could be severely damaged.

### **Impact**

Impacts associated with degrading permafrost include surface subsidence, infrastructure, building, and/or road damage. Ground failure does not pose a sudden and catastrophic hazard but improperly designed and constructed buildings can settle as permafrost melts and the ground subsides, resulting in loss of the structure or expensive repairs. Permafrost restricts use of the ground surface, and affects road design and location, buildings, communities, pipelines, airfields, and bridges. To avoid costly damage to these facilities, careful planning and location and facility construction design is warranted.

The Project Team stated that the vast majority of their utility poles lean at precarious angle stressing power and telephone lines; roads are slowly sinking into the tundra, the airport runway has a major depression which spans across the width, almost all the homes and most of the structures suffer some form of ground failure impacts.

### **Probability of Future Events**

Even though there are few written records defining ground failure impacts for the City, the Project Team has solid evidence of their annually recurring permafrost damages throughout the community – to structures, roads, and the airport. The Project Team further stated the probability for permafrost occurring follows the criteria in Table 5-2, the probability of future damage resulting from permafrost is highly likely in the next calendar year (event has up to 1 in 1 years chance of occurring) as the history of events is greater than 33 percent likely per year (Quinhagak 2011).

### 5.3.5 Weather (Severe)

#### 5.3.5.1 *Nature*

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

- **Heavy Rain** occurs rather frequently over the coastal areas along the Bering Sea and the Gulf of Alaska. Heavy rain is a severe threat to Quinhagak.
- **Heavy Snow** generally means snowfall accumulating to four inches or more in depth in 12 hours or less or six inches or more in depth in 24 hours or less.
- **Drifting Snow** is the uneven distribution of snowfall and snow depth caused by strong surface winds. Drifting snow may occur during or after a snowfall.
- **Freezing Rain and Ice Storms** occur when rain or drizzle freezes on surfaces, accumulating 12 inches in less than 24 hours. Ice accumulations can damage trees, utility poles, and communication towers which disrupts transportation, power, and communications.
- **Extreme Cold** is the definition of extreme cold varies according to the normal climate of a region. In areas unaccustomed to winter weather, near freezing temperatures are considered “extreme”. In Alaska, extreme cold usually involves temperatures between -20 to -50°F. Excessive cold may accompany winter storms, be left in their wake, or can occur without storm activity. Extreme cold accompanied by wind exacerbates exposure injuries such as frostbite and hypothermia.
- **High Winds** occur in Alaska when there are winter low-pressure systems in the North Pacific Ocean and the Gulf of Alaska. Alaska’s high wind can equal hurricane force but fall under a different classification because they are not cyclonic nor possess other hurricane characteristics. In Alaska, high winds (winds in excess of 60 mph) occur rather frequently over the coastal areas along the Bering Sea and the Gulf of Alaska. High winds are a severe threat to Quinhagak.

Strong winds occasionally occur over the interior due to strong pressure differences, especially where influenced by mountainous terrain, but the windiest places in Alaska are generally along the coastlines.

(NWS 2011)

#### 5.3.5.2 *History*

The City is continually impacted by severe weather. For example, in late 2010 DHS&EM received a call from the Department of Environmental Conservation’s Division of Water’s Village Safe Water section, stating that “the water system in Quinhagak was in danger of freezing up and the water tank had only 4 feet left.” The City was able to find the problem and resolved it rather quickly preventing further damage to their system. This is the most recent event of prolonged cold spell causing the City’s water line to freeze leaving the community nearly without water.

Table 5-8 lists 95 major storm events the National Weather Service identified for Quinhagak’s Weather Zone (AKZ155). Each weather event may not have specifically impacted the City but they are listed due to the City’s close proximity to listed communities or by location within the identified zone.

**Table 5-8 Severe Weather Events**

Location	Date	Event Type	Magnitude
Countywide	11/13/2000	Storm Surge	Strong hurricane force storm with peak winds reaching 63 mph (55 kts), heavy rains, and high tides. Coastal flooding caused significant damage to several locations. \$500K damages
AKZ155	12/8/2000	High Wind	60 mph (52 kts)
AKZ155 - 161 - 171 - 181 - 185 - 191 - 195	12/11/2000	High Wind	75 mph (65 kts)
AKZ101 - 121 - 125 - 155 - 161 - 171	12/19/2000	High Wind	128 mph (111 kts), \$5K damages
AKZ101 - 155 - 161 - 171 - 181 - 185	1/25/2001	High Wind	135 mph (117 kts), \$100K damages
AKZ155 - 161 - 171 - 181 - 185 - 191	2/16/2001	High Wind	72 mph (63 kts)
AKZ155 - 181	4/10/2001	Blizzard	N/A
AKZ155 - 161	9/4/2001	Flood	\$7K damages
AKZ155	1/1/2002	Ice Storm	N/A
AKZ155 - 181	1/28/2002	Blizzard	N/A
AKZ155 - 181 - 195	2/13/2002	Blizzard	N/A
AKZ155 - 195	2/21/2002	Blizzard	N/A
AKZ155	3/12/2002	Blizzard	N/A
AKZ155	3/13/2002	High Wind	88 mph (77 kts)
AKZ155	3/15/2002	Blizzard	N/A
AKZ155	4/19/2002	Blizzard	N/A
Countywide	9/12/2002	Storm Surge	Strong winds in Bristol Bay and Kuskokwim Delta zone. (\$1K damages)
AKZ155	10/18/2002	Ice Storm	N/A
AKZ155	12/19/2002	Blizzard	N/A
AKZ155 - 161 - 181 - 191 - 195	1/6/2003	Blizzard	N/A
AKZ155	11/26/2003	Blizzard	N/A
AKZ155 - 161	12/9/2003	Storm Surge	N/A
AKZ155	12/26/2003	Blizzard	N/A
AKZ155	12/27/2003	Blizzard	N/A
AKZ155	2/7/2004	Blizzard	N/A
AKZ155	9/9/2004	Flood	N/A
AKZ155 - 161	10/10/2004	Blizzard	N/A
AKZ155	10/18/2004	Flood	Hurricane force wind produced a storm surge and high tides caused coastal flooding and beach erosion. \$22K damages

**Table 5-8 Severe Weather Events**

Location	Date	Event Type	Magnitude
AKZ125 - 131 - 135 - 155 - 161	11/2/2004	Blizzard	N/A
AKZ155 - 185	11/9/2004	Blizzard	N/A
AKZ155	11/19/2004	Flood	Strong southeasterly winds combined with high astronomical tide, resulted in coastal flooding
AKZ155	12/21/2004	Blizzard	N/A
AKZ155	9/22/2005	Flood	Strong southwest wind with storm surge and high tides, all low lying areas flooded at Quinhagak
AKZ155	11/16/2005	Blizzard	N/A
AKZ155	2/2/2006	Blizzard	N/A
AKZ155	2/25/2006	Blizzard	N/A
AKZ155	3/1/2006	Blizzard	N/A
AKZ155	3/11/2006	Blizzard	N/A
AKZ155	4/3/2006	Blizzard	N/A
AKZ155	4/7/2006	Blizzard	N/A
AKZ155 - 195	4/15/2006	Blizzard	N/A
AKZ155 - 161	9/6/2006	Coastal Flood	Storm surge and the very high tides produced minor coastal flooding along the Bristol Bay coast and the Kuskokwim Delta coast
AKZ155 - 161	10/10/2006	Coastal Flood	N/A
AKZ155	10/15/2006	Coastal Flood	Strong south to southwest wind produced surge along the Kuskokwim Delta coast
AKZ155	11/26/2006	Blizzard	Snow, strong wind, blizzard conditions
AKZ155 - 161	12/15/2006	Blizzard	Snow, strong wind, blizzard conditions
AKZ155	12/28/2006	Blizzard	Blizzard conditions across most of the central and eastern Bering Sea
AKZ155	1/9/2007	Blizzard	Gusty south winds, snow, and blowing snow; winds peaked at 56 mph (48 kts), visibilities reduced to near zero.
AKZ155	1/25/2007	Blizzard	Strong wind and snow, produced blizzard conditions
AKZ155	1/30/2007	High Wind	Storm caused wide spread power outages in the Kuskokwim Delta, damaged roofs two houses, two houses shifted on their foundation and minor tidal overflow along Kuskokwim Bay. Wind 78 mph (68 kts) \$100K damages
AKZ155	3/7/2007	Blizzard	N/A
AKZ155	3/26/2007	Blizzard	N/A
AKZ155	4/17/2007	Blizzard	N/A
61 Bethel	7/5/2007	Thunderstorm Wind	Thunderstorm moved through the Kuskokwim Delta producing large hail and strong gusty wind near 60 mph (52 kts)
AKZ155	1/15/2008	Blizzard	N/A
AKZ155 - 161	1/19/2008	High Wind	79 mph (69 kts)
AKZ155	1/24/2008	Blizzard	N/A

**Table 5-8 Severe Weather Events**

Location	Date	Event Type	Magnitude
AKZ155	1/26/2008	Blizzard	N/A
AKZ155 - 181 - 185	2/12/2008	Blizzard	N/A
AKZ155	2/16/2008	Blizzard	N/A
AKZ155	2/20/2008	Blizzard	N/A
AKZ155	3/5/2008	Blizzard	N/A
AKZ155	3/6/2008	Blizzard	N/A
AKZ155	3/9/2008	Blizzard	N/A
AKZ155	3/14/2008	Blizzard	N/A
AKZ155	3/29/2008	Blizzard	N/A
AKZ155	4/2/2008	Blizzard	N/A
AKZ155	12/24/2008	Blizzard	N/A
AKZ155	1/16/2009	Blizzard	N/A
AKZ155 - 181	2/7/2009	Blizzard	N/A
AKZ155	2/12/2009	Blizzard	N/A
AKZ155	2/15/2009	Blizzard	N/A
AKZ155	2/17/2009	Blizzard	N/A
AKZ155	2/21/2009	Blizzard	N/A
AKZ155	2/25/2009	Blizzard	Hurricane force storm moved into the eastern Bering Sea, blizzard conditions, Wind gusts >100 mph (86kts) \$200K damages
AKZ155	2/27/2009	Blizzard	N/A
AKZ155	3/1/2009	Blizzard	N/A
AKZ155	3/5/2009	Blizzard	N/A
AKZ155	3/7/2009	Blizzard	N/A
AKZ155 - 185	3/25/2009	Blizzard	N/A
AKZ155 - 161	3/28/2009	Blizzard	N/A
AKZ155	4/5/2009	Blizzard	N/A
AKZ155	4/21/2009	Blizzard	N/A
AKZ155	11/15/2009	Blizzard	N/A
AKZ155	11/30/2009	Blizzard	N/A
AKZ155 - 161	12/20/2009	High Wind	Bering Sea Storm, high wind along the Kuskokwim Delta and Bristol Bay coast of Alaska. Peak wind was 78 mph (68 kts)
AKZ155	1/4/2010	Blizzard	N/A
AKZ155	1/10/2010	High Wind	A deep cold arctic air mass strong wind in the Kuskokwim Delta reached 70 mph (61 kts)
AKZ155	2/8/2010	Blizzard	N/A
AKZ155	4/9/2010	Blizzard	N/A
AKZ155	4/12/2010	Blizzard	N/A
AKZ155	4/15/2010	Blizzard	N/A

(Albanese 2011, NWS 2011, DHS&EM 2010)

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

#### **Location**

The City experiences periodic severe weather impacts. The National Weather Service has continued to modify their system for assigning weather zones to facilitate and more accurately confine weather patterns to relevant geographic areas. Consequently the data in Table 5-7 reflects different zone numbering patterns and should be used to depict weather events that have historically impacted the area; some of which may not have impacted the City as severely as other areas within the same zone.

#### **Extent**

The entire City is equally vulnerable to the severe weather effects. The City experiences severe storm conditions with heavy snow depths; wind speeds exceeding 100 mph; and extreme low temperatures that reach -34°F.

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

#### **Impact**

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

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

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

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

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

### Probability of Future Events

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

#### 5.3.6 Wildland Fire

##### 5.3.6.1 *Nature*

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

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

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

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

The indirect effects of wildland fires can be catastrophic. In addition to stripping the land of vegetation and destroying forest resources, large, intense fires can harm the soil, waterways, and the land itself. Soil exposed to intense heat may lose its capability to absorb moisture and support life. Exposed soils erode quickly and enhance rivers and stream siltation, thereby enhancing flood

potential, harming aquatic life, and degrading water quality. Lands stripped of vegetation are also subject to increased debris flow hazards.

### 5.3.6.2 History

Wildland fires have not been documented within the boundaries of the City; however, wildland fires have occurred in the City's vicinity. The Alaska Interagency Coordination Center (AICC) maintains a website (<http://fire.ak.blm.gov/aicc.php>) to consolidate Alaska's wildland fire information. Information in Table 5-9 and Figure 5-9 were obtained from this site.

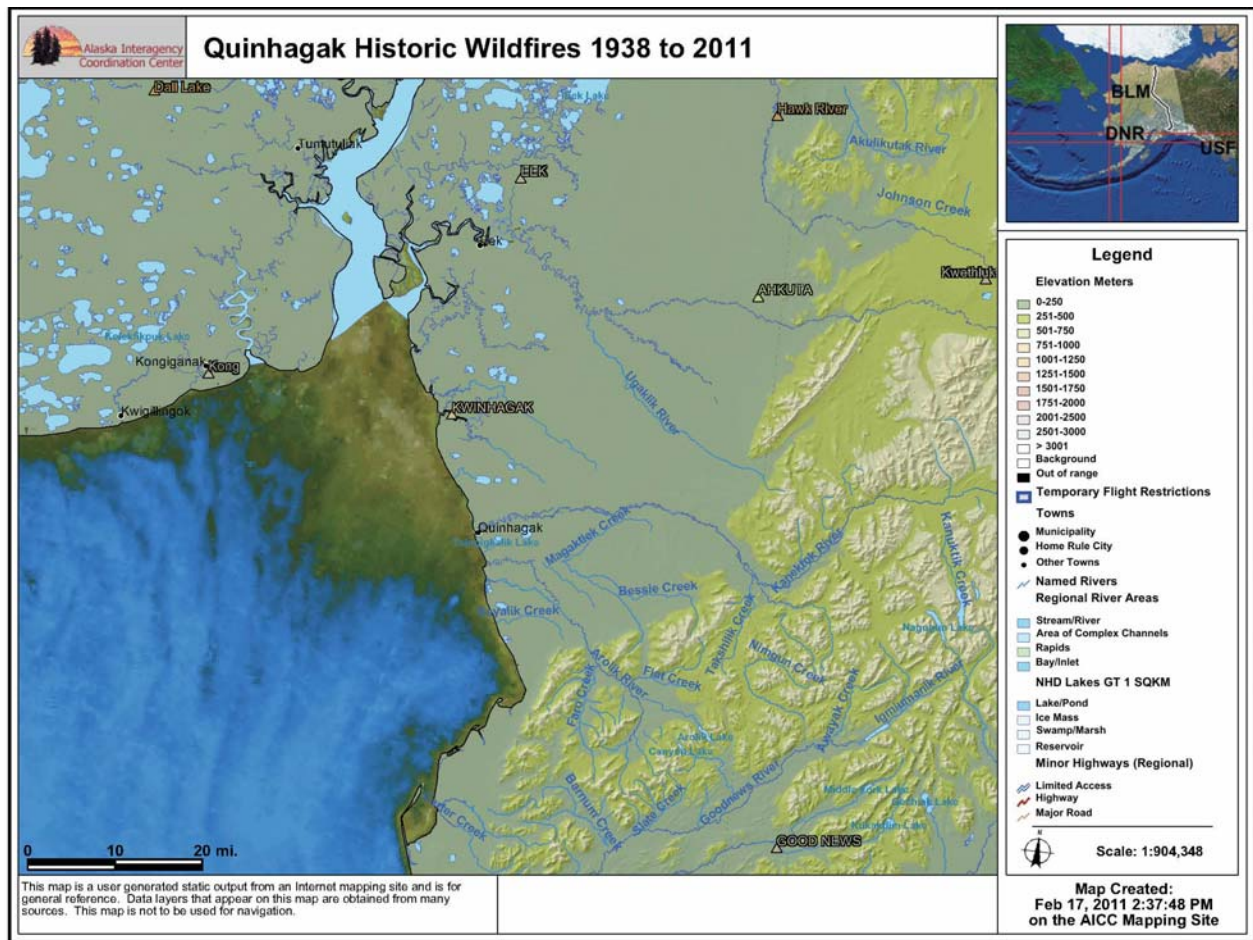
Table 5-9 lists only seven wildland fires that occurred within 50 miles of the City during the past 72 year historical period (i.e., from 1939 to 2011).

**Table 5-9 Wildfire Locations Since 1939 within 50 Miles of Quinhagak**

Fire Name	Fire Year	Estimated Acres	Latitude	Longitude	Cause
Good News	1997	1	59.28333	-160.83333	Lightning
Kong	1991	0.5	59.95	-162.86667	Other
Ahkuta	1974	10,025	60.18333	-161.08333	Lightning
Eek	1993	1	60.33333	-161.91667	Other
Kwinhagak	1960	1,000	59.93333	-162.05	Unknown
Dall Lake	2008	170	60.39917	-163.17305	Lightning
Hawk River	2010	10,766	60.48333	-161.08333	Lightning

(AICC 2011)





**Figure 5-9 Quinhagak's Historical Wildfires (AICC 2011)**

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

#### Location

Under certain conditions wildland fires may occur in any area with fuel surrounding the City of Quinhagak. Since fuels data is not readily available, for the purposes of this plan, all areas outside City limits are considered to be vulnerable to tundra/wildland fire impacts. Since 1938, only seven Quinhagak wildland fire events have occurred within 50 miles of the City (Figure 5-9).

#### Extent

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

Fuel, weather, and topography influence wildland fire behavior. Fuel determines how much energy the fire releases, how quickly the fire spreads, and how much effort is needed to contain the fire. Weather is the most variable factor. High temperatures and low humidity encourage fire activity while low temperatures and high humidity retard fire spread. Wind affects the speed and direction of fire spread. Topography directs the movement of air, which also affects fire behavior.

When the terrain funnels air, as happens in a canyon, it can lead to faster spreading. Fire also spreads up slope faster than down slope.

Only one fire located approximately 13.5 miles from Quinhagak (Kwinhagak) in 1960 burning approximately 1,000 acres. The cause of the fire was unknown. It is difficult to determine the average number of acres burned as the fires were vastly different for each of the seven wildland fire events identified in Table 5-8 (DOF 2009). An average based on such diverse data would easily be overstated.

Based on the limited number of past wildland fire events and the criteria identified in Table 5-3, the magnitude and severity of impacts in the City of Quinhagak are considered negligible with minor injuries, there is potential for critical facilities to be shut down for less than 24 hours, less than 10 percent of property or critical infrastructure being severely damaged, and little to no permanent damage to transportation or infrastructure or the economy.

### **Impact**

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

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

### **Probability of Future Events**

Fire is recognized as a critical feature of the natural history of many ecosystems. It is essential to maintain the biodiversity and long-term ecological health of the land. The role of 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 firefighters, public safety and welfare; natural and cultural resources threatened; and the other values to be protected dictate the appropriate management response to the fire. In Alaska, and within 50 miles of the City of Quinhagak, the natural fire regime is characterized by a return interval of approximately 150 due to their tundra vegetation, gently rolling topography, and coastal location.

Based on the history of wildland fires in the Quinhagak area and applying the criteria identified in Table 5-2, it is unlikely but possible a wildland fire event will occur within in the next ten years. The event has up to 1 in 10 years chance of occurring and the history of events is less than or equal to 10 percent likely each year.

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

### 6.1 OVERVIEW OF A VULNERABILITY ANALYSIS

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

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

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

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

#### DMA 2000 Requirements: Risk Assessment, Assessing Vulnerability, Overview

##### Assessing Vulnerability: Overview

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

##### Element

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

Source: FEMA, July 2008.

- Identification of the types and numbers of RL properties in the identified hazard areas.

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

##### Assessing Vulnerability: Addressing Repetitive Loss Properties

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

##### Element

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

Source: FEMA, July 2008.

- An identification of the types and numbers of existing vulnerable buildings, infrastructure, and critical facilities and, if possible, the types and numbers of vulnerable future development.

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

#### Assessing Vulnerability: Identifying Structures

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

#### Element

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

Source: FEMA, July 2008.

- Estimate of potential dollar losses to vulnerable structures and the methodology used to prepare the estimate.

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

#### Assessing Vulnerability: Estimating Potential Losses

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

#### Element

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

Source: FEMA, July 2008.

## 6.2 VULNERABILITY ANALYSIS: SPECIFIC STEPS

### 6.2.1 Asset Inventory

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

#### 6.2.1.1 Population and Building Stock

Population data for the City were obtained from the 2000 U.S. Census. The City's total population for 2000 was 555 and 2010 DCCED/DCRA data reported a population of 669 (Table 6-1).

**Table 6-1 Estimated Population and Building Inventory**

Population		Residential Buildings	
2000 Census	DCCED 2010 Data	Total Building Count	Total Value of Buildings <sup>1</sup>
555	669	153	\$61,200,000

Sources: The City of Qinhagak, U.S. Census 2000, and 2010 DCCED/DCRA Certified population data.

<sup>1</sup> Project Team determined that the average structural replacement value of all single-family residential buildings is \$400,000 per structure.

Estimated replacement values for those structures, as shown in Table 6-1, were obtained from the 2000 U.S. Census, and DCCED/DCRA. A total of 136 single-family residential buildings were considered in this analysis. However the City stated that residential replacement values are generally understated as the cost for materials, shipping, and labor exceed the US Census determined value.

### **6.2.1.2 Repetitive Loss Properties**

This section estimating the number and type of structures at risk to repetitive flooding. (Properties which have experienced RL, and the extent of flood depth and damage potential.)

RL properties have had at least two \$1,000 claims within any 10-year period since 1978.

SRL properties are most at risk for repeat flooding. These properties include every property that has experienced: four or more separate building and content claims since 1978 each exceeding \$5,000 with cumulative claims exceeding \$20,000; or at least two separate building claims with cumulative losses exceeding the value of the main living structure.

The City of Quinhagak does not participate in the NFIP neither do they have a repetitive flood property inventory that meets the RL or SRL criteria as the loss thresholds are substantially below FEMA values.

### **6.2.1.3 Existing Critical Facilities and Infrastructure**

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

- Government facilities, such as city and tribal administrative offices, departments, or agencies
- Emergency response facilities, including police department and firefighting equipment
- Educational facilities, including K-12
- Care facilities, such as medical clinics, congregate living health, residential and continuing care, and retirement facilities
- Community gathering places, such as community and youth centers
- Utilities, such as electric generation, communications, water and waste water treatment, sewage lagoons, landfills

The City's critical facilities and infrastructure are listed in Table 6-2.

**Table 6-2 Critical Facilities and Infrastructure**

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Weather (Severe)	Tundra/Wildland Fire
Government	15	City Office, Tribal Council Office, Post Office (1984)	Carter Road	59.75004	-161.9031	\$335,800	W1	X		X	X	X	X
	2	National Guard Armory (new)	Qunirtuuq Drive	59.7541	-161.89215	\$500,000	W1	X		X	X	X	X
	0	Old Armory				\$250,000	W2			X			
Transportation	0	NVK Quinhagak Airport	John O Mark Road	59.75437	-161.88261	\$17,129,426	ARW	X		X	X	X	X
	0	NVK Quinhagak Airport Terminal Building	John O Mark Road	59.75437	-161.88261	\$52,500	AMF	X		X	X	X	X
	2	City Garage	John O Mark Road	59.75355	-161.89412	\$3,000,000	S2L	X		X	X	X	X
	0	City Dock	Fish Plant Road	N/A	N/A	\$300,193	PWS	X	X	X	X	X	X
	0	Small Boat Harbor	Boat Harbor Road	N/A	N/A	\$150,000	PWS	X	X	X	X	X	X
Emergency Response	6	Quinhagak Public Safety Building, Police, Tribal Court, (1982)	Qunirtuuq Drive	59.75233	-161.89799	\$342,550	W1	X		X	X	X	X
	0	Fire Station, out of use	Qunirtuuq Drive	N/A	N/A	\$500,000	S2L	X		X	X	X	X
Educational	188	Kuinerrarmiut Elitnaurviat Elementary/High School (1981), 20,520 sq ft,	Qunirtuuq Drive	59.75253	-161.89496	\$15,000,000	S2L	X		X	X	X	X
	30	Vocation Education Building, 1,200 sq ft	Qunirtuuq Drive	N/A	N/A	\$500,000	S2L	X		X	X	X	X

**Table 6-2 Critical Facilities and Infrastructure**

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Weather (Severe)	Tundra/Wildland Fire
	25	Kindergarten Building	Qunirtuuq Drive	N/A	N/A	\$400,000	W1	X		X	X	X	X
	0	Old School and Play Deck	LKSD Street	59.74817	-161.9055	\$50,000		X		X	X	X	X
	17	Headstart Building (2003)	Carter Road			\$840,000	W1	X		X	X	X	X
Medical	4	Quinhagak Health Clinic(1999)	Carter Road	59.7485	-161.90408	\$3,242,500	W1	X		X	X	X	X
Community	0	Cemetery	Carter Road	59.75236	-161.90329	N/A	N/A	X		X	X	X	X
	0	Cemetery (#2)	Petmilleq Heights	59.74635	-161.90468	N/A	N/A	X		X	X	X	X
	200	Moravian Church	Petmilleq Heights	59.75136	-161.90325	\$750,000	W1	X		X	X	X	X
	50	Community Hall/Bingo Hall	Qunirtuuq Drive	59.74853	-161.90399	\$750,000	W1	X		X	X	X	X
	0	School Play Area	Qunirtuuq Drive	59.75201	-161.89611	\$50,000		X		X	X	X	X
	0	A/C Store,(1968)	Agalik Avenue	59.75225	-161.90039	\$1,500,000	W1	X		X	X	X	X
	10	Qarirtuuq Store (New)	Qunirtuuq Drive	59.75067	-161.90109	\$1,500,000	W1	X		X	X	X	X
	2	Qarirtuuq Shop	Qunirtuuq Drive	N/A	N/A	\$150,000	W1	X		X	X	X	X
	2	Qarirtuuq Hardware Store	Qunirtuuq Drive	N/A	N/A	\$500,000	W1	X		X	X	X	X
	0	Qarirtuuq Lumber Storage	Qunirtuuq Drive	N/A	N/A	\$50,000	W1	X		X	X	X	X
	0	Qarirtuuq Warehouse	Qunirtuuq Drive	N/A	N/A	\$75,000	W2	X		X	X	X	X
	0	Qarirtuuq Quanset Hut	N/A	N/A	N/A	\$150,000	W3						



**Table 6-2 Critical Facilities and Infrastructure**

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Weather (Severe)	Tundra/Wildland Fire
	12	CVRF Fish Plant	Qunirtuuq Drive	N/A	N/A	\$1,400,000	S2L	X		X	X	X	X
	2	Video Mania	Petmilleq Heights	N/A	N/A	\$100,000	W1	X		X	X	X	X
	16	Teachers Quarters (8 structures)	LKSD Street	59.74905	-161.90599	\$3,200,000	W1	X		X	X	X	X
Roads		Community Roads (13.1 miles @)	N/A	N/A	N/A	\$3,500,000				X			
	0	Arolik Avenue	N/A	N/A	N/A		HRD2	X		X	X	X	X
	0	Beach Access Road	N/A	N/A	N/A								
	0	Jen Fox Drive	N/A	N/A	N/A		HRD3	X		X	X	X	X
	0	Pleasant Drive	N/A	N/A	N/A		HRD4	X		X	X	X	X
	0	Seahawk Lane	N/A	N/A	N/A		HRD5	X		X	X	X	X
	0	Smith Drive	N/A	N/A	N/A		HRD6	X		X	X	X	X
	0	Gravel Pit Road	N/A	N/A	N/A								
	0	Qanirtuuq Drive	N/A	N/A	N/A		HRD7	X		X	X	X	X
	0	Tundra Drive	N/A	N/A	N/A		HRD8	X		X	X	X	X
	0	Petmilleq Heights	N/A	N/A	N/A		HRD9	X		X	X	X	X
	0	KSD Street	N/A	N/A	N/A		HRD10	X		X	X	X	X
	0	Mission Road	N/A	N/A	N/A		HRD11	X		X	X	X	X
	0	Boat Harbor Road	N/A	N/A	N/A		HRD12	X		X	X	X	X
	0	Fish Plant Road	N/A	N/A	N/A		HRD13	X	X	X	X	X	X
	0	Well Access road	N/A	N/A	N/A								
	0	Old Dumpsite Road	N/A	N/A	N/A		HRD14	X	X	X	X	X	X
	0	Old Village Road	N/A	N/A	N/A								
	0	John O Mark	N/A	N/A	N/A		HRD15	X		X	X	X	X

**Table 6-2 Critical Facilities and Infrastructure**

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Weather (Severe)	Tundra/Wildland Fire
		Road											
	0	Old Airport Road (Small Access Road)	N/A	N/A	N/A								
Bridges		None	N/A	N/A	N/A	N/A	N/A	-	-	-	-	-	-
Utilities	0	Moravian Church Fuel Storage Tanks, 37 GALS	LKSD Street	59.74896	-161.91041	\$5,000,000	OTF	X		X	X	X	X
	0	AVEC Generator Fuel Storage Tanks, 104,300 GALS	Qanirtuuq Drive	59.74819	-161.90865			X		X	X	X	X
	0	Qanirtuuq Generator Plant Fuel Storage Tanks, 43,700 GALS	Fish Plant Road	59.74833	-161.90595			X		X	X	X	X
	0	City Fuel Storage Tanks, 12,900 GALS	Fish Plant Road	59.75291	-161.89361			X	X	X	X	X	X
	0	Airport Fuel Storage Tanks (>500gal)	John O Mark Road	59.75745	-161.88235			X		X	X	X	X
	0	A/C Store Fuel Storage Tanks, 9,600 GALS	Agalik Avenue	59.75225	-161.90039			X		X	X	X	X

**Table 6-2 Critical Facilities and Infrastructure**

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Weather (Severe)	Tundra/Wildland Fire
	0	Army National Guard Fuel Storage Tanks, 4,500 GALS	Qunirtuuq Drive	59.7541	-161.89215			X		X	X	X	X
	0	School Fuel Storage Tanks, 42,200 GALS	Qunirtuuq Drive	N/A	N/A			X		X	X	X	X
	0	School Generator Building	Qunirtuuq Drive	N/A	N/A	\$100,000	EOOS	X			X	X	X
	0	AVEC Power Generation Facility	Qunirtuuq Drive	59.74846	-161.90857	\$100,000	EOOS	X			X	X	X
	0	Qunirtuuq Generator Plant	Fish Plant Road	59.74848	-161.90535	\$100,000	EOOS	X			X	X	X
	0	Water Treatment Plant Generator (Backup)	Petmilleq Heights	59.75329	-161.89755	\$100,000	EOOS	X			X	X	X
	1	Wind Farm Construction (2010?) Wind Turbines	Sewage Lagoon Road	N/A	N/A	\$4,316,603		X			X	X	X
	1	Quinhagak Class III Muni Landfill	Arolik Road	59.74939	-161.88674	\$650,000		X	X		X	X	X

**Table 6-2 Critical Facilities and Infrastructure**

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Weather (Severe)	Tundra/Wildland Fire
	0	New Sewage Lagoon	Arolik Road	59.74939	-161.88674	\$1,300,000		X	X		X	X	X
	1	Water Intake/ Infiltration Gallery	Petmilleq Heights	N/A	N/A	\$200,000			X	X			
	0	Water Treatment Plant (1997), 64 ft. by 32 ft., 2048 sq. ft.	Petmilleq Heights	59.75331	-161.89742	\$3,500,000	PWTS	X			X	X	X
	0	Water Storage Tank (1997), 45,000 GALS	Petmilleq Heights	59.75331	-161.89742	\$800,000	PSTGS	X			X	X	X
	0	City Well	Petmilleq Heights	59.75619	-161.89286	\$400,000	PWE	X			X	X	X
	0	South Sewage Lagoon	John O Mark Road	N/A	N/A	\$750,000		X			X	X	X
	0	School Sewage Lagoon (No longer in use)	Qunirtuuq Drive	59.7526	-161.89264	\$750,000		X			X	X	X
	0	Community Health Sanitation Building	Sewage Lagoon Road	N/A	N/A	\$500,000	WWTM						

Table 6-2 Critical Facilities and Infrastructure

Facilities	Number of Occupants	Facilities	Address	Latitude	Longitude	Estimated Value	Building Type	Earthquake	Erosion	Flood	Ground Failure	Weather (Severe)	Tundra/Wildland Fire
	0	Sanitation System	Community-wide	N/A	N/A	\$8,694,632	OIP						
	2	Washateria/ Offices	Carter Road	59.74839	-161.90419	\$2,098,000	W1	X			X	X	X
	0	Washateria's Gray Water Sewage Lagoon	Carter Road	59.74742	-161.9089	\$750,000	W1	X			X	X	X
	0	United Utilities Inc., Tower,	Arolik Road	N/A	N/A	\$1,000,000	S2L						
	2	United Utilities Inc., GCI, Satellite Dish	Petmilleq Heights	N/A	N/A	\$500,000	W1	X			X	X	X

(Quinhagak 2011, DHS&EM 2009a)

#### 6.2.1.4 Future Critical Facilities and Infrastructure

Immediate plans for future development in the City includes potentially constructing a renewable energy wind farm with wind turbine technology, adding Department of Environmental Conservations, Village Safe Water (DEC/VSW) funded additional piped water and sewer services with in-home plumbing, a Department of Transportation (DOT)/Public Facilities (PF) funded new harbor entrance improvements, and DOT/PF and Federal Aviation Administration (FAA) funded airport rehabilitation, and air terminal building projects.

Figure 6-1 depicts the City's layout with future residential, critical facility, and infrastructure locations.

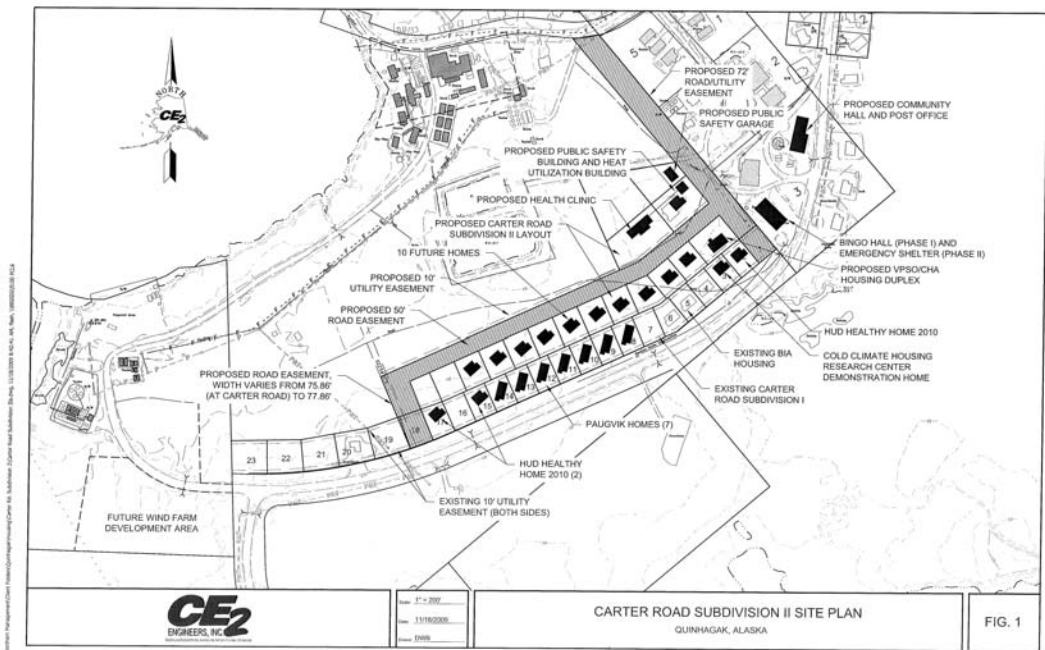


Figure 6-1 Quinhagak's Community Layout (AICC 2010)

Figure 6-2 depicts DEC/VSW's 95% complete Quinhagak future sewer infrastructure locations for the 2011-2013 construction seasons.

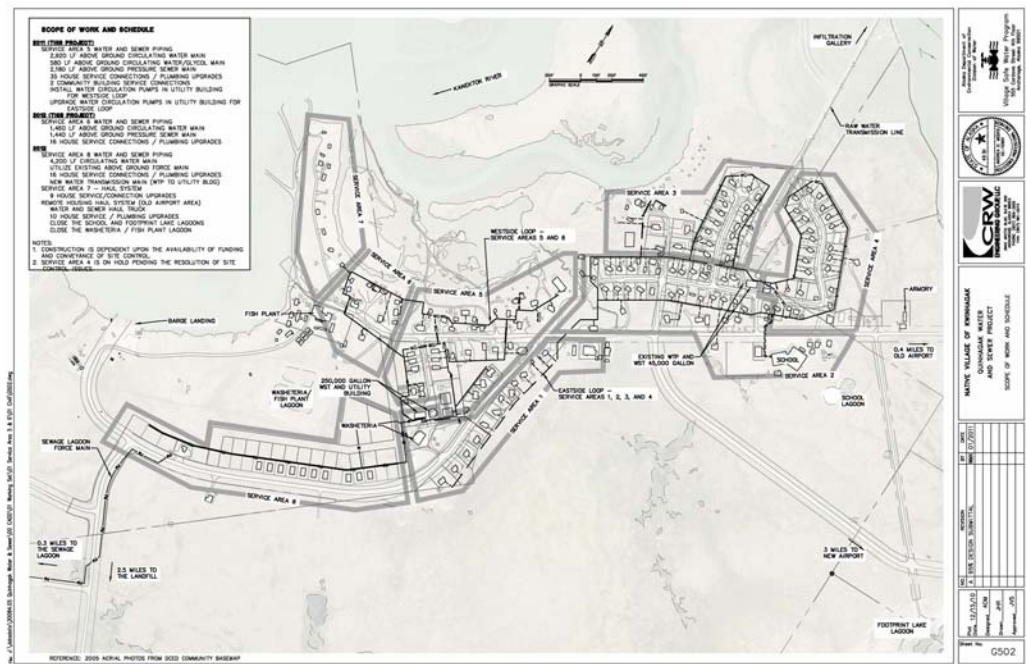


Figure 6-2 Quinhagak's Sewer Project 2011-2013 (DEC/VSW 2011)

### 6.2.2 Methodology

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

The methodology used a two pronged effort. First, The Project Team used the State's Critical Facility Inventory and locally obtained GPS coordinate data to identify critical facility locations in relation to potential hazard's threat exposure and vulnerability. Second this data was used to develop a vulnerability assessment for those hazards where GIS based hazard mapping information was available.

Replacement structure and contents values were developed for physical assets. These value estimates were provided by the Project Team. For each physical asset located within a hazard area, exposure was calculated by assuming the worst-case scenario (that is, the asset would be completely destroyed and would have to be replaced). Finally, the aggregate exposure, in terms of replacement value or insurance coverage, for each category of structure or facility was estimated. A similar analysis was used to evaluate the proportion of the population at risk. However, the analysis simply represents the number of people at risk; no estimate of the number of potential injuries or deaths was prepared.

### 6.2.3 Data Limitations

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

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

### 6.2.4 Exposure Analysis

There is limited GIS data available for the City of Quinhagak. The results of the GIS based exposure analysis for loss estimations in the City are summarized in Tables 6-3 and 6-4. The following discussion contains data from GIS analysis and information obtained from the Project Team.

**Table 6-3 Potential Hazard Exposure Analysis – Critical Facilities**

			Government and Emergency Response		Educational		Medical		Community	
Hazard Type	Hazard Area	Methodology	* # Bldgs/ # Occ	Value (\$)	* # Bldgs/ # Occ	Value (\$)	* # Bldgs/ # Occ	Value (\$)	* # Bldgs/ # Occ	Value (\$)
Earthquake	--	Descriptive	5/23	1,928,350	5/233	16,790,000	1/4	3,242,500	15/294	10,175,000
Erosion	--	Within 300 ft of erosion areas	--	--	--	--	--	--	--	--
Flood	--	Descriptive	23/5	1,928,350	5/260	16,790,000	¼	3,242,500	15/294	9,425,000
Ground Failure	--	Descriptive	5/23	1,928,350	5/233	16,790,000	1/4	3,242,500	15/294	10,175,000
Weather, Severe	--	Descriptive	5/23	1,928,350	5/233	16,790,000	1/4	3,242,500	15/294	10,175,000
Wildland Fire	Low	Low fuel rank	3/23	4,077,500	2/188	15,050,000	1/4	3,242,500	8/276	7,750,000
	Moderate	Moderate fuel rank	--	--	--	--	--	--	--	--
	High	High fuel rank	--	--	--	--	--	--	--	--
	Extreme	Extreme fuel rank	--	--	--	--	--	--	--	--



**Table 6-4 Potential Hazard Exposure Analysis – Critical Infrastructure**

			Highway		Bridges		Transportation Facilities		Utilities	
Hazard Type	Hazard Area	Methodology	Miles	Value (\$)	No.	Value (\$)	# Bldgs/ # Occ	Value (\$)	# Bldgs/ # Occ	Value (\$)
Earthquake	--	Descriptive	13.1	3,500,000	--	--	5/2	20,632,119	27/7	31,609,235
Erosion	--	Within 300 ft of erosion areas	0.5	500,000	--	--	2/0	450,193	4/2	2,250,000
Flood	--	Descriptive	19/0	6,750,000	--	--	5/2	20,632,119	26/7	27,335,798
Ground Failure	--	Descriptive	13.1	3,500,000	--	--	5/2	20,632,119	27/7	31,609,235
Weather, Severe	--	Descriptive	13.1	3,500,000	--	--	5/2	20,632,119	27/7	31,609,235
Wildland Fire	Low	Low fuel rank	--	--	--	--	3/2	20,181,926	14/3	10,398,000
	Moderate	Moderate fuel rank	--	--	--	--	--	--	4/0	5,150,000
	High	High fuel rank	--	--	--	--	--	--	--	--
	Extreme	Extreme fuel rank	--	--	--	--	--	--	--	--

### *Earthquake*

Based on earthquake probability (PGA) maps produced by the USGS, the entire City area is at risk of experiencing moderate earthquake impacts a result of its proximity to the Denali Fault-Togiak-Tikchik and south by south west of the Ataskaksovluk-Holokuk Fault Zone. However, the probability is low (see Section 5.3.1.3). Impacts to the community such as significant ground movement that may result in infrastructure damage are not expected. The entire existing and future Quinhagak population, residences, and critical facilities are exposed to the effects of an earthquake. This includes 669 people in 153 residences (worth approximately \$61,200,000) and 590 people in all 79 critical facilities (worth approximately \$87,877,204).

Impacts to the community such as significant ground movement that may result in infrastructure damage are not expected. Minor shaking may be seen or felt based on past events. Although all structures are exposed to earthquakes, buildings within the City constructed with wood have slightly less vulnerability to the effects of earthquakes than those with masonry.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same low impact level as the City is not located in an area with a high probability of strong shaking (i.e., >4.8M).

### *Erosion*

Based on local knowledge, areas within the City affected by erosion are located adjacent to the River (see Section 5.3.2.3). There are approximately 22 people in 5 residences (worth \$2,000,000) and approximately 20 essential fish camps located in areas exposed and historically prone to erosion. There are two transportation facilities (worth approximately \$450,000), two roads (worth approximately \$600,000), the City's tank farm (worth \$2,000,000), the new sewage lagoon (worth approximately \$1,300,000), the new water infiltration gallery (worth approximately \$200,000), and the new solid waste landfill (worth approximately \$650,000) located in historically erosion prone areas.

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

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level until the City institutes land use controls prohibiting new construction in erosion prone areas. Impacts could also be lessened if affected properties could be relocated.

### *Flood*

The City Council stated "the entire City is located within the 100 year floodplain." However, no detailed 100 year flood analysis has been prepared for the City. The USACE information does not include 100 year floodplain map for the current townsites.

Impacts associated with flooding in the City is water damage to structures and contents, roadbed erosion and damage, boat strandings, areas of standing water in roadways, and damage or displacement of fuel tanks, power lines, or other infrastructure. Buildings on slab foundations, not located on raised foundations, and/or not constructed with materials designed to withstand

flooding events (e.g., cross vents to allow water to pass through an open area under the main floor of a building) are more vulnerable to the impacts of flooding (see Section 5.3.3.3).

This includes 669 people in 153 residences (worth \$61,200,000), 20 essential fish camps, and all 80 critical facilities (worth approximately \$52,448,254).

The City anticipates that impacts to future populations, residences, critical facilities, and infrastructure are at the same historical impact level.

### ***Ground Failure***

Ground Failure occurs throughout Alaska from landslides, land subsidence, and melting permafrost. These hazards periodically cause houses to shift due to ground shifting, sinking, and upheaval. According to mapping completed by the DGGs, the entire City is underlain by and exposed to permafrost impacts (see Section 5.3.4.3). This includes 669 people in 153 residences (worth approximately \$61,200,000) and 590 people in all 79 critical facilities (worth approximately \$87,877,204).

Impacts associated with ground failure include surface subsidence, infrastructure, structure, and/or road damage. Buildings that are built on slab foundations and/or not constructed with materials designed to accommodate the ground movement associated with building on permafrost and other land subsidence and impacts are more vulnerable damage.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level. To lessen future impacts the City could institute and enforce land use controls, building codes, and to prohibit new construction in ground failure prone areas.

### ***Weather (Severe)***

Using information provided by the City of Quinhagak and the National Weather Service, the entire existing and future City's population, residences, and critical facilities are equally exposed to the effects of a severe weather event. This includes 669 people in 153 residences (worth approximately \$61,200,000) and 590 people in all 79 critical facilities (worth approximately \$87,877,204).

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

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level. To lessen future impacts the City could institute and enforce building codes to accommodate the effects of severe weather on structures.

### ***Wildland Fire***

Impacts associated with a wildland fire event include the potential for loss of life and property. It can also impact livestock and pets and destroy forest resources and contaminate water supplies.

Buildings closer to the outer edge of town, those with a lot of vegetation surrounding the structure, and those constructed with wood are some of the buildings that are more vulnerable to the impacts of wildland fire.

Impacts to future populations, residences, critical facilities, and infrastructure are anticipated at the same impact level. Community education, building materials, and prepared response personnel are some things that could lessen future impacts.

According to the Alaska Fire Service, there are no wildland fire areas within Quinhagak's boundaries. However, seven wildland fires have occurred within a 50-mile radius of the City (see Section 5.3.6.3). There is potential for wildland fire to interface with the population center of the City.

Wildland fire hazard areas were identified using a model incorporating slope, aspect, and fuel load (See Figure 5-12). South-facing, steep, and heavily vegetated areas were assigned the highest fuel values while areas with little slope and natural vegetation were assigned the lowest fuel risk values. Risk levels of low, moderate, high, and extreme were assigned to the entire region based on the results of this modeling. There are approximately 669 people in 153 residences (worth \$61,200,000) located in the City that are potentially threatened by wildfire events.

Quinhagak has critical facilities and infrastructure located within areas of low, moderate, high, and extreme risk. Low risk areas contain 17 people in two government facilities (worth approximately \$835,000), six people in one emergency response facility (worth approximately \$342,550), 188 people in one educational facilities (worth approximately \$15,050,000), four people in one care facility (worth approximately \$3,242,500), 276 people in eight community facilities (worth approximately \$7,750,000), two people in three transportation facilities (worth approximately \$20,181,926), and three people in fourteen utilities (worth approximately \$10,398,000).

Moderate risk areas contain four utilities (worth \$5,150,000).

There are no residences or critical facilities located in High or Extreme wildfire hazard areas.

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

#### Assessing Vulnerability: Analyzing Development Trends

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

#### Element

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

Source: FEMA, July 2008.

## 6.3 LAND USE AND DEVELOPMENT TRENDS

Land use in the City is predominately residential with limited area for commercial services and community (or institutional) facilities. Suitable developable vacant land is in short supply within the boundaries of the City, and open space and various hydrological bodies surround the community. One area of town is classified as airport land use.

The 2010 Quinhagak Comprehensive Development Plan expresses several future land use issues and concerns with possible solutions for them:

### **4.6.1. Current Status**

#### **Current Status**

***Issue:** “No less than 100 housing units are needed for Quinhagak tribal members, and as of 2009, nearly 1/3 of the existing housing stock has been determined to be beyond repair and facing imminent collapse due to extensive [wet] dry-rot and deterioration.*

#### **Solutions:**

*Quinhagak's annual NAHASDA allocations are inadequate to address the severe housing shortage. Consequently, in 2009, the Tribe approved securing a Title VI loan, leveraging its existing tribal allocations, which allowed the Tribe to award a construction contract to Paug Vik to construct (7) new units during the fall/winter of 2009/2010.*

*To address the existing housing stock, the Tribe invited the Cold Climate Housing Research Center to Quinhagak to inspect the severely rotten and dangerous homes. Their report made statewide news, a link to which was posted to the Anchorage Daily News online edition. The short term solution is to shore up the homes to prevent collapse, The long term solution is to continue to encourage home ownership through the use of HUD and/or USDA loan guarantees and other financing mechanisms....*

### **4.6.3 Lots, Land and Subdivisions for Future Development Issues:**

*Quinhagak lacks sufficient lots to cover the 10 year housing demand; currently site control is in place for only 10–16 lots along Carter Rd. No less than 100 additional lots are needed*

#### **Solutions:**

*During the Land Use planning sessions, additional areas were identified for future housing to address the long term need for housing land [Native Village of Kwinhagak] NVK needs to secure site control to additional tracts of land in Quinhagak as identified in the Land Use plan*

- *Additional subdivisions need to be designed, platted, recorded....*

### **4.7.2 City Dock and Channel Dredging**

#### **Issues:**

*Most freight and all fisheries commerce hinge on easy access to the Quinhagak dock; this access is currently impeded by the siltation of the Kanektok River channel, making it difficult for large barges to enter the mouth of the River*

- *The existing City Dock is inadequate in size to meet the commercial fisheries needs*

#### **Solutions:**

- *Quantify long-term gravel needs, commission a study to identify gravel extraction sites*
- *Initiate permitting process and material sales agreement negotiations*
- *Coordinate with CVRF*
- *Apply for Denali Commission Waterfront Development funding*
- *Coordinate with U.S. Army Corps of Engineers*

### **4.7.3. Expanded Community Facilities and Infrastructure to Meet Growing Population/Demand**

#### **Expanded Community Facilities and Infrastructure to Meeting Growing Population/Demand**

#### **Issues:**

*Many essential community buildings in Quinhagak have become too small to meet the growing population and/or demand; in particular, the following facilities were identified:*

- NVK/City Tribal Offices
- Qanirtuuq, Inc. store [expansion in progress 2007]
- Community Hall/Community gathering area [non-existent]
- Post Office [need at least a 1200–1500 SF facility]
- Bulk Fuel Tank Farm [in conceptual planning stage]
- Fish Processing Plant [Relocate to City Dock Area]
- Fisheries Support Facility [in planning/design stage]
- Public Safety Building [in conceptual planning stage]
- New Clinic [in conceptual planning stage]
- Quinhagak School....

### **4.8. Land Use**

#### **Land Use**

##### **4.8.1. Land**

#### **Land**

##### **Issues:**

- Allotments need to be [re-]surveyed
- Determine the old dumpsite land use once covered
- 14(C)3 Municipal Lands are unresolved
- We need to identify all lots within the vicinity of Quinhagak for almost immediate construction
- We need to identify City, Qanirtuuq, Native Allotments and NVK lands

##### **Solutions:**

##### **Identify buildings that can be moved or demolished**

- Relocate old clinic rental unit for public facility development
- Remove old buildings to free up land
- Land Management training for NVK and City Staff to include: Site control and surveying
- Gift deeded land needs to be surveyed before signed by land owner
- We need to acquire 14(C)3 lands

##### **Additional Solutions:**

- Have Qanirtuuq, City and NVK... work together on land issues
- We need to be able to do land plotting
- NVK, City, Qanirtuuq and Church need to improve land policy
- Hire a surveyor....

### **4.8.5. Waterfront**

#### **Waterfront**

##### **Issues:**

- Dredge the boat harbor
- Dock expansion to fish plant
- Boat Harbor upgrades including access road....

## 4.8.8. Roads

### Roads

#### Issues:

- Need more road signs
- Build a bridge ... [across both] Arolik and Kanetok Rivers
- New road development near community
- Identify areas needing bridges
- Manage layout and drainage system....

(Quinhagak 2010)

### Development Trends

Table 6-5 delineates Quinhagak's future, planned, and funded projects and their tentative status of stages of completion.

**Table 6-5 Planned and Funded Projects**

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
Division of Community and Regional Affairs (DCRA)	2011	funded	Emergency Shelter Facility: Planning & Design Funds - Comments: Legislative - Emergency Shelter	Preliminary	\$1,500,000
Alaska Energy Authority Alternative Energy and Energy Efficiency (AEA/AEEE)	2009	Funded	Quinhagak Wind Farm Construction - Comments: OTHER FUNDING: Federal	Contract	\$4,316,603
Department of Environmental Conservation/ Village Safe Water (DEC/VSW)	2010	Funded	Piped Water and Sewer System Upgrades - Comments: Design and construction of an additional piped water and sewer system, including water and sewer mains and services, water source, treatment and storage upgrades.	Preliminary	\$891,496
DEC/VSW	2009	Funded	Water and sewer service.	Preliminary	\$1,618,369
DEC/VSW	2009	Funded	In-home plumbing and a sewage pumper truck	Preliminary	\$1,071,121
DEC/VSW	2009	Funded	Design and Construction of Water and Sewer Facilities	Preliminary	\$1,332,911
DEC/VSW	2009	Funded	Water treatment plant upgrades	Preliminary	\$206,225

**Table 6-5 Planned and Funded Projects**

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
DCRA	2008	Funded	Public Safety Facility Design and Permitting - Comments: CDBG	Preliminary	\$100,000
DEC/VSW	2005	Funded	Design Piped Water/Sewer Improvement. - Comments: USDA/RD - 2005 - \$225,000.	Preliminary	\$300,000
DEC/VSW	2004	Funded	Sanitation Improvements, PH IV - Comments: RD - 2004 - \$1,497,300,000.0	Preliminary	\$1,996,500
DEC/VSW	2002	Funded	Sanitation Improvements - Comments: USDA/RD - 2002 - \$750,000 Construct lagoon, pump stations, and partial construction of sewer pipeline between school and washeteria. Close school and community lagoons. Sanitation Improvements	Preliminary	\$1,000,000
DEC/VSW	2000	Funded	Sanitation Facilities Improvements - Comments: USDA/RD - 2000 - \$1,000,125. Decommission old WTP, removal of old WST, water and sewer mains for service area 1.	Preliminary	\$1,333,475
DEC/VSW	1998	Funded	Washeteria, Phase III - Comments: USDA/RD - 1998 - \$612,500.	Preliminary	\$612,500
Housing and Urban Development (HUD)	2009	Funded	Indian Housing Block Grant / Native American Housing Assistance and Self Determination Act (IHBG/NAHASDA) administration, operating & construction funds	Contract	\$441,844
FAA	2004	Funded	Snow Removal Equipment	Contract	\$551,250
FAA	2004	Funded	Construct New Airport	Contract	\$2,435,891
FAA	2004	Funded	Construct Terminal Building	Contract	\$52,500



**Table 6-5 Planned and Funded Projects**

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
Denali	2009	Funded	Kwinhagak Harbor Entrance Improvements - Comments: OTHER FUNDING: FTA Sec 5309 Waterfront FY2007, State of AK Trans Match FY08. Planning Phase of Project Development. SAFETEA-LU Section 5309 - \$160,000 and SOA Gen Fund - \$40,000 matching.	Plan/Design	\$200,000
HUD	2008	Funded	IHBG/NAHASDA administration, operating & construction funds	Design	\$391,238
HUD	2007	Funded	Housing Rehabilitation - Comments: Indian Community Development Block Grant (ICDBG)	Design	\$600,000
ANTHC	2007	Funded	Water & Sewer	Construction	\$330,000
ANTHC	2007	Funded	Water Treatment Plant Upgrade	Construction	\$1,135,200
HUD	2007	Funded	IHBG/NAHASDA administration, operating & construction funds	Construction	\$452,659
EDA	2004	Funded	Airport Extension and Terminal Building - Comments: To allow for easier fish cargo exportation. Estimated (189 jobs; \$1,280,000 private investment)	Construction	\$1,529,862
DEC/VSW	2003	Funded	Sanitation Improvements, Phase 2 - Comments: USDA/RD - 2003 - \$1,682,000 Design and construct water tank and utility building.	Construction	\$2,242,700
DEC/VSW	2002	Funded	Sanitation Facilities Improvement Project - Comments: OTHER FUNDING: EPA - 2002 - \$1,000,000 Construct a lift station and force main to a community lagoon.	Construction	\$1,000,000
DEC/VSW	1999	Funded	Sanitation Facilities Improvement Project	Construction	\$612,500

(DCRA 2011)

The City of Quinhagak has benefited from numerous funding opportunities to assist them with upgrading their infrastructure. The City had a new honey haul system implemented with a new sewage lagoon and gravel access road constructed in 1983. The 1990's brought improved sewer and solid waste management improvements, a new water treatment plant, and washateria, bulk fuel storage tank consolidation and dispensing facility development; dock, harbor and erosion control improvements implemented, and incorporating the health clinic building into the existing washateria building.

Airport improvements began in 1999 with a 3000 ft. runway construction project, while the year 2000 brought a new salmon processing plant, and Headstart building project. The turn of the

century brought a new Youth Center and multi-purpose building, an airport extension project, various housing improvements, and sanitation facility projects.

The City's Comprehensive Development Plan states,

*"The plan is designed to aid local leaders in the community's continued growth, organization, and development, as well as ensure local residents that a comprehensive and permanent plan is easily accessible and representative in guiding the decision-making and future needs assessments by local leaders.*

*Though growth and development are vital to our community, the people of Quinhagak are deeply committed to preserving, practicing, and protecting our land, environment, culture, traditions and heritage which strengthen both our people and our future...*

*Sewage facilities in Quinhagak include a honey bucket haul system, a partially developed small haul collection system, and three sewage lagoons. The honey bucket system consists of approximately 25 bins scattered throughout the community. The bins, which are periodically collected by NVK, are trailered to Footprint Lake Lagoon where they are emptied...*

*The City Dock is the only facility in Quinhagak that can accommodate vessels of any substantial size. It is at the City Dock that Quinhagak receives bulk fuel shipments, large barges of cargo, and the commercial fishing deliveries...The channel and harbor in front of the Quinhagak city dock is the only location in Quinhagak that can accommodate any barges or large vessels. It is also the primary location for the delivery of salmon by local commercial fishermen...*

*The existing road network is constructed primarily from pit-run material. The thickness of the road embankment is between two and three feet... Kwinhagak roads are dusty during the summer, and slippery and unsafe during rains. A major concern identified by NVK with the current road system is dust created from gravel surfaced roads...*

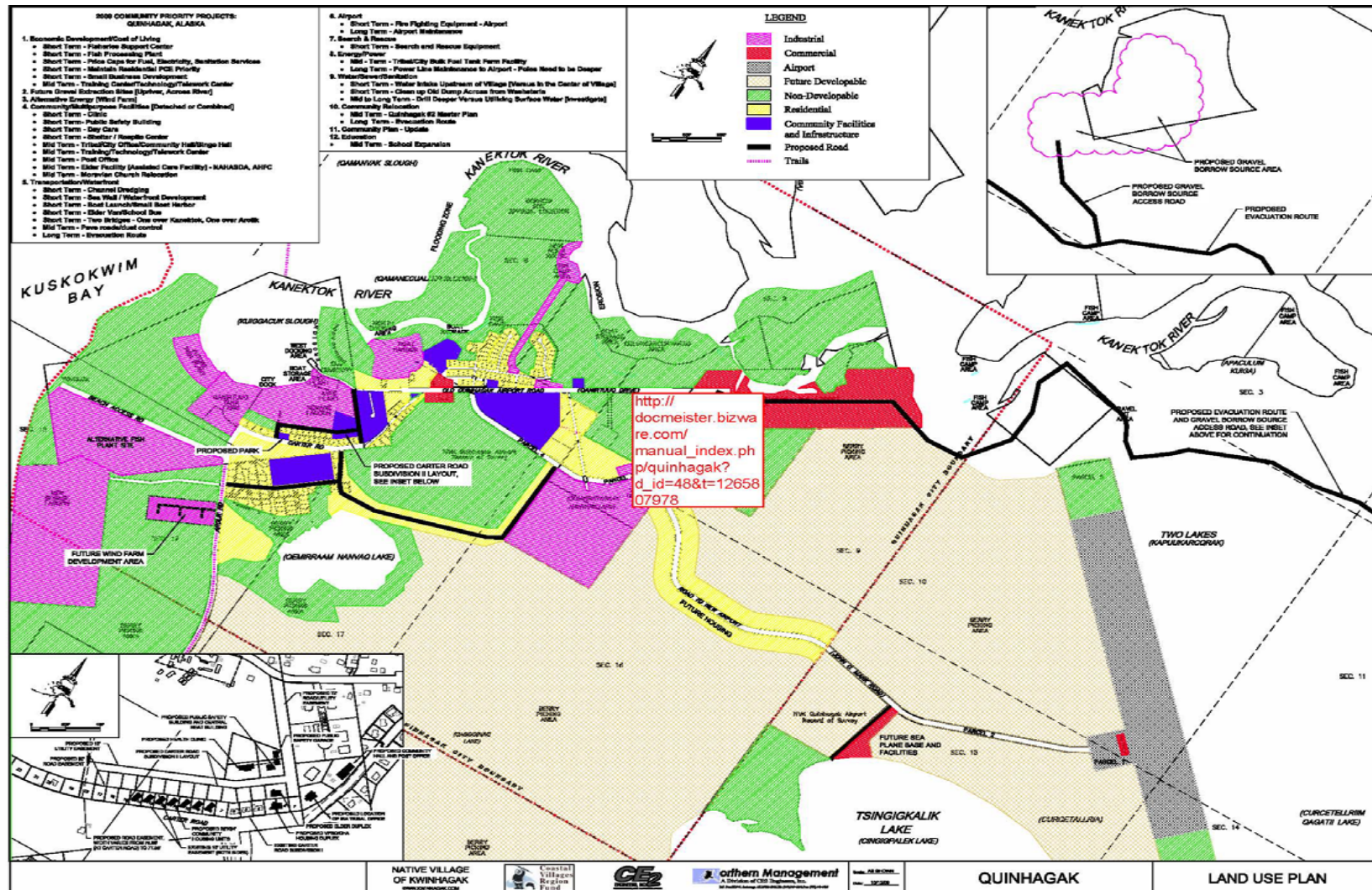
*There is no formally constructed drainage system. Culverts are placed when needs arise... The existing drainage system throughout the Native Village of Kwinhagak is not adequate to eliminate heavy ponding along the roads. The roadside ponding not only erodes the road embankment but also contributes to an unstable road subgrade...*

*The 10 year housing needs in Quinhagak exceed 150 units, overcrowding is rampant... nearly 1/3 of the existing housing stock has been determined to be beyond repair and facing imminent collapse due to extensive dry-rot and deterioration...*

*Quinhagak lacks sufficient lots to cover the 10 year housing demand; currently site control is in place for only 10-16 lots along Carter Rd. No less than 100 additional lots are needed....NVK needs to secure site control to additional tracts of land in Quinhagak as identified in the Land Use plan... Additional subdivisions need to be designed, platted, recorded...*

*Most freight and all fisheries commerce hinge on easy access to the Quinhagak dock; this access is currently impeded by the siltation of the Kanektok River channel, making it difficult for large barges to enter the mouth of the River...The existing City Dock is inadequate in size to meet the commercial fisheries needs...Most freight and all fisheries commerce hinge on easy access to the Quinhagak dock; this access is currently impeded by the siltation of the Kanektok River channel, making it difficult for large barges to enter the mouth of the River...The existing City Dock is inadequate in size to meet the commercial fisheries needs" (CDP 2010).*

Figure 6-3 Depicts the City of Quinhagak’s 2009 land use area map. It is important to note the extent of the “green” non-developable areas adjacent to wetland or historical flood impact areas.



**Figure 6-3 City of Quinhagak's Land Use Map (CDP 2009)**

The City of Quinhagak has a major concern, the outcome of which may very well determine their City's long-term economic survival as stated in the NOAA Coast Pilot 9, edition 28, 2010 states:

*"Quinhagak, 66 miles N of Cape Newenham, is difficult to approach by water because of the great mudflats bordering its shores. Launches can enter the river here only at the highest tides, and even small craft can hardly get within sight of the village and remain afloat at low water. Supplies are landed with great difficulty, because of the extensive flats and their exposure. Quinhagak has a Moravian mission, a store, and a school. Radiotelegraph communications are maintained. A limited amount of supplies may be procured. The church steeple is sometimes visible from Eek Channel. Kanektok River, entering Kuskokwim Bay at Quinhagak, runs fine clear mountain water at all stages of the tide". (NOAA 2010).*

Table 6-6 list the City's DCRA funded "completed" infrastructure improvement projects. They provide a depiction of the community's ongoing development trends and focus toward improving aging infrastructure.

**Table 6-6 Completed Projects**

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
Denali	2006	Funded	Unknown	Completed	\$14,708
Denali	2002	Funded	Bulk Fuel Business Plan and Conceptual Design	Completed	\$113,866
BIA	2002	Funded	Winter Trail Marking to Eek (29 mi.) and Kanertok (39 mi.) - Comments: DOT will purchase materials and BIA with contract with tribes for labor	Completed	\$70,000
Denali	2006	Funded	N/A	Completed	\$14,708
Denali	2002	Funded	Bulk Fuel Business Plan and Conceptual Design	Completed	\$113,866
Bureau of Indian Affairs (BIA)	2002	Funded	Winter Trail Marking to Eek (29 mi.) and Kanertok (39 mi.) - Comments: Department of Transportation/Public Facilities (DOT/PF) will purchase materials and BIA with contract with tribes for labor	Completed	\$70,000
Alaska Native Tribal Health Consortium (ANTHC)	2007	Funded	Water & Sewer	Construction	\$330,000
ANTHC	2007	Funded	Water Treatment Plant Upgrade	Construction	\$1,135,200
Housing and Urban Development (HUD)	2007	Funded	Indian Community Development Block Grant / Native American Housing Assistance and Self Determination Act (IHBG/NAHASDA) administration, operating & construction funds	Construction	\$452,659

**Table 6-6 Completed Projects**

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
Economic Development Administration (EDA)	2004	Funded	Airport Extension and Terminal Building - Comments: To allow for easier fish cargo exportation. Estimated (189 jobs; \$1,280,000 private investment)	Construction	\$1,529,862
Department of Environmental Conservation/ Village Safe Water (DEC/VSW)	2003	Funded	Sanitation Improvements, Phase 2 - Comments: US Department of Agriculture/Rural Development (USDA/RD) - 2003 - \$1,682,000 Design and construct water tank and utility building.	Construction	\$2,242,700
DEC/VSW	2002	Funded	Sanitation Facilities Improvement Project - Comments: OTHER FUNDING: Environmental Protection Agency (EPA) - 2002 - \$1,000,000 Construct a lift station and force main to a community lagoon.	Construction	\$1,000,000
DEC/VSW	1999	Funded	Sanitation Facilities Improvement Project	Construction	\$612,500
Department of Community and Regional Affairs (DCRA)	2006	Funded	Multi-Use Facility Conceptual Planning - Comments: Multi-Use Facility Program. OTHER FUNDING: Denali Commission Multi-Use Facility Conceptual Planning	Completed	\$20,000
HUD	2006	Funded	IHBG/NAHASDA administration, operating & construction funds	Completed	\$445,132
HUD	2005	Funded	IHBG/NAHASDA administration, operating & construction funds	Completed	\$436,629
HUD	2004	Funded	IHBG/NAHASDA administration, operating & construction funds	Completed	\$469,198
Denali	2003	Funded	Quinhagak Airport Extension Project - Comments: LOCAL FUNDING: Qanirtuuq Inc.: \$7,500; Native Village of Kwinhagak: \$10,000. OTHER FUNDING: State of Alaska /Department of Community, Commerce and Economic Development (SOA/DCCED): \$87,500; Coastal Village Regional Fund: \$60,000. Complete the airport extension.	Completed	\$173,835
DCRA	2003	Funded	Youth Center Multi-Purpose Facility - Comments: Capital Matching	Completed	\$26,316
DCRA	2003	Funded	Youth Center and Multipurpose Facility - Comments: Multi-Use Facility Program. OTHER FUNDING: Denali Commission \$565,585; CDBG \$75,000; Indian Community Development Block Grant (ICDBG); \$500,000; Rasmuson \$102,024; Capital Matching Grant \$25,000.	Completed	\$553,515
HUD	2003	Funded	IHBG/NAHASDA administration, operating & construction funds	Completed	\$590,086

**Table 6-6 Completed Projects**

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
US Army Corp of Engineers (USACE)	2002	Funded	Harbor/Pre-Construction	Completed	\$750,000
COE	2002	Funded	Harbor/Feasibility & Design - Comments: Feasibility due March 2004; Design Aug 2007	Completed	\$50,000
Federal Aviation Administration (FAA)	2002	Funded	Unknown – Airport Construction	Completed	\$446,250
FAA	2002	Funded	Construct New Airport	Completed	\$2,039,499
HUD	2002	Funded	IHBG/NAHASDA administration, operating & construction funds	Completed	\$521,860
DCRA	2002	Funded	Headstart Building - Comments: Capital Matching	Completed	\$26,316
HUD	2002	Funded	Youth Center/Multi-Purpose Facility - Comments: ICDBG Program.	Completed	\$500,000
DCRA	2002	Funded	Airport Design/Engineering - Comments: Community Development Block Grant (CDBG)	Completed	\$87,500
Denali	2001	Funded	Efficiency Upgrades - Comments: Other Funding = Alaska Village Electric Cooperative (AVEC): \$50,000. Efficiency Upgrades	Completed	\$205,752
DCRA	2001	Funded	Youth Center/Multi-Purpose Facility Design/Engineering of - Comments: CDBG	Completed	\$75,000
HUD	2001	Funded	IHBG/NAHASDA administration, operating & construction funds	Completed	\$520,858
DEC/VSW	2001	Funded	Sanitation Facilities Improvement Project - Comments: DOT - 2001 - \$595,707	Completed	\$595,707
DCRA	2001	Funded	Headstart Building Construction - Comments: Capital Matching Headstart Building Construction	Completed	\$26,316
DCRA	2000	Funded	Headstart Building Design - Comments: Capital Matching	Completed	\$25,000
DCRA	2000	Funded	Salmon Processing Plant - Comments: CDBG. Coastal Villages Investment Fund, USDA/RD funding	Completed	\$732,000
HUD	2000	Funded	IHBG/NAHASDA administration, operating & construction funds	Completed	\$449,137
FAA	1999	Funded	Construct New Airport	Completed	\$492,027
FAA	1999	Funded	Construct New Airport - Comments: 3,000' runway construction.	Completed	\$5,270,231
HUD	1999	Funded	IHBG/NAHASDA administration, operating & construction funds	Completed	\$471,730

**Table 6-6 Completed Projects**

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
DEC/VSW	1999	Funded	Sanitation Facilities Improvements - Comments: OTHER FUNDING: Environmental Protection Agency/Inspector General (EPA/IG) - 1999 - \$1,300,000. Partial construction of sewage lagoon, construct solid waste landfill, burn box, hazardous waste storage.	Completed	\$1,950,000
DCRA	1999	Funded	Headstart Building - Comments: Capital Matching	Completed	\$26,316
ANTHC	1998	Funded	New Washeteria Completion - Comments: DEC VSW lead. IHS funding	Completed	\$348,000
DOT/PF	1998	Funded	Unknown	Completed	\$550,000
DEC/VSW	1998	Funded	Washeteria, Phase III - Comments: RD - 1997 - \$275,000. Construct a portion of new washeteria and purchase washers and dryers	Completed	\$550,000
DOT/PF	1998	Funded	Airport Relocation, Ph I - Comments: Master plan completed. Local priority, from 1997 US Department of Agriculture/Rural Development (USDA/RD) survey of villages	Completed	\$4,360,000
Bureau of Indian Affairs (BIA)	1998	Funded	Road to Arolik River - Comments: 6.1 km. Complete in 1998. Improvements, including Church to Bridge, Tundra Drive, Carter Road, Dock to Fish Plant, Arolik Avenue Extension, Mission Drive Extension, Upriver Road, Petmilleq Heights Upgrade and Lagoon Access Road. Local priority, from 19	Completed	\$3,500,000
DCRA	1998	Funded	Headstart Building - Comments: Capital Matching	Completed	\$26,316
HUD	1998	Funded	IHBG/NAHASDA administration, operating & construction funds	Completed	\$496,365
DCRA	1997	Funded	Health Clinic Addition to Washeteria for Head Start and other health programs - Comments: Capital Matching. Local priority, from 1997 USDA/RD survey of villages	Completed	\$26,316
USDA/RD	1997	Funded	New Washeteria - Comments: Includes equipment	Completed	\$550,000
DEC/VSW	1997	Funded	School Sewage Lagoon Repair Study - Comments: Study to evaluate alternatives for the school sewage lagoon; study completed 9/00; recommend building sewage force main to the washeteria sewage lagoon	Completed	\$48,000

**Table 6-6 Completed Projects**

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
ANTHC	1997	Funded	New Washeteria, Phase I - Comments: DEC VSW lead. IHS funding. Foundation, design and permits	Completed	\$450,000
DCRA	1997	Funded	N/A	Completed	\$5,875
HUD/ICDBG	1997	Funded	Community Health Sanitation Bldg - Comments: ICDBG Program	Completed	\$500,000
DCRA	1996	Funded	Integrate New Health Clinic into Washeteria Facility - Comments: CDBG	Completed	\$400,475
DCRA	1996	Funded	Kanektok River Safari Business Marketing - Comments: Rural Development Assistance/US Forest Service (RDA/USFS) Mini-Grant	Completed	\$51,000
DCRA	1996	Funded	Community Facilities & Equipment - Comments: Capital Matching	Completed	\$26,316
ANTHC	1996	Funded	New Washeteria - Comments: DEC VSW lead. IHS funding	Completed	\$200,000
ANTHC	1996	Funded	New Water Treatment Plant - Comments: DEC/VSW lead. Indian Housing Service (IHS) funding. The foundation underlying the water plant, water tank, and waterline is frost jacking and corroding. Construct new water treatment plant	Completed	\$850,000
HUD/CGP	1995	Funded	Housing Modernization - Comments: Interiors	Completed	\$101,520
BIA	1995	Funded	Road to Arolik River / Design - Comments: Design in 1995; Construction in 1997	Completed	\$0
DCRA	1995	Funded	Dock Reconstruction Completion - Comments: RDA. Local priority, from 1997 USDA/RD survey of villages	Completed	\$69,877
USDA/RD	1995	Funded	N/A	Completed	\$1,090,000
HUD/ICDBG	1995	Funded	Flush and Haul Water & Sewer System - Comments: ICDBG Program. 30 homes installed; 107 unserved	Completed	\$328,525
DCRA	1995	Funded	Water & Sewer/Washeteria Relocation - Comments: Capital Matching	Completed	\$26,316
ANTHC	1994	Funded	Water & Sewer/9 HUD homes - Comments: DEC/VSW lead. IHS \$520,000. Includes moving water treatment plant	Completed	\$620,000
HUD/CGP	1994	Funded	Housing Modernization - Comments: Foundations	Completed	\$60,000
DCRA	1994	Funded	Dock/Harbor Construction & Erosion Control - Comments: Capital Matching	Completed	\$26,316
DCRA	1994	Funded	Dock/Harbor Construction & Erosion Control - Comments: Legislative Grant	Completed	\$205,000



**Table 6-6 Completed Projects**

Lead Agency	Fiscal Year	Project Status	Project Description/Comments	Project Stage	Total Cost
DCRA	1994	Funded	Ice Production Plant Equipment - Comments: RDA	Completed	\$860,000
FAA	1994	Funded	Conduct Airport Master Plan Study - Comments: OTHER FUNDING: DOT/PF	Completed	\$294,331
DCRA	1993	Funded	Bulk Fuel Storage Consolidation - Comments: CDBG. Purchase fuel tanks and construct consolidated fuel dispensing facility	Completed	\$266,000
HUD/Comprehensive Grant Program (CGP)	1993	Funded	Housing Modernization - Comments: Interiors - 55 units, Housing Modernization	Completed	\$550,000
HUD/Alaska Housing Finance Corporation (AHFC)	1992	Funded	Construct nine Low Rent Housing Units	Completed	\$1,074,231
HUD/CGP	1992	Funded	Housing Modernization - Comments: Handicapped needs, exteriors, mechanical ventilation	Completed	\$959,000
DEC/VSW	1991	Funded	Water, Sewer, Solid Waste - Comments: Purchase equipment for honey bucket haul system; site control surveying for Native allotments	Completed	\$200,000
DEC/Municipal Grants and Loans (MGL)	1990	Funded	Flush Haul Improvements - Comments: Land Problem	Completed	\$200,000
DEC/VSW	1983	Funded	Sewer - Comments: Construct a sewage lagoon with gravel road for access; develop honey bucket haul system	Completed	\$300,000
DCRA	2011	Funded	Emergency Shelter Facility: Planning & Design Funds: Legislative - Emergency Shelter	Preliminary	\$1,500,000

(DCRA 2011)

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

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

Within this section the Project Team developed the mitigation goals and potential mitigation actions for the City of Quinhagak.

### 7.1 DEVELOPING MITIGATION GOALS

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

DMA 2000 Requirements: Mitigation Strategy – Local Hazard Mitigation Goals	
<b>Local Hazard Mitigation Goals</b>	
<b>Requirement §201.6(c)(3)(i):</b> [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.	
<b>Element</b>	
<ul style="list-style-type: none"><li>■ Does the new or updated plan include a description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards?</li></ul>	
<i>Source: FEMA, July 2008.</i>	

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

**Table 7-1 Mitigation Goals**

No.	Goal Description
1	Promote recognition and mitigation of all natural hazards that affect the City of Quinhagak.
2	Promote cross-referencing mitigation goals and actions with other City planning mechanisms and projects.
3	Reduce possibility of losses from all natural hazards that affect the City.
4	Reduce vulnerability of structures to earthquake damage.
5	Reduce possibility of damage and losses from erosion.
6	Reduce the possibility of damage and losses from flooding.
7	Reduce possibility of damage and losses from ground failure.
8	Reduce vulnerability of structures to severe weather damage.
9	Reduce possibility of damage and losses from wildland fires.

## 7.2 IDENTIFYING MITIGATION ACTIONS

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

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

#### **Identification and Analysis of Mitigation Actions**

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

#### **Element**

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

*Source: FEMA, July 2008.*

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

#### **Identification and Analysis of Mitigation Actions: NFIP Compliance**

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

#### **Element**

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

*Source: FEMA, July 2008.*

After mitigation goals and actions were developed, the Project Team assessed the potential mitigation actions to carry forward into the mitigation strategy. Mitigation actions are activities, measures, or projects that help achieve the goals of a mitigation plan. Mitigation actions are usually grouped into three broad categories: property protection, public education and awareness, and structural projects. On May 12, 2011, the Project Team selected 22 mitigation actions for potential implantation during the five-year life cycle of this HMP. The Project Team placed particular emphasis on projects and programs that reduce the effects of hazards on both new and existing buildings and infrastructure. These potential projects are listed in Table 7-2 below.

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

Goals		Actions	
No	Description	ID	Description
1	Promote recognizing and mitigating all natural hazards that affect the City of Quinhagak (City).	<b>A</b>	Establish a formal role for the jurisdictional Hazard Mitigation Planning Committee to develop a sustainable process to implement, monitor, and evaluate community wide mitigation actions.
		<b>B</b>	Disseminate FEMA pamphlets to educate and encourage homeowners concerning structural and non-structural retrofit benefits.
		<b>C</b>	Identify and pursue funding opportunities to implement mitigation actions.
		<b>D</b>	Identify evacuation routes away from high hazard areas and develop outreach program to educate the public concerning warnings and evacuation procedures.
2	Reduce possibility of losses from all natural hazards that affect the City.	<b>A</b>	The City will strive to manage their existing plans to ensure they incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, and land use plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.
		<b>B</b>	Update or develop, implement, and maintain Stormwater Management Plans.
		<b>C</b>	Develop ordinances to protect drinking water resources.
3	Cross reference Mitigation goals and actions with other City planning mechanisms and projects.	<b>A</b>	Increase power line wire size and incorporate quick disconnects (break away devices) to reduce ice load and wind storm power line failure during severe wind or winter ice storm events.
		<b>B</b>	Acquire (buy-out), demolish, or relocate structures from hazard prone area. Property deeds shall be restricted for open space uses in perpetuity to keep people from rebuilding in hazard areas.
		<b>C</b>	Harden riverbank infiltration gallery and perform planning to relocate existing system to reduce or eliminate water source contamination.
4	Reduce vulnerability of structures to earthquake damage.	<b>A</b>	Encourage AVEC companies to evaluate and harden vulnerable infrastructure elements (utility poles, utility lines, etc.) for sustainability.
5	Reduce possibility of damage and losses from erosion.	<b>A</b>	Maintain and update erosion hazard locations, identify critical facilities and cultural sites that are potentially impacted and develop mitigation initiatives such as bank stabilization or facility relocation to prevent or reduce damages from storm surge, beach front erosion.
		<b>B</b>	Install embankment protection such as rip-rap (large rocks), sheet pilings, gabion baskets, articulated matting, concrete, asphalt, vegetation, or other armoring or protective materials.
6	Reduce the possibility of damage and losses from flooding.	<b>A</b>	Develop and maintain critical facility inventory for all structures located within 100-year and 500-year floodplains.
		<b>B</b>	Increase culvert sizes to improve drainage efficiency over current capabilities.
		<b>C</b>	Dredge Kanektok River and Kuskokwim Bay confluence. Flooding events has changed the River channel and also brings severe debris and sedimentation which is precluding access to the dock facilities for fuel, community supply delivery, and 84 fishing vessels.
7	Reduce possibility of damage and losses from ground failure.	<b>A</b>	Develop a Storm Water Management Plan to control runoff, both for flood reduction and to minimize saturated soils on steep slopes that can cause ground failure.
		<b>B</b>	Identify and map existing permafrost areas to assist in new critical facility siting and existing facility relocation siting.

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

Goals		Actions	
No	Description	ID	Description
		<b>C</b>	Promote permafrost sensitive construction to reduce permafrost damage.
		<b>D</b>	Initiate monitoring activities to determine construction/permafrost degradation effects.
8	Reduce vulnerability of structures to severe weather damage.	<b>A</b>	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure and residential properties from severe winter events.
9	Reduce possibility of damage and losses from wildland fires.	<b>A</b>	Provide wildland fire information which address human and lightning caused impacts in an easily distributed format for all residents.

## 7.3 EVALUATING AND PRIORITIZING MITIGATION ACTIONS

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

DMA 2000 Requirements: Mitigation Strategy - Implementation of Mitigation Actions	
<b>Implementation of Mitigation Actions</b>	
<b>Requirement: §201.6(c)(3)(iii):</b> [The mitigation strategy section shall include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.	
<b>Element</b>	
<ul style="list-style-type: none"> <li>■ Does the new or updated mitigation strategy include how the actions are prioritized?</li> <li>■ Does the new or updated mitigation strategy address how the actions will be implemented and administered?</li> <li>■ Does the new or updated prioritization process include an emphasis on the use of a cost-benefit review to maximize benefits?</li> <li>■ <i>Does the updated plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged (i.e., deferred), does the updated plan describe why no changes occurred? (Not applicable until 2014 update)</i></li> </ul>	
Source: FEMA, July 2008.	

The Project Team evaluated and prioritized each of the mitigation actions on April 12, 2011 to determine which actions would be included in the Mitigation Action Plan. The Mitigation Action Plan represents mitigation projects and programs to be implemented through the cooperation of multiple entities in the City. To complete this task, the Project Team first prioritized the hazards that were regarded as the most significant within the community (earthquake, erosion, flood, permafrost, severe weather, and wildland fire).

The Project Team reviewed the simplified social, technical, administrative, political, legal, economic, and environmental (STAPLEE) evaluation criteria (shown in Table 7-3) and the Benefit-Cost Analysis Fact Sheet (Appendix D) to consider the opportunities and constraints of implementing each particular mitigation action. For each action considered for implementation, a qualitative statement is provided regarding the benefits and costs and, where available, the technical feasibility. A detailed cost-benefit analysis is anticipated as part of the application process for those projects the City chooses to implement.

**Table 7-3 Evaluation Criteria for Mitigation Actions**

Social, Technical, Administrative, Political, Legal, Economic, and Environmental (STAPLEE)

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

On April 12, 2011, the hazard mitigation Project Team prioritized 21 mitigation actions that were chosen to carry forward into the Mitigation Action Plan. The hazard mitigation Project Team considered each hazard's history, extent, and probability to determine each potential actions priority. A rating system based on high, medium, or low was used. High priorities are associated with actions for hazards that impact the community on an annual or near annual basis and generate impacts to critical facilities and/or people. Medium priorities are associated with actions for hazards that impact the community less frequently, and do not typically generate impacts to critical facilities and/or people. Low priorities are associated with actions for hazards that rarely impact the community and have rarely generated documented impacts to critical facilities and/or people.

Prioritizing the mitigation actions in the Mitigation Action Plan Matrix was completed to provide the City with an approach to implementing the Mitigation Action Plan. Table 7-4 defines the mitigation action priorities.

## 7.4 IMPLEMENTING A MITIGATION ACTION PLAN

Table 7-4 shows the City's Mitigation Action Plan Matrix that shows how the mitigation actions were prioritized, how the overall benefit/costs were taken into consideration, and how each mitigation action will be implemented and administered by the Project Team.

**Table 7-4 City of Quinhagak's Mitigation Action Plan Matrix**

*(See acronym and abbreviations list for complete titles)*

Action ID	Description	Priority	Responsible Entity	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
1A	Establish a formal role for the jurisdictional Hazard Mitigation Planning Committees to develop a sustainable process to implement, monitor, and evaluate community wide mitigation actions.	Medium	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council	1-3 years	B/C: The existing team has gained experience throughout this process which can provide insight for ensuring a sustained effort toward mitigating natural hazard damages. TF: This is technically feasible because it requires application of knowledge of the hazard mitigation plan and other planning efforts. Feasibility is reliant on technical skills already possessed by HMP development activities.
1B	Disseminate FEMA pamphlets to educate and encourage homeowners concerning structural and non-structural retrofit benefits.	Low	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, Federal Emergency Management Agency (FEMA) HMA programs, AFG, FP&S, and SAFER	1-3 years	B/C: Sustained mitigation outreach programs have minimal cost and will help build and support area-wide capacity. This type activity enables the public to prepare for, respond to, and recover from disasters. TF: This low cost activity can be combined with recurring community meetings where hazard specific information can be presented in small increments. This activity is ongoing demonstrating its feasibility.
1C	Identify and pursue funding opportunities to implement mitigation actions.	High	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, (See Section 8.4 for Federal and State funding sources)	Ongoing	B/C: This ongoing activity is essential for the City as there are limited funds available to accomplish effective mitigation actions. TF: This activity is ongoing



**Table 7-4 City of Quinhagak's Mitigation Action Plan Matrix**

*(See acronym and abbreviations list for complete titles)*

Action ID	Description	Priority	Responsible Entity	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
						demonstrating its feasibility.
1D	Identify evacuation routes away from high hazard areas and develop outreach program to educate the public concerning warnings and evacuation procedures.	Low	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, Denali Commission Division of Community and Regional Affairs (DCRA), DOF: VFAG, RAGP	1-3 years	B/C: This project will ensure the community looks closely at their hazard areas to ensure they can safely evacuate their residents and visitors to safety during a natural hazard event. TF: This is technically feasible using existing city and tribal resources.
2A	The City will strive to manage their existing plans to ensure they incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, and land use plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.	Medium	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, Denali Commission, Division of Community and Regional Affairs (DCRA)	1-3 years	B/C: Coordinated planning ensures effective damage abatement and ensures proper attention is assigned to reduce losses and damage to structures and City residents. TF: This is technically feasible because it requires application of knowledge of the hazard mitigation plan and other planning efforts. Feasibility is reliant on technical skills already possessed by employees holding positions that would implement this action.
2B 7A	Update or develop, implement, and maintain Stormwater Management Plans.	Medium	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, HMA, NAFSMA, DEC/VSW, ANA, Denali Commission	1-4 years	B/C: Stormwater Management plans are an essential disaster management tool. Focused and coordinated planning enables effective damage abatement and ensures proper attention is assigned to reduce losses, damage, and materials management. TF: This action is feasible with limited fund expenditures.
2C	Develop a plan and associated ordinances to protect drinking water resources	High	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, HMA, DEC/VSW, DEC/ADWF, DEC/ACWF/	1-4 years	B/C: Drinking Water Protection plan and associated ordinances and plans are an essential tool disaster management tool. Focused and coordinated planning

**Table 7-4 City of Quinhagak's Mitigation Action Plan Matrix**

*(See acronym and abbreviations list for complete titles)*

Action ID	Description	Priority	Responsible Entity	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
				CWSRF), ANA, Denali Commission, USACE		enables effective damage abatement and ensures proper attention is assigned to reduce losses, damage, and materials management.  TF: This action is feasible with limited fund expenditures.
3A	Work with AVEC to increase power line wire size and incorporate quick disconnects (break away devices) to reduce ice load and wind storm power line failure during severe wind or winter ice storm events.	Low	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, HMA, Natural Resources Conservation Service (NRCS), ANA, USACE, US Department of Agriculture (USDA), Lindbergh Grants Program	1-5 years	B/C: This project would ensure threatened infrastructures are available for use – there loss would exacerbate potential damages and further threaten survivability.  F: This project is feasible using existing staff skills, equipment, and materials.
3B	Acquire (buy-out), demolish, or relocate structures from hazard prone area. Property deeds shall be restricted for open space uses in perpetuity to keep people from rebuilding in hazard areas.	High	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, HMA, Natural Resources Conservation Service (NRCS), ANA, USACE, US Department of Agriculture (USDA), Lindbergh Grants Program	1-5 years	B/C: This project would remove threatened structures from hazard areas, eliminating future damage while keeping land clear for perpetuity.  F: This project is feasible using existing staff skills, equipment, and materials. Acquiring contractor expertise may be required for large facilities.
3C	Expand hardening riverbank infiltration gallery and perform planning to relocate existing system to reduce or eliminate continuing water source contamination.	High	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, Lindberg Foundation, Denali Commission, HMA, ANA, NRCS, USACE	Ongoing	B/C: Pre-planning and implementing appropriate embankment stability will greatly reduce or delay potential infrastructure and residential losses. Project costs would outweigh replacement costs of lost facilities.  TF: The community has the skill to implement this action. Specialized skills may need to be contracted-out with materials and equipment barged in depending on the method selected.

**Table 7-4 City of Quinhagak's Mitigation Action Plan Matrix**

*(See acronym and abbreviations list for complete titles)*

Action ID	Description	Priority	Responsible Entity	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
4A	Encourage AVEC to evaluate and harden vulnerable infrastructure elements (utility poles, utility lines, etc.) for sustainability.	Medium	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, HMA, Natural Resources Conservation Service (NRCS), ANA, USACE, US Department of Agriculture (USDA), Lindbergh Grants Program	1-5 years	B/C: This project would ensure threatened infrastructures are available for use – their loss would exacerbate potential damages and further threaten survivability. F: This project is feasible using existing staff skills, equipment, and materials.
5A	Maintain and update erosion hazard locations, identify critical facilities and cultural sites that are potentially impacted and develop mitigation initiatives such as bank stabilization or facility relocation to prevent or reduce damages from storm surge, beach front erosion.	High	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, NRCS, USACE	2-4 years	B/C: Identifying threatened infrastructure proximity to natural hazards is vital to their sustainability. There are currently few mapped hazard areas. This is a vital first step. This knowledge will help the community focus on activities to protect their vital infrastructure. TF: The project is technically feasible as the community has considerable knowledge about their resources and historical impact areas.
5B	Install embankment protection such as rip-rap (large rocks), sheet pilings, gabion baskets, articulated matting, concrete, asphalt, vegetation, or other armoring or protective materials.	High	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, HMA, ANA, NRCS, USACE	Ongoing	B/C: Improving embankment and slope stability will greatly reduce potential infrastructure and residential losses. Project costs would outweigh replacement costs of lost facilities. TF: The community has the skill to implement this action. Specialized skills may need to be contracted-out with materials and equipment barged in depending on the method selected.
6B	Increase culvert size to 24 inches to increase its drainage efficiency.	High	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, HMA, ANA	2-4 years	B/C: Improving water flow capability will greatly reduce potential infrastructure and residential losses. Project costs would outweigh

**Table 7-4 City of Quinhagak's Mitigation Action Plan Matrix**

*(See acronym and abbreviations list for complete titles)*

Action ID	Description	Priority	Responsible Entity	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
						replacement costs of lost facilities.  TF: The community has the skill to implement this action. Specialized skills may need to be contracted-out with materials and equipment barged in depending on the method selected.
6C	Dredge Kanektok River and Kuskokwim Bay confluence. Flooding events has changed the River channel and also brings severe debris and sedimentation which is precluding access to the dock facilities for fuel and community supply delivery and to enable 84 fishing	High	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, Lindberg Foundation, HMA, NRCS, USACE, USDA/EWP, USDA/ECP, DCRA/Alaska Climate Change Impact Mitigation Program (ACCIMP)	1-3 years	B/C: The community's fishing fleet, barge services, and ongoing fuel delivery access is rapidly being lost to river debris and sedimentation accumulation preventing dock access. Many vessels can no longer navigate the shallow channel even at high tide. The Planning Team stated that reduced and disappearing access threatens the community's lifelines. They further stated the community could cease to exist because income, essential supplies and materials, and fuel delivery may no longer be economically viable.  TF: This project is technically feasible by the funding entities that specialize in this complex hydrological / coastal engineering project.
7B	Identify and map existing permafrost areas to assist in new critical facility siting and existing facility relocation siting	Medium	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, ANA, NRCS, Denali Commission, DCRA, USACE	Ongoing	B/C: Identifying ground failure locations is a minimal cost project which would decrease damage to facilities if they were sited appropriately. Project must be associated with an eligible relocation or construction project.  TF: Technically feasible as the community currently has identified permafrost locations but they have not created a map defining the area and they dig test holes to determine

**Table 7-4 City of Quinhagak's Mitigation Action Plan Matrix**


*(See acronym and abbreviations list for complete titles)*

Action ID	Description	Priority	Responsible Entity	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
						permafrost depth prior to construction.
7C	Promote permafrost sensitive construction to reduce permafrost damage.	Low	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, ANA, HMA, NRCS, Denali Commission, DCRA, USACE	Ongoing	B/C: This outreach project would decrease damage to facilities if they were sited and used the most appropriate construction practices. TF: Technically feasible as the community is currently working with UAF and other entities to determine most viable permafrost construction practices.
7D	Initiate monitoring activities to determine construction/permafrost degradation effects.	Medium	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, ANA, NRCS, Denali Commission, DCRA, USACE	2-4 years	B/C: Monitoring permafrost degradation would decrease damage to facilities if they were sited and constructed appropriately. TF: Technically feasible as the community is currently working with UAF and other entities to determine most viable permafrost construction practices.
8A	Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure and residential properties from severe winter events.	Low	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, DCCED/CDBG, Denali Commission	3-5 years	B/C: Scheduling maintenance and implementing mitigation activities will potentially reduce severe winter storm damages caused by heavy snow loads, wind, and freezing rain. TF: This type activity is technically feasible within the community typically using existing labor, equipment, and materials. Specialized methods are not new to rural communities as they are used to importing required contractors.
9A	Provide wildland fire information which address human and lightning caused impacts in an easily distributed format for all	Low	City of Quinhagak, Kwinhagak Tribal Council	City of Quinhagak, Kwinhagak Tribal Council, AFG, FP&S	1-3 Years	B/C: Sustained mitigation outreach programs have minimal cost and will help build and support community capacity enabling the public to

**Table 7-4 City of Quinhagak's Mitigation Action Plan Matrix**

*(See acronym and abbreviations list for complete titles)*

Action ID	Description	Priority	Responsible Entity	Potential Funding	Timeframe	Benefit-Costs / Technical Feasibility
	residents.					appropriately prepare for, respond to, and recover from disasters.  TF: This project is technically feasible using existing City and Tribal staff.

 Designates potential FEMA fundable projects

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

The following three process steps are addressed in detail here:

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

### 8.1 MONITORING, EVALUATING, AND UPDATING THE HMP

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

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

##### Monitoring, Evaluating and Updating the Plan

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

##### Element

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

Source: FEMA, July 2008.

The HMP was prepared as a collaborative effort. To maintain momentum and build upon previous hazard mitigation planning efforts and successes, the City will continue to use the Project Team to monitor, evaluate, and update the HMP. Each authority identified in Table 7-4 will be responsible for implementing the Mitigation Action Plan. The City Mayor, the hazard mitigation Project Team Leader, (or designee), will serve as the primary point of contact and will coordinate local efforts to monitor, evaluate, and revise the HMP.

Each member of the Project Team will conduct an annual review during the anniversary week of the plan's official FEMA approval date to monitor the progress in implementing the HMP, particularly the Mitigation Action Plan. As shown in Appendix E, the Annual Review Worksheet will provide the basis for possible changes in the HMP Mitigation Action Plan by refocusing on new or more threatening hazards, adjusting to changes to or increases in resource allocations, and engaging additional support for the HMP implementation. The Project Team Leader will initiate the annual review two months prior to the scheduled planning meeting date to ensure that all data is assembled for discussion with the Project Team. The findings from these reviews will be presented at the annual Project Team Meeting. Each review, as shown on the Annual Review Worksheet, will include an evaluation of the following:

- Participation of authorities and others in the HMP implementation
- Notable changes in the risk of natural or human-caused hazards



- Impacts of land development activities and related programs on hazard mitigation
- Progress made with the Mitigation Action Plan (identify problems and suggest improvements as necessary)
- The adequacy of local resources for implementation of the HMP

A system of reviewing the progress on achieving the mitigation goals and implementing the Mitigation Action Plan activities and projects will also be accomplished during the annual review process. During each annual review, each authority administering a mitigation project will submit a Progress Report to the Project Team. As shown in Appendix E, the report will include the current status of the mitigation project, including any changes made to the project, the identification of implementation problems and appropriate strategies to overcome them, and whether or not the project has helped achieved the appropriate goals identified in the plan.

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

- Request grant assistance for DHS&EM to update the HMP (this can take up to one year to obtain and one year to update the plan)
- Thoroughly analyze and update the risk of natural and human-made hazards
- Provide a new annual review (as noted above), plus a review of the three previous annual reviews
- Provide a detailed review and revision of the mitigation strategy
- Prepare a new Mitigation Action Plan for the City of Quinhagak
- Prepare a new draft HMP
- Submit an updated HMP to the DH&EM and FEMA for approval
- Submit the FEMA approved plan for adoption by the City of Quinhagak
- Return adoption resolution to DH&EM and FEMA to receive formal approval

### **8.2 IMPLEMENTATION THROUGH EXISTING PLANNING MECHANISMS**

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

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

#### Incorporation into Existing Planning Mechanisms

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

#### Element

- Does the new or updated plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?
- Does the new or updated plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?
- *Does the updated plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate? (Not applicable until 2014 update)*

Source: FEMA, July 2008.

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

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

### 8.3 CITY OF QUINHAGAK CAPABILITY ASSESSMENT

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

**Table 8-1 Quinhagak's Regulatory Tools**

Regulatory Tools (ordinances, codes, plans)	Existing?	Comments (Year of most recent update; problems administering it, etc.)
Comprehensive Plan	Yes	Community Development Plan, 2010. Explains the City's land use initiatives and natural hazard impacts.
Land Use Plan	Yes	Quinhagak Land Use Plan, 2009. Explains Quinhagak's land use goals and initiatives.
Tribal Corporation Land Use Plan	Yes	Kwihagak Capital and Land Use Plan, 1999, Describes the Village's community development goals and initiatives.
Emergency Response Plan	No	
Wildland Fire Protection Plan	No	
Building code	No	The City can exercise this authority.
Zoning ordinances	No	The City can exercise this authority.

**Table 8-1 Quinhagak's Regulatory Tools**

Regulatory Tools (ordinances, codes, plans)	Existing?	Comments (Year of most recent update; problems administering it, etc.)
Subdivision ordinances or regulations	No	The City can exercise this authority.
Special purpose ordinances	No	The City can exercise this authority.

### Federal Resources

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

- FEMA, through its Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from FEMA Publication Warehouse (1-800-480-2520) and are briefly described here:
  - How-to Guides. FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides describe the four major phases of hazard mitigation planning. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting DMA 2000 requirements (<http://www.fema.gov/plan/mitplanning/resources.shtm#1>).
  - 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.
  - A Guide to Recovery Programs FEMA 229(4), September 2005. The programs described in this guide may all be of assistance during disaster incident recovery. Some are available only after a Presidential declaration of disaster, but others are available without a declaration. Please see the individual program descriptions for details. (<http://www.fema.gov/txt/rebuild/ltrc/recoveryprograms229.txt>)
  - The Emergency Management Guide for Business and Industry. FEMA 141, October 1993. This guide provides a step-by-step approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This

- effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to a community's industries and businesses located in hazard prone areas.
- The FEMA Hazard Mitigation Assistance (HMA Unified Guidance, June 1, 2010). The guidance introduces the five HMA grant programs, funding opportunities, award information, eligibility, application and submission information, application review process, administering the grant, contracts, additional program guidance, additional project guidance, and contains information and resource appendices(FEMA 2009).
  - FEMA also administers emergency management grants (<http://www.fema.gov/help/site.shtm>) and various firefighter grant programs (<http://www.firegrantsupport.com/>) such as
    - Emergency Management Performance Grant (EMPG). This is a pass through grant. The amount is determined by the State. The grant is intended to support critical assistance to sustain and enhance State and local emergency management capabilities at the State and local levels for all-hazard mitigation, preparedness, response, and recovery including coordination of inter-governmental (Federal, State, regional, local, and tribal) resources, joint operations, and mutual aid compacts state-to-state and nationwide. Sub-recipients must be compliant with NIMS implementation as a condition for receiving funds. Requires 50% match.
    - Assistance to Fire Fighters Grant (AFG), Fire Prevention and Safety (FP&S), Staffing for Adequate Fire and Emergency Response Grants (SAFER), and Assistance to Firefighters Station Construction Grant programs. Information can be found at: (<http://forestry.alaska.gov/fire/vfarfa.htm>).
  - Department of Homeland Security provides the following grants:
    - Homeland Security Grant Program (HSGP), State Homeland Security Program (SHSP) are 80% pass through grants. SHSP supports implementing the State Homeland Security Strategies to address identified planning, organization, equipment, training, and exercise needs for acts of terrorism and other catastrophic events. In addition, SHSP supports implementing the National Preparedness Guidelines, the National Incident Management System (NIMS), and the National Response Framework (NRF). Must ensure at least 25% of funds are dedicated towards law enforcement terrorism prevention-oriented activities.
    - Citizen Corps Program (CCP). The Citizen Corps mission is to bring community and government leaders together to coordinate involving community members in emergency preparedness, planning, mitigation, response, and recovery activities.
    - Emergency Operations Center (EOC) This program is intended to improve emergency management and preparedness capabilities by supporting flexible, sustainable, secure, strategically located, and fully interoperable Emergency Operations Centers (EOCs) with a focus on addressing identified deficiencies and needs. Fully capable emergency operations facilities at the State and local levels are an essential element of a comprehensive national emergency management system and

- are necessary to ensure continuity of operations and continuity of government in major disasters or emergencies caused by any hazard. Requires 25% match.
- U.S. Department of Commerce's grant programs include:
    - Remote Community Alert Systems (RCASP) grant for outdoor alerting technologies in remote communities effectively underserved by commercial mobile service for the purpose of enabling residents of those communities to receive emergency messages. This program is a contributing element of the Warning, Alert, and Response Network (WARN) Act.
    - National Oceanic and Atmospheric Administration (NOAA), provides funds to the State of Alaska due to Alaska's high threat for tsunami. The allocation supports the promotion of local, regional, and state level tsunami mitigation and preparedness; installation of warning communications systems; installation of warning communications systems; installation of tsunami signage; promotion of the Tsunami Ready Program in Alaska; development of inundation models; and delivery of inundation maps and decision-support tools to communities in Alaska.
  - Department of Agriculture (USDA). Disaster assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Forest Restoration Program, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.  
(<http://www.fsa.usda.gov/FSA/webapp?area=home&subject=diap&topic=landing>)
  - Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program (<http://www1.eere.energy.gov/wip/wap.html>). 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.
    - The Tribal Energy Program offers financial and technical assistance to Indian tribes to help them create sustainable renewable energy installations on their lands. This program promotes tribal energy self-sufficiency and fosters employment and economic development on America's tribal lands.  
(<http://www1.eere.energy.gov/wip/tribal.html>)
  - US Environmental Protection Agency (EPA). Under EPA's Clean Water State Revolving Fund (CWSRF) program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management projects.  
(<http://yosemite.epa.gov/R10/ecocomm.nsf/6da048b9966d22518825662d00729a35/7b68c420b668ada5882569ab00720988!OpenDocument>)
    - Public Works and Development Facilities Program. This program provides assistance to help distressed communities attract new industry, encourage business expansion, diversify local economies, and generate long-term, private sector jobs. Among the types of projects funded are water and sewer facilities, primarily serving industry and

commerce; access roads to industrial parks or sites; port improvements; business incubator facilities; technology infrastructure; sustainable development activities; export programs; brownfields redevelopment; aquaculture facilities; and other infrastructure projects. Specific activities may include demolition, renovation, and construction of public facilities; provision of water or sewer infrastructure; or the development of stormwater control mechanisms (e.g., a retention pond) as part of an industrial park or other eligible project.

([http://cfpub.epa.gov/fedfund/program.cfm?prog\\_num=51](http://cfpub.epa.gov/fedfund/program.cfm?prog_num=51))

- Department of Health and Human Services, Administration of Children & Families, Administration for Native Americans (ANA). The ANA awards funds through grants to American Indians, Native Americans, Native Alaskans, Native Hawaiians, and Pacific Islanders. These grants are awarded to individual organizations that successfully apply for discretionary funds. ANA publishes in the Federal Register an announcement of funds available, the primary areas of focus, review criteria, and the method of application. ([http://www.acf.hhs.gov/programs/ana/programs/program\\_information.html](http://www.acf.hhs.gov/programs/ana/programs/program_information.html))
- Department of Housing and Urban Development (HUD) provides a variety of disaster resources. They also partner with Federal and state agencies to help implement disaster recovery assistance. Under the *National Response Framework* the FEMA and the Small Business Administration (SBA) offer initial recovery assistance. ([http://www.hud.gov/info/disasterresources\\_dev.cfm](http://www.hud.gov/info/disasterresources_dev.cfm))
  - HUD, Office of Homes and Communities, Section 108 Loan Guarantee Programs. This program provides loan guarantees as security for Federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing. (<http://www.hud.gov/offices/cpd/communitydevelopment/programs/108/index.cfm>)
  - HUD, Office of Homes and Communities, Section 184 Indian Home Loan Guarantee Programs. The Section 184 Indian Home Loan Guarantee Program is a home mortgage specifically designed for American Indian and Alaska Native families, Alaska Villages, Tribes, or Tribally Designated Housing Entities. Section 184 loans can be used, both on and off native lands, for new construction, rehabilitation, purchase of an existing home, or refinance.
  - Because of the unique status of Indian lands being held in Trust, Native American homeownership has historically been an underserved market. Working with an expanding network of private sector and tribal partners, the Section 184 Program endeavors to increase access to capital for Native Americans and provide private funding opportunities for tribal housing agencies with the Section 184 Program. (<http://www.hud.gov/offices/pih/ih/homeownership/184/>)
  - HUD/CDBG provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons (<http://www.hud.gov/offices/cpd/communitydevelopment/programs/>)
- Department of Labor (DOL), Employment and Training Administration, Disaster Unemployment Assistance. Provides weekly unemployment subsistence grants for those

who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible. (<http://www.workforcesecurity.doleta.gov/unemploy/disaster.asp>)

- The Workforce Investment Act contains provisions aimed at supporting employment and training activities for Indian, Alaska Native, and Native Hawaiian individuals. The Department of Labor's Indian and Native American Programs (INAP) funds grant programs that provide training opportunities at the local level for this target population. (<http://www.dol.gov/dol/topic/training/indianprograms.htm>)
- U.S. Department of Transportation, Hazardous Materials Emergency Preparedness Grant. To increase State, Territorial, Tribal and local effectiveness in safely and efficiently handling hazardous materials accidents and incidents, enhance implementation of the Emergency Planning and Community Right-to-Know Act of 1986, and encourage a comprehensive approach to emergency training and planning by incorporating the unique challenges of responses to transportation situations, through planning and training. Requires a 20% local match.
- Federal Financial Institutions. Member banks of Federal Deposit Insurance Corporation, Financial Reporting Standards or Federal Home Loan Bank Board may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.
- Internal Revenue Service (IRS), Disaster Tax Relief. Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous year's tax returns (<http://www.irs.gov/newsroom/article/0,,id=108362,00.html>).
- Natural Resources Conservation Service (NRCS) has several funding sources to fulfill mitigation needs. Further information is located at: <http://www.ak.nrcs.usda.gov/sitemap.html>
  - The Emergency Watershed Protection Program (EWP). This funding source is designed is to undertake emergency measures, including the purchase of flood plain easements, for runoff retardation and soil erosion prevention to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood or any other natural occurrence is causing or has caused a sudden impairment of the watershed.
  - Wildlife habitat Incentives Program (WHIP). This is a voluntary program for conservation-minded landowners who want to develop and improve wildlife habitat on agricultural land, nonindustrial private forest land, and Indian land.
  - Watershed Planning. NRCS watershed activities in Alaska are voluntary efforts requested through conservation districts and units of government and/or tribes. The watershed activities are lead locally by a "watershed management committee" that is comprised of local interest groups, local units of government, local tribal representatives and any organization that has a vested interest in the watershed planning activity. This committee provides direction to the process as well as provides the decision-making necessary to implement the process. Technical assistance is provided to the watershed management committee through a "technical advisory committee" comprised of local, state and federal technical specialist. These

- specialists provide information to the watershed management committee as needed to make sound decisions. NRCS also provides training on watershed planning organization and process.
- U.S. SBA Disaster Assistance (<http://www.sba.gov/category/navigation-structure/starting-managing-business/managing-business/running-business/emergency-preparedness-and-disaster->) provides information concerning disaster assistance, preparedness, planning, cleanup, and recovery planning.
    - May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster. (<http://www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/disaster-loans>). Requests for SBA loan assistance should be submitted to DHS&EM.
  - United States Army Corps of Engineers (USACE) Alaska District's Civil Works Branch studies potential water resource projects in Alaska. These studies analyze and solve water resource issues of concern to the local communities. These issues may involve navigational improvements, flood control or ecosystem restoration. The agency also tracks flood hazard data for over 300 Alaskan communities on floodplains or the sea coast. These data help local communities assess the risk of floods to their communities and prepare for potential future floods (<http://www.poa.usace.army.mil/en/cw/index.htm>). The USACE is a member and co-chair of the Alaska Climate Change Sub-Cabinet.

### State Resources

- DHS&EM is responsible for improving hazard mitigation technical assistance for local governments for the State of Alaska. Providing hazard mitigation training, current hazard information and communication facilitation with other agencies will enhance local hazard mitigation efforts. DHS&EM administers FEMA mitigation grants to mitigate future disaster damages such as those that may affect infrastructure including elevating, relocating, or acquiring hazard-prone properties. (<http://www.ak-prepared.com/plans/mitigation/mitigati.htm>)

DHS&EM also provides mitigation funding resources for mitigation planning on their Web site at <http://www.ak-prepared.com/plans/mitigation/localhazmitplan.htm>.
- Division of Senior Services (DSS): Provides special outreach services for seniors, including food, shelter and clothing. (<http://www.hss.state.ak.us/dsds/seniorInfoResources.htm>)
- Division of Insurance (DOI): Provides assistance in obtaining copies of policies and provides information regarding filing claims. (<http://www.dced.state.ak.us/insurance/>)
- Department of Military and Veterans Affairs (DMVA): Provides damage appraisals and settlements for VA-insured homes, and assists with filing of survivor benefits. (<http://veterans.alaska.gov/links.htm>)
- DCRA within the DCCED. DCRA administers the HUD/CDBG, FMA Program, and the Climate Change Sub-Cabinet's Interagency Working Group's program funds and administers various flood and erosion mitigation projects, including the elevation, relocation, or acquisition of flood-prone homes and businesses throughout the State. This



department also administers programs for State "distressed" and "targeted" communities. (<http://www.commerce.state.ak.us/dca/>)

- Department of Environmental Conservation (DEC). The DEC primary roles and responsibilities concerning hazards mitigation are ensuring safe food and safe water, and pollution prevention and pollution response. DEC ensures water treatment plants, landfills, and bulk fuel storage tank farms are safely constructed and operated in communities. Agency and facility response plans include hazards identification and pollution prevention and response strategies. (<http://dec.alaska.gov/>)
  - The Division of Water's Village Safe Water Program works with rural communities to develop sustainable sanitation facilities. Communities apply each year to VSW for grants for sanitation projects. Federal and state funding for this program is administered and managed by the State of Alaska's Village Safe Water (VSW) program. VSW provides technical and financial support to Alaska's smallest communities to design and construct water and wastewater systems. In some cases, funding is awarded by VSW through the Alaska Native Tribal Health Consortium, who in turn assist communities in design and construct of sanitation projects.
  - Municipal Grants and Loans Program. The Department of Environmental Conservation / Division of Water administer the Alaska Clean Water Fund (ACWF) and the Alaska Drinking Water Fund (ADWF). The division is fiscally responsible to the Environmental Protection Agency (EPA) to administer the loan funds as the EPA provides capitalization grants to the division for each of the loan funds. In addition, it is prudent upon the division to administer the funds in a manner that ensures their continued viability.
  - Under EPA's Clean Water State Revolving Fund (CWSRF) program, each state maintains a revolving loan fund to provide independent and permanent sources of low-cost financing for a wide range of water quality infrastructure projects, including: municipal wastewater treatment projects; non-point source projects; watershed protection or restoration projects; and estuary management, [and stormwater management] projects.  
(<http://yosemite.epa.gov/R10/ecocomm.nsf/6da048b9966d22518825662d00729a35/7b68c420b668ada5882569ab00720988!OpenDocument>)  
  
Alaska's Revolving Loan Fund Program, prescribed by Title VI of the Clean Water Act as amended by the Water Quality Act of 1987, Public Law 100-4. DEC will use the ACWF account to administer the loan fund. This Agreement will continue from year-to-year and will be incorporated by reference into the annual capitalization grant agreement between EPA and the DEC. DEC will use a fiscal year of July 1 to June 30 for reporting purposes.  
([http://www.epa.gov/region10/pdf/water/srf/cwsrf\\_alaska\\_operating\\_agreement.pdf](http://www.epa.gov/region10/pdf/water/srf/cwsrf_alaska_operating_agreement.pdf))
- Department of Transportation and Public Facilities (DOT/PF) personnel provide technical assistance to the various emergency management programs, to include mitigation. This assistance is addressed in the DHS&EM-DOT/PF Memorandum of Agreement and includes but is not limited to: environmental reviews, archaeological surveys, and historic preservation reviews.

- DOT/PF and DHS&EM coordinate buy-out projects to ensure that there are no potential right-of-way conflicts with future use of land for bridge and highway projects, and collaborate on earthquake mitigation.
- Additionally, DOT/PF provides the safe, efficient, economical, and effective State highway, harbor, and airport operation. DOT/PF uses its Planning, Design and Engineering, Maintenance and Operations, and Intelligent Transportation Systems resources to identify hazards, plan and initiate mitigation activities to meet the transportation needs of Alaskans, and make Alaska a better place to live and work. DOT/PF budgets for temporary bridge replacements and materials necessary to make the multi-modal transportation system operational following natural disaster events.
- DNR administers various projects designed to reduce stream bank erosion, reduce localized flooding, improve drainage, and improve discharge water quality through the stormwater grant program funds. Within DNR,
  - The Division of Geological and Geophysical Survey (DGGS) is responsible Alaska's mineral, land, and water resources use, development, and earthquake mitigation collaboration.

Their geologists and support staff are leaders in researching Alaska's geology and implementing technological tools to most efficiently collect, interpret, publish, archive, and disseminate information to the public. Information is available at: ([http://www.dggs.dnr.state.ak.us/index.php?menu\\_link=publications&link=publications\\_search#](http://www.dggs.dnr.state.ak.us/index.php?menu_link=publications&link=publications_search#))
  - The DNR's Division of Forestry (DOF) participates in a statewide wildfire control program in cooperation with the forest industry, rural fire departments and other agencies. Prescribed burning may increase the risks of fire hazards; however, prescribed burning reduces the availability of fire fuels and therefore the potential for future, more serious fires.

(<http://forestry.alaska.gov/pdfs/08FireSuppressionMediaGuide.pdf>)
  - DOF also manages various wildland fire programs, activities, and grant programs such as the FireWise Program (<http://forestry.alaska.gov/fire/firewise.htm>), Community Forestry Program (CFP) (<http://forestry.alaska.gov/community/>), Assistance to Fire Fighters Grant (AFG), Fire Prevention and Safety (FP&S), Staffing for Adequate Fire and Emergency Response Grants (SAFER), and Volunteer Fire Assistance and Rural Fire Assistance Grant (VFA-RFA) programs (<http://forestry.alaska.gov/fire/vfarfa.htm>). Information can be found at <http://forestry.alaska.gov/fire/current.htm>.

### Other Funding Sources and Resources

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

- FEMA, <http://www.fema.gov> - includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.

- American Planning Association (APA), <http://www.planning.org> - a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
- Institute for Business and Home Safety (IBHS), <http://ibhs.org> - an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters.
- American Red Cross (ARC). Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided.
- Crisis Counseling Program. Provides grants to State and Borough Mental Health Departments, which in turn provide training for screening, diagnosing and counseling techniques. Also provides funds for counseling, outreach, and consultation for those affected by disaster. (<http://dialoguemakers.org/Resourses4states+Nonprofits.htm>)
- Denali Commission. Introduced by Congress in 1998, the Denali Commission is an independent federal agency designed to provide critical utilities, infrastructure, and economic support throughout Alaska. With the creation of the Denali Commission, Congress acknowledged the need for increased inter-agency cooperation and focus on Alaska's remote communities. Since its first meeting in April 1999, the Commission is credited with providing numerous cost-shared infrastructure projects across the State that exemplifies effective and efficient partnership between federal and state agencies, and the private sector.  
([http://www.denali.gov/index.php?option=com\\_content&view=section&id=1&Itemid=3](http://www.denali.gov/index.php?option=com_content&view=section&id=1&Itemid=3))
  - The Energy Program primarily funds design and construction of replacement bulk fuel storage facilities, upgrades to community power generation and distribution systems, alternative-renewable energy projects, and some energy cost reduction projects. The Commission works with the Alaska Energy Authority (AEA), Alaska Village Electric Cooperative (AVEC), Alaska Power and Telephone and other partners to meet rural communities' fuel storage and power generation needs.
  - The goal of the solid waste program at the Denali Commission is to provide funding to address deficiencies in solid waste disposal sites which threaten to contaminate rural drinking water supplies.
- Lindbergh Foundation Grants. Each year, The Charles A. and Anne Morrow Lindbergh Foundation provides grants of up to \$10,580 (a symbolic amount representing the cost of the Spirit of St. Louis) to men and women whose individual initiative and work in a wide spectrum of disciplines furthers the Lindberghs' vision of a balance between the advance of technology and the preservation of the natural/human environment.  
(<http://www.lindberghfoundation.org/docs/index.php/our-grants>)
- Rasmuson Foundation Grants. The Rasmuson foundation invests both in individuals and well-managed 501(c)(3) organizations dedicated to improving the quality of life for Alaskans.

The Foundation seeks to support not-for-profit organizations that are focused and effective in the pursuit of their goals, with special consideration for those organizations that demonstrate strong leadership, clarity of purpose and cautious use of resources.

The Foundation trustees believe successful organizations can sustain their basic operations through other means of support and prefer to assist organizations with specific needs, focusing on requests which allow the organizations to become more efficient and effective. The trustees look favorably on organizations which demonstrate broad community support, superior fiscal management and matching project support.  
(<http://www.rasmuson.org/index.php>)

### **Local Resources**

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

**Table 8-2 Quinhagak's Technical Resources for Hazard Mitigation**

<b>Staff/Personnel Resources</b>	<b>Y/N</b>	<b>Department/Agency and Position</b>
Planner or engineer with knowledge of land development and land management practices	No	The City hires consultants with land development and land management knowledge
Engineer or professional trained in construction practices related to buildings and/or infrastructure	No	The City may hire engineering consulting services
Planner or engineer with an understanding of natural and/or human-caused hazards	No	The City hires consultants with hazard mitigation knowledge
Floodplain Manager	No	Taunnie Boothby, State Floodplain Manager
Surveyors	No	The City may hire surveying consulting services
Staff with education or expertise to assess the jurisdiction's vulnerability to hazards	No	The City hires consultants with this knowledge
Personnel skilled in Geospatial Information System (GIS) and/or HAZUS-MH	No	The City hires consultants with this knowledge
Scientists familiar with the hazards of the jurisdiction	No	U.S. Fish & Wildlife Service local office; Alaska Dept of Fish & Game local office
Emergency Manager	Yes	City Mayor or Tribal Chief (Situation dependent)
Finance (Grant writers)	Yes	City or Tribal Administrator (Situation dependent)
Public Information Officer	Yes	City Mayor or Tribal Chief (Situation dependent)

**Table 8-3 Financial Resources Available for Hazard Mitigation**

Financial Resource	Accessible or Eligible to Use for Mitigation Activities
General funds	Limited funding, can exercise this authority with voter approval
Community Development Block Grants	Limited funding, can exercise this authority with voter approval
Capital Improvement Projects Funding	Limited funding, can exercise this authority with voter approval
Authority to levy taxes for specific purposes	Limited funding, can exercise this authority with voter approval
Incur debt through general obligation bonds	Can exercise this authority with voter approval
Incur debt through special tax and revenue bonds	Can exercise this authority with voter approval
Incur debt through private activity bonds	Can exercise this authority with voter approval
Hazard Mitigation Grant Program (HMGP)	FEMA funding which is available to local communities after a Presidentially-declared disaster. It can be used to fund both pre- and post-disaster mitigation plans and projects.
Pre-Disaster Mitigation (PDM) grant program	FEMA funding which available on an annual basis. This grant can only be used to fund pre-disaster mitigation plans and projects only
Flood Mitigation Assistance (FMA) grant program	FEMA funding which is available on an annual basis. This grant can be used to mitigate repetitively flooded structures and infrastructure to protect repetitive flood structures.
United State Fire Administration (USFA) Grants	The purpose of these grants is to assist state, regional, national or local organizations to address fire prevention and safety. The primary goal is to reach high-risk target groups including children, seniors and firefighters.
Fire Mitigation Fees	Finance future fire protection facilities and fire capital expenditures required because of new development within Special Districts.

## 8.4 CONTINUED PUBLIC INVOLVEMENT

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

<p align="center"><b>DMA 2000 Requirements: Plan Maintenance Process - Continued Public Involvement</b></p> <p><b>Continued Public Involvement</b></p> <p><b>Requirement §201.6(c)(4)(iii):</b> [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.</p> <p><b>Element</b></p> <ul style="list-style-type: none"> <li>Does the new or updated plan explain how continued public participation will be obtained?</li> </ul> <p><i>Source: FEMA, July 2010.</i></p>
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The City is dedicated to involving the public directly in the continual reshaping and updating of the HMP. A paper copy of the HMP and any proposed changes will be available at the City Office. An address and phone number of the Project Team Leader to whom people can direct their comments or concerns will also be available at the City Office.

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

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## **Appendix A**

### **Crosswalk**

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# LOCAL MITIGATION PLAN REVIEW CROSSWALK

## LOCAL MITIGATION PLAN REVIEW SUMMARY

The plan cannot be approved if the plan has not been formally adopted. Each requirement includes separate elements. All elements of the requirement must be rated "Satisfactory" in order for the requirement to be fulfilled and receive a score of "Satisfactory." Elements of each requirement are listed on the following pages of the Plan Review Crosswalk. A "Needs Improvement" score on elements shaded in gray (recommended but not required) will not preclude the plan from passing. Reviewer's comments must be provided for requirements receiving a "Needs Improvement" score.

### Prerequisite(s) (Check Applicable Box)

1. Adoption by the Local Governing Body:  
§201.6(c)(5) OR

NOT MET	MET
	X

2. Multi-Jurisdictional Plan Adoption: §201.6(c)(5)  
AND

	N/A
--	-----

3. Multi-Jurisdictional Planning Participation: §201.6(a)(3)

	N/A
--	-----

### Planning Process

4. Documentation of the Planning Process: §201.6(b)  
and §201.6(c)(1)

N	S
	X

### Risk Assessment

5. Identifying Hazards: §201.6(c)(2)(i)

N	S
	X

6. Profiling Hazards: §201.6(c)(2)(i)

	X
--	---

7. Assessing Vulnerability: Overview: §201.6(c)(2)(ii)

	X
--	---

8. Assessing Vulnerability: Addressing Repetitive  
Loss Properties. §201.6(c)(2)(ii)

	X
--	---

9. Assessing Vulnerability: Identifying Structures,  
Infrastructure, and Critical Facilities: §201.6(c)(2)(ii)(B)

	X
--	---

10. Assessing Vulnerability: Estimating Potential Losses:  
§201.6(c)(2)(ii)(B)

	X
--	---

11. Assessing Vulnerability: Analyzing Development  
Trends: §201.6(c)(2)(ii)(C)

	X
--	---

12. Multi-Jurisdictional Risk Assessment: §201.6(c)(2)(iii)

	N/A
--	-----

\*States that have additional requirements can add them in the appropriate sections of the *Local Multi-Hazard Mitigation Planning Guidance* or create a new section and modify this Plan Review Crosswalk to record the score for those requirements.

## SCORING SYSTEM

Please check one of the following for each requirement.

**N – Needs Improvement:** The plan does not meet the minimum for the requirement. Reviewer's comments must be provided.

**S – Satisfactory:** The plan meets the minimum for the requirement. Reviewer's comments are encouraged, but not required.

### Mitigation Strategy

13. Local Hazard Mitigation Goals: §201.6(c)(3)(i)

N	S
---	---

14. Identification and Analysis of Mitigation Actions:  
§201.6(c)(3)(ii)

	X
--	---

15. Identification and Analysis of Mitigation  
Actions: NFIP Compliance. §201.6(c)(3)(ii)

	X
--	---

16. Implementation of Mitigation Actions:  
§201.6(c)(3)(iii)

	X
--	---

17. Multi-Jurisdictional Mitigation Actions:  
§201.6(c)(3)(iv)

	N/A
--	-----

### Plan Maintenance Process

18. Monitoring, Evaluating, and Updating the Plan:  
§201.6(c)(4)(ii)

N	S
---	---

19. Incorporation into Existing Planning  
Mechanisms: §201.6(c)(4)(ii)

	X
--	---

20. Continued Public Involvement: §201.6(c)(4)(iii)

	X
--	---

### Additional State Requirements\*

Insert State Requirement

N	S
---	---

Insert State Requirement

	N/A
--	-----

Insert State Requirement

	N/A
--	-----

## LOCAL MITIGATION PLAN APPROVAL STATUS

PLAN NOT APPROVED

See Reviewer's Comments

PLAN APPROVED

X

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### Local Mitigation Plan Review and Approval Status

<b>Jurisdiction:</b> City of Quinhagak	<b>Title of Plan:</b> City of Quinhagak Hazard Mitigation Plan	<b>Date of Plan:</b> August 2011
<b>Local Point of Contact:</b> Willard Church	<b>Address:</b>  City of Quinhagak P.O. Box 90 Quinhagak, AK 99655	
<b>Title:</b> Mayor		
<b>Agency:</b> City of Quinhagak		
<b>Phone Number:</b> 907.556.8202	<b>E-Mail:</b> <a href="mailto:wchurch.cityofquinhagak@hotmail.com">wchurch.cityofquinhagak@hotmail.com</a>	

<b>State Reviewer:</b>	<b>Title:</b>	<b>Date:</b>
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<b>FEMA Reviewer:</b> Brett Holt	<b>Title:</b> Mitigation Planner	<b>Date:</b> November 21, 2011
<b>Date Received in FEMA Region X</b>	November 2, 2011	
<b>Plan Not Approved</b>		
<b>Plan Approved</b>	X	
<b>Date Approved</b>	January 25, 2012	

Jurisdiction:	NFIP Status*			
	Y	N	N/A	CRS Class
1. City of Quinhagak		X		
2.				
3.				
4.				
5. [ATTACH PAGE(S) WITH ADDITIONAL JURISDICTIONS]				

\* Notes:                      Y = Participating                      N = Not Participating                      N/A = Not Mapped

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### PREREQUISITE(S)

#### 1. Adoption by the Local Governing Body

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Has the local governing body adopted <b>new</b> or updated plan?	Pg 2-1	The jurisdiction adopted the plan.		X
B. Is supporting documentation, such as a resolution, included?	Appendix B	The jurisdiction submitted a resolution to FEMA.		X
SUMMARY SCORE				X

#### 2. Multi-Jurisdictional Plan Adoption

**Requirement §201.6(c)(5):** For multi-jurisdictional plans, each jurisdiction requesting approval of the plan **must** document that it has been formally adopted.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Does the <b>new</b> or updated plan indicate the specific jurisdictions represented in the plan?	N/A			N/A
B. For each jurisdiction, has the local governing body adopted the <b>new or updated</b> plan?	N/A			N/A
C. Is supporting documentation, such as a resolution, included for each participating jurisdiction?	N/A			N/A
SUMMARY SCORE				N/A

#### 3. Multi-Jurisdictional Planning Participation

**Requirement §201.6(a)(3):** Multi-jurisdictional plans (e.g., watershed plans) may be accepted, as appropriate, as long as each jurisdiction has participated in the process ... Statewide plans will not be accepted as multi-jurisdictional plans.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			NOT MET	MET
A. Does the <b>new or updated</b> plan describe <b>how</b> each jurisdiction participated in the plan's development?	N/A			N/A
B. Does the updated plan identify all participating jurisdictions, including new, continuing, and the jurisdictions that no longer participate in the plan?	N/A			N/A
SUMMARY SCORE				N/A



## LOCAL MITIGATION PLAN REVIEW CROSSWALK

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

### 4. Documentation of the Planning Process

**Requirement §201.6(b):** *In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process **shall** include:*

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

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the plan provide a narrative description of the process followed to prepare the <b>new</b> or updated plan?	pp. 4-1 to 4-3	The planning process is described.		X
B. Does the <b>new</b> or updated plan indicate who was involved in the <b>current</b> planning process? (For example, who led the development at the staff level and were there any external contributors such as contractors? Who participated on the plan committee, provided information, reviewed drafts, etc.?)	p. 4-3	The planning team is listed.		X
C. Does the <b>new</b> or updated plan indicate how the public was involved? (Was the public provided an opportunity to comment on the plan during the drafting stage and prior to the plan approval?)	pp. 4-3 to 4-4	The plan indicates how the public was involved.		X
D. Does the <b>new</b> or updated plan discuss the opportunity for neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties to be involved in the planning process?	pp. 4-3 to 4-4	The plan discusses opportunities for other organizations and agencies.		X
E. Does the planning process describe the review and incorporation, if appropriate, of existing plans, studies, reports, and technical information?	pp. 4-4, 9-1 to 9-3	The plan incorporates a variety of sources.		X
F. Does the updated plan document how the planning team reviewed and analyzed each section of the plan and whether each section was revised as part of the update process?	N/A			N/A
SUMMARY SCORE				X

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

**RISK ASSESSMENT:** §201.6(c)(2): *The plan shall include a risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.*

### 5. Identifying Hazards

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan include a description of the types of all natural hazards that affect the jurisdiction?	p. 5-2	The plan identifies all natural hazards that can affect the area.		X
SUMMARY SCORE				X

### 6. Profiling Hazards

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the risk assessment identify the <b>location</b> (i.e., geographic area affected) of each natural hazard addressed in the <b>new</b> or updated plan?	Section 5	The location of each natural hazard is identified.		X
B. Does the risk assessment identify the <b>extent</b> (i.e., magnitude or severity) of each hazard addressed in the <b>new</b> or updated plan?	Section 5	The extent of each natural hazard is addressed.		X
C. Does the plan provide information on <b>previous occurrences</b> of each hazard addressed in the <b>new</b> or updated plan?	Section 5	The plan provides information on previous occurrences of each natural hazard.		X
D. Does the plan include the <b>probability of future events</b> (i.e., chance of occurrence) for each hazard addressed in the <b>new</b> plan?	Section 5	The plan includes the probability of future events for each natural hazard.		X
SUMMARY SCORE				X

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 7. Assessing Vulnerability: Overview

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan include an <b>overall summary</b> description of the jurisdiction's <b>vulnerability</b> to each hazard?	Sections 6.1 and 6.2	The plan includes an overall summary description of the jurisdiction's vulnerability.		X
B. Does the <b>new</b> or updated plan address the <b>impact</b> of each hazard on the jurisdiction?	Section 5	The impact of each natural hazard is addressed.		X
SUMMARY SCORE				X

### 8. Assessing Vulnerability: Addressing Repetitive Loss Properties

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan describe vulnerability in terms of the types and numbers of <i>repetitive loss properties</i> located in the identified hazard areas?	p. 6-3	The City does not participate in the NFIP, nor do they have repetitive loss properties.		X
SUMMARY SCORE				X

### 9. Assessing Vulnerability: Identifying Structures

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan describe vulnerability in terms of the <b>types and numbers</b> of <b>existing</b> buildings, infrastructure, and critical facilities located in the identified hazard areas?	Table 6-2	The plan describes vulnerability in terms of the types and numbers of existing buildings, infrastructure, and critical facilities located in the identified hazard areas.		X
B. Does the <b>new</b> or updated plan describe vulnerability in terms of the <b>types and numbers</b> of <b>future</b> buildings, infrastructure, and critical facilities located in the identified hazard areas?	Table 6-5	The plan describes vulnerability in terms of the types and numbers of future buildings, infrastructure, and critical facilities located in the identified hazard areas.		X
SUMMARY SCORE				X

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 10. Assessing Vulnerability: Estimating Potential Losses

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan estimate <b>potential dollar losses</b> to vulnerable structures? <i>Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.</i>	Section 6.2.4	The plan estimates potential dollar losses to vulnerable structures.		X
B. Does the <b>new</b> or updated plan describe the <b>methodology</b> used to prepare the estimate? <i>Note: A "Needs Improvement" score on this requirement will not preclude the plan from passing.</i>	Section 6.2.2	The plan describes the methodology.		X
SUMMARY SCORE				X

### 11. Assessing Vulnerability: Analyzing Development Trends

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan describe land uses and development trends?	Section 6.3	The plan describes land uses and development trends.		X
SUMMARY SCORE				X

### 12. Multi-Jurisdictional Risk Assessment

**Requirement §201.6(c)(2)(iii):** For multi-jurisdictional plans, the risk assessment **must** assess each jurisdiction's risks where they vary from the risks facing the entire planning area.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan include a risk assessment for each participating jurisdiction as needed to reflect unique or varied risks?	N/A			N/A
SUMMARY SCORE				N/A

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

**MITIGATION STRATEGY:** §201.6(c)(3): *The plan shall include a mitigation strategy that provides the jurisdiction's blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.*

### 13. Local Hazard Mitigation Goals

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A Does the <b>new</b> or updated plan include a description of mitigation <b>goals</b> to reduce or avoid long-term vulnerabilities to the identified hazards?	p. 7-1	9 goals are identified.		X
SUMMARY SCORE				X

### 14. Identification and Analysis of Mitigation Actions

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan identify and analyze a <b>comprehensive range</b> of specific mitigation actions and projects for each hazard?	pp. 7-7 to 7-13	The plan identifies a range of mitigation actions.		X
B Do the identified actions and projects address reducing the effects of hazards on <b>new</b> buildings and infrastructure?	pp. 7-7 to 7-13	The plan addresses reducing the effects of hazards on new buildings and infrastructure.		X
C. Do the identified actions and projects address reducing the effects of hazards on <b>existing</b> buildings and infrastructure?	pp. 7-7 to 7-13	The plan addresses reducing the effects of hazards on existing buildings and infrastructure.		X
SUMMARY SCORE				X

### 15. Identification and Analysis of Mitigation Actions: National Flood Insurance Program (NFIP) Compliance

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan describe the jurisdiction (s) participation in the NFIP?	p. 1-3	The City of Angoon does not participate in the NFIP.		X
B. Does the mitigation strategy identify, analyze and prioritize actions related to continued compliance with the NFIP?	p. 1-3	The City of Angoon does not participate in the NFIP.		X
SUMMARY SCORE				X

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### 16. Implementation of Mitigation Actions

**Requirement: §201.6(c)(3)(iii):** [The mitigation strategy section **shall** include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization **shall** include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated mitigation strategy include how the actions are <b>prioritized</b> ? (For example, is there a discussion of the process and criteria used?)	pp. 7-5 to 7-6	The plan includes how the actions are prioritized.		X
B. Does the <b>new</b> or updated mitigation strategy address how the actions will be implemented and administered, including the responsible department, existing and potential resources and the timeframe to complete each action?	pp. 7-7 to 7-13	Each mitigation action has an identified "Responsible Department", "Potential Funding", and "Timeframe".		X
C. Does the <b>new</b> or updated prioritization process include an emphasis on the use of a <b>cost-benefit review</b> to maximize benefits?	pp. 7-6 to 7-13	The Benefit-Costs are identified for each action.		X
D. Does the <b>updated</b> plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged ( <i>i.e.</i> , deferred), does the updated plan describe why no changes occurred?	N/A			N/A
SUMMARY SCORE				X

### 17. Multi-Jurisdictional Mitigation Actions

**Requirement §201.6(c)(3)(iv):** For multi-jurisdictional plans, there **must** be identifiable action items specific to the jurisdiction requesting FEMA approval or credit of the plan.

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan include identifiable <b>action items</b> for each jurisdiction requesting FEMA approval of the plan?	N/A			N/A
B. Does the <b>updated</b> plan identify the completed, deleted or deferred mitigation actions as a benchmark for progress, and if activities are unchanged ( <i>i.e.</i> , deferred), does the updated plan describe why no changes occurred?	N/A			N/A
SUMMARY SCORE				N/A

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### PLAN MAINTENANCE PROCESS

#### 18. Monitoring, Evaluating, and Updating the Plan

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan describe the method and schedule for <b>monitoring</b> the plan, including the responsible department?	pp. 8-1 to 8-2	The plan describes how it will be monitored.		X
B. Does the <b>new</b> or updated plan describe the method and schedule for <b>evaluating</b> the plan, including how, when and by whom (i.e. the responsible department)?	pp. 8-1 to 8-2	The plan describes how it will be evaluated.		X
C. Does the <b>new</b> or updated plan describe the method and schedule for <b>updating</b> the plan within the five-year cycle?	p. 8-2	The plan describes how it will be updated.		X
SUMMARY SCORE				X

#### 19. Incorporation into Existing Planning Mechanisms

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan identify other local planning mechanisms available for incorporating the mitigation requirements of the mitigation plan?	pp. 4-4, pp. 8-2 to 8-3	The plan identifies local planning mechanisms.		X
B. Does the <b>new</b> or updated plan include a process by which the local government will incorporate the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?	p. 8-3	The plan includes a process by which the local government will incorporate the mitigation strategy and other information contained in the plan.		X
C. Does the <b>updated</b> plan explain how the local government incorporated the mitigation strategy and other information contained in the plan (e.g., risk assessment) into other planning mechanisms, when appropriate?	N/A			N/A
SUMMARY SCORE				X

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### Continued Public Involvement

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

Element	Location in the Plan (section or annex and page #)	Reviewer's Comments	SCORE	
			N	S
A. Does the <b>new</b> or updated plan explain how <b>continued public participation</b> will be obtained? (For example, will there be public notices, an on-going mitigation plan committee, or annual review meetings with stakeholders?)	pp. 8-14 to 8-15	The plan explains continued public participation.		X
SUMMARY SCORE				X



## LOCAL MITIGATION PLAN REVIEW CROSSWALK

### MATRIX A: PROFILING HAZARDS

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that their plan addresses each natural hazard that can affect the jurisdiction. **Completing the matrix is not required.**

**Note:** First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each applicable hazard. An “N” for any element of any identified hazard will result in a “Needs Improvement” score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Location		B. Extent		C. Previous Occurrences		D. Probability of Future Events	
	Yes	N	S	N	S	N	S	N	S
Avalanche	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Erosion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dam Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drought	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Earthquake	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Expansive Soils	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Levee Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Hailstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hurricane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Land Subsidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Landslide	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe Winter Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tornado	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tsunami	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcano	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wildfire	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Windstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other <u>Erosion</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other <u>Ground Failure</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other <u>Weather, Severe</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

To check boxes, double click on the box and change the default value to “checked”

Legend:

§201.6(c)(2)(i) Profiling Hazards

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

### MATRIX B: ASSESSING VULNERABILITY

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure that the new or updated plan addresses each requirement. **Completing the matrix is not required.**

*Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each **applicable** hazard. An “N” for any element of any identified hazard will result in a “Needs Improvement” score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk. Note: Receiving an N in the shaded columns will not preclude the plan from passing.*

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)		A. Overall Summary Description of Vulnerability		B. Hazard Impact			A. Types and Number of Existing Structures in Hazard Area (Estimate)		B. Types and Number of Future Structures in Hazard Area (Estimate)			A. Loss Estimate		B. Methodology				
	Yes		N	S	N	S		N	S	N	S		N	S	N	S			
Avalanche	<input type="checkbox"/>	§201.6(c)(2)(ii) Assessing Vulnerability: Overview	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	§201.6(c)(2)(ii) Assessing Vulnerability: Identifying Structures	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	§201.6(c)(2)(ii) Assessing Vulnerability: Estimating Potential Losses	<input type="checkbox"/>	<input type="checkbox"/>	To check boxes, double click on the box and change the default value to "checked."	<input type="checkbox"/>	<input type="checkbox"/>		
Coastal Erosion	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Coastal Storm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Dam Failure	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Drought	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		
Earthquake	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Expansive Soils	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Levee Failure	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Hailstorm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hurricane	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Land Subsidence	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Landslide	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe Winter Storm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tornado	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tsunami	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcano	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wildfire	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Windstorm	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other <u>Erosion</u>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>		<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other <u>Ground Failure</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>				
Other <u>Weather, Severe</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>				

### Legend:

§201.6(c)(2)(ii) Assessing Vulnerability: Overview

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

§201.6(c)(2)(ii)(A) Assessing Vulnerability: Identifying Structures

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

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

§201.6(c)(2)(ii)(B) Assessing Vulnerability: Estimating Potential Losses

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

## MATRIX C: IDENTIFICATION AND ANALYSIS OF MITIGATION ACTIONS

## LOCAL MITIGATION PLAN REVIEW CROSSWALK

This matrix can assist FEMA and the State in scoring each hazard. Local jurisdictions may find the matrix useful to ensure consideration of a range of actions for each hazard. **Completing the matrix is not required.**

*Note: First, check which hazards are identified in requirement §201.6(c)(2)(i). Then, place a checkmark in either the N or S box for each **applicable** hazard. An “N” for any identified hazard will result in a “Needs Improvement” score for this requirement. List the hazard and its related shortcoming in the comments section of the Plan Review Crosswalk.*

Hazard Type	Hazards Identified Per Requirement §201.6(c)(2)(i)	A. Comprehensive Range of Actions and Projects	
		N	S
Avalanche	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Erosion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coastal Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dam Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Drought	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Earthquake	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Expansive Soils	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Levee Failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Flood	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Hailstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hurricane	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Land Subsidence	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Landslide	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe Winter Storm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tornado	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Tsunami	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Volcano	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wildfire	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Windstorm	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other <u>Erosion</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other <u>Ground Failure</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Other <u>Weather, Severe</u>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

*To check boxes, double  
click on the box and  
change the default value  
to “checked”*

### Legend:

§201.6(c)(3)(ii) Identification and Analysis of Mitigation Actions

A. Does the **new or updated** plan identify and analyze a comprehensive range of specific mitigation actions and projects for each hazard?

**Appendix B**  
**Adoption Resolution**

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City of Quinhagak  
City Council  
P.O. Box 90  
Quinhagak, Alaska 99655  
Ph: (907) 556-8202  
Fax: (907) 556-8166



Native Village of Kwinhagak  
IRA Council  
P.O. Box 149  
Quinhagak, Alaska 99655  
Ph: (907) 556-8165  
Fax: (907) 556-8166

December 14, 2011

URS Alaska  
R. Scott Simmons  
700 G Street, Suite 500  
Anchorage, AK 99501

Dear Mr. Simmons,

City of Quinhagak, Alaska Hazard Mitigation Plan was reviewed 12/13/11 with the city council's regular meeting. Resolution was approved with a full vote.

We are looking forward to working with you.

Sincerely,

Fannie Moore  
City Administrator



City of Quinhagak  
City Council  
P.O. Box 90  
Quinhagak, Alaska 99655  
Ph: (907) 556-8202  
Fax: (907) 556-8166



Native Village of Kwinhagak  
IRA Council  
P.O. Box 149  
Quinhagak, Alaska 99655  
Ph: (907) 556-8165  
Fax: (907) 556-8166

## RESOLUTION No. 11-12-24

### City of Quinhagak, Alaska Hazard Mitigation Plan

**WHEREAS**, City of Quinhagak is a second class city, incorporated on the thirteenth day of February A.D. 1975 by Title 29 of the Alaska Statutes, and is the governing body of the City of Quinhagak with a seven member Council which is fully authorized to act for and on behalf of the citizens of the City of Quinhagak, Alaska, and

**WHEREAS**, Quinhagak is vulnerable to damages from natural hazard events which pose a threat to public health and safety and could result in property loss and economic hardship;

**WHEREAS**, a Hazard Mitigation Plan (the Plan) has been developed through the work of the Quinhagak City Council, and interested parties within Quinhagak, Alaska;

**WHEREAS**, the Plan recommends hazard mitigation actions that will protect people and property affected by natural hazards that face Quinhagak, that will reduce future public, private, community, and personal costs of disaster response and recovery; and that will reinforce Quinhagak's leadership in emergency preparedness efforts;

**WHEREAS**, the Disaster Mitigation Act of 2000 (P.L. 106-390) (DMA 2000) and associated Federal regulations published under 44 CFR Part 201 require the City of Quinhagak to formally adopt a Hazard Mitigation Plan subject to the approval of the Federal Emergency Management Agency to be eligible for federal hazard mitigation projects and activities funds;

**WHEREAS**, public meetings were held to receive comment on the Plan as required by DMA 2000;



City of Quinhagak  
City Council  
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Quinhagak, Alaska 99655  
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Fax: (907) 556-8166

Native Village of Kwinhagak  
IRA Council  
P.O. Box 149  
Quinhagak, Alaska 99655  
Ph: (907) 556-8165  
Fax: (907) 556-8166

**NOW THEREFORE BE IT RESOLVED**, by the City Council of Quinhagak, Alaska that:

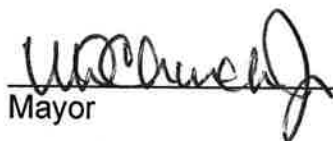
1. The Plan is hereby adopted as an official plan of the City of Quinhagak.
2. The Quinhagak officials identified in the Mitigation Action Plan (Section 8) are hereby directed to implement the recommended actions assigned to them. These officials will report quarterly on their activities, accomplishments, and progress to the Quinhagak City Council.
3. The Quinhagak Hazard Mitigation Planning Team will provide annual progress reports on the status of the implemented Mitigation Action Plan's projects to the Planning Team Leader. This report shall be submitted to the Quinhagak City Council annually by the Plan's adoption anniversary date.
4. The Quinhagak Planning Team, will complete periodic updates of the Plan as indicated in the Plan Maintenance Section (Section 8), but no less frequently than every five years.

**NOW THEREFORE, BE IT RESOLVED**, City Council of Quinhagak, Alaska adopts the Quinhagak, Alaska Hazard Mitigation Plan, dated December 13, 2011 as this jurisdiction's Hazard Mitigation Plan, and resolves to execute the actions in the Plan.

### CERTIFICATION

The foregoing resolution was duly considered and adopted at a meeting of the City of Quinhagak City Council in Quinhagak, Alaska on the 13 day of December 2011, by a vote of 7 for, 0 against, and 0 abstained.

Signed,

  
Mayor

  
Secretary







**Appendix C**  
**Public Outreach**

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# Memorandum

700 G Street, Suite 500  
Anchorage, AK 99503  
Phone: 907.261.9706  
Fax: 907.562.1297

**SUBJECT:** Division of Homeland Security and Emergency Management (DHS&EM) Hazard Mitigation Plan (HMP) /Hazard Mitigation Grant Program (HMGP) Project – Gambell Kick-Off – Team Meeting

**Community:** Quinhagak, 984.6614

**Date/Time:** March 15, 2011, 10:30 A.M.

**From:** R. Scott Simmons

**Attendees:**

- Willard Church, Mayor
- City Council Members
- Jim Galanas, The Boutet Co., Inc.
- Mark Roberts, DHS&EM, State Hazard Mitigation Officer
- Ervin Petty, DHS&EM

**Subjects covered included:**

- The Boutet Company Inc. received a grant to develop hazard mitigation plans and to develop one DHS&EM eligible HMGP project application based on the City's mitigatable natural hazard threats, potential impacts, population threatened, and their priorities.
- Mr. Galanas, The Boutet' Company Inc., will assist the Planning Team with identifying mitigation actions and projects. These projects will then be prioritized to determine the most important for the community while meeting FEMA's strict eligibility criteria. The top project will be developed for The Boutet' Company to prepare a separately DHS&EM funded HMGP Project Grant Application.
- It is URS' responsibility to write the plan and take on the bulk of the work to guarantee FEMA compliance, but we need several critical items that only the community can provide:
  - The attendees identified and screened hazards that impact the community and provided brief histories. Attendees also screened which hazards need to be profiled and included in the plan.
  - URS explained the Data Sheets (homework) and how they would be used
  - The Critical Facilities Inventory Spreadsheet needs to list any facilities not on the list. The list needs additional information such as facilities' physical locations (GPS coordinates and street addresses), estimated values, and estimated number of occupants to enable URS to complete a usable risk assessment and vulnerability analysis.
  - The Capability Assessment Data Sheet lists community resources for implementing and administering projects.
- URS explained FEMA project eligibility. Scott further explained how a mitigation plan ensures community grant eligibility once the plan is completed; community adopted, and receives FEMA final approval.
- A FEMA approved HMP will allow the community to apply for FEMA, and potentially other federal agency, grant funding which they are not currently eligible for... the more the information gathered, the better the plan.
- Once the HMP is completed, The Boutet Company will work with the community to develop a Hazard Mitigation Grant Program (HMGP) grant application. This prepares the community to potentially obtain funding to implement projects one of their highest priority "FEMA eligible" projects.
- URS explained that public meetings and newsletters provide the public opportunities to contribute to the process and lets the public know where a copy of the plan is available for review, etc.



# Memorandum

700 G Street, Suite 500  
Anchorage, AK 99503  
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## **City of Quinhagak Planning Team**

- Prior telephonic discussion occurred to encourage the team to take-on HMP data gathering – to spread the work among the team members reducing the workload on the Team Leader, and to have periodic meetings to check progress and to obtain guidance from URS which can save time for everyone. Teams are far more successful than any individual as one idea can lead to several – increasing the success of the Team.
- Public Involvement will help the team:
  - Identify known natural hazards
  - Identify critical facilities
  - Provide historic event and damage information
  - Provide location information
- URS and the Boutet Co., Inc. encourages public meeting during development to fulfill FEMA requirements, to ensure public awareness of the hazards that potentially threaten the community, and to gain public support for projects to protect infrastructure and the population.

## **City Council Comments:**

- Mayor Church had several concerns facing the community: permafrost affecting roads, utility poles, houses, the runway, storm surge, coastal and river embankment erosion, harbor/dock area sedimentation, and poor residential structure (55 with mildew, mold, and poor overall condition), subsistence fishing impacts from barge and other upriver traffic, nearly impossible for community fishermen to return to the dock area due to heavy sediment, silt, and low water level – City drastically needs to have adjacent rivers dredged.
- The Mayor and the City Council have very hard feelings from various agency's lack of concern. The City feels no one is considering their inability to access traditional fishing grounds, current living conditions, or how outsider's activities are impacting their future survival. Nearly all agencies tell them the benefit derived from constructing corrective measures is to little compared to the cost - their economy does not generate enough money and there are too few people to benefit from these measures.

# CITY OF QUINHAGAK HAZARD MITIGATION PLAN

March 2011

*This newsletter discusses the preparation of the Quinhagak Hazard Mitigation Plan. It has been prepared to inform interested agencies, stakeholders, and the public about the project and to solicit comments. This newsletter can also be viewed on the State of Alaska Division of Homeland Security and Emergency Management Website at <http://www.ready.alaska.gov>.*

The State of Alaska, Department of Military and Veterans Affairs, Division of Homeland Security and Emergency Management (DHS&EM) was awarded a Pre-Disaster Mitigation Program grant from the Federal Emergency Management Agency (FEMA) to prepare Hazard Mitigation Plans (HMP) for six Alaskan Communities. Quinhagak was selected for participation in this effort.

DHS&EM, and their contractor The Boutet Company, Inc. and URS Corporation are sharing information to assist the community with preparing a FEMA approvable hazard mitigation plan and subsequent hazard mitigation grant program application during 2011 and 2012.

The Quinhagak Hazard Mitigation Plan will identify all natural hazards, such as earthquake, erosion, flood, severe weather, and wildland fire hazards and others. The plan will also identify the people and facilities potentially at risk and ways to mitigate damage from future hazard impacts. The public participation and planning process is documented as part of these projects.

The Hazard Mitigation Grant Program project application development process will focus on determining the most essential and FEMA eligible project for the City to develop with The Boutet Company, Inc. The completed project application will then be presented to DHS&EM for statewide competitive grant prioritization and potential FEMA funding.

## What is Hazard Mitigation?

Across the United States, natural and human-caused disasters have increasingly caused injury, death, property damage, and business and government service interruptions. The toll on individuals, families, and businesses can be very high. The time, money, and emotional effort required to respond to and recover from these disasters takes public resources and attention away from other important programs and problems.

The people and property in the State of Alaska are at risk from a variety of natural hazards that can potentially cause human injury, property damage, or environmental harm.

Hazard mitigation projects eliminate the risk or reduce the hazard impact severity to people and property. Projects may include short- or long-term activities to reduce exposure to or the effects of known hazards. Hazard mitigation activities include relocating or elevating buildings, replacing insufficiently sized culverts, using alternative construction techniques, or developing, implementing, or enforcing building codes, and education.

## Why Do We Need A Hazard Mitigation Plan?

Communities must have a State, FEMA approved, and community adopted mitigation plan to receive a project grant from FEMA's pre- and post- disaster grants identified in their

Hazard Mitigation Assistance and other agency's mitigation grant programs. The City of Quinhagak plans to apply for mitigation funds after our plan is complete.

The rules have changed. The Local government HMP and Flood Mitigation Assistance (FMA) plans' requirements were consolidated into one planning mechanism. Additionally the Pre-Disaster Mitigation (PDM), Flood Mitigation Assistance (FMA), Repetitive Flood Loss (RL), Severe Repetitive Flood Loss (SRL) grant programs were also consolidated under FEMA's newly developed Hazard Mitigation Assistance (HMA) program. Each of these programs must use the same application process and eligibility requirements for nationally competitive funding.

The Hazard Mitigation Grant Program (HMGP) is a disaster related assistance program. Applicants typically compete on a statewide basis.

## The Planning Process

There are very specific federal requirements that must be met when preparing a hazard mitigation plan. These requirements are commonly referred to as the Disaster Mitigation Act of 2000, or DMA2000 criteria. Information about the criteria and other applicable laws and regulations may be found at: <http://www.fema.gov/plan/mitplanning/guidance.shtm>

The DMA2000 requires the plan to include and document the following topics:

- ☐ Plan development process
- ☐ Identify hazards specific to the jurisdiction
- ☐ Identify the population and structures' risks
- ☐ Define the jurisdiction's mitigation goals
- ☐ List the jurisdiction's mitigation programs, selected actions, and implemented projects
- ☐ Provide a copy of the jurisdiction's resolution adopting the plan

FEMA has prepared Planning Guidance which is available at: <http://www.fema.gov/library/viewRecord.do?id=4225>; and "How to" Guides that explain in detail how each of the DMA2000 requirements are met. These guides are available at <http://www.fema.gov/plan/mitplanning/resources.shtm>. The City's Hazard Mitigation Plan will follow those guidelines.

We are currently in the very beginning stages of preparing the plan. We will be conducting a public meeting to introduce the project and planning team, and to gather comments from our community residents. Specifically we will complete the hazard identification task, and collect data to conduct the risk assessment.

DHS&EM has previously identified natural hazards that occur in the Bethel Census Area that may also occur specifically in Quinhagak.

## We Need Your Help

Please use the following table to identify any hazards you have observed in your area that DHS&EM is not aware of AND any additional natural hazards that may not be on the list.

Quinhagak Hazard Worksheet		
Hazard	Bethel Census Area*	Quinhagak
Avalanche	Yes	N
Earthquake	Yes	Yes
Erosion	Yes	Yes
Flood	Yes	Yes
Ground Failure (Landslide, Permafrost)	No	Yes
Tsunami & Seiche	Yes	No
Volcano	Unknown	No
Weather (Severe)	Yes	Yes
Wildland Fire	Yes	Yes
*Hazard Matrix from the State of Alaska Hazard Mitigation Plan for the Bethel Census Area		

DHS&EM identified critical facilities within the City of Quinhagak as part of the Alaska Critical Facilities Inventory, but the list of critical facilities needs to be updated and the estimated value and location (latitude/longitude) determined.

In addition, the number and value of structures, and the number of people living in each structure will need to be documented. Once this information is collected we will determine which critical facilities, residences, and populations are vulnerable to specific hazards in Quinhagak. Please add additional facilities if needed.

Please email or fax updated hazard and critical facility information directly to URS or provide it to your community planning & project team leader.

Quinhagak Critical Facilities*	
Facility Type	Facility Name
Airport	Quinhagak Airport
Cemetery	Cemetery 2
Cemetery	Cemetery 1
Church	Moravian Church
Community Hall	Community Hall
Fire Station	Fire Station
Fuel Storage Tanks (>500gal)	Fuel Storage 1
Fuel Storage Tanks (>500gal)	Fuel Storage 2
Fuel Storage Tanks (>500gal)	Fuel Storage 3
Fuel Storage Tanks (>500gal)	Fuel Storage 4
Fuel Storage Tanks (>500gal)	Fuel Storage 5
Generator	Backup Generator
Generator	Generator Plant
Hospital/Clinic/ER	Quinhagak Health Clinic
Landfill/Incinerator	Quinhagak Class III Muni Landfill
National Guard	National Guard Armory
Offices	City Offices
Offices	Native Village Office
Park	Play Area
Park	Play Deck
Police Station	Quinhagak Police Dept.
Post Office	NA
Potable Water Production and Treatment Facility	Water Treatment and Storage Facility
Power Generation Facility	AVEC Generator
Reservoir/Water Supply	Well
School	KUINERRAMIUT ELITNAURVIAT
Service/Maintenance Shop	City Garage
Sewage Lagoon	1
Sewage Lagoon	2
Sewage Lagoon	Gray Water Lagoon
Store	A&C Market
Store	Village Corp Store
Teachers Quarters	1
Washateria	Located next to Gray Water Lagoon
* Alaska Critical Facilities Inventory	

## The Planning Team

The planning team is being led by Title and Name with assistance from \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. URS Corporation has been contracted by DHS&EM to provide assistance and guidance to the planning team throughout the planning process.

## Public Participation

Public involvement will continue throughout the project. The goal is to receive comments, identify key issues or concerns, and improve ideas for mitigation. When the Draft Quinhagak Hazard Mitigation Plan is complete, the results will be presented to the community before DHS&EM and FEMA approval, and community adoption.

*We encourage you to take an active part in preparing the City of Quinhagak's Hazard Mitigation Plan and the Mitigation Project Application Development effort. The purpose of this newsletter is to keep you informed and to allow you every opportunity to voice your opinion regarding these important projects. Please contact your community representative, URS planning coordinators, or The Boutet Company Inc. if you have any questions, comments, or requests for more information:*

Quinhagak Planning Team Leader

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## Memo for Record

700 G Street, Suite 500  
Anchorage, AK 99501  
Phone: 907.261.9706  
Fax: 907.562.1297

**SUBJECT:** DHSEM HMP – Mitigation Strategy Teleconference Minutes

**Community:** Quinhagak, AK

**Date/Time:** May 12, 2011/8:30 a.m.

**From:** R. Scott Simmons

### Attendees:

- URS: Scott Simmons
- DHSEM: Chris Tomsen
- Jim Galanes
- Mayor Willard Church

### Comments:

- **Subjects covered included:**
  - Section Seven (7) Mitigation Strategy
- **Participant Introduction**
- **Mitigation Strategy Development:**
  - Explained the Mitigation Strategy development process
  - Introduced Mitigation Goals purpose and reached consensus on suggested goals for the City
  - Reviewed the Mitigation Project Consideration Sheet,
  - Identified ongoing or existing City mitigation initiatives
  - Selected mitigation initiatives for implementation and refinement within the Mitigation Action Plan Matrix.
  - Explained how the information discussed would be implemented and expanded within the Mitigation Action Plan Matrix and returned to the community for review.
    - Matrix will include:
      - Initiative Priority
      - Responsible Entity
      - Potential Funding Sources
      - Timeframe for implementation
      - Benefit /Cost and Technical Feasibility narrative description
  - Teleconference Follow-up
  - A second newsletter will be developed once the Mitigation Strategy is finalized and incorporated into the Draft HMP. The newsletter should be posted or distributed throughout the community to inform the community that the HMP is available for public review and comment.





# CITY OF QUINHAGAK HAZARD MITIGATION PLAN

June 2011

Newsletter 2

*This newsletter discusses the preparation of the City of Quinhagak Hazard Mitigation Plan. It has been prepared to inform interested agencies, stakeholders, and the public about the project and to solicit comments. This newsletter can also be viewed on the State of Alaska Division of Homeland Security and Emergency Management Website at <http://www.ready.alaska.gov>.*

The City of Quinhagak was one of six communities selected by the State of Alaska, Division of Homeland Security and Emergency Management (DHS&EM) for a Hazard Mitigation Planning (HMP) development project. The plan identifies natural hazards that affect the community including earthquake, erosion, flood, ground failure, severe weather, and wildland fire. The HMP also identifies the people and facilities potentially at risk and ways to mitigate hazards. The public participation and planning process has been documented as part of the project. The Boutet Co. Inc. contracted with URS Corporation (URS) to assist in preparing the HMP. The Boutet Co. Inc. will prepare a Hazard Mitigation Grant Program project application for an eligible project identified within the City's Mitigation Strategy.

## What is Hazard Mitigation?

Across the United States, natural disasters have increasingly caused injury, death, property damage, and business and government service interruptions. The toll on individuals, families, and businesses can be very high. The time, money, and emotional effort required to respond to and recover from these disasters take public resources and attention away from other important programs and problems.

The people and property in the State of Alaska are at risk from a variety of hazards that have the potential for causing human injury, property damage, or environmental harm.

The purpose of hazard mitigation is to implement projects that eliminate the risk or reduce the severity of hazards on people and property. Mitigation programs may include short-term and long-term activities to reduce the hazards, reduce exposure to hazards, or reduce the effects of hazards. Mitigation could include education, and construction projects. Hazard mitigation activity examples include relocating buildings, developing or strengthening building codes, and educating residents and building owners.

## Why Do We Need A Hazard Mitigation Plan?

A community is only eligible to receive grant money for mitigation programs by preparing and adopting a hazard mitigation plan. Communities must have an approved mitigation plan to receive grant funding from the Federal

Emergency Management Agency (FEMA) for eligible mitigation projects. The Boutet Co. Inc. will work with the City of Quinhagak to develop an eligible project grant application after the HMP is approved by DHS&EM and FEMA and adopted by the City.

## The Planning Process

There are very specific federal requirements that must be met when preparing a hazard mitigation plan. These requirements are commonly referred to as the Disaster Mitigation Act of 2000, or DMA2000 criteria. Information about the criteria may be found on the Internet at: <http://www.fema.gov/plan/mitplanning/guidance.shtm>

The DMA2000 requires the plan to document the following topics:

- ☐ Planning process
- ☐ Hazard identification
- ☐ Risk assessment
- ☐ Goals
- ☐ Mitigation programs, actions, and projects
- ☐ A resolution from the community adopting the plan

FEMA has prepared Planning Guidance which is available at: <http://www.fema.gov/library/viewRecord.do?id=4225>; and "How to" Guides that explain in detail how each of the DMA2000 requirements is met. These guides are available at <http://www.fema.gov/plan/mitplanning/resources.shtm>. The Quinhagak Hazard Mitigation Plan will follow those guidelines.

In March 2011 the planning process kicked-off by establishing a local planning committee and holding a public meeting. The planning committee examined the full spectrum of hazards listed in the State Hazard Mitigation Plan and identified six hazards the HMP would address.

After the first public meeting, City staff and URS began identifying critical facilities, compiling the hazard profiles, assessing capabilities, and conducting the risk assessment for the identified hazards. Critical facilities are facilities that are critical to the recovery of a community in the event of a disaster. After collection of this information, URS helped to determine which critical facilities and estimated populations are vulnerable to the identified hazards in Quinhagak.

A mitigation strategy was the next component of the plan to be developed. Understanding the community's local capabilities and using information gathered from the public and the local planning committee and the expertise of the consultants and agency staff, a mitigation strategy was developed. The mitigation strategy is based on an evaluation of the hazards, and the assets at risk from those hazards. Mitigation goals and a list of potential actions/projects were developed as the foundation of the mitigation strategy. Mitigation goals are defined as general guidelines that explain what a community wants to achieve in terms of hazard and loss prevention. Goals are positively stated future situations that are typically long-range, policy-oriented statements representing community-wide visions. Mitigation actions/projects are undertaken in order to achieve your stated objectives. On May 12, 2011, the local planning committee identified projects/actions for each hazard that focus on six categories: prevention, property protection, public education and awareness, natural resource protection, emergency services, and structural projects. The mitigation actions identified as a high priority by the planning team are listed below, and explained in more detail in the plan.

The selected projects/actions will potentially be implemented over the next five years as funding becomes

available. A maintenance plan has also been developed for the hazard mitigation plan. It outlines how the community will monitor progress on achievement of the projects/actions that will help meet the stated goals and objectives, as well as an outline for continued public involvement.

The draft plan is available in the City office and on the State website (<http://www.ready.alaska.gov>) for public review and comment. Comments should be made via email, fax, or phone to the contact person below and be received no later than June 15, 2011. The plan will be provided to DHS&EM and FEMA for their approval prior to formal adoption by Quinhagak's City Council.

## The Planning Committee

The plan was developed with the assistance from a planning committee consisting of a cross section of the community. Planning committee members who helped with development of the plan include Mayor and Team Leader Willard Church, with assistance from Fannie Moore, Vera Roberts, and Pauline Matthew. URS Corporation, The Boutet Co. Inc., and DHS&EM are also providing assistance to the planning committee.

Sample of the City of Quinhagak's Mitigation Actions. Review the draft HMP for a complete list.		
Establish a formal role for the jurisdictional Hazard Mitigation Planning Committees to develop a sustainable process to implement, monitor, and evaluate community wide mitigation actions.	The City will aggressively manage their existing plans to ensure they incorporate mitigation planning provisions into all community planning processes such as comprehensive, capital improvement, and land use plans, etc. to demonstrate multi-benefit considerations and facilitate using multiple funding source consideration.	Encourage utility companies to evaluate and harden vulnerable infrastructure elements (utility poles, telephone and electric power lines, etc.) for sustainability.
Dredge Kanektok River and Kuskokwim Bay confluence. Flooding events has changed the River channel and also brings severe debris and sedimentation which is precluding access to the dock facilities for fuel and community supply delivery and to enable 84 fishing	Maintain and update erosion hazard locations, identify critical facilities and cultural sites that are potentially impacted and develop mitigation initiatives such as bank stabilization or facility relocation to prevent or reduce damages from storm surge, beach front erosion.	Encourage AVEC to increase power line wire size and incorporate quick disconnects (break away devices) to reduce ice load and wind storm power line failure during severe wind or winter ice storm events.
Acquire (buy-out), demolish, or relocate structures from hazard prone area. Property deeds shall be restricted for open space uses in perpetuity to keep people from rebuilding in hazard areas.	Install embankment protection such as rip-rap (large rocks), sheet piling, gabion baskets, articulated matting, concrete, asphalt, vegetation, or other armoring or protective materials.	Disseminate FEMA pamphlets to educate and encourage homeowners concerning structural and non-structural retrofit benefits.
Identify evacuation routes away from high hazard areas and develop outreach program to educate the public concerning warnings and evacuation procedures.	Harden riverbank infiltration gallery and perform planning to relocate existing system to reduce or eliminate water source contamination.	Increase culvert size to 24 inches to increase its drainage efficiency.
Identify and pursue funding opportunities to implement mitigation actions.	Update or develop, implement, and maintain Stormwater Management Plans.	Promote permafrost sensitive construction to reduce permafrost damage.
Develop and implement programs to coordinate maintenance and mitigation activities to reduce risk to public infrastructure and residential properties from severe winter events.	Identify and map existing permafrost areas to assist in new critical facility siting and existing facility relocation siting	Initiate monitoring activities to determine construction/permafrost degradation effects.
Develop ordinances to protect drinking water resources	Provide wildland fire information which address human and lightning caused impacts in an easily distributed format for all residents.	

*We encourage you to learn more about the City of Quinhagak's Hazard Mitigation Plan. The purpose of this newsletter is to keep you informed and to allow you every opportunity to voice your opinion regarding this important project. If you have any questions, comments, or requests for more information, please contact:*

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FEMA

November 22, 2011

Mr. Erv Petty  
State Hazard Mitigation Planner  
Alaska Division of Homeland Security  
and Emergency Management  
P.O. Box 5750  
Fort Richardson, Alaska 99505-5750

Dear Mr. Petty:

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

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

Please contact our Regional Mitigation Planning Manager, Kristen Meyers, at (425) 487-4543 with any questions.

Sincerely,

A handwritten signature in blue ink, appearing to read "Ryan Ike", written over a faint circular stamp.

Ryan Ike  
Risk Analysis Branch Chief  
Mitigation Division

BH:bb



**Appendix D**  
**Benefit–Cost Analysis Fact Sheet**

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## **Benefit-Cost Analysis Fact Sheet**

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

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

### **All Benefit-Costs must be:**

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

### **General Data Requirements:**

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

### **Damage and Benefit Data**

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



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

### **Building Data**

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

### **Use Correct Occupancy Data**

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

### **Questions to Be Answered**

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

### **Common Shortcomings**

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

**Appendix E**  
**Plan Maintenance Documents**

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## Annual Review Questionnaire

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

## Mitigation Action Progress Report

Page 1 of 3

Progress Report Period: \_\_\_\_\_ to \_\_\_\_\_  
(date) (date)

Project Title: \_\_\_\_\_ Project ID# \_\_\_\_\_

Responsible Agency: \_\_\_\_\_

Address: \_\_\_\_\_

Contact Person: \_\_\_\_\_ Title: \_\_\_\_\_

Phone #(s): \_\_\_\_\_ email address: \_\_\_\_\_

List Supporting Agencies and Contacts:

Total Project Cost: \_\_\_\_\_

Anticipated Cost Overrun/Underrun: \_\_\_\_\_

Date of Project Approval: \_\_\_\_\_ Start date of the project: \_\_\_\_\_

Anticipated completion date: \_\_\_\_\_

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

[illegible]

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Plan Goal (s) Addressed:

Page 2 of 3

Goal: \_\_\_\_\_

Indicator of Success: \_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Project Status

Project Cost Status

☐ Project on schedule

☐ Cost unchanged

☐ Project completed

☐ Cost overrun\*

☐ Project delayed\*

\*explain: \_\_\_\_\_

\*explain: \_\_\_\_\_

\_\_\_\_\_

☐ Cost underrun\*

☐ Project canceled

\*explain: \_\_\_\_\_

\_\_\_\_\_

Summary of progress on project for this report:

A. What was accomplished during this reporting period?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

C. How was each problem resolved?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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

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Other Comments:

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